Initial Environmental Examination

Report
June 2017

VAN: Cyclone Pam Road Reconstruction Project - Additional Financing

Prepared by Ministry of Infrastructure and Public Utilities for the Vanuatu Government and the Asian Development Bank.

ABBREVIATIONS

ADB	Asian Development Bank
AP	affected persons
BBB	'build back better'
CCAs	Community Conservation Areas
CCP	community consultation plan (for the Project)
CEMP	Contractor's Environmental Management
CPRRP	Cyclone Pam Road Recovery Project
CLMO	Customary Lands Management Office
DCZ	Designated Conservation Zone
DEPC	Department of Environment and Conservation
DFAT	Department of Foreign Affair and Trade
DOL	Department of Lands
DP	displaced persons
DSC	design and supervision consultants
EARF	Environmental; Assessment and review Framework
EIA	Environmental Impact Assessment
EMC	Environmental Management and Conservation
EMP	Environmental Management Plan
EMMP	Environmental Management and Monitoring Plan
EPC	Environmental Protection and Conservation
ERR	Efate Ring Road
ERP	Emergency Response Plan
ESO	Environmental Safety Office
FDA	Foreshore Development Act
FDP	Foreshore development Permit
GDP	Gross Domestic Product
GRM	Grievance Redress Mechanism
IEE	Initial Environmental Examination
LAA	Land Acquisition Act
MCC	Ministry of Climate Change
MDG	Millennium Development Goals
MIPU	Ministry of Infrastructure and Public Utilities
MDG	Millennium Development Goal
MOU	Memorandum of understanding
NBSAP	National Biodiversity Strategy and Action Plan
NO	Nitrogen Oxides
NGOs	Non-government organisations
PAA	Priorities and Action Agenda
PAM	project administration manual
PEA	Preliminary Environmental Assessment
PIU	Project Implementation Unit
PMU	Project Management unit (within MIPU)
POL	Petrol Oil Lubricant
PRC	Program Recovery Committee (within Prime Minister's Office)
PSD	Primary Sector Development
PWD	Public Works Department (within MIPU)
RE	Resident Engineer
SDG	Sustainabile Development Goals
SO_2	Sulphur Dioxide

SPS	Safeguard Policy Statement 2009 (of ADB)
SPCZ	South Pacific Convergence Zone
SSF	Social Safeguard framework
SSO	Senior Safeguard Officer
UNESCO	United Nations Educational, Scientific and Cultural Organization
VEMC	Vanuatu Environmental Management and Conservation
VIAR	Vanuatu Impact Assessment Report
VTSSP	Vanuatu Transport Sector Support Program
WRM	Water Resources Management

CURRENCY EQUIVALENTS
(as of 12 April 2017)

Currency unit – Vatu (Vt)
Vt1.00 = $0.00929
$1.00 = Vt107.638

NOTES

(i) The fiscal year (FY) of the Government of Vanuatu and its agencies ends on 31 December. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 31 December 2011.
(ii) In this report, "$" refers to US dollars unless otherwise stated.

EXECUTIVE SUMMARY

Introduction

Severe Tropical Cyclone Pam (TC Pam) was a category 5 cyclone that impacted Vanuatu on 13 March 2015. The ensuing damage resulted in vital infrastructure including roads, bridges, housing, and sewerage and water supply systems being damaged and destroyed. Large flows and debris build-up caused damage to bridges, including to piers, abutments and scour protection. Approaches to bridges, causeways and culverts collapsed or were washed away and road pavement stability was affected in a number of locations.

The Cyclone Pam Road Reconstruction Project (the Project) aims to accelerate economic and social recovery in Vanuatu's Cyclone Pam-affected areas and contribute to Ni-Vanuatu resilience. The development objective is to restore socioeconomic activities of people around the Efate ring road to pre-cyclone levels. This will be achieved by providing disaster resilient road and bridge infrastructure by reconstructing priority assets, i.e., "building back better" (BBB). The Ministry of Finance and Economic Management is the Project executing agency and the Public Works Department (PWD) of the Ministry of Infratsructire and Public Utilities (MIPU) is the impleneting agency.

The original Project scope for 21 subprojects, has now been designed and physical works are being procured – this is now known as "Phase I". This document is the initial environmental examination (IEE) for the scope of the additional financing, known as "Phase II." It is targeted at increasing the scope of works at two sites under Phase I and the inclusion of four others. It forms part of the Feasibility Study Report for Phase II and identifies baseline conditions and impacts and addresses the anticipated environmental impacts of seven additional subprojects with a set of design mitigations to control environmental impacts and risk. It also provides guidance to the construction contractor in the preparation of the Contractor's Environmental Management Plan (CEMP) to address site specific pre-construction and construction risks and how to deal with any concerns or issues raised during the construction phase.

Legislation and policy

The Project needs to satisfy the requirements of the Vanuatu Environmental Management and Conservation Act No. 12 as amended by the Environmental Management and Conservation (Amendment) Act No. 28 (EPC Act). The EPC Act states that all projects, proposals or development activities that:

(a) cause or are likely to cause significant environmental, social and/or custom impacts; or

(b) cause impacts relating to the matters listed in subsection (2);

are subject to an environmental impact assessment (EIA).

The Department of Environment and Conservation (DEPC) were consulted and it was agreed that the Project will prepare the application for clearance under the EPC Act, to obtain an environmental permit. DEPC will undertake the preliminary environmental assessment (PEA) application based on the IEE and additional information templates. A determination of the need for further assessment and issues related to the environmental permit will then be made by the DEPC.

A permit is also required under the Foreshore Development Act, another key piece of environmental planning legislation, which concerns the protection and development of the foreshore. The foreshore is defined as, "the land below the mean high water mark and the bed of the sea within the territorial waters of Vanuatu."

The subprojects are on the Efate ring road (Efate's coastal road) and some structures are located in the inter-tidal zone. As a result, there are two subprojects which may require a Foreshore Development Permit. Landowner consent is being sought as part of the memorandum of understanding (MOU) process, and permit applications prepared.

Following screening as per the Asian Development Bank (ADB) Safeguards Policy Statement 2009 (SPS), the overall Project was classified as category B and the subprojects under the additional financing are also category B.

Existing environment

Table ES-1 summarises the existing environment in the vicinity of the seven subprojects.

Table ES1 – Summary of subproject existing environmental conditions

Subproject	Physical environment	Biological environment	Socio-economic environment
Wassisi Culvert	The geology of the area is mixed alluvium over remnant limestone reef. The soils along the creek are sandy from upland areas surrounding a lowland wetland over peat wetland soil mainly downstream of the road. The catchment makes up an area of approximately 175 Ha. The presence of significant amounts of the upland sandy solis has led to sedimentation in the creek bed downstream. The site is presently under construction.	The impact area has been highly modified with human intervention with weed infestation, bamboo stands and vines and significant amount of solid waste dumped in and arounf the waterway. There are scattered large lowland rainforest trees which suggest a significant wetland rainforest or open canopy forest was presnt downstream. From field inpsection the water quality appears excellent with no turbidity issues. The water flow is strong and appears to be groundwater under pressure from fissures in the underlying limestone geology below the culvert under construction. Upstream the surface water flow appaears to have been effectively stopped by the current construction activities.	The area has scattered settlement on the upland side of the road with a broken unsealed access road leading to a low standard housing area approximately 50 metres upstream on the eastern side.
Saama Culvert	5-10% gradients both upstream and downstream of culvert that flows to the sea approximately 150 m downstream. Evidence of sheet flow over the road	A highly modified environment made up of secondary vegetation and various weeds. Bull rushes and other introduced reed species dominate on either side of the road restricting proper flow into the culvert	The site is approximately 1 km from the nearest village (Saama) and is relatively isolated.
Tanoliu Bridge	Located adjacent to the coast The Sanoa Marine Protected Area (community-led initiative) is nearby. The bed material is sandy and the domimant flows are tidal.	There are mangroves present upstream but the immediate vicinity of the bridge is highly modified due to the proximity of the village also upstream Fauna species associated with mangroves present in large numbers (e.g. fiddler crabs, mangrove crabs, mudskippers, hermit crabs) are present in Havannah bay which is adjacent to the bridge and approximtely 20 metres from the fringing beach.	Residence situated north-east of bridge. A bench is located south-west of the bridge for use as waiting area for busses. For people travelling and commuting from the adjacent offshore islands. Anecdotal evidence from two consultations was divided as to whether mangroves are exploited in the area upstream for charcoal production.
Ulei Culvert	The geology is a small pocket of limestone (up lifted reef) with a perennial freshwater spring. The spring is one of two such features identified in the local area. The spring enters the tidal saltwater below a locally constructed rock weir approximately one hundred metres from the existing culvert. Water quality of both spring pool and saltwater is very clear with no apparent pollution except laundry soap. The Sanoa Marine Protected Area (community-led initiative) is nearby.	Fringing vegetation is a combination of dominant climbing woody vine with some mangrove near the coast Freshwater fish, eels and prawns were observed in the freshwater pool. Likely migration to the saltwater would occur over the rock weir.	The freshwater spring is used by 100 households from the village for water supply, laundry and bathing activities. There is increasing population pressure on the eastern side of the stream with immigrants from the Shepherd Islands. Access to the spring is via a side road which was suggested as a detour route for construction (not to be utilised).
Epule Bridge	Epule crosses a relatively long estuarine river that is relatively approximately 10-15 km in length and deep enough for the use of kayaks and canoes. The geology at the bridge is recent up-lifted limestone but further upstream the source is in the older limestone. The channel is dominated by tidal flows with very good water quality. There was no evidence of sedimentation in the channel.	The area is well vegetated both up and downstream of the bridge. The coastal side of the bridge has mostly cleared and grassy vegetation which is highly modified with many weed species. Inland there is more private land there are planted gardens along the northern side of the river by the residence and further upstream. The river supports a diverse ecosystem of endemic salt and estuarine fish and crustaceans such as eel fish and estuarine shrimp.	There is a residence to the immediate northeast that rents out kayaks and does river tours. The village population is scatterd in private houses on both sides of the river which are all relatively close to the bridge There is fenced off private land on either side of the bridge along the river which is fenced using barbed wire.
Tassiriki Road upgrade and drainage	The underlying geology is recent limestone overlain by relatively sandy alluvium surrounding the Erakor lagoons. There are clay pockest	The northern side of the corridor has a heavily vegetated mixed canopy forest with some mature local trees on the steep catchment slopes. The flat areas between	The area to the south of the corridor is heavily populated with residential and tourist related activity. The USP

Subproject	Physical environment	Biological environment	Socio-economic environment
improvements	associated with the road corridor which affects current drainge. The areas away from the road have high infiltration rates due to the sandy soils.	the forest and the road support parkland introduced grasses. There is also fringing commercial uses on the north eastern end of the corridor immeditely adjacent to steep open cliff faces. The southern side from the road to the lagoons is all highly modified with urban uses, (residential , tourism, retail, commercial)	campus is located on the western end of the proposed corridor where the road is heavily constrained on both sides with brick walls protecting the residences and the USP campus areas.

Proposed works

There are seven subprojects being considered and various options to increase climate resilience were developed and then evaluated and selected for each subproject.

The preferred options at each site are summarised below:

> Seven (7) 900 mm diameter culvert pipes under the road and concrete causeway at Wassisi

> New single-span, two-lane steel truss bridges at Epule to replace existing bridge

> New two-lane width box culverts at Tanoliu and Ulei to replace existing short span bridges

> Major road upgrade including pavement reconstruction, drainage, footpaths at Tassiriki

> Drainage and scour protection to Saama

Concept design drawings are included in Appendix A – Engineering Report of the main feasibility study report.

Anticipated environmental impacts

Based on the field work carried out to date, the site specific environmental impacts of the majority of subprojects were found to be of low significance. Of these, the construction phase impacts were considered to be more substantive than impacts or risks that could occur during the pre-construction or operational phases. As the subprojects are all in proximity to the coast, the critical elements of risk are related to coastal, estuarine and riverine ecology and include:

> Estuarine ecology, conservation of water quality and remnant mangroves in Erakor lagoon system in Port Vila. Major roadworks at Tassiriki are more than 350m from the Lagoon, however, a high-flow drainage outlet will be constructed to discharge to the Lagoon, adjacent to the existing road

> Freshwater fisheries conservation of endemic freshwater fish and invertebrates in Ulei

> Improvements to urban drainage management in Tassiriki using swale designs and infiltration basins to address high intensity storm events

The Project adopted the principle of “build back better” which has led to environmental enhancements using design mitigations for the more complex subprojects (e.g., Tassiriki). At these sites, some of the risk to natural habitat could be reduced and also the positive socioeconomic impacts could be maximised.

Design measures have been included to address this issue as well as in locations where areas of existing natural habitat were considered to require protection, rehabilitation and/or enhancement.

Impact identification

Impact identification and assessment was undertaken for all subprojects for the three phases of activities, i.e., pre-construction, construction and operations and each component of the environment (physical, biological and social). The outcomes of this assessment are presented in full and in a matrix, in the IEE document attached in ***Section VIII*.**

The construction phase of the Project will lead to the majority of impacts. Two subprojects were considered low risk without mitigations (Saama and Wassisi). Also, due to the localised nature of activities, the scale and duration of construction required and the relatively low population density in the vicinity of most subprojects, the impacts of another four of the subprojects were assessed as being of medium to low risk with mitigations in place. One of the subprojects (Tassiriki) was considered a moderate risk, even with mitigations in place.

The works are focussed on reconstruction within existing road corridors. The road corridor does not traverse stream segments with critical or natural habitats and is not located in, or adjacent to protected areas. However, rivers and mangroves on Efate Island are listed as important places and habitats of conservation under the Vanuatu National Biodiversity Strategy Action Plan. There is potential for environmental enhancement with design mitigations involving a range of tree and ground cover planting in selected locations. Using typical mitigation measures to reduce risk on the more complex subprojects, the cumulative impacts of the project overall are considered manageable.

Pre-construction impacts

The project will comply with the requirments of the EPC Act and SPS. The application under the EPC Act and applications under the Forehore Developemnt Act will be made during the pre-contrsuction phase. The design and supervision consultant (DSC) supporting the PWD to implement the Project can assist the contractor to prepare their CEMP and will provide assistance in the event that permits are required from Department of Geology and Mines for sourcing materials.

Sources of construction materials for the Project will comply with the requirements of the Department of Geology, Mines and Water Resources within the Ministry of Land and Natural Resources and the Quarry Act 2013 as well as good practice for extracting, storing and transporting materials and rehabilitation of the extraction sites as required, as set out in the EMP (Section VIII of this IEE).

It is the responsibility of the Contractor to obtain the necessary materials extraction licences. Should a Contractor elect to source aggregates locally, they will be required to ensure it is sourced from sites that have a permit issued by the Department of Geology, Mines and Water Resources (DGMW), either to the owner of the quarry, to the PWD or directly to the Contractor for the extraction of materials. Any site that is opened by the Contractor will comply with relevant laws and requirements including the documentation to accompany the permit application (work program, site plan, EMP, health and safety plan, and rehabilitation plan).

Follwing DSC clearance of the CEMP, the contractor will be provided possession of the site. The pre-construction impacts will be generated by the activities of mobilising and setting up the construction management team, workforce, facilities and equipment required to implement the project during the construction phase. The more significant issues relate to worker recruitment policy, the need for construction camp(s), its proposed location and the location of storage yards for materials, machinery fuel, oil and lubricants (POL) particularly those classified as hazardous or dangerous goods.

If a construction camp is required, this can result in both positive and negative impacts. There will be nuisance impacts associated with noise, localised air quality and potential for disruption due to outsiders. A camp can also lead to positive impacts through local people selling food and water to the workers. The project itself can generate some local employment. Establishment of storage facilities will lead to negative nuisance impacts such as air quality and noise and a slight increase in risk to any nearby population. With typical mitigations put in place by the Contractor, as outlined in the EMP (refer to Section VIII of this IEE), the impact would be reduced. Direct and positive employment impacts can be anticipated if clear local employment policies are put in place and implemented. Such a policy is being developed as part of the construction tender documentation.

Construction impacts

The impact identification and assessment matrix in the IEE shows that the construction impacts of the Project are more varied and have the potential to be more far-reaching than pre-construction impacts. The scale and duration of negative impacts for the subprojects in rural locations were considered to be low risk, even without standard mitigations in place for one sub project and low to moderate for the four others, assuming all recommended mitigations are implemented. The broad distribution of the subprojects around the ring road also means that the cumulative impacts of the Project will be low risk, with no single subproject affecting and compounding the impact on the environment of any other.

Of the six subprojects covered by the additional financing, Tassiriki is more complex. It is a three-kilometre long, urban road corridor improvement. The corridor traverses a diverse mix of land uses, including education (Univeristy of the South Pacific (USP) campus and Port Vila International School) residential, recreational, tourism, retail, light industrial (Pacific Supplies, Vanuatu Wota) and other commercial uses.

Another feature of the area is the Erakor lagoon system to the south of the residential area which is important to ecology, recreational use, livelihoods in Erakor and numerous resorts on the lagoon foreshore. with potential impacts during construction associated with a number of environmental components including noise, air quality, hydrological and land use impacts. The risks, without mitigations in place, were considered moderate to high. These impacts are exacerbated by the narrow width along the roadside in the USP section and along the eastern section which limits road shoulder width and drainage options.

These different land uses interact with proposed road and drainage improvements which will require the Contractor to address the different needs of stakeholders under continued use of the corridor during construction. There will be detailed traffic management planning as part of the CEMP, developed in conjunction with the PWD, to effectively plan to inform the public, maintain vehicular and pedestrian traffic flow and maintain access to properties. To maintain traffic flow, works will take place under traffic control, where only one lane is open during working hours. Construction noise will be less of an issue for most residences, as most already experience the noise generated by this busy road and have substantial perimeter walls in place, adjacent to the road.

Air quality impacts will be a significant issue during dry periods and standard mitigations such as water spray trucks will be required. There is also the potential for turbid water flows during storm events. A construction stormwater management plan will be required, to plan temporary drainage to maintain separation of clean and dirty water, by diverting surface water around the working area and site runoff into management facilities in the adjacent park area, on the northern side of the corridor. Dependent on expected storm frequency, silt mesh should also be placed across the entry point to each small drainage catchment.

The Tassiriki subproject requires approximately 5000 m^3 of road base and aggregate to be transported from local quarries, leading to air quality, noise and road safety impacts, due to increased truck traffic. The volume of road base is expected to be delivered over a period of five weeks, at a rate of 15 trucks per working day. With standard mitigation measures and site specific management planning in place to address nuisance, drainage, traffic and safety issues, the risk level of these issues was reduced to moderate.

At Epule, construction of the bridge and road realignment will require the use of pile driving equipment. Given the proximity of the village, the risk of significant noise disturbance is considered high. However, the period of high noise level is not expected to last for more than 3-4 weeks. With specific mitigations, including an agreed noise management plan in place, community consultation, muffling the equipment at source and strict control of the hours of operation, the risk can be reduced to moderate.

Air quality and noise impacts were considered to be low risk with site specific mitigations in place in three other subprojects in the other rural areas. At Waisisi, Tanoliu and Ulei, the construction of culverts and associated earthworks will lead to shorter term noise and air quality (during dry periods) which are considered acceptable with standard mitigations in place. Reconstruciton of the road surface at Waisisi will lead to more significant air quality impacts during dry periods and a dedicated water spray truck would be required to be permanently on station during the earthworks as there are sensitive receptors downwind, including the nearby school.

At Tanoliu and Ulei, the suggestion has been raised on several occasions, to create temporary traffic diversions through the villages. This is no longer being actively considered and the Contractor will be required to undertake the works within the existing road corridor.

Water quality impacts occur during construction activities when soils, wastewater, oils and lubricants, sewage and other materials from exposed ground surfaces, construction facilities and equipment are allowed to move into the surrounding air, ground and waterways. Construction activities that may exacerbate the movement of these materials into the freshwater or marine water environments were assessed as being a low risk, provided standard mitigation measures are nominated in the CEMP and implemented by the Contractor.

Socioeconomic impacts are expected to be generally positive due to the likely stimulation of local village employment and indirect services provided to the construction workforce. There are potential moderate to high risks associated with the need for a construction camp in the more remote sections of eastern Efate. A social mitigation program to address social risks such as HIV/AIDS and other public health issues would form part of the site specific CEMP if a camp were required. The DSC will be conducting a pre-construction

HIV/AIDS awareness program, through engagement with a local provider. The decision on the location and scope of training will depend on the scope and location of proposed contract packages.

In summary, the construction phase of the Project will lead to the majority of more significant risks if unmitigated. However, due to the localised nature of activities, the scale and duration of construction required and the relatively low population density in the vicinity of most subprojects, the impacts were generally assessed as being of low significance without mitigation. A minority of subprojects showed moderate to high direct or indirect impacts without mitigation or management intervention.

Operations impacts

The Efate ring road has existed for some time, it has been upgraded in some sections and some bridges have been replaced/reconstructed by other development partners. The traffic volume is, and is likely to remain, relatively low and therefore impacts and risks during operation stage are of low significance.

Hydrology and water quality

The Tassiriki subproject is located generally upstream of the sensitive ecological area of the Erakor lagoons. On the western section, the distance to the nearest lagoon is approximately 400 metres. On the eastern section, the Second lagoon is approximately 50 metres from the road corridor. The land use along the edge of the lagoons is predominantly tourist accommodation and residential development. The most sensitive water quality indicator for this type of land use is turbidity and the lagoons are currently perceived as being transparent.

The PVUDP reports indicates that currently there are very limited direct discharges of stormwater into the lagoon system. This is as a result of the high infiltration rates of the soils which are predominantly sandy and porous coronous stratum. Consequently, the any captured surface water flows from the road corridor, which do not pass through a cleansing (detention/retention/infiltration/swale) facility, is considered to be a high risk of affecting the lagoons' water quality. It is recommended that that the drainage design optimise the use of soft swale drainage systems directed to side roads or open land to reduce the risk of the road corridor having negative effects on lagoon water quality during operation of the road and drainage system. The engineering design incorporates this recommendation.

Soils and erosion

Excavation sites will either be backfilled or the slopes stabilised during construction. Soil erosion from the road itself is not expected. Roadside drainage systems will be maintained by PWD with community based programs and contractors, and this requires the removal of accumulated sediments or vegetation. If vegetation control is required in drains, this should be removed manually (by slashing) rather than excavated by machine which will leave behind a larger and an erodible surface.

Flora and fauna

Impacts on terrestrial and aquatic flora and fauna were assessed as a low risk as the road has already provided initial access to these areas. A baseline biodiversity study has been commissioned under the Project, for three waterways in Efate, including Ulei. As the reconstruction works will mainly take place in the existing road corridor there will be no potential for adverse impacts that could arise from increased access to inland forests or other habitat areas. The areas where works will occur outside of the corridor are small and not heavily vegetated. New planted areas will require upkeep to an agreed schedule with PWD and Port Vila Municipal Council (PVMC), as part of the asset management plan.

Conclusion

The works will largely focus on reconstruction within the existing corridor which were generally found to be highly modified due to the past operation of the Ring Road. For all subprojects, the road corridor does not traverse stream sections which include critical or natural habitats, as these are defined in the SPS.

Design mitigations

Design mitigations have been proposed to address any impacts rated moderate to high. A baseline study of a sample of freshwater streams was undertaken for Epau and Creek Ai, to identify flora and fauna which could require additional mitigation measures. The results will be integrated into the construction environmental management plan (CEMP). The baseline study will form the basis for a possible restocking

and/or conservation program for specific species in designated stream sections to further reduce risk if considered warranted.

ES2 – Proposed design mitigations

Subproject	Proposed Design Mitigation/ Management Program
Tanoliu and Ulei culverts	The culverts will be replaced with open box design and an additional culvert upstream, to maintain the tidal flow into the saltwater area. Any works with the potential to divert river flow will be timed at periods of low flow and also to avoid any endemic fish and invertebrate fauna spawning seasons. This information is currently being obtained from the fish biodiversity study
Tassiriki road and drainage improvement	The drainage flows from the road corridor are considered to be a high risk of affecting on-going lagoon water quality, especially turbidity. It is recommended that that the drainage design optimise the use of soft swale drainage systems directed to side roads or open land to reduce the risk of the road corridor having negative effects on lagoon water quality during operation of the road and drainage system
The freshwater stream at Ulei	A baseline biodiversity study of freshwater fish and invertebrates is presently being conducted in selected subprojects to promote selective restocking programs (Epau, Creek Ai and Ulei). Ulei freshwater stream has been proposed for inclusion in the baseline due to its importance as a village water supply and to check the species and abundance from the limestone spring source which was reported as lcsoll rare by the community. Also due to the sensitivity of the freshwater stream at Ulei it was reccomended that construction of the culvert only consider options which will accommodate traffic control measures within the corridor.
Road safety	Guardrails were improved at every site where guardrails were either existing or required. All existing guardrails at structures were either substandard in alignment, height, connectivity, length or a combination of these. There was no guardrail in several locations where guardrails should be present and these were provided in the concept design. Handrails and footways were provided to all new structures. Concrete footpaths, up to 25m long, were designed at the ends of a bridge footway (either existing or provided in the design). This improves pedestrian safety as it prevents vegetation growing on the approach to the footway. And it provides greatly improved access for people with disabilities, contributing to the achievement of universal access provision.

Subproject	Proposed Design Mitigation/ Management Program
	At Tassiriki, consideration is still being given to the opportunities to include pedestrian refuge islands at locations where pedestrians frequently cross the road.

Environmental management and mitigations

There are site specific noise mitigations required for Epule Bridge due to the need for the use of pile driving equipment. The noise impact analysis predicted for the duration of piling (6-8 weeks) there would be excessive noise in the nearby village area.

The excessive noise of the pile driver will require mitigations including:

- Notification to all receptors and the Contractor will prepare a schedule of operations that will be approved by the village chief. The construction schedule will identify days on which there should be no work, and hours of work for each construction activity and identify the types of equipment to be used
- Restricting the hours of operation to agreed times
- Requirements in the CEMP and contract documents that all vehicle exhaust systems and noise generating equipment be maintained in good working order and that regular equipment maintenance will be undertaken
- Noise incurred by construction workers from construction machinery is a workplace health and safety hazard. Workers will be provided with noise abatement personal protective equipment as may be required
- Complaints regarding noise will be dealt with in accordance with the community consultation plan (CCP) which includes the grievance redress mechanism (GRM)

For Tanoliu and Ulei, the possibility of temporary traffic diversions outside of the nominal road corridor was assessed as being of moderate significance for health and safety and also for potential ecological impacts at Ulei. Therefore, it was excluded from the planning for these sites.

A quality assurance audit of Contractor practices will be carried out by the DEPC biodiversity officer and/or their independent representative, in conjunction with the DSC's site monitoring, before site works affecting the current flow regime

The adoption of the "build back better" principle led to the development of environmental enhancements (in addition to the mitigations) where risk to some elements of natural habitat could be reduced, damage to the natural environment from the cyclone could be restored and/or positive ecological and socioeconomic impacts could be maximised.

An EMP was prepared. This includes the proposed design mitigation measures in locations where areas of existing natural habitat were considered to require rehabilitation and/or enhancement. The EMP also provides guidance to the Contractor for the preparation of the CEMP, with management and mitigation principles and a guide to the development of a monitoring system.

The complete environmental mitigation and monitoring matrix focused on the preparation of the CEMP for the subprojects,[1] is in Section VIII. It outlines the management and mitigation principles and provides guidance for the Contractor responsible for the preparation of a CEMP. It also provides guidance on the necessary monitoring program that will be required to ensure compliance with the EPC Act and ADB requirements during implementation of the subprojects.

[1] It is planned at this stage that all Phase II works except Tassiriki, will be a variation to the Phase I contractor. Tassiriki would be tendered out as a stand-alone tender package. If this is the case, the Phase I contractor will need to amend their CEMP (and other documents) to include these additional sites. Tassiriki will require its own CEMP under the separate contract

An integral part the EMP is the grievance redress mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP prepared for the overall project and which will extend to also cover the additional financning component.

Conclusion and recommendation

The anticipated impacts and risks will be localised and specific to the six sites along the existing road corridor. Prior to mobilisation to any site, the contractor will be inducted into their environmental management requirements and responsibilities under the Project. With the proposed design and construction mitigation measures proposed and implementation of a CEMP with site specific and routine construction mitigation measures to be prepared by the Contractor, the identified risks can be lowered to an acceptable level.

TABLE OF CONTENTS

I. INTRODUCTION

A. Background

1. Severe Tropical Cyclone Pam (TC Pam) was a category 5 cyclone that moved through Vanuatu on 13 March 2015. Passing just east of the island of Efate, the ensuing impact resulted in severe damage to infrastructure including roads, bridges, housing, telecommunications, and sewerage and water supply systems. 17,000 buildings were destroyed or damaged, livelihoods dependent on agriculture were compromised[1] and 11 fatalities were suffered.[2]

2. Large waterway flows and debris build-up caused damage to bridges, including to piers, abutments and scour protection. Road approaches to bridges, causeways and culverts collapsed or were washed away and road pavement stability was affected in a number of locations. The major damage to the transport sector was to the Efate Ring Road. This road is a 120 km sealed two-way road, providing transport services to the rural population (about 29,150 people) around the Efate Island and connects to the capital (Port Vila, with an urban population of 55,525); it is the only road link servicing the rural population of Efate.

3. This disaster caused the Vanuatu's gross domestic product (GDP) growth to contract to 0.9 per cent in 2015, down from 2.3 per cent in 2014[3]. TC Pam had a notable effect on tourism, with immediate and future bookings affected for up to 12 months.

4. On 25 August 2015, the Government of the Republic of Vanuatu (the government) requested the assistance of the Asian Development Bank (ADB) to assess the damage to roads and their structures on the island of Efate. ADB provided this assistance by scoping the Cyclone Pam Road Rehabilitation Project (the Project), confirming loan and grant funding availability and procuring a design and supervision consultant (DSC) to support the Public Works Department (PWD) of the Ministry of Infrastructure and Public Utilities (MIPU) to implement the Project.

5. The original scope of the Project, which analysed 23 subprojects, was designed and tenders issued in January 2017. Following a request from government, ADB have identified further funds for the Project. This additional financing is known as "Phase II" and is targeted at increasing the scope of works at two sites under what is now known as "Phase I". These sites are Tanoliu and Epule. Phase II will also address new works at three sites - Tassiriki, Saama, Waisisi and Ulei.

B. Objectives, Impacts and Outcome of the investment

6. The impact and outcome of the additional financing is the same as the original project. The target impact of the Project is to accelerate economic and social recovery in Vanuatu's Cyclone Pam-affected areas and contribute to Ni-Vanuatu resilience. The development objective (outcome) is to restore socioeconomic activities of people around the Efate ring road to pre-cyclone levels. This will be achieved by providing climate and disaster resilient road and bridge infrastructure by protecting and reconstructing priority assets, i.e., to "build back better" (BBB).

C. Structure of this report

7. This document is the initial environmental examination (IEE) of Phase II of the Project. It is part of the Feasibility Study Report for Phase II and identifies baseline conditions and addresses the anticipated environmental impacts of the six additional subprojects with a set of design mitigations to control environmental risk. It also provides guidance to the construction contractor in the preparation of the Construction Environmental Management Plan (CEMP) to be prepared by the Contractor to address site

[1] Widespread crop destruction occurred to 80% of Vanuatu's rural communities (Government of Vanuatu, 2015)
[2] Government of Vanuatu. 2015. *Post Disaster Needs Assessment Report*. Port Vila.
[3] http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=VU, accessed 03/08/2016

specific pre-construction and construction risks and how to deal with any concerns or issues raised during the construction phase.

8. The report contains the following sections:

> Section II – policy and legal framework, covering both Vanuatu and ADB safeguards systems

> Section III – description of subprojects, including locations and scopes of work

> Section IV – description of the physical, biological and socio-economic environment

> Section V – environmental impacts and mitigation measures. These are the anticipated impacts on the physical, biological and socio-economic environment, which could occur during the pre-construction, construction and operational phases

> Section VI – information disclosure, consultation, and participation

> Section VII – grievance redress mechanism

> Section VIII - Environmental Management Plan, including institutional arrangement and responsibilities, mitigation and management, grievance redress mechanism, monitoring and reporting, monitoring matrix

> Section IX – conclusions and recommendations

II. POLICY AND LEGAL FRAMEWORK

A. Government of Vanuatu

1. Policy background

a) Sustainable Development Goals (2015)

9. The Millennium Development Goals (MDGs) were replaced by the Sustainabile Development Goals by the United Nations in 2015. There are now 17 goals replacing the eight MDGs and the work will build on the good progress made on the MDGs by Vanuatu. One of the priority areas set out in the MDGs was to 'ensure environmental sustainability'. It aimed to integrate the principles of sustainable development into the country policies and programs and reverse the loss of environmental resources (UNDP, 2005).

10. One initiative arising from the MDGs was to build the Efate Ring Road to modern highway standards, which since construction in 2008-2010, facilitated the further economic development of Shefa Province. This Project will repair structures and pavements on the ring road following the devastating effects of TC Pam.

b) National Sustainability Development Plan 2016 to 2030

11. The Priorities and Action Agenda (PAA) 2006-2015 set out the national strategic priorities which includes 'Primary Sector Development (natural resources and the environment)'. It has now been replaced by the National Sustainability Development Plan 2016 to 2030. It takes a three pillars approach to grouping targets. Most notably, the second pillar is for the environment. Under this heading, five policy objectives are identified:

> Food and nutrition security

> Blue-Green economic growth

> Climate and disaster resilience

> Natural resource management

> Ecosystems and biodiversity

12. These high-level political commitments strengthen department level efforts to pursue positive environmental outcomes. Environmental management is the responsibility of the DEPC, although other departments including agriculture, forestry and fisheries also have some responsibilities in relation to environmental conservation.

c) Disaster Risk Reduction and Disaster Management National Action Plan 2006-2016

13. The Disaster Risk Reduction and Disaster Management National Action Plan 2006-2016, prepared by the Pacific Islands Applied Geoscience Commission in partnership with the Government of Vanuatu and The Pacific Disaster Risk Management Partnership Network, details 11 guiding principles for disaster risk management. These include that it is a sustainable development issue and that it requires a strong governance framework with clear policies and legislation. The plan is structured around eight main themes:

> Governance and policy context

> Mainstreaming disaster risk reduction and disaster management in national planning and budgetary processes

> Mainstreaming disaster risk reduction

> Strengthening disaster management

> Information, information system and knowledge management

> Capacity building

> Monitoring, evaluation and reporting

> Implementation of the National Action Plan

14. Each theme has an associated set of actions, expected results, identification of a responsible agency or agencies, indicators, and completion dates.

15. Climate change and disaster risk reduction using build back better policies is a key component of planning for this Project.

d) Vanuatu National Environment Policy and Implementation Plan 2016-2030

16. On 31 March 2017, DEPC launched the Vanuatu National Environment Policy and Implementation Plan 2016-2030 (NEPIP). It is a further illustraton of the government's commitment to environmental sustainability both under the legislation and the National Sustainability Development Plan. The policy aims to strengthen the linkages and co-ordination between the various sector policies, government and private sector bodies operating in the environment. It aims to promote environmentally sound and safe management and conservation of the natural resources and environment of Vanuatu" (NEPIP, 2017:3)

2. Legislation

a) The Environmental Management and Conservation Act No. 12 as amended by The Environmental Protection and Conservation (Amendment) Act No. 28

17. The Environmental Protection and Conservation Act 2002 (EPC Act) is the umbrella environmental legislation in Vanuatu. The EPC Act is administered by the department of Environmental Protection and Conservation (DEPC) and focuses on four main areas:

> Administration

> Environmental impact assessments

> Biodiversity

> Bio-prospecting laws and community conservation areas (CCAs)

18. The Amendment Act makes a number of important changes directly relevant to climate change:

> Includes a definition of climate change

> Adds the concept of ecosystem services and processes to the Act

> Applies the precautionary principle to any decision made regarding the environment that may risk human health or threaten damage to the environment

> Specifies that any decision made under the terms of the Act must be guided by consideration of climate change adaptation and mitigation issues

19. Further amendments include enforcement provisions, environmental impact assessment procedures, bio-prospecting processes, and details of what constitutes an offence.

20. The Act states that all projects, proposals or development activities that: (a) cause or are likely to cause significant environmental, social and/or custom impacts; or (b) cause impacts relating to the matters listed in subsection (2); are subject to an EIA. Subsection 2 lists projects that:

a) affect coastal dynamics or result in coastal erosion;

b) result in the pollution of water resources;

c) affect any protected, rare, threatened or endangered species, its habitat or nesting grounds;

d) result in the contamination of land;

e) endanger public health;

f) affect important custom resources;

g) affect protected or proposed protected areas;

h) affect air quality;

i) result in the unsustainable use of renewable resources;

j) result in the introduction of foreign organisms and species;

k) result in any other activity prescribed by regulation.

21. The Project is not likely to cause significant environmental, social and/or custom impacts. While it does have the potential to result in pollution of water resources, the mitigation and management measures that are being required will ensure that no water pollution is generated as part of the works. Further, the Project will have a positive effect on reducing or reversing coastal erosion by stabilisation or embankment construction for some subprojects. It does not trigger any of the other matters listed in Subsection 2.

22. Under the Act, proponents of these activities must make an application for environmental permit. The application is on the prescribed form and includes additional information as required (by way of this IEE) for the Project and each application will require a PEA, to be conducted by DEPC. The DEPC determines whether further assessment is required, and/or recommend that an environmental permit (with or without conditions) be issued for the activity.

b) Foreshore Development Act [Cap 90] and the Foreshore Development (Amendment) Act 2013

23. The Foreshore Development Act concerns the protection and development of the foreshore. The foreshore is defined as the land below the mean high water mark and the bed of the sea within the territorial waters of Vanuatu (including the ports and harbours thereof); and including land below mean high water mark in any lagoon having direct access to the open sea. The Act states that no person shall undertake, or cause or permit to be undertaken, any development on the foreshore of the coast of any island in Vanuatu without having first obtained the written consent to such development of the Minister responsible for town and country planning.

24. The Foreshore Development (Amendment) Act 2013 amends the Foreshore Development Act with respect to:

> Consent of Minister required for foreshore development

> Powers of an enforcement officer (defined by this Act)

> Registration of existing developments

> Offences

> Minister’s power to make Regulations

25. The Schedule to the principal Act is repealed.

26. The subprojects are on the Efate ring road (Efate’s coastal road) and some structures are located in the inter-tidal zone. As a result, there are four subprojects which may require a Foreshore Development Permit (FDP). Presently, due to the small scale and short duration of construction, and the low risks associated with the impacts of the Project on the environment, a waiver for this permit is being requested from the Minister of Internal Affairs for the four sites considered to be affected by this legislation. However, landowner consent is being sought as part of the memorandum of understanding process, and permit applications prepared.

c) The Fisheries Act No. 10 of 2014

27. An Act to repeal the Fisheries Act [CAP 315] and to make provision for the management, development and regulation of fisheries within Vanuatu waters, and for the control of fishing vessels entitled to fly the flag of Vanuatu outside of Vanuatu waters in a manner consistent with Vanuatu’s international obligations, and for related matters.

28. Some of the subprojects are located near the coast and all watercourses associated with the Project, drain into the seas. It, therefore, has the ability to impact on fisheries. The minimal works associated with the Project, coupled with stringent mitigation and management measures will ensure however that the Project does not have a negative impact on fisheries in Vanuatu.

d) The Forestry Act [Cap 276]

29. The Forestry Act (No. 26 of 2001) was developed following a review of the previous Forestry Act (Cap 147 of 1981). The accompanying regulations were developed in 2002 and the Act was subsequently gazetted in 2003. The Forestry Act provides for the protection, development and sustainable management of forests and for the regulation of the forestry sector in Vanuatu and covers:

- Forestry sector planning
- Requirements for commercial forestry operations
- Protection of the forest environment
- Reforestation
- Timber export

30. The Project does not include any subprojects located within forest environments.

e) Water Resources Management Act 9 of 2002

31. The Water Resources Management Act allows for the designation of policies to protect water resources; and provides for water conservation zones to be established. Section 7 of the Act states that 'a person must apply to the Director for the right to construct, operate or maintain works for any purpose that does not comply with Section 4 or 5, including:

a) any work in or adjacent to any water or any bore; or

b) any work whose purpose is to supply water to any other person.'

32. The majority of subprojects are located across watercourses. As such, this Act applies to the Project and an application to the Director will be made prior to works commencing.

B. ADB Safeguard Policy Statement

33. Safeguard policies are generally understood to be operational policies that seek to avoid, minimise, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. ADB's safeguard policy framework – Safeguard Policy Statement, 2009 (SPS) – consists of three policies on the environment, indigenous peoples, and involuntary resettlement.

1. Environmental safeguards

34. ADB's environmental safeguards aim to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the Project decision-making process. The SPS requires borrowers to identify Project impacts and assess their significance; examine alternatives; and prepare, implement, and monitor environmental management plans. The SPS requires borrowers to consult people likely to be affected by the Project and disclose relevant information in a timely manner and in a form and in languages understandable to those being consulted.

35. Proposed projects are screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts.

36. Projects are classified into the following four categories:

- **Category A** – A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or

facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required

- **Category B** – The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required
- **Category C** – A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed
- **Category FI** – A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities have minimal or no environmental impacts or risks

37. The Project was classified on a preliminary basis as a Category B project for environment[2] and this IEE forms part of satisfying the requirements of the SPS. An IEE describes the environmental condition of a project, including potential impacts, the formulation of mitigation measures, and the preparation of institutional requirements and environmental monitoring for the Project.

2. Environmental Assessment and Review Framework

38. An Environmental Assessment and Review Framework (EARF) was prepared for the Project in 2015. This document is required for projects where the types of activities to be undertaken and types of subprojects to be implemented are known in general terms but only a small number of subprojects might be identified during project appraisal. The framework sets out the processes to be followed for the Project as a whole and for individual subprojects as and when they are identified. The framework covers the types of subprojects to be implemented (in terms of identifying generic impacts and mitigations) and clearly identifies the process to be followed (from screening through to monitoring) and the implementation arrangements (procedures, roles, responsibilities, and budget). The process identified in the EARF was followed for the two IEEs prepared for the original project and for this IEE covering the six sites covered by the additional financing.

[2] ADB, 2015, Environmental Assessment and Review Framework, Para, 90

III. DESCRIPTION OF THE SUBPROJECTS

A. Project components and location

1. Purpose

39. The target impact of the Project is to accelerate economic and social recovery in Vanuatu's Cyclone Pam-affected areas[5] and contribute to Ni-Vanuatu resilience. The development objective (outcome) is to restore socioeconomic activities of people around the Efate ring road to pre-cyclone levels.[6] This will be achieved by providing climate and disaster resilient road and bridge infrastructure by protecting and reconstructing priority assets by adopting BBB approach to design and location of priority infrastructure. .

2. Rationale

40. When TC Pam damaged pavements and structures on the Efate Ring Road, many communities were isolated for days and weeks. This prevented critical supplies and services from being able to reach the villages, and disrupted economic activities for many months. Therefore, the rationale for the Project is that by improving the connectivity security of the Efate Ring Road, economic and social endeavours can be pursued with greater confidence, leading to economic growth and development.

41. The subprojects were evaluated and prioritised according to criteria including TC Pam damage, criticality to road network, structure longevity, population served and traffic growth forecasts. Several options were considered at each site, and these were assessed in conjunction with the priority of each site. Complementary benefits, such as social facility improvements, environmental protection, climate change adaptation and road safety were integrated. Extensive consultation was carried out to ensure that adverse unintended consequences will not be imposed during construction and operation.

3. Subproject locations

42. There are six subprojects in Phase II of the Project. The locations of each are shown in **Figure 3-1**.

43. Site measurements and observations were made during site visits to determine the form and condition of the existing roads and structures. No as-built drawings or geotechnical information for the structures is available. Thus, the observations, measurements and knowledge of current and former staff and contractors was essential to forming a picture of the current conditions, age of the structures, likely remaining service life and maintenance requirements.

44. The ring road pavements around Efate are in generally good condition. There are some areas near the coast, however, where the storm surge has damaged the pavement.

45. The crossings are in various states of disrepair due to TC Pam and subsequent storms and use. Damage ranges from destruction of guardrails to distorted steel deck panels and degraded pavement. The current condition of each subproject and relevant photos are discussed in the sections below.

[5] PAM, Para. 2
[6] ibid

Figure 3-1 Subproject locations

4. Waisisi Culvert

The design involves:

- Installation of seven (7) 900 mm diameter pipes
- Concrete pavement causeway
- Downstream scour protection to the outlet
- Inlet scour protection
- Lining of road side drains

There is currently some emergency works underway at this site, follow TC Cook and TC Donna in April and May 2017. A gravel side road and temporary drainage is installed and a 1.5 m wide x 0.75 m high precast

concrete box culvert is under construction. It is intended to allow this new culvert to remain in place during construction of the proposed works at this site.

5. Ulei Bridge

46. Ulei Bridge is a 6.08 m single span, single lane steel beam structure with a timber deck with a clear distance of 3.32m between concrete abutments. The crossing is located about 10 m from the coastline on a relatively straight valley reach with dense vegetation lining the banks on the upstream side.

47. The stream is fed by a freshwater spring located about 60 m upstream. The stream is reported to have a continuous flow and supports various species of aquatic life.

6. Tanoliu Culvert

48. Tanoliu Bridge is located in the village of Tanoliu, adjacent to the coastline. It is a single-span, single lane bridge comprising two (2) steel girders supporting a 140mm thick timber deck and having an overall length of 8.4 m. The ends of the beams are cast into the concrete wall abutments. “T” section cross braces are provided at the mid-span and quarter span locations and equal angle cross-bracing is provided in the end bays adjacent to the abutments. The bridge has no footway or traffic barriers but continuous timber kerbs are provided along both edges of the bridge; the clear width between kerbs is 3.3m. Guardrails are provided at all four corners of the bridge. There are no utilities on the bridge however there are overhead power lines that pass about 3m horizontally away from the upstream edge of the bridge.

49. The Vanuatu Impact Assessment Report prepared in April 2015 stated “There was no impact on the bridge and its approaches due to Cyclone Pam.”

7. Saama Culvert

50. The existing Saama culvert is a 600 mm diameter reinforced concrete pipe culvert, which is located at a small localised low point on the ring road in north Efate. The upstream catchment is approximately 2.3 ha, and drains a heavily vegetated area with slopes in the order of 5-10%. The capacity of the culvert, and of the inlet drain flowing to that culvert, is limited due to the dense vegetation in this area.

8. Epule Bridge

51. Epule Bridge is a single-lane, single span “Standard” Bailey bridge comprising eleven (11) standard bays of 10 feet each giving it an overall length of 33.52 8m (110 feet). The bridge has a TSR3 configuration (Triple Single Reinforced), two (2) transoms per bay, timber deck and has a clear width between panels of 3.3 m. No footway is provided on the bridge. It is understood that the bridge was erected in 2010 as part of the works for the construction of the Efate Ring Road when concern was expressed over the ability of the original bridge to carry heavy construction traffic loads. As a result, the Bailey bridge was built above the original bridge.

52. Local villagers report that the bridge was overtopped by floodwaters to a depth of about 1 m following TC Pam but receded after approximately one hour. The local villagers further report that the bridge is overtopped about twice a year.

53. It is noted that the original bridge subsequently collapsed in 2015 as a consequence of TC Pam and the partial remains of the centre pier and sections of steel beam are still visible above the waterline at the northern end.

Plate 3-1 Epule bridge

9. Tassiriki Road and drainage improvements

54. One of the major subprojects of the Phase II works is the Tassiriki Road upgrade (RD04). This proposed improvement starts at the roundabout adjacent to the University of South Pacific (USP) and ends at the second Japanese (JICA) Monument on the Efate Ring Road. The subproject consists of two sections:

> Section 1 – Road Improvement – Approximate length of 2.7km

> Section 2 – Reseal of Existing Road – Approximate length of 3.3km

Figure 3-2 Tassiriki Road – Section 1

B. Project scope

55. The preferred options at each site form the Project scope for Phase II. These are summarised here and described in more detail in following sections:

> New single-span, two-lane steel truss bridges at Epule to replace existing bridge

> New two-lane width box culverts at Tanoliu and Ulei to replace existing short span bridges

> Major road upgrade including pavement reconstruction, drainage, footpaths at Tassiriki

> Drainage and scour protection to Saama and Waisisi

56. All concept designs are included in Appendix A – Engineering Report, of the main feasibility study report.

1. Tanoliu Bridge (BR03)

57. Tanoliu was included in Phase II to review and increase the Phase I scope of works. Phase I scope was to replace the existing bridge with reinforced concrete planks, one lane wide, with a footway and coastal protection.

58. Options investigated for Phase II were a triple cell reinforced box culvert option or a new single-span, two-lane concrete bridge with footway and coastal protection.

59. The box culvert option was considered to effectively address the site requirements, at a lower capital and maintenance cost and therefore was selected by PWD.

2. Epule Bridge (BR04)

60. Epule Bridge was ranked as priority site No.20, during Phase I, due to low traffic volumes, and the limited damage sustained in TC Pam. However, given its criticality to ring road connectivity and its age and condition, PWD requested that a new bridge be provided.

61. The options for a new bridge at Epule focussed primarily on an improved road alignment. Different structure types were considered (refer Appendix B of the feasibility study report), and an Eastbridge type through truss was determined. The bridge will be a 48 m lone, two-lane structure on a 25-degree skew to the river.

62. Each alternative alignment option involves some land use outside of the existing corridor. The option agreed achieved an improvement in design speed, but minimised the land area required to be leased for use.

3. Tassiriki Road upgrade (RD04)

63. This road upgrade starts at the roundabout adjacent to the University of South Pacific (USP) and ends at the second Japanese (JICA) Monument on the Efate Ring Road. The subproject consists of two sections:

> Section 1 – road improvement – approximate length of 2.7km

> Section 2 – reseal of existing road – approximate length of 3.3km

64. The major upgrade is for Section 1 and involves drainage, pavement works, footpath and intersection improvements. Other aspects that will be included if possible are landscaping/parkland, pedestrian facilities, bus bays, street trees and integration with Korman informal markets. Section 2 design is for a reseal and minor drainage improvements to the shoulders.

4. Ulei Bridge (BR08)

65. Options investigated for Ulei bridge were a single cell reinforced box culvert option or a new single-span, two-lane concrete bridge with footway and coastal protection.

66. The box culvert option was considered to effectively address the site requirements, at a lower capital and maintenance cost and therefore was selected by PWD.

67. It should be noted that a culvert to the south of Ulei bridge services a much larger catchment, is well undersized for the task, and is known to overtop in moderate rainfall events. PWD should consider improvements to this site.

5. Saama culvert (CT11)

68. Options investigated for Saama were to simply line the inlet channel to the existing single cell pipe culvert, or to replace the culvert with larger pipes. The increased pipe culvert option was considered to effectively address the site requirements, at a low capital and maintenance cost and therefore was

selected by PWD. A single 1200 mm diameter pipe will be installed to replace the existing and road side drains will be concrete lined.

6. Waisisi culvert (CT12)

69. Based on the limited information available to date, the proposed preliminary design is for the augmentation of the single cell box culvert (under construction), with seven (7) 900 mm pipe culverts. A concrete pavement will act as a causeway in events approaching a 1:2 year ARI event (including the effects of climate change), where the road would be overtopped by up to 100 mm of flow. As the proposed pipes have a large diameter, the likelihood of blockage is limited, and the concrete pavement is robust against damage in the case where the flow overtops the road.

70. The road level is raised by up to 300 mm at the culvert location, requiring pavement reconstruction for a length of approximately 140 m.

C. Construction staging

71. Tender packaging and construction staging of the works has not yet been confirmed. It is planned at this stage that all Phase II works will be tendered out as a stand-alone tender package. If this is the case, the works will will require its own CEMP under the separate contract.

D. Construction activities

1. Equipment and workforce

72. All sites will require site establishment facilities, road construction equipment (rollers, gravel delivery trucks, water cart, bitumen sealing trucks) and guardrail installation.

At Epule, where bridgeworks and river channelling are proposed, specific equipment and workforce requirements are estimated to be:

> Pile driving rig

> Excavation equipment (track mounted excavators, up to 35 t)

> Mobile crane

> Concrete delivery, pumping and formwork

> The workforce is expected to peak at 40-50 workers

At Waisisi, Tanoliu and Ulei, specific equipment and workforce requirements are estimated to be:

> Excavation equipment (track mounted excavators, up to 35 t)

> Concrete delivery, pumping and formwork

> The workforce at each site is expected to peak at 20 workers

2. Temporary storage areas

73. Temporary laydown areas will be established nearby to each location of major works; specifically, where new bridges and culverts will be constructed. These areas would be clearly identified in the site-specific CEMP to be prepared by the Contractor. Subprojects where minor works such as repair of guardrails are required, will not need a temporary storage area.

3. Source materials

74. Fill and road base and concrete aggregate materials will be required at some subproject sites. The source (quarry) to be used will be decided by the construction Contractor, based on the required fill characteristics and the economics of transport.

75. To operate a quarry, the owner or operator must hold a permit under the Quarry Act, issued by the Department of Geology, Mines, and Water Resources. It will be the Contractor's decision as to whether

they will select to open their own quarry and submit the relevant permit application, or obtain materials from quarries with existing, valid permits. For the purposes of this assessment, it was assumed that all quarries to be used will be owned and operated by the private sector and all have operating permits in place.

76. Water will be required for construction activities including drilling, road pavement construction, concrete curing, dust suppression, washing, amenities and ablutions. The Contractor will determine their need for water and the source. If water is required to be used from the waterways, an application to the Department of Geology, Mines, and Water Resources is required under the Water Resources Management Act. A water extraction permit may be granted, defining the conditions of the protection, management and use of water including stormwater and wastewater.

77. Due to the small quantities of concrete required for construction, and the possibility of pre-casting several elements, concrete batching is expected to take place off-site in a commercial batching plant and/or pre-casting yard. If an on-site concrete batching plant is required, this will need to be addressed in the CEMP.

E. Operation and maintenance

78. There are operation and maintenance requirements for bridges, culverts and paved road.

79. Bridge maintenance is determined by the type of bridge being built. Pre-engineered truss type bridges, such as those proposed for Mele and Marona, have maintenance inspection requirements due to the number of components and connections and the risk of vehicle collision damage to the ends of the bridge. To reduce the risk of the latter, guardrails are provided to the bridge approaches and a traffic barrier will be installed on the inside of the truss, to protect the structural members from direct damage.

80. Sedimentation and blockage by debris of open drains, culverts and under bridges is an ongoing routine maintenance requirement. Based on the observation of the existing culverts with relatively low flows such as Creek Ai and Morona, there is an understanding that such routine maintenance programs have not included such works. The proposed design mitigates this by the rebuilding of culverts with significantly larger cross-sectional area, to reduce blockage risk from debris and slow flow. The minimum low-flow allowances will also enhance fish and crustacean passage.

F. Analysis of priority and options

81. Environmental factors were included in the analysis of options by comparing each subproject. Given the disparate rationale for the inclusion of the six subprojects in Phase II, comparison against each other was not meaningful.

82. Instead, options for each subproject were developed collaboratively within the DSC, drawing on the views and information gathered from PWD, agencies, site observations, historical data and experience and community views and concerns. These were presented at the Options Workshop on 23 March 2017 for comment and discussion. After the workshop, comments were considered, combined with additional information gathered, and the options were revised to produce alternatives that were subject to economic analysis, social and environmental screening, engineering feasibility and climate change considerations for this feasibility study.

83. A preferred option was recommended at each site in the draft feasibility study. This will be reviewed by PWD and ADB.

G. Build back better

84. Each option presented for consideration in the feasibility study contains elements to build the infrastructure back better than it was before TC Pam. Known as BBB, the concept is to not only restore

roads and their drainage, formations and structures to their former levels of functionality, but to include features that increase the future resilience of critical assets. The underlying intention is that when a similar natural disaster strikes Efate, these structures will not fail in the same ways that caused losses and economic disruption in the aftermath of TC Pam.

85. The success of BBB relies on the conduct of routine and periodic maintenance. This requires commitment from government for planning and budgeting and from MIPU in particular to implement regular inspections of assets and perform the works recommended by such inspections.

86. The prioritisation of sites and matching of appropriate scopes to these sites will ultimately determine the strength of BBB that can be applied to a particular site.

87. The BBB principles adopted for this Project include:

> Climate change design parameters
> Resilience to future disasters
> Road and pedestrian safety
> Permits
> Environmental restoration
> Community engagement

IV. DESCRIPTION OF THE ENVIRONMENT

88. The “environment” includes the road corridor at each subproject location and adjacent laydown areas with some possible road diversions on the Efate ring road. There are five locations on the coast in predominananly rural area and the other – Tassiriki – is in the urban area of Port Vila.

A. Physical resources

1. Climate

89. Vanuatu experiences two main seasons; the cold and dry season from May to October and the hot and wet season from November to April (Republic of Vanuatu, 2014).

90. Temperatures do not vary greatly throughout the year, given its geographical position near the equator. Air temperatures in Port Vila,[3] in the south west of Efate, vary between an average of 23°C in August and 27°C in February. Monthly maximum, mean and minimum temperatures from 1992 to 2016 are illustrated in **Figure 4-1**. Temperatures are not collected on other areas of the island (Republic of Vanuatu, 2014).

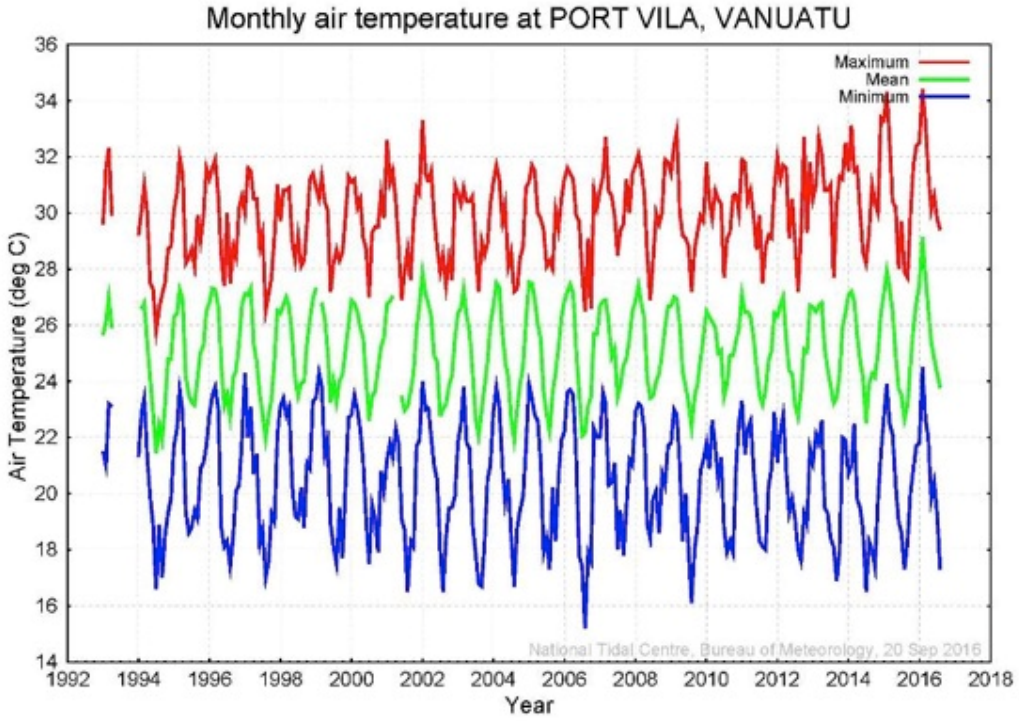
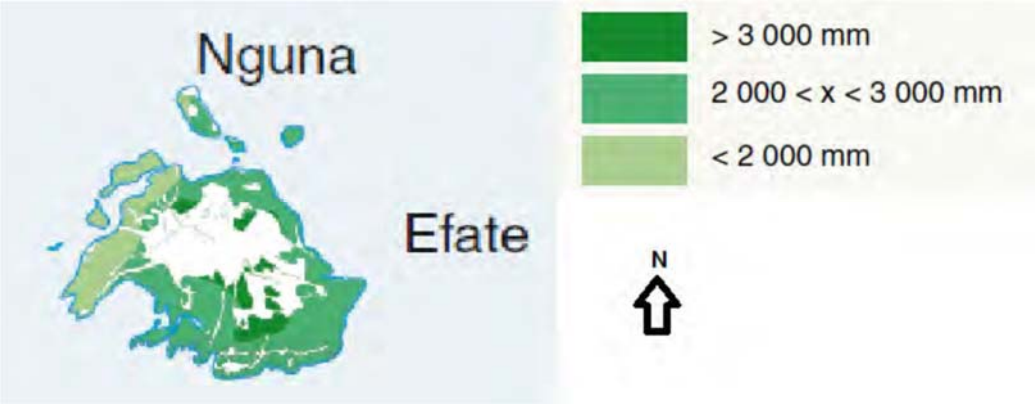


Figure 4-1 Monthly air temperatures in Port Vila

91. Rainfall distribution patterns across Vanuatu is determined by seasonal wind flow, topographic features (i.e. rain shadow effects) and the South Pacific Convergence Zone (SPCZ). During the wet (hot) season, rainfall is higher on the south east, the windward side. On Efate, annual rainfall ranges from 2400-3000 mm on the east and is almost half that amount on the leeward/west side. The wettest month in Vanuatu is usually March and the driest month is August (Government of Vanuatu, 2014).

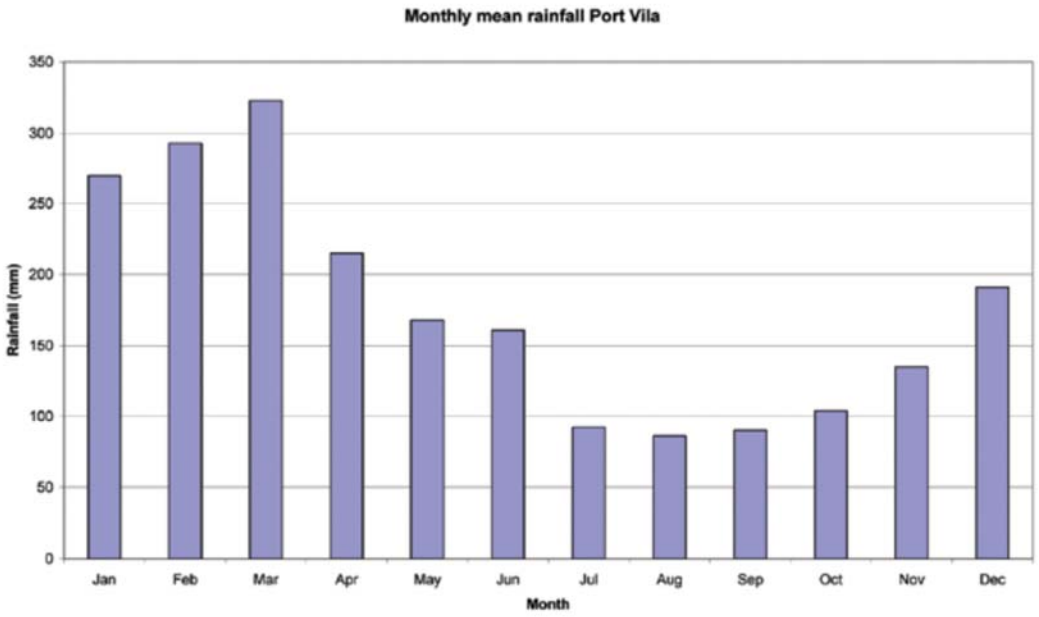
[3] Official temperature records are not available for any other location on Efate. Variations in microclimate temperature could be expected, but stable across this area.



Source: Simeoni and Lebot, 2012

Figure 4-2 Rainfall pattern

92. Mean rainfall in Port Vila, in the south west of the island) is presented in **Figure 4-3**. The wettest month in Vanuatu is usually March and the driest month is August.



Source: Vanuatu Meteo, 2016

Figure 4-3 Mean rainfall, Port Vila

93. Cyclone season in Vanuatu is between November and April, when it receives 2-3 cyclones a season on average. The greatest frequency is in January and February. Historically, during the course of ten years, Vanuatu is hit by three to five destructive cyclones.

2. Geology and soils

94. Vanuatu is composed of 83 volcanic islands formed during the Miocence Era. The Project is located on Efate, a volcanic and raised coral island in the Shefa province of Vanuatu. The geology is composed of volcanic deposits, estimated to be less than 3 million years old. The island has manganese, limestone, pozzolana and possibly gold deposits (Republic of Vanuatu, 2014).

95. The geology of Efate, as described by Ash *et al*, (1978), comprises three major rock formations:

> Efate Pumice Formation – a Pliocene-Pleistocene series of submarine pumice tuff and breccias occurring the central part of the island

> Pleistocene Basalt Volcanic Formation –this cannot be demonstrated in the field because of poor exposure

> Late Pleistocene to Recent Reef Limestone Formation – an extensive series of limestone terraces overlaying the two older volcanic formations. It has an extensive outcrop totalling nearly 500 km^2 on Efate and near-shore islands (Ash et al. 1978)

96. Alluvial soil areas are limited across the island with the largest area on the floodplain to the south east of the island with two larger rivers – the La Colle (Prima) and the Mele waterway. In relative terms erosion rates have been found to be low compared to other Pacific countries (Dumas P,M Fossey, 2009). Epule Bridge is also located in a pocket of alluvium. Tanolui, Ulei and Saama have underlying young limestone reef geology with Tanoliu and Ulei also having tidal flows with estuarine sands.

97. Tassiriki has underlying young reef limestone over a large pocket of alluvium which includes the Erakor lagoon system.

3. Hydrology and surface water quality

98. Accessible fresh water is an important resource in Vanuatu and is used for the following purposes:

> Household use, including washing; often done at source

> Traditional taro irrigation/cultivation

> Small scale aqua-culturing of introduced fish, *Tilapia naloticus* and freshwater prawn, *Macrobrachium lar*

> Drinking water for domesticated animals

99. In the capital, Port Vila, aquifers are the main source of water, and the urban water supply is distributed by UNELCO. These aquifers are under increasing pressure from housing, agriculture, tourism and land development. Outside of the areas of the reticulated supply, no formal assessment has been made on the available water resources (SPC, 2012).

100. From visual observation water quality at the five predominantly rural area sites involving crossings is very good and there are no consistent records of water quality collected by the Dept. of Mines, Geology and Water Resources at any of these sites.

101. There is some consistent but dated water quality data available for the Erakor lagoon system which is located downstream in the Tassiriki Road & Drainage sub- project drainage catchment in Port Vila. The Erakor lagoon system is considered as being both a Nationa level tourist asset as well as having local ecological significance.

102. The general layout of the Erakor Lagoon system is shown in **Figure 4-4**. There are two lagoons, Ekasuvat, a 178 hectare, 10.7 m deep lagoon that has an entrance to the ocean at the southern end, and a second outlet that leads to Emten Lagoon, a 219 hectare, 6.4 m deep lagoon. There are no significant fresh water river tributaries to the lagoons and the watersheds to each are rather small, 327.5 hectares and 1,542.5 hectares respectively.

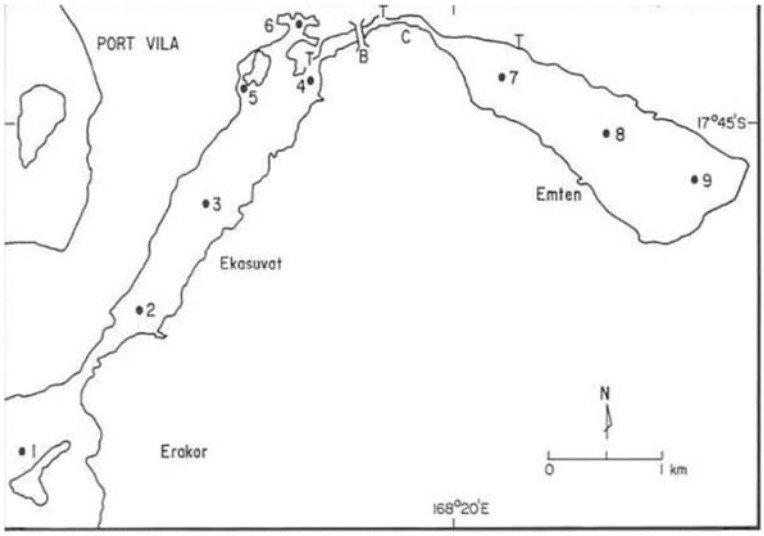


Figure 4-4 Water quality monitoring sites in the Erakor lagoon system

103. Tourist developments line the banks most sections of the lower lagoon and private residentiial development has ocurred in the fringinging areas on the northern and eastern section of the connecting tidal channel and upper lagooon. The southern shoreline of the lagoons has much less development with mangrove systems apparent on the lower lagoon with increasing density towards the outlet to the sea. Normal physcial and biological water quality parameters including turbidiity measured as transparency has been monitored for in 1983,1985,1986 and 1990. (Carter, 1983)

104. A 1990 water quality review concluded that overall water quality had been deteriorating but the main pollution source was reported as septic tank seepage leading to high phosphate levels in the water column, but confined to areas in the more confined smaller coves at the northern end of the lower lagoon.

105. Even though there was a significant buildup in these phosphate levels it had not significantly affected tranparency:

> *"…During the survey the total freshwater discharge from lower Erakor Lagoon appeared to be on the order of 100,000 m^3/tide with 60 percent coming from the higher Emten Lagoon. The domestic water supplied to the Erakor watershed is approximately 660 m^3 per day. Assuming 50 percent appears in septic tank seepage or 330 m^3 per day would leach into the lagoons. This amount is not significant, except for nutrients that it contributes.*
>
> *The transparency of the water and the plankton concentration indicate a high nutrient level in the lagoon water. When the transparency is reduced to less than one meter depth due to plankton then serious odour problems can be expected. However there does not appear to be a significant change in transparency between the 1980 and 1983 surveys in either of the lagoons to match what appears to be a trend in the dissolved oxygen concentration. "…… (Carter,1990)*

Station #	Secchi Disk Transparency (metres) 13 July 1983	23 July 1986	21 August 1990
2	6.10	5.5	4.50
3	5.18	5.5	3.20
4	2.90	3.5	1.68
5	2.29	2.5	2.74
6	1.52	2.5	1.52
7	3.51	5.5	2.44
8	3.72	4.5	2.13
9	2.44	3.25	2.44

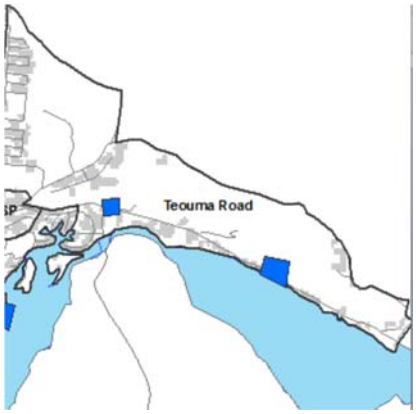
Source : Carter (1990)

106. The transparency of the water and the plankton concentration indicate a high nutrient level in the lagoon water. When the transparency is reduced to less than one-metre depth due to plankton, then

serious odour problems can be expected. However, there does not appear to be a significant change in transparency between the 1980 and 1983 surveys in either of the lagoons to match what appears to be a trend in the dissolved oxygen concentration.

107. Significantly from the persrpective of drainage engineering, it was also noted in the surveys that there were no significant surface water discharges (such as urban drainage) into either lagoons. Based on the limited visual observation of the northern side of the connecting tidal channel this sitaution has not changed.

108. The recent UN Habitat Report on Climate Change Vulnerability (Treadle, 2015) listed two areas of flash flooding identified during community consultations which are both found in the drainage catchment of the Tassiriki drainage catchment area. No information was reported on the length of time that flooding remained and any transport access was restricted (see **Figure 4-5**).



Source: Treadle (2015)

Figure 4-5 Location of flash-flooding "hotspots "

a) Surface water

Efate has a number of surface water sources, including creeks, rivers and lakes. With the exception of Tassiriki, each subproject is located at a waterway crossing on the Efate ring road. These are:

> La Colle River
> Tanoliu tidal stream
> Ulei tidal stream
> Saama intermittent freshwater
> Epule River

b) Groundwater

109. Anecdotal evidence suggests that groundwater resources in some parts of Vanuatu such as around Port Vila are diminishing. Anecdotal evidence and sporadic water quality testing also indicate "hotspots" for water pollution. Infrequent testing programmes and poorly maintained records mean creating a comprehensive water resource picture is difficult (SOPAC, 2007).

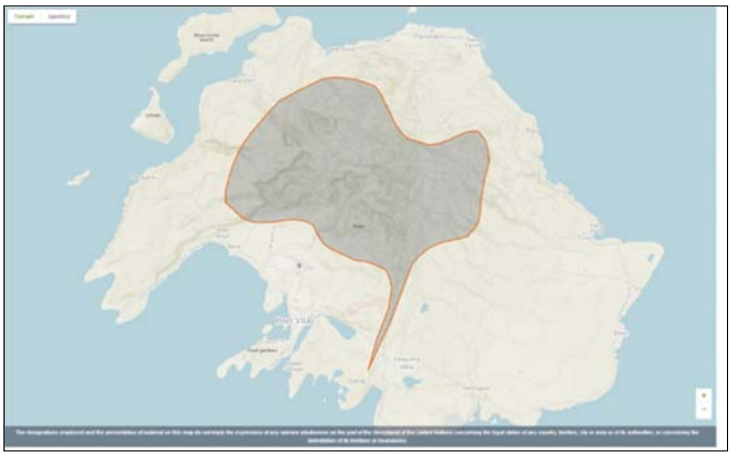
c) Biological resources

110. Mangrove ecosystems only cover 0.2% of the total land area of Vanuatu, primarily on Malekula Island (~2,000 ha). Other sizable stands occur in another eight (8) of the 80 islands. On Efate, mangroves only cover 10 ha (0.1%) of the island. They have been previously cleared for various developments as well as being felled for firewood and building materials.

111. This is evident at Havannah Bay, where anecdotal evidence suggests that mangroves have been removed for coastal development. The historical mangrove coverage is currently under further investigation.

4. Sensitive areas

112. There are 34 protected areas in Vanuatu, covering 538 km^2 (4% of total land area). Only one is located on Efate – Central Efate forest conservation area (Teouma) in the centre of the island (see **Figure 4-6**). None of the subproject sites are within or adjacent to this area.



Source: Protected Planet, 2016

Figure 4-6 Central Efate forest conservation area

113. Vanuatu has eight existing wetland sites (2009 Wetland Inventory), two of which are on Efate Island (Duck Lake (Emaotul) and Emaotfer Swamp, east of Port Vila) (Government of Vanuatu, 2014).

114. The Vanuatu National Biodiversity Strategy Action Plan (Environment Unit, 1999) lists places and habitats of conservation significance in three categories – Important places, Places that are damaged due to human impact and Vulnerable places. The areas relevant to these categories and their relevance to the subprojects are described below.

5. Important places

Bat caves in Efate

115. There has not been any specific study conducted on bats of Vanuatu and as such, their important roosting areas are not well defined. This is reflected for Efate, when during the National Biodiversity Strategy and Action Plan (NBSAP) consultations, the only areas noted for bats was around Devils Point on northwest Efate, Teouma in South Efate, Siviri in north Efate and Forari. Large scale land clearing for cattle grazing in particular and coconut plantations are causes for the decline of the species, but so too is the degradation of habitats. Without proper management these mammals could further decline, or become extinct. The areas where the bats are said to be located are not relevant to the project areas.

Mangroves on Efate

116. Mangroves on Efate are generally found in small clumps at estuary mouths. The exception to this is a large area found on the Erakor Lagoons (Emten and Eksauvat) and Eratap Lagoon. The other large area is on Moso Island. As Mangroves play an important role in the supply of food and materials for the communities concerned and as nursery shelter for numerous terrestrial and marine wildlife species, the mangrove areas are recognized as important places for where they are located.

117. While the mangrove areas of Efate are recognized as important places, none of the areas have neither a resource management plan nor have been designated Marine Protected Area (MPA) either by the government or by the communities concerned.

118. During consultations on the National Biodiversity Strategy (1999), participants from around Efate expressed the importance of protecting mangroves but there has been no evidence of continued practical support from the communities concerned. This has resulted in mangrove areas like Erakor Lagoons and Eratap Lagoon being destroyed for tourism development and reclamation for private residential developments.

119. No mangroves will be removed or damaged as a result of the works. The presence of the mangroves in the Erakor Lagoon system is to be noted in the mitigations required on discharge to the lagoon during construction or operational phases of the Tassiriki road upgrade subproject.

Rivers of Efate

120. The only freshwater survey conducted in Efate was at Creek Ai by the DEPC. There have been other studies conducted by the Department of Geology, Mines and Water Resources but these were mainly for water quality for human consumption. All the major rivers around Efate are important places as they contribute to terrestrial and freshwater wildlife as they are commonly known but there is no specific information to confirm which of the rivers are important for specific terrestrial and freshwater wildlife.

6. Places that are damaged or degraded due to human impact

Mangroves throughout Vanuatu

121. Mangroves under this category in Vanuatu are generally found in small clumps except for a large area in Malekula, with approximately 1975 hectares found in four main. Some are also found in other islands, including Efate. Damage or degradation to mangroves throughout Vanuatu have been caused by:

> Degradation of mangroves due to development practices

> Declining respect for traditional resource management systems

> Overexploitation of mangrove resources for subsistence purposes

> Clearing of mangrove forest for agriculture practices

> Coastal reclamation for commercial tourism development

> Damages to mangroves by flooding from crop production areas

> Natural disasters such as cyclones, earthquakes and sea level rise. According to past experiences, some of these cyclones were very devastating to the natural environment therefore have also contributed to the reduction in the population of many species

> Uplifting of coastal areas due to earthquakes

> Introduction of invasive species

122. There are mangroves in this category identified on Efate, mainly in Erakor and Eratap Lagoons. There is also small scattered clump of trees around Efate which have been degraded due to agricultural activities and more recently for commercial coastal developments. New development practices are also leading to the degradation of some mangrove ecosystems but more disturbing is the countrywide declining respect for traditional resource management systems and traditional authority structures.

123. No mangroves will be removed or damaged as a result of the works. The presence of the mangroves in the Erakor Lagoon system is to be noted in the mitigations required on discharge to the lagoon during construction or operational phases of the Tassiriki road upgrade subproject.

Rivers of Efate

124. All the rivers of Efate are essential for communities. Throughout Efate there are many springs, streams and rivers. However, waterways and their corresponding environments, remain and continue to be heavily utilised and modified. Many of them can dry up towards the end of the dry season especially on the drier western side of the island. Most rivers around Efate are located in areas where there are

commercial and private agricultural activities. In the south, southeast, north and northwest Efate where most of the large rivers are located (Teouma, Rentapao (south), Epule, Forari, Marona, Creek Ai and Prima), these rivers have been degraded by human activities which include logging, gardening and coconut plantations. Most river systems have secondary forests that are a result of different land use activities such as those listed. These activities have contributed to the decrease in the water level of many rivers. Couple with these activities, downstream activities by recent housing and other commercial activities continue to put pressure on the water quality of the rivers.

125. Natural disasters have also contributed to the huge sediment deposits in the main rivers of Efate. The major rivers located in the Phase II of the project sites have all been degraded to a large extent by agriculture and logging activities and also by natural disasters. The NBSAP listed Efate as one of the islands which has rivers that have been damaged and degraded due to human impacts specifically for all major rivers of the island.

126. The subprojects require work in, around and over waterways during the construction phase. The impacts of this work will be mitigated by strategies outlined in Section VIII.

7. Vulnerable places

Mangroves throughout Vanuatu

127. Mangrove communities throughout Vanuatu are important habitats. They are generally associated with a high faunal diversity of microbes, invertebrates, fish and birds. Mangrove ecosystems are renowned for providing services that are highly valued by the people. There are four sites listed as the most vulnerable mangrove communities Vanuatu, two of which are in Efate:

> Erakor Lagoons (Emten and Ekasuvat)

> Eratap Lagoon

128. While Crab Bay is a declared Marine Protected Area (MPA), Port Sandwich, Erakor and Eratap Lagoons have no resource management or MPA at present. The most threatening activities to these mangrove areas is the expansion of tourism developments, agricultural activities and coastal reclamation. Other areas are less vulnerable but they contribute significantly to the marine and terrestrial wildlife of those areas like in Maskelyn Island and Moso Island.

Rivers of Efate

129. All major rivers of Efate are vulnerable due to the increasing pressure on land for agricultural activities. And as the population increase the use of rivers as source of water and for food intensify. Threats to the rivers and the environment of the project area is the introduction of invasive species. Most of the invasive species are land based but there are also water invasive species like the Water hyacinth (*Eichhornia*) under scrutiny from the Department of Quarantine.

8. Terrestrial flora and fauna/land cover

a) Birds

130. Vanuatu has 126 recorded bird species, including 11 endemic species, 16 migrant species and 8 introduced species. One endemic species is now extinct (Republic of Vanuatu, 2014). The endemic species are presented in **Table 4-1** below (in the absence of site specific reports or observations, all assumed relevant to the subproject sites).

Table 4-1 Endemic bird species

Scientific name	Common name	Conservation status	Habitat
Ptilinopus tannensis	Tanna Fruit Dove	Least concern	Endemic to Vanuatu, it occurs on most islands. It inhabits old-growth rainforest, and also degraded habitats with large fruiting trees, including open woodland, parkland, plantations and gardens. It is

Scientific name	Common name	Conservation status	Habitat
			most common in the lowlands and hills, but is also present in mountains to at least 1500 m
Charmosyna palmarum	Green Palm Lorikeet	Vulnerable	as a fluctuating range in the Santa Cruz islands of the Solomon Islands and in Vanuatu. It appears to occupy high montane altitude forest at elevations in excess of 1,000 m, but flocks regularly descend to coastal trees, especially to feed on coconut blossoms
Aplonis zelandica rufipennis	Rusty-winged Starling	Not yet assessed	Central and North Vanuatu and Banks Group
Erythrura (cyaneovirens) regia	Royal Parrot Finch	Vulnerable	The bird is endemic to Vanuatu. It has been recorded from most islands in the archipelago but has not been observed for many years on several islands, such as Aneityum, and may be locally extinct on these. There are recent records, often of single birds, on Gaua, Espiritu Santo, Efate and Epi.

Source: Republic of Vanuatu, 2014; IUCN RedList 2016

b) Mammals

131. Vanuatu's terrestrial mammal species are represented solely by nine known bat species and two subspecies (see **Table 4-2**). One has become extinct in Vanuatu; and another is awaiting verification. There are also have nine marine mammal species (Government of Vanuatu, 2014):

- Dugong – *Dugong dugong*
- Humpback Whale – *Megaptera novaeangliae*
- Blainville's Beaked Whale – *Mesoplodon densirostris*
- Ginkgo-toothed Beaked Whale – *Mesoplodon ginkgodens*
- Hector's Beaked Whale – *Mesoplodon hectori*
- Pantropical Spotted Dolphin – *Stenella attenuata*
- Striped Dolphin – *Stenella coeruleoalba*
- Spinner Dolphin – *Stenella longirostris*
- Fraser's Dolphin – *Lagenodelphis hosei*

Table 4-2 Bats of Vanuatu

Scientific name	Common name	Status	Habitat/distribution
Fruit bats *(Pteropodidae)*			
Notopteris macdonaldi	Fijian Blossom-bat	Vulnerable	Restricted to Fiji and Vanuatu. Occurs in Efate, among other islands. Roosts in caves and forages in lowland forests and intermediate altitude vegetation.
Insectivorous bats			
Miniopterus tristis	Great Bent-winged Bat	Least Concern	A native species, known from the islands of Espiritu Santo and Efate in Vanuatu. Roosts only in caves and forages in agricultural areas and disturbed lowland forest near sea level
Miniopterus australis	Little Long-fingered Bat	Least Concern	Native to Vanuatu, this bat is found roosting in colonies in caves and tunnels, and may also be

Scientific name	Common name	Status	Habitat/distribution
			found roosting in tree holes. It forages for insects in rainforest, Meleleuca swamps and dry sclerophyll forests. Unlikely to be affected by this proposal

Source: IUCN RedList

c) Reptiles and amphibians

132. Vanuatu has 40 amphibian and reptile species, 32 of which are native, nine are endemic and four are introduced (Government of Vanuatu, 2014).

Table 4-3 Amphibians and reptiles of Vanuatu

Scientific name	Common name	Status	Habitat/distribution
Amphibia			
Litoria aurea	Green and golden bell frog	Vulnerable	This frog was introduced to Vanuatu in the 1960s and is native to Australia. It is found in Efate, Malekula and Santo islands. The natural habitat requirements of the species have proved difficult to define because it has been associated with almost every type of water body except fast-flowing streams. There also appears to be some confusion over whether or not forested habitats are utilized by the species (Hero et al 2004).
Reptilia			
Brachylophus bulabula	Banded Iguana	Endangered	Banded Iguanas are native to Fiji and were Introduced to Vanuatu by a reptile dealer in the 1960s. It is found on Efate Island. The Fiji Banded Iguana lives in both wet and dry forest, but wetter forests contain preferred plant species. Iguanas are sometimes found in marginal habitats of non-native plants, native hibiscus, and degraded forest around resorts and also along ocean margins, but always where trees are at least six meters in height (Fisher et al 2012)
Gehyra oceanica	Oceanic Gecko	Least concern	This is a nocturnal, arboreal gecko. It occurs in primary and secondary forested habitats and coastal thickets. It also occurs in edificarian habitats such as rural gardens and urban areas and many populations are commensal with humans (Fisher et al 2015). IT is known to occur on Efate Island.
HeMIPU DPWactylus frenatus	Common House Gecko	Least concern	This gecko was introduced to Vanuatu. It is a nocturnal species which is found on boulders, beneath rocks or rotting logs, on trees, and, most commonly on buildings. This species is found in both villages and large urban areas; it is usually found close to electric lights at dusk. In addition, this species also occurs in a diverse range of habitats, including rain forests, savannahs, and deserts (Ota and Whitaker 2010). This species is found on Efate Island.
Lepidodactylus vanuatuensis	Vanuatu Gecko	Least concern	Endemic to Vanuatu, this gecko is known from Efate, Espiritu Santo and Anatom Islands. It is likely, however to occur on all main islands (Hamilton et al 2013).
Emoia nigromarginata	Vanuatu Silver Vineskink	Least Concern	Endemic to Vanuatu, it has been recorded from Efate Island, Pentecost Island, Malakula Island, Espiritu Santo Island, and Ambrym Islands, although it is possible that this species is limited to Efate Island and specimens from other islands may represent different species. This is an arboreal species, found in areas covered by seral or climax forest, and to a lesser extent , in areas with

Scientific name	Common name	Status	Habitat/distribution
			reduced tree cover such as strand forest, partly cleared forest, tree-studded pastures and gardens and plantations (Hamilton et al 2013).
Emoia sanfordi	Vanuatu Green Tree Skink	Least Concern	Endemic to Vanuatu, this skink is found from the Torres Islands south to Efate. This is a strongly arboreal species, and can be found in overgrown coconut plantations, primary forest, secondary forest, rural gardens, trees within villages (Harlow 2013).
Lipinia noctua	Moth Skink	Not yet assessed	An arboreal skink that occurs in Santo, Malo, Aore, Pentecost, Malakula, Ambrym, Epi, Efate, Tanna, and Anatom. (Reptiledatabase 2016)

Source: IUCN Redlist, www.iucnredlist.org/

133. Sea turtles are protected by Fisheries Regulations Order No. 28 of 2009 developed under the Fisheries Act No. 315 of 2009. In some islands of Vanuatu, sea turtles are hunted as protein for the traditional new yam harvesting season from the month of April to June every year. The traditional harvesting has been accommodated in this Regulation through a quota system that allocates a quota each year for the islands still practicing this tradition (Government of Vanuatu, 2014).

d) Flora

134. There are 171 families of plants in Vanuatu with 842 genera and over a thousand species. The department of Forestry maintains the Vanauaflora database on their website (Republic of Vanuatu, 2014).

135. Thirteen species of mangroves are found in Vanuatu, listed below (in the absence of site specific reports or observations, all assumed relevant to the subproject sites).:

- *Avicennia marina*
- *Bruguiera gymnorhiza*
- *B. parviflora*
- *Ceriops tagal*
- *Exocecaria agallocha*
- *Heritiera littoralis*
- *Lumnitzera littorea*
- *Rhizophora sylosa*
- *R. mucronata*
- *R. apiculata*
- *Sonneratia caseolaris*
- *S. alba*
- *Xylocarpus qranatum*

9. Estuarine and freshwater flora and fauna

136. Previous studies on the freshwater fauna of Vanuatu (Keith et al 2010) indicate that there are nine eel species, six *Microphis spp.* (pipefish), 37 other fish species and 29 crustacean species in the country. On Efate Island, six endemic species were found (see **Table 4-4**) (Republic of Vanuatu, 2014).

Table 4-4 Endemic freshwater species

Scientific name	Common name	Conservation status	Habitat
Sicyopterus aiensis	Creek Ai goby	Near threatened	This species inhabits clear fast flowing streams with gravel and rocky substrate. It feeds by scraping algae from rocks. The species is amphidromous and the embryonic development takes place in freshwater. Larvae are carried to sea after hatching and develop into post-larvae over 70–80 days, ready to return to freshwater. There has been a documented decline in this species' range since the species was described (within two or three years). The habitat range of this species continues to decline (P. Keith pers. comm. 2011, Lord 2009). This species was observed during field studies conducted for the Project in June 2017.
Stiphodon mele	Mele's stiphodon	Data deficient	This species inhabits clear and high gradient streams with rocky substrate. Individuals are mostly found on riverbeds on top of rocks and also found swimming in open water in currents between rocks or large pools (Keith *et al*. 2009). During a 2009 survey of the Mele River in Vanuatu, only two specimens were collected (D. Boseto, pers. obs. August 2009). The species appears to be naturally rare.

10. Invasive species

137. There are nine known invasive species occurring in Efate Island, as listed in the Global Invasive Species Database (ISSG 2016); three flora species and six fauna species. Only one of the fauna species and several of the flora species were observed at the subproject sites:

- *Euglandina fulica*– Giant African Snail (seen at several subproject sites)
- *Lantana camara* – Wild Sage
- *Macfadyena unguis-cate* – perennial, climbing liana
- *Meremia species* – American rope (which are suppressing regrowth of tree forest and can cause loss of wildlife)
- *Acridothere tristis* – Indian Mynah Bird (is highly competing with native bird species and taking over the habitat by destroying the eggs and nests)

B. Socioeconomic, land and cultural resources

1. Land use systems

138. Vanuatu has a total land area of 1.23 million hectares. Land use division is as shown in **Table 4-5** (as at 2011).

Table 4-5 Land use

Land use	Percentage
Agricultural land	15.3%
Arable land	1.6%
Permanent crops	10.3%
Permanent pasture	3.4%
Forests	36.1%
Other	48.6%

139. 74% of this (900,000 ha) was forested in 1993. In 2010, forested area was estimated at 440,000 ha (36%) so there was a period of significant clearing of native vegetation. All logging activity has now been stopped.

2. Community profiles

140. The following information was obtained from the 2009 Census, a more detailed description of the communities (and impacts upon them) may be found in the social safeguards due diligence report.

a) Epule village – North Efate Area Council

141. Epule (about 62 km from Port Vila) is part of the North Efate Area Council and has a population of 317, of whom 150 are males and 167 are female. There are 55 households.

142. The main source of income is agriculture, with farmers, mainly women, taking their produce to the Port Vila central market for sale. Other activities include cattle farming, fishing and some tourism activities on the Epule River, which all members of the community are involved in. Some adults commute to Port Vila town for work, including in government agencies, commercial institutes, retail shops, private companies as well as resorts. The income from the above activities is used for basic needs and school fees.

143. Children either travel to Ekipe village to attend the Ekipe English-speaking primary school, or to attend the nearby Matarisu French-speaking primary school. The village has a health clinic but it is no longer in operation. Therefore, villagers either travel to Paunangisu Health Centre or to Port Vila, to access health services.

144. The village has access to communal water supply and also from water tanks storing rain water, mainly used for drinking purposes. Although the Epule River is easily accessible to the village, the village has no reticulate water supply system to supply water to households. The village is located on a tidal reach of the river. Most villagers bath and wash in the river. Students from the nearby secondary school frequently come to Epule River for recreational swimming.

145. There is no electricity supplied to the village. However, solar panels owned by individuals within the community primarily provide electricity for lighting.

146. Except for the Paramount Chief and the indigenous people of Epule, most of the villagers are originally from the Shepherd Islands, a group of islands lying between the larger islands of Epi and Efate, in Shefa Province. They migrated to Epule in the 1960-70s as a result of good friendships and relationships that their descendants had with the paramount chief of Epule. The Chief invited his friends to Epule and gave them land to live on and farm. Over time, more Shepherds Islands families moved to Epule, who were also either given land or bought land to live on and grow crops.

147. There are locally and foreign owned restaurants within the vicinity of the village and tourist scenic tours are operated by the local community. Some villagers also own small retail shops which sell basic food and household items. There are also kava nakamals and kava bars in the area. Most of the kava that is being sold is not originally planted at Epule, but bought from markets in Port Vila, then prepared for sale.

148. The Project site within this area is: Epule bridge.

b) Tanoliu – North West Efate Area Council

149. Tanoliu village is located 25km from Port Vila. It comes under the jurisdiction of the North West Efate Area Council and has a population of 158, of which 80 are males and 78 are females. There are 29 households. Tanoliu has close ties with Moso Island, a nearby island that has a population of about 240, known for fishing charters and picnic areas. It also has close ties with the village of Malafau about 2 km

north of Tanoliu (on the mainland), with a population of about 30. They also depend on agriculture and fishing as the main economic activities.

150. The main sources of income for the Tanoliu villagers are from agriculture with some fishing activities. A large portion of adults comprise the workforce at a number of tourist resorts in the surrounding area such as the 4-star Havannah Resort. A few also commute to Port Vila for paid jobs, working in private companies, shops and hotels. There are also occasional tourist activities, such as cultural tours and local food tasting, in which community members are involved in. Women sell handicrafts and artefacts on the road stalls. Villages are also involved in production of charcoal which is sold in Port Vila.

151. The increased economic activities around the area, has improved livelihoods of the villagers. This is reflected in the dwelling or housing types in the village, where most are permanent buildings. The village has its own water supply system sourced from a local spring, and some private water tanks.

152. The National Disaster Management Office (NDMO) has recently set up a disaster centre within the village, due to the area being vulnerable to natural disasters and there being a secondary school nearby.

153. The village has a secondary and primary school – Ulei Primary and Junior Secondary Schools, within 200m of the village. Students from other villages and islands also attend at the Junior Secondary School.

154. Various Christian affiliated denominations are represented in the village – the main ones being Presbyterian Church (largest membership), Assemblies of God and Jehovah's Witnesses.

155. Tanoliu was formerly used as a base for the Americans during World War II. Many artefacts, such as Coca Cola bottles and remains of artillery equipment, can still be seen around the area. The old American swimming pool still exists near Ulei Junior Secondary School and is still frequently being used by students, villagers and visitors.

156. The Project sites within this area are the Tanoliu bridge. Ulei bridge is nearby.

c) Ulei – North Efate Area Council

157. Ulei, located 30.5km from Port Vila, is the name given to the area adjacent to Tanoliu village, towards the north. This area is governed by the North Efate Area Council within Shefa Province and is part of Tanoliu village. Ulei was previously a primary boarding school in the early 1980s to 1990s. In 2000, the school became a detached secondary school.

158. Ulei Junior Secondary School is a secondary boarding school located within the vicinity, with a total of about 190 students and 11 staff. Food consumption by students and teachers is usually based on the rations purchased by the school and supply from the school farm. The school community also purchases fresh produce and root crops such a taro, sweet potatoes, tapioca from nearby villages.

159. In 2016, a temporary settlement was established approximately 200 m from the project site as a result of an eviction undertaken by the government of a settlement near Havannah harbour. The locals were relocated to Tanoliu temporarily. The number of people currently occupying this temporary residence is estimated to be 100.

160. Until recently, the school supplied its own electricity through diesel fuelled generators. The UNELCO electrification project expanded to the north Efate area and the coverage has now included the school. Hence the school now has access to grid electricity. Telecommunications has improved as a result. The internet accessible by staff, but limited access for students. Mobile phones are used by staff as the most common method of communication. Most villagers own a mobile phone.

161. Water is collected from the nearby spring, which supplies the whole school and staff (and which also feeds the waterway bridged by Ulei Bridge on the ring road). The American Pool used during World War

II still remains as a primary feature of this location and is still frequently used by students, villagers and visitors.

162. The Project site within this area is the Ulei bridge, which crosses over the main stream used by the school community.

d) Waisisi – Mele Area Council

163. Waisisi, a rural residential and agricultural area, is located 10 km from Port Vila and around 4 km from Mele village. Waisisi falls within the Mele Area Council within Efate. The custom owners of the area are the villagers from Mele, however the population living around the area are not villagers from Mele. The population living around the Waisisi area are from Tanna.

164. Population within the area has increased over the past 10 years, with subdivisions of land at Prima area. There is a primary school that located 400 m away from the project site. The school has also been affected during events of flooding due to heavy rainfall. A water factory – Vanuatu Beverage - is located 500 m from the Wasisi on the western side of the La Colle river. Surrounding the upstream catchment are settlements made of semi-permanent houses. There is access to electricity along the main road, however, the subdivisions within the Prima area including Waisisi have not yet been supplied with electricity and no reticulated water systems in place within the area. Most households rely on the nearby rivers for washing and bathing, and use water tanks for drinking and cooking.

165. Waisisi is located between Port Vila and north of Efate and is a heavily used road by people from north and western Efate areas and Mele who commute daily to work or school in the town.

166. Although there have been numerous events of flooding in the area during heavy rainfall and cyclones, attempts to relocate the settlements that are often flooded had not been very successful. Majority of the occupiers of the land are low income earners, and have preferred to rebuild rather than relocate to safer areas. The supply of water from the waterway and nearby La Colle river (Prima) and the fertile agricultural land are features of the area that continue to drive people to continue living in the flood-prone area despite the risks.

167. The Project site within this area is the Waisisi culvert which will involve new pipe drainage structures.

e) Saama – North Efate Area Council

168. Saama is part of the North Efate Area Council, and has a population of 193. There are 42 households, of whom 101 are males and 92 females.

169. The main income generating activities is subsistence agriculture, with the sale of surplus cash crops at the Port Vila central market. Women also sell their crops as well as cooked food along the roadside markets. Fishing is also a main source of income.

170. Christian affiliated denominations in the village include Presbyterian and Assemblies of God.

171. Saama is now connected to the UNELCO power grid. It is situated about 200 m from Emua Village which has a banking facility and some retail shops. Saama community uses a gravity feed system. From the water source at the foot of Pol Hill, via pipes and storage tanks, water is distributed to a stand pipe at each household. Since this water is not treated, it is used mainly for washing and bathing. For drinking and cooking, most families have a small water tank where they store rain water and a larger community rain water tank is installed beside the community church building for all to use.

172. There is good public transportation available between the village and Port Vila, enabling villagers to commute to work. A Digicel tower is approximately 500 m away from the village centre providing good mobile phone reception and most villagers own a mobile phone. Health services are provided by the Paunangisu Health Centre, located about 3 km away.

173. The Project site within this area is the Saama culvert.

f) Tassiriki – Port Vila Municipal Council

174. Tassiriki is a residential middle/upper level income area located within the Port Vila urban area. Port Vila has a total population of 44,039 (2009 Census) and an urban growth rate of 4.1%. The custom owners of this area are the villagers of Erakor. Residential areas situated around Tassiriki area include the University of the South Pacific's Emalus Campus, the Bellevue area, Nambatu Lagoon, Korman Stadium, numerous resorts, and Erakor village. There are also several commercial premises and two informal markets.

175. Tassiriki falls under the jurisdiction of the Port Vila Municipality Council (PVMC) and is regularly serviced by the municipal services such as weekly rubbish collection. Under the Municipalities Act, Cap.126, PVMC holds jurisdiction over the formal municipal area of the city whose boundaries are set out in in the Port Vila Municipality (Composition of Council and Wards) Order 21 of 1980. There are currently 5 wards within Port Vila city. Freswota-Tassiriki is the Census subdistrict of Port Vila which is bisected by the Tassiriki road corridor.

176. Each ward comprises representatives from the council of Chiefs, church groups, youth groups, women's groups and the Vanuatu Disabled People's Association. Areas outside of the Port Vila municipality, including peri-urban areas, fall under the jurisdiction of the Shefa Provincial Council, and is governed by customary law and managed by members of the Vaturisu, which is the Efate Council of chiefs. Both PVMC and the Shefa Province are monitored by national government agencies and both report to the Department of Local Authorities (DLA) under the Ministry of Internal Affairs.

177. Port Vila's peri-urban population is removed from 'Rural' growth calculations, national non-urban annual growth between 1999 and 2009 falls to less than 1%.

178. In contrast Freswota-Tassirikki District has similarly grown at an average rate of 13.5% p.a., driven by urban infill in Le Meridien and urban expansion eastward in Freswota. Population density in Freswata is low for an urban area at less than 500 per km^2. The density increases substantially on the western end of the road corridor associated with the USP campus (see **Figure 4-7**). Since 2009, the population at such as high growth rate would have more than doubled.

179. As a result, proposals to expand the Port Vila municipal boundary to integrate peri-urban areas remain highly contested by stakeholders, with the differing governance systems acting as a barrier to cross-border provision of services and strategic planning for ongoing urbanisation (particularly regarding subdivision policies).

180. The main income source for the area is formal employment within government offices, hotels, retail businesses and informal markets selling agriculture produce along the road. The area is close to the lagoon and with a number of smaller and larger hotels including Cocomo and Holiday Inn within the area.

181. There are about 15 retail shops and business houses that line the road section from the USP Roundabout to the Nambatu Lagoon area. These businesses include, a butchery, two fuel stations, garage, Au Bon Marche, Pacific Supplies and a vegetable market at the Korman roundabout area. A large proportion of the market vendors are either from the nearby semi-urban areas or from the Teouma Valley. A sub-municipal census in 2009 indicated that approximately four out of five households in Port Vila rely on wage-based salaries as their primary source of income. Majority of the market vendors rely heavily on the sale of their local produce for their daily needs and for school fees. The location of one the supermarket (Au Bon Marche) and the location of two fuel stations near the fruit market, makes it an ideal one-stop shopping centre for regular customers in the area hence a convenient location for the market vendors to do business.

182. The only university in the country, University of the South Pacific, Emalus Campus, is located near the western end of the proposed works. Port Vila International School is also located in the Tassiriki area

on the Erakor Road. There are also other schools within the ward that are within the range of communities surrounding the subproject site such as the Epau to Primary and Secondary School and the Montmartre Secondary School, which is a French boarding school.

183. Tassiriki households, business and institutions are connected to the municipal water supply and are connected to the main power grid (UNELCO).

184. The road at Tassiriki is the main road which joins the villages and settlements in the north east and eastern Efate to Port Vila, such as Teouma, Rentapau, Eton, Forari (Pangpang), Epau, Epule. During normal weekdays, traffic is relatively heavy with commuters, workers and students from the outskirts of Port Vila travelling to town.

185. The Project site within this area is the Tassiriki road reconstruction and drainage works.

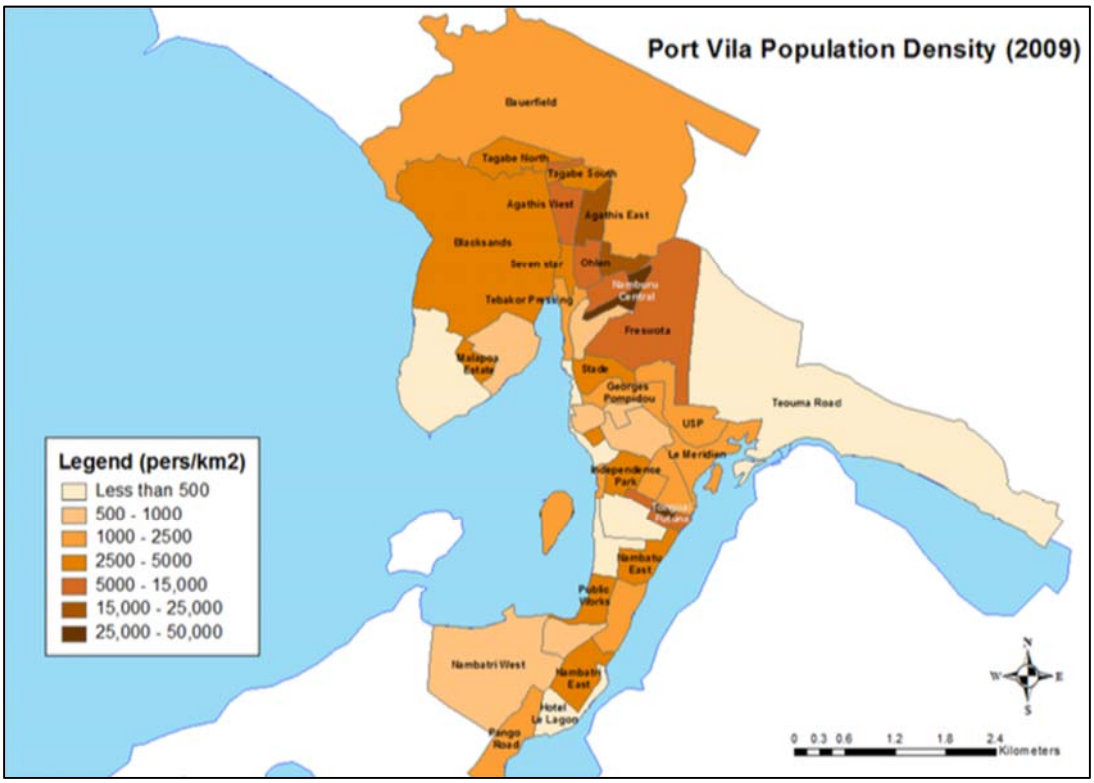


Figure 4-7 Population density in Port Vila

3. Economy

186. The majority (73.9%) of the Vanuatu population lives in rural areas and 65% of the labour force are engaged in agricultural production. This is primarily subsidence production for their own use; as such the economic value of primary production is disproportionately small (Department of Strategic Policy, Planning and Aid Coordination, 2011).

187. Gross domestic product (GDP) in 2015 was USD 685 million, with growth rates of 2% in 2013, 2.3% in 2014 and an estimated 0.9% in 2015 (due to TC Pam). The structure of Vanuatu's GDP in 2015 (est.) was comprised of:

> Services – 61.1%

> Primary (agriculture, including forestry and fisheries) sector – 30.2%

> Manufacturing – 8.7% (CIA, 2015)

188. The high proportion of GDP generated in services is a reflection of:

> Tourism-related activities – restaurants, hotels, and transportation

> Public administration

> Offshore financial services sector (Department of Strategic Policy, Planning and Aid Coordination, 2011).

189. Since 2002, the Vanuatu government has increased efforts to promote tourism by improving flight connections, resorts, and cruise ship facilities. Australia and New Zealand are the main source of tourists (CIA, 2015). Economic development in Vanuatu is hindered by:

> Dependence on a small number of commodity exports

> Vulnerability to natural disasters

> Long distances from main markets and between constituent islands (CIA, 2015)

190. Tax revenue is derived mainly from import duties (CIA, 2015).

4. Traffic volumes

191. Traffic data was obtained by conducting a traffic count at three locations (Mele, Rentapau, Takara) on the ring road and by holding interviews with selected drivers (origin and destination survey). The 24-hour traffic counts were conducted over three days, from 3-5 August 2016. The days selected aligned with a cruise ship day, normal work day, and peak market transport day. Based on these surveys, the base case average annual daily traffic (AADT) at Mele in 2018, is estimated at 4,558.

192. The data has been contrasted and compared against data from previous traffic counts in 2008 and 2010, as well as a recent traffic count conducted by PWD in August. The data was used to inform a traffic growth forecast required for the pavement design and economic analysis and as a baseline for monitoring and evaluation indicators.

5. Subproject specific existing environment

193. The environmental conditions at each subproject site are presented in **Table 4-6**.

Table 4-6 Subproject specific existing environment

Subproject	Physical environment	Biological environment	Socio-economic environment
Wassisi Culvert	 The geology of the area is mixed alluvium over remnant limestone reef. The soils along the creek are sandy from upland areas surrounding a lowland wetland over peat wetland soil mainly downstream of the road. The catchment makes up an area of approximately 175 Ha. The presence of significant amounts of the upland sandy solis has led to sedimentation in the creek bed downstream. The site is presently under construction.	The impact area has been highly modified with human intervention with weed infestation, bamboo stands and vines and significant amount of solid waste dumped in and arounf the waterway. There are scattered large lowland rainforest trees which suggest a significant wetland rainforest or open canopy forest was presnt downstream. From field inpsection the water quality appears excellent with no turbidity issues. The water flow is strong and appears to be groundwater under pressure from fissures in the underlying limestone geology below the culvert under construction. Upstream the surface water flow appaears to have been effectively stopped by the current construction activities.	The area has scattered settlement on the upland side of the road with a broken unsealed access road leading to a low standard housing area approximately 50 metres upstream on the eastern side.
Saama Culvert	Steep gradients both upstream and downstream of culvert that flows to the sea approximately 150 m downstream. Evidence of sheet flow over the road	A highly modified environment made up of secondary vegetation and various weeds. Bull rushes and other introduced reed species dominate on either side of the road restricting flow into the culvert	The site is approximately one km from the nearest village and is relatively isolated.
Tanoliu Bridge	Located adjacent to the coast The Sanoa Marine Protected Area (community-led initiative) is nearby. The bed material is sandy and the domimant flows are tidal.	There are mangroves present upstream but the immediate vicinity of the bridge is highly modified due to the proximity of the village also upstream Fauna species associated with mangroves present in large numbers (e.g. fiddler crabs, mangrove crabs, mudskippers, hermit crabs) are presnt in Havannah bay which is adjacent to the bridge and approximtely 20 metres from the fringing beach.	Residence situated north-east of bridge. A bench is located south-west of the bridge for use as waiting area for busses. For people travelling and commuting from the adjacent offshore islands. Anecdotal evidence from two consultations was divided as to whether mangroves are exploited in the area upstream for charcoal production.

			
Ulei Culvert	The geology is a small pocket of limestone (up lifted reef) with a perennial freshwater spring. The spring is one of two such features identified in the local area. The spring enters the tidal saltwater below a locally constructed rock weir approximately one hundred metres from the existing culvert. Water quality of both spring pool and saltwater is very clear with no apparrentt pollution except laundry soap. The Sanoa Marine Protected Area (community-led initiative) is nearby. The bed material is sandy and the domimant flows are tidal.	Fringing vegetation is a combination of dominant climbing woody vine with some mangrove near the coast Freshwater fish, eels and prawns were observed in the freshwater pool. Likely migration to the saltwater would occur over the rock weir.	The freshwater spring is used by 100 households from the village for water supply, laundry and bathing activities.There is increasing population pressure on the eastern side of the stream with immigrants from the Shepherd Islands, Access to the spring is via a side road which was suggested (but will not be used) as a detour route during construction.
Epule Bridge	Epule crosses a relatively long estuarine river that is relatively approximately 10-15 km in length and deep enough for the use of kayaks and canoes. The geology at the bridge is recent up- lifted limestone but further tream the source is in the older limestone. The channel is dominated by tidal flows with very good water quality. There was no evidence of sedimentation in the channel.	The area is well vegetated both up and downstream of the bridge. The coastal side of the bridge has mostly cleared and grassy vegetation which is highly modified with many weed species. Inland, there is more private land there are planted gardens along the northern side of the river by the residence and further upstream. The river supports a diverse ecosystem of endemic salt and estuarine fish and crustaceans such as eel fish and estuarine shrimp.	There is a residence to the immediate northeast that rents out kayaks and does river tours. The village population is scatterd in private houses on both sides of the river which are all relatively close to the bridge There is fenced off private land on either side of the bridge along the river which is fenced using barbed wire. 

Tassiriki Road Upgrade and Drainage Improvements	The underlying geology is recent limestone overlain by relatively sandy alluvium surrounding the Erakor lagoons. There are clay pockest associated with the road corridor which affects current drainge. The areas away from the road have high infiltration rates due to the sandy soils.	The northern side of the corridor has a heavily vegetated mixed canopy forest with some mature local trees on the steep catchment slopes. The flat areas between the forest and the road support parkland introduced grasses. There is also fringing commercial uses on the north eastern end of the corridor immeditely adjacent to steep open cliff faces. The southern side from the road to the lagoons is all highly modified with urban uses, (residential , tourism, retail, commercial)	The area to the south of the corridor is heavily populated with residential and tourist related activity. The USP campus is located on the western end of the proposed corridor where the road is heavily constrained on both sides with brick walls protecting the residences and the USP campus areas.

V. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Screening of potential impact

194. All subprojects were assessed for all three phases of the Project: pre-construction, construction and operations, across three components of the environment, for each major activity.

195. Impact mitigation matrices using a range of relative criteria, were completed, using the assumption that proposed design and standard pre-construction and construction mitigations are not implemented. The effect of implementing design and standard construction mitigations will be to lower environmental risk. The complete matrices are in **Appendix A**. A description of the impacts and proposed mitigation measures for each subproject is set out below.

196. The bridge refurbishments at Prima were assessed under the IEE for Phase I of the Project. In the interest of a holistic and cumulative assessment of the works, the assessment of impacts includes the impacts of both the bridge works under Phase I and road/drainage works at Waisisi under Phase II.

B. Pre-construction impacts

197. Pre-construction impacts are limited to the following activities:

> Identification and demarcation of the works and the designated area controlled by the Contractor

> A wider footprint required for road embankment and structure works; construction access paths will be wider again

> At Epule, additional land beside the bridge will be required for access to new road and bridge alignment

> Preparation of a working area near the structures

> Storage areas for materials

> Presence of both foreign and local construction workers of up to 30 on-site personnel

1. Physical environment

Climate change and adaptation

198. Except at Tassiriki, the subprojects will not create any impacts on rainfall, unexpected groundwater depletion, or carbon emissions, which in turn could affect the risk of, or induce, climate change. Climate change measures were integrated in the design of the works with maximum flood levels taken into consideration.

199. At Tassiriki, the proposed works involves 3.0 km of road repairs and associated drainage improvements in an area which has two identified flash flood areas in a previous climate change studies. The subproject is not expected to create any impacts on rainfall, unexpected groundwater depletion, or additional carbon emissions, which in turn could affect the risk of, or induce, climate change. However, the main consideration was to design the works to minimise the risk of future very high storm flash flood event adversely affecting that section of the road in the future.

2. Biological environment

Vegetation removal during surveying, demarcation and clearance

200. There will be no need for removal of any non-land assets including trees and crops as little road space is affected, except at Epule, where the road and bridge will be on a new alignment. There will be a need to remove grass and weeds. There is adequate space shown in the concept design to stockpile materials and equipment and secure a working area within a perimeter fence.

201. Plant species present within the impact area are either introduced species or ubiquitous native species, which are highly tolerant of disturbances. There is no vegetation that has any conservation significance nor is it representative of the original vegetative cover. Plant species near the sites are common in the designated subproject area.

202. The Ulei culvert is located in a coastal permanent drainage line that flows to the sea. Most of the time the stream flows freshwater from spring source approximately 100 metres upstream. It is also affected by tidal flows for up to 80 metres. For Ulei and Tassiriki, a separate storage yard for POL would be required in a separate location which will be the responsibility of the Contractor.

203. There will be mitigating measures included in the CEMP to ensure minimisation of impacts from vegetation removal which include:

> Vegetation clearance during surveying and demarcation activities of trees along the river banks. There are no road side trees of significant height that will be affected

> Construction workers will be informed about general environmental protection and the need to avoid unnecessary felling of trees and mangroves

3. Social environment

204. It is normal practice for PWD contractors to pay damages for crops and trees (or structures) if affected by road and bridge works and there is a standard contract clause for the Contractor to pay damages for such an occurrence.

205. There is generally no requirement for a permanent realign the road. At Epule, a new road alignment is proposed and in this case, land owners have been notified and discussions and consultations are ongoing to agree on the details of an MOU.

C. Wassisi Culvert

1. Construction impacts

a) Physical environment

206. Construction involves the following activities:

> Minor earthworks for channel and bank excavations and stockpiling of materials for culvert repairs

> Transportation of construction materials such as sand, gravel, cement and guardrail components

> Stockpiling of small quantities of construction materials such as sand, gravel, cement;

> Connection to road side drains as required

> A temporary stockpile for deposited sediment spoil will be required but all spoil will be reused on site.

> No traffic diversion will be required and all works will stay within the corridor

> Clearing and rehabilitation of upstream side drainage

> Safety signage improvement works

> Construction of scour protection measures upstream and downstream

Air quality

207. The quality of air within the subproject area is very good and typical of a semi-rural setting. During the day, the main sources of pollution are from traffic exhaust from all vehicle types. At night traffic becomes very infrequent. The proximity of the site to the coast and the prevailing south-easterly winds also regulate air quality. Due to the tropical (high) rainfall throughout the year, dust generated by traffic is minimal. Standard mitigation measures will be implemented and include:

- Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring
- Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site
- Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne
- Damping down any exposed areas in the working area near the bridge under dry conditions
- Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions

Soils, sedimentation and erosion

208. The culvert is located about 250 m from Mele Bay and flow in the stream is permanent. There was evidence of significant sedimentation with sand accumulation in the downstream environment from upland areas which may be associated with the effects of Cyclone Pam.

209. The risk of continuing sedimentation and erosion and deposition is considered low due to the presence of wetland areas upstream which would drop out sediment. To mitigate the impact of flooding, in-stream boulders to reduce energy at the culvert outlet was considered but the frequency of flooding is very limited.

Water quality

210. The risk to water quality is considered low as the flow is permanent and appears to be under pressure from groundwater sources and the road corridor acts as a natural detention basin for high flows .

211. Mitigating measures include:

- Separate, bunded area for storage of POL. The contractor will be required to store chemicals in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material
- Sediment control measures including, sedimentation ponds, bunds and silt fences around the work areas whenever required to contain plumes of disturbed water from getting into water bodies. The site will be secured each day with sediment controls in place.
- A waste management sub-plan as part of the CEMP

b) Biological environment

Flora and fauna

212. Most culvert works will be carried out on the existing road alignment, therefore minimal impacts on vegetation are expected.

213. If required, extraction of construction materials will be carried out from existing quarries with no vegetation impacts expected. Standard mitigating measures include:

- Minimise vegetation clearance during construction activities, especially of any small, endemic trees along the river banks and road side

> The Contractor will be responsible for informing construction workers about general environmental protection and safety at weekly toolbox meetings, including the need to avoid unnecessary felling of trees wherever possible

c) Social environment

Public access and local mobility

214. No diversion of traffic will be necessary as the volume of traffic through the subproject is low and the culvert will be built one half at a time, to maintain a minimum of one lane open at all times. The approximate time of construction will be up to 2 months. The following mitigations will be required:

> Construction will be timed during the dry season so that local flash flood risk is reduced

> Permanent traffic control will be required to operate the single lane and traffic controllers will be used to control traffic during works

> After working hours, the traffic volume is low and any hazards will be appropriately protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> The contractor will negotiate access with landowners if additional access outside the road corridor is required (considered unlikely)

Health and safety

215. The area is on the rural urabn fringe and the nearest sub standard no permament houses are approximately 100 metres away.

216. The risk to the general public is considered low, assuming that standard mitigation measures are used. There is no proposed accommodation construction camp. Some of these low risks and mitigation measures have been indirectly addressed above. To further mitigate these low risks, the Contractor will be required to:

> Provide adequate knowledge to construction workers on work safety issues and facilities management. Even though there is no plan to use a construction camp for temporary accommodation, the Contractor will conduct an STI and HIV/AIDS awareness program for the construction force and nearby villagers

> Develop a Safety, Security and Health sub-plan and Solid and Liquid Waste Management sub-plan as part of the CEMP. This document will address both community and workforce .The sub-plans will cover typical issues such as:

- Septic tanks and solid waste receptacles to be set up at fay facilities. These will be required to be regularly cleared by the Contractor to prevent outbreak of diseases
- Solid waste and septage to be transferred to nominated waste disposal sites on a frequent basis
- Adequate signage and security are to be provided at the construction sites for prevention of unauthorised persons (including children) entering the construction sites.
- Provision for adequate protection to the general public in the vicinity of the work site, including advanced notice of commencement of works, installing safety barriers and signage or marking of the work areas will be carried out
- Provide an Environmental Safety Officer (ESO) and Community Liaison Officer (CLO) to address health and safety concerns and liaise with villagers
- Provision of adequate health care facilities including first aid, at the site. The Contractor will train construction workers in basic sanitation, hygiene and health care issues, health and safety matters, and on the specific hazards of their work

- Provision of personal protective equipment, such as safety boots, reflective vests, hard hats, gloves, protective clothing and goggles
- Store all POL inside a bunded enclosure and away from the frequent (annual) flood zone

Noise

217. Construction noise is considered a low risk even though the site has several poor quality residences nearby due to the nature of the proposed works which are very low in scale. The pattern of intermittent generated noise for two months and the scale of construction is not considered to be significant enough to generate noise complaints. Nonetheless, the following mitigations will be required:

> The nearest houses would be notified one week in advance, of any sources of noise that may cause complaint

> An integral part the EMP structure is the Grievance Redress Mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

Accidental discovery of archaeological resources

218. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

219. The CLO will establish the communications protocol between the Contractor and community in accordance with the Project CCP. The Contractor will have a dedicated member of their staff to be the liaison between the village chief and elders and the Contractor.

220. Should construction workers be permitted to go into the nearby villages or residences for any reason, the Contractor will be responsible for their behaviour. In the event that there are complaints about the behaviour or conduct of construction workers, complaints will be dealt with using the GRM procedure.

2. Operations impacts

a) Physical environment

221. Although unrelated to the Project, physical impacts during the operational phase are not considered likely, as traffic forecasts predict that traffic growth will be low. However, if routine and periodic maintenance works are carried out effectively by PWD and community contractors, existing infrastructure is expected to meet service standards..

222. The risk of impacts on the culvert structure involves accumulation of debris from possible intermiitent flooding incidents after heavy rain and regular maintenance is considered essential to maintain flows under the culvert, reduce channel changes and reduce scour and erosion around the inlet.

D. Tanoliu Bridge

1. Construction impacts

a) Physical environment

223. Construction involves the following activities:

> Earthmoving for channel and bank excavations and stockpiling of materials for reuse in Elcorock® bags

> Transportation of construction materials such as sand, gravel, cement and guardrail components

- Receipt of concrete by truck from existing batching plants in the Port Vila area
- Establishment of site amenities (possibly to serve multiple sites) may be necessary (no accommodation camp)
- Temporary diversion of the creek to allow compaction of foundation and construction of concrete base slab in sections
- Removal of single lane timber and steel bridge
- Use of mobile crane for removal of existing steel girders and installation of precast concrete culvert units
- Improvements to pedestrian safety and access to the beach
- Possible import of small amounts of concrete for slab preparation
- Installation of new signage and safety works including guardrail for pedestrians

Air quality

224. The quality of air within the subproject area is very good and typical of a semi-rural setting. During the day, the main sources of pollution are from traffic exhaust from all vehicle types. At night traffic becomes very infrequent. The proximity of the site to the coast and the prevailing south-easterly winds also regulate air quality. Due to the tropical (high) rainfall throughout the year, dust generated by traffic is minimal.

225. During the construction phase the key activities that might have impacts on air quality are the machines used for excavation and vehicles transporting materials on site. Some sulphur dioxide (SO_2) and nitrogen oxide (NO) gases will be generated by these construction vehicles. Standard mitigation measures will be implemented and include:

- Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring
- Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site
- Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne
- Damping down any exposed areas in the working area near the new culvert under dry conditions
- Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions

Soils, sedimentation and erosion

226. The existing timber bridge is located across a narrow tidal channel approximately 20 m from the beach on Havannah Bay. The stream flows freshwater intermittently but is mainly influenced by high tide movements.

227. The risk of sedimentation and erosion caused by the construction is considered low but if required, soil erosion and sedimentation impacts will be mitigated by:

- The Contractor being solely responsible for repairing the damage and/or paying damages if the Contractor causes damage to agricultural land upstream, productive land or gardens
- The side slopes of embankments, including the river bank areas surrounding bridges and approaches will be protected and designs used that protect soils as included in the project specifications in order to

reduce erosion. Geotextile sand-filled bags will be used around bridge abutments to mitigate scouring and erosion

> Embankments and in-stream/river activities will be monitored during construction for potential erosion and, if necessary, prevention or permanent measures would be placed as soon as possible

> Slope areas needed for access will be revegetated with fast growing species, or other plants in consultation with the land owners and village chiefs, as quickly as possible after work in the slope areas has been completed. Dependent on species availability off set mangrove species will be planted in appropriate upstream and downstream locations.

> Random and uncontrolled tipping of spoil, or any material, will not be permitted, with all spoil to be removed by the Contractors

> Crane use to place prefabricated concrete sections will minimise the need for work area scour

Water quality

228. Sand and sand derived soils predominate in the immediate vicinity of the working area. Any silt runoff from the lay out area will be minimal so water quality issues are considered a low risk. Mitigating measures include:

> Separate, bunded area for storage of POL. The contractor will be required to store chemicals in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material

> Sediment control measures if considered necessary include: bunding and silt fences around the work areas whenever required to contain plumes of disturbed water from getting into water bodies. The site will be secured each day with sediment controls in place.

> A waste management sub-plan as part of the CEMP for the old timber bridge removal.

> Any material stockpiles (laydown areas) must be located outside the 1:1 year ARI flood zone (i.e. the annual flood zone)

b) Biological environment

Flora and fauna

229. In this location there will be moderate impacts on the adjacent vegetation. Some of the works will need to be carried out outside the existing road corridor resulting in the need for some impacts on vegetation. There will be a need for removal of any non-land assets including trees and shrubs as additional shoulder area will be required to accommodate the second traffic lane. There will be a need to remove any small trees, grass and weeds. Additional temporary area will be required to stockpile materials and equipment and secure a working area within a perimeter fence.

230. Plant species present within the impact area are predominantly introduced species or local mangrove species. One of two fringing mangrove rees of conservation significance may need removal.

231. The work area and establishment of material stockpile areas and site amenities for the bridgeworks will require removal of secondary weed vegetation. To minimise clearance, facilities will be constructed in unused open space and, upon completion, will be revegetated back to pre-construction condition or better

232. Supply of construction materials will be carried out from quarries with valid permits with no additional vegetation impacts expected. Additional measures to be included to ensure protection of flora and fauna within the subproject area include:

> Approval by the Engineer for all sites for material stockpile areas and site amenities. These will not be permitted in any ecologically important sites or areas valuable for conservation (of which there are none near the subproject site)

- > Minimise vegetation clearance during construction activities, especially of the fringing bank species of mangroves and any other small, endemic trees along the river banks and road side
- > Stockpile vegetative cover and top soil cleared from the roadside for use in slope protection and re-vegetation works will be stored. Contractors will be responsible for re-vegetation in areas for their facilities
- > Provision of adequate knowledge of fauna to construction workers. This is to be undertaken by the Contractor, in accordance with the contract documents and technical specifications.
- > The Contractor will be responsible for supplying appropriate and adequate cooking fuel in site amenities to prevent any possible fuel-wood collection using mangroves
- > The Contractor will be responsible for informing construction workers about general environmental protection and safety at weekly toolbox meetings, including the need to avoid unnecessary felling of mangrove trees or endemic species wherever possible

Protected riverine flora and fauna ecosystems

233. As the existing channel has very low flows under normal conditions, generally influenced only by tidal flows, the risks to in stream flora and fauna are considered low. The upstream area has been heavily modified by the village area and also showed evidence of some pollution caused by upstream users. There were mangroves observed in the upstream area further up from the village which indicates that the main flow is due to tidal saltwater flows. The general condition of the upstream was highly modified and there has been some reports of the clearing of mangroves in this area for production of charcoal. The risk to protected species from the limited construction works was considered low even when unmitigated.

c) Social environment

Public access and local mobility

234. There is likely to be a need to close the bridge intermittently during cranage operations to remove the old bridge and replace with the drop in culvert structures. The area is semi-rural the normal traffic volume is low. Given the limitations of the site, a temporary diversion to maintain traffic flow is not being considered. It should be emphasised that access to villages along the subproject road will essentially be maintained at all times.

Health and safety

235. There will be a low risk of impacts on community health and safety as there is no proposed accommodation construction camp for the subproject.

236. Some of the risks and mitigation measures have been indirectly addressed above. To further mitigate these low risks, the Contractor will be required to:

- > Provide adequate knowledge to construction workers on work safety issues and facilities management. Even though there is no plan to use a construction camp for temporary accommodation, the Contractor will conduct an STI and HIV/AIDS awareness program for the construction force and nearby villagers
- > Develop a Safety, Security and Health sub-plan and Solid and Liquid Waste Management sub-plan as part of the CEMP. This document will address both community and workforce issues and include a layout and design of Contractor facilities. The sub-plans will cover typical issues such as:
    - Septic tanks and solid waste receptacles to be set up at facilities. These will be required to be regularly cleared by the Contractor to prevent outbreak of diseases
    - Solid waste and septage to be transferred to nominated waste disposal sites on a frequent basis
    - Adequate signage and security are to be provided at the construction sites for prevention of unauthorised persons (including children) entering the construction sites.

- Provision for adequate protection to the general public in the vicinity of the work site, including advanced notice of commencement of works, installing safety barriers and signage or marking of the work areas will be carried out
- Provide an Environmental Safety Officer (ESO) and Community Liaison Officer (CLO) to address health and safety concerns and liaise with villagers
- Provision of adequate health care facilities including first aid, at the site. The Contractor will train construction workers in basic sanitation, hygiene and health care issues, health and safety matters, and on the specific hazards of their work
- Provision of personal protective equipment, such as safety boots, reflective vests, hard hats, gloves, protective clothing and goggles
- Capture of wastewater to prevent discharge to local water bodies
- Fit any day kitchen facilities with grease traps to reduce odours and vermin infestation
- Provision of safe and clean facilities including sanitation and drinking water
- Store all POL inside a bunded enclosure and away from the frequent (annual) flood zone

237. Using the diversion road through the village will cause a decrease in safety and will require specific mitigation. The following mitigations will be required:

> Notification well in advance to the local villages and the general public about the upcoming closure

> Signs and other appropriate safety features will be used to indicate construction works are being undertaken

> In order to address this temporary impact, at least three traffic controllers will control traffic speed through the detour and if necessary stop traffic for any hazardous truck or other machinery movements

> The diversion works would only take place on a weekend or non-school time

> Agreed speed limits will be imposed and posted for all sections of the detour

> After working hours, the traffic volume is low and any hazards will be appropriately protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> Disposal sites and haul routes to existing concrete batching plants and quarries will be identified

> The Contractor will negotiate access with landowners if additional access is required for specific purposes

Noise levels

238. Construction noise will cause moderate disturbance to some of the neighbouring community within the immediate village area. As shown in **Table 5-2,** the immediate vicinity of the bridge is not used for any activities (i.e. up to 61 m). However, within 122 m there are 7 receptors which are mainly residences. Most of the village is within 250 m of the culvert site. The noise will be mitigated by the prevailing south east breeze. However, these receptors will be slightly affected by some of the normal machinery (as shown in the table), as the activity will exceed the daytime standard for residential receptors.

239. Using an attenuation rate of 6 dBA per doubling of distance, the projected noise was found to be within the standard at the main village, using the accepted daytime level of 55 dBA for residential land use in the village. All other noise sources were found to be at generally acceptable levels at the village.

Table 5-2 Noise attenuation at Tanoliu Culvert*

Distance from source (m)	15.24	30	61	122	244	488	975

Number of receptors	0	0	0	7	20	29	29+
Dump truck	76	70	64	58	52	46	40
Excavator	81	75	69	63	57	51	45

* Daytime (7am-10pm) maximum noise levels: Residential = 55 dBA; Commercial = 70 dBA

Source: U.S. Federal Highway Administration and IFC

240. The excessive noise of the machinery will require mitigations, including:

> Notification to all receptors. Contractor will prepare a schedule of operations that will be approved by village chiefs and the Engineer. The schedule will establish the days, including identifying days on which there should be no work, and hours of work for each construction activity and identify the types of equipment to be used

> Requirements in the CEMP and contract documents that all vehicle exhaust systems and noise generating equipment be maintained in good working order and that regular equipment maintenance will be undertaken

> Noise incurred by construction workers from construction machine is a workplace health and safety hazard. Workers will be provided with noise abatement personal protective equipment as may be required

> An integral part the EMP structure is the grievance redress mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

241. There may also be a temporary increase in noise for houses along the diversion road. This impact will be mitigated by the proposed measures set out above under **Safety impact**.

Accidental discovery of archaeological resources

242. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can un-earth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not re-commence until the authorities have signed-off that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

243. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

2. Operations impacts

a) Physical environment

244. Although unrelated to the Project physical impacts during the operational phase are likely, as traffic forecasts predict that traffic growth will be moderate to low. However, if routine and periodic maintenance works are carried out effectively by PWD and community contractors, existing infrastructure is expected to remain suitable.

245. The risk of impacts on the culvert structures involves accumulation of debris from the frequent flooding incidents and regular maintenance is considered essential to maintain flows under the bridge, reduce channel changes and reduce scour and erosion around the abutments.

246. Regular monitoring and maintenance is the responsibility of PWD, who works with communities to undertake desilting of culverts, pothole patching, vegetation control and removal of debris.

b) Biological environment

Flora and fauna and protected areas

247. There are no protected areas in the subproject area. It is envisaged, the operation of the bridge would not have any impact on any protected area.

c) Social environment

Noise levels

248. Ambient noise levels are assessed to be low against typical rural standard conditions.

E. Ulei Bridge

1. Construction impacts

a) Physical environment

249. Construction involves the following activities:

> Proposed works are limited to minor earthworks and any required excavations to replace the existing one lane timber bridge approximately 5 metres long with a two lane concrete culvert

> Receipt of concrete by truck from existing batching plants in the Port Vila area for culvert slab construction

> Placement of prefabricated culvert by mobile crane.

> Stockpiling of small quantities of construction materials such as sand, gravel, cement

> Culvert approach road reshaping and filling to ensure smooth transition to culvert pavement

> Connection to road side drains as required

> A temporary stockpile for deposited sediment spoil will be required but all spoil will be reused on site

> No traffic diversion is recommended and all works will stay within the existing road corridor

> Safety improvement works such as new signage

> Preparation of any foundations for Elcorock or concrete base slabs

Air quality

250. The quality of air within the subproject area is very good and typical of a semi-rural setting. During the day, the main sources of pollution are from traffic exhaust from all vehicle types. At night traffic becomes very infrequent. The proximity of the site to the coast and the prevailing south-easterly winds also regulate air quality. Due to the tropical (high) rainfall throughout the year, dust generated by traffic is minimal.

251. During the construction phase the key activities that might have impacts on air quality are the machines used for excavation and vehicles transporting materials on site. Some sulphur dioxide (SO_2) and nitrogen oxide (NO) gases will be generated by these construction vehicles. Standard mitigation measures will be implemented and include:

> Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring

> Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site

> Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne

> Damping down any exposed areas in the working area near the bridge under dry conditions

> Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions

Soils, sedimentation and erosion

252. The culvert is located on the coast in a small bay only metres from the sea and flow in the stream is permanent freshwater mixed with tidal flows at high tide. There was no evidence of significant sedimentation.

253. The risk of normal sedimentation and erosion and deposition from upstream is considered very low as the upstream catchment is very limited in area and the surrounding soil is coastal sand.

Water quality

254. The risk to water quality of the construction at the proposed culvert location is considered low as the surrounding soils are very sandy or coastal sand and coming from a relatively limited catchment. The distance to the estuary is approximately ten metres and is flushed daily by the tide. There is a village washing area upstream at approximately 90 metres that currently discharges soap and detergent and there was no evidence of significant pollution at the proposed culvert site. Standard mitigating measures would be necessary and include:

> Separate, bunded area for storage of POL. The contractor will be required to store chemicals and any cement required in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material

> Sediment control measures including bunds and silt fences around the work areas whenever required to contain plumes of disturbed water with concrete spoil from getting into water bodies. Any disturbed area at the site will be secured each day with sediment controls in place.

> A waste management sub-plan as part of the CEMP would address the disposal of the old bridge and footings.

b) Biological environment

Flora and fauna

255. Most culvert works will be carried out on a slightly expanded corridor but minimal impacts on vegetation are expected.

256. Supply of construction materials will be carried out from quarries with valid permits with no additional vegetation impacts expected. Additional measures to be included to ensure protection of flora and fauna within the subproject area include:

> Approval by the Engineer for all sites for material stockpile areas and site amenities. These will not be permitted in any ecologically important sites or areas valuable for conservation (of which there are none near the subproject site)

> Minimise vegetation clearance during construction activities, especially of any small, endemic trees along the river banks and road side

> The Contractor will be responsible for informing construction workers about general environmental protection and safety at weekly toolbox meetings, including the need to avoid unnecessary felling of trees wherever possible

c) Social environment

Public access and local mobility

257. No diversion of traffic has been recommended as the volume of traffic through the subproject is low and the culvert will be built one half at a time, to maintain a minimum of one lane open at all times. The approximate time of construction will be up to three months. The following mitigations will be required:

> Construction will be timed during the dry season so that local flash flood risk is reduced

> Permanent traffic control will be required to operate the single lane and traffic controllers will be used to control traffic when trucks enter and leave the road

> After working hours, the traffic volume is low and any hazards will be appropriately protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> Disposal sites and haul routes to existing concrete batching plants and quarries will be identified

> The contractor will negotiate access with landowners if additional access outside the road corridor is required (considered unlikely)

Health and safety

258. There will be a low risk of impacts on community health and safety as there is no proposed accommodation construction camp for the subproject.

259. Some of the risks and mitigation measures have been indirectly addressed above. To further mitigate these low risks, the Contractor will be required to:

> Provide adequate knowledge to construction workers on work safety issues and facilities management. Even though there is no plan to use a construction camp for temporary accommodation, the Contractor will conduct an STI and HIV/AIDS awareness program for the construction force and nearby villagers

> The proximity of the spring freshwater source approximately 100 metres upstream and its importance to the village requires specific protection. The area is used by up to 100 households who use the source for freshwater, bathing and laundry. This area will be a designated no go area for all contractor personnel to ensure protection of the source and village security.

> Develop a Safety, Security and Health sub-plan and Solid and Liquid Waste Management sub-plan as part of the CEMP. This document will address both community and workforce issues and include a layout and design of Contractor facilities. The sub-plans will cover typical issues such as:

- Septic tanks and solid waste receptacles to be set up at facilities. These will be required to be regularly cleared by the Contractor to prevent outbreak of diseases
- Solid waste and septage to be transferred to nominated waste disposal sites on a frequent basis
- Adequate signage and security are to be provided at the construction sites for prevention of unauthorised persons (including children) entering the construction sites.
- Provision for adequate protection to the general public in the vicinity of the work site, including advanced notice of commencement of works, installing safety barriers and signage or marking of the work areas will be carried out
- Provide an Environmental Safety Officer (ESO) and Community Liaison Officer (CLO) to address health and safety concerns and liaise with villagers

- Provision of adequate health care facilities including first aid, at the site. The Contractor will train construction workers in basic sanitation, hygiene and health care issues, health and safety matters, and on the specific hazards of their work
- Provision of personal protective equipment, such as safety boots, reflective vests, hard hats, gloves, protective clothing and goggles
- Capture of wastewater to prevent discharge to local water bodies
- Fit day kitchen facilities with grease traps to reduce odours and vermin infestation
- Provision of safe and clean facilities including sanitation and drinking water
- Store all POL inside a bunded enclosure and away from the frequent (annual) flood zone

Noise

260. Even though the Tanoliu/Ulei community is nearby the construction noise is considered to be a low risk. The pattern of intermittent generated noise for three months and the scale of construction is not considered to be significant enough to generate noise complaints. Nonetheless, the following mitigations will be required:

> Nearby residents would be notified one week in advance, of any sources of noise that may cause complaint

> An integral part the EMP structure is the Grievance Redress Mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

Accidental discovery of archaeological resources

261. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

262. The CLO will establish the communications protocol between the Contractor and community in accordance with the Project CCP. The Contractor will have a dedicated member of their staff to be the liaison between the village chief and elders and the Contractor.

263. Should construction workers be permitted to go into villages for any reason, the Contractor will be responsible for their behaviour. In the event that there are complaints about the behaviour or conduct of construction workers, complaints will be dealt with using the GRM procedure.

2. Operations impacts

a) Physical environment

264. Operational physical impacts are considered to be low as traffic forecasts predict that traffic growth will be stable. If routine and periodic maintenance works are carried out effectively by PWD and community contractors, existing infrastructure is expected to remain suitable.

265. The risk of impacts on the culvert structure involves accumulation of debris from the frequent flooding incidents and regular maintenance is considered essential to maintain flows under the culvert, reduce channel changes and reduce scour and erosion around the inlets.

F. Saama Culvert

1. Construction impacts

a) Physical environment

266. Construction involves the following activities:

> Minor earthworks for channel and bank excavations and stockpiling of materials for culvert repairs
> Transportation of construction materials such as sand, gravel, cement and guardrail components
> Stockpiling of small quantities of construction materials such as sand, gravel, cement;
> Connection to road side drains as required
> A temporary stockpile for deposited sediment spoil will be required but all spoil will be reused on site.
> No traffic diversion will be required and all works will stay within the corridor
> Clearing and rehabilitation of upstream side drainage
> Safety signage improvement works
> Construction of scour protection measures upstream and downstream

Air quality

267. The quality of air within the subproject area is very good and typical of a semi-rural setting. During the day, the main sources of pollution are from traffic exhaust from all vehicle types. At night traffic becomes very infrequent. The proximity of the site to the coast and the prevailing south-easterly winds also regulate air quality. Due to the tropical (high) rainfall throughout the year, dust generated by traffic is minimal. Standard mitigation measures will be implemented and include:

> Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring
> Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site
> Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne
> Damping down any exposed areas in the working area near the bridge under dry conditions
> Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions

Soils, sedimentation and erosion

268. The culvert is located about 150 m from Havannah Bay and flow in the stream is intermittent. There was no evidence of significant sedimentation other than rocks and boulders resulting from the flooding during TC Pam, which also affected the culvert scour protection.

269. The risk of normal sedimentation and erosion and deposition is considered low. To mitigate the impact of flooding, in-stream boulders to reduce energy at the culvert outlet was considered but the frequency of flooding is very limited.

Water quality

270. The risk to water quality is considered low as the flow is very intermittent and coming from a relatively limited and clean catchment. Mitigating measures include:

- Separate, bunded area for storage of POL. The contractor will be required to store chemicals in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material
- Sediment control measures including, sedimentation ponds, bunds and silt fences around the work areas whenever required to contain plumes of disturbed water from getting into water bodies. The site will be secured each day with sediment controls in place.
- A waste management sub-plan as part of the CEMP

b) Biological environment

Flora and fauna

271. Most culvert works will be carried out on the existing road alignment, therefore minimal impacts on vegetation are expected.

272. If required, extraction of construction materials will be carried out from existing quarries with no vegetation impacts expected. Standard mitigating measures include:

- Minimise vegetation clearance during construction activities, especially of any small, endemic trees along the river banks and road side
- The Contractor will be responsible for informing construction workers about general environmental protection and safety at weekly toolbox meetings, including the need to avoid unnecessary felling of trees wherever possible

c) Social environment

Public access and local mobility

273. No diversion of traffic will be necessary as the volume of traffic through the subproject is low and the culvert will be built one half at a time, to maintain a minimum of one lane open at all times. The approximate time of construction will be up to 2 months. The following mitigations will be required:

- Construction will be timed during the dry season so that local flash flood risk is reduced
- Permanent traffic control will be required to operate the single lane and traffic controllers will be used to control traffic during works
- After working hours, the traffic volume is low and any hazards will be appropriately protected
- Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road
- Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)
- The contractor will negotiate access with landowners if additional access outside the road corridor is required (considered unlikely)

Health and safety

274. The area is rural and relatively remote and the nearest village is approximately one kilometre away.

275. The risk to the general public is considered low, assuming that standard mitigation measures are used. There is no proposed accommodation construction camp. Some of these low risks and mitigation measures have been indirectly addressed above. To further mitigate these low risks, the Contractor will be required to:

- Provide adequate knowledge to construction workers on work safety issues and facilities management. Even though there is no plan to use a construction camp for temporary accommodation, the Contractor will conduct an STI and HIV/AIDS awareness program for the construction force and nearby villagers

> Develop a Safety, Security and Health sub-plan and Solid and Liquid Waste Management sub-plan as part of the CEMP. This document will address both community and workforce .The sub-plans will cover typical issues such as:

- Septic tanks and solid waste receptacles to be set up at fay facilities. These will be required to be regularly cleared by the Contractor to prevent outbreak of diseases
- Solid waste and septage to be transferred to nominated waste disposal sites on a frequent basis
- Adequate signage and security are to be provided at the construction sites for prevention of unauthorised persons (including children) entering the construction sites.
- Provision for adequate protection to the general public in the vicinity of the work site, including advanced notice of commencement of works, installing safety barriers and signage or marking of the work areas will be carried out
- Provide an Environmental Safety Officer (ESO) and Community Liaison Officer (CLO) to address health and safety concerns and liaise with villagers
- Provision of adequate health care facilities including first aid, at the site. The Contractor will train construction workers in basic sanitation, hygiene and health care issues, health and safety matters, and on the specific hazards of their work
- Provision of personal protective equipment, such as safety boots, reflective vests, hard hats, gloves, protective clothing and goggles
- Store all POL inside a bunded enclosure and away from the frequent (annual) flood zone

Noise

276. Construction noise is considered a low risk as the site is remote. The pattern of intermittent generated noise for two months and the scale of construction is not considered to be significant enough to generate noise complaints. Nonetheless, the following mitigations will be required:

> The nearest village would be notified one week in advance, of any sources of noise that may cause complaint

> An integral part the EMP structure is the Grievance Redress Mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

Accidental discovery of archaeological resources

277. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

278. The CLO will establish the communications protocol between the Contractor and community in accordance with the Project CCP. The Contractor will have a dedicated member of their staff to be the liaison between the village chief and elders and the Contractor.

279. Should construction workers be permitted to go into villages for any reason, the Contractor will be responsible for their behaviour. In the event that there are complaints about the behaviour or conduct of construction workers, complaints will be dealt with using the GRM procedure.

2. Operations impacts

a) Physical environment

280. Although unrelated to the Project, physical impacts during the operational phase are likely, as traffic forecasts predict that traffic growth will be low. However, if routine and periodic maintenance works are carried out effectively by PWD and community contractors, existing infrastructure is expected to remain suitable.

281. The risk of impacts on the culvert structure involves accumulation of debris from the frequent flooding incidents and regular maintenance is considered essential to maintain flows under the culvert, reduce channel changes and reduce scour and erosion around the inlet.

G. Epule Bridge

1. Construction impacts

a) Physical environment

282. Construction involves the following activities:

> Removal of the existing bridge after the new structure is built to a stage to allow at least one lane traffic flow.

> Construction of the new bridge immediately downstream

> Pile driving for new abutments

> Preparation of laydown areas in new road corridor for prefabricated truss sections

> Vegetation clearance and replanting with local shrubs and grasses on the all approaches to the new bridge of approximately 100 m on either side of the river

> Realignment and resealing of the carriageway and shoulders of the new approaches

> Preparation of scour protection on the new abutments

> Import of concrete and quarried road base and aggregates by truck for abutment construction and approach road areas

> Construction of a cantilevered pedestrian footway to improve safety on the new bridge

> Connection of all new roadway to road side drains as required

> Transportation of construction materials bridge sections,

> A temporary stockpile for top soil cleared for replanting area

> Replanting of approach verges

Air quality

283. The quality of air within the subproject area is very good and typical of a semi-rural setting. During the day, the main sources of pollution are from traffic exhaust from all vehicle types. At night traffic becomes very infrequent. The proximity of the site to the coast and the prevailing south-easterly winds also regulate air quality. Due to the tropical (high) rainfall throughout the year, dust generated by traffic is minimal.

284. During the construction phase, the need to build new approaches will require clearing and exposure of up to 800 m^2 of land on either side of the bridge. Impacts of a significant dust problem during dry periods is considered moderate to high. Also activities that might have other impacts on air quality are the machines used for excavation and vehicles transporting materials on site. Some sulphur dioxide (SO_2) and nitrogen oxide (NO) gases will be generated by these construction vehicles.

285. Required mitigation measures that will need to be implemented and include:

- Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring
- Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site
- Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne
- An on station water tanker to be available for the entire construction period when open soil areas are exposed. Hourly damping down any exposed areas in the working area near the proposed bridge approaches under dry conditions
- Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions
- Active liaison with the nearby village concerning perceptions of dust generation at each residence by periodic survey

Noise levels

286. Construction noise will cause moderate disturbance to the neighbouring communities due to the need for the temporary use of a pile driver, large machinery and the proximity of the village. The village is located on both sides of the river and seven houses are within 200 metres. Some protection to the south will be afforded by the high cut area of the hill on the southwest side of the approaches for houses to the immediate south.

287. Using an attenuation rate of 6 dBA per doubling of distance, the projected noise was found to be within the standard at the main village, using the accepted daytime level of 55 dBA for residential land use in the village. All other noise sources exceeded the standard at the commercial premises, however, were found to be at acceptable levels at the village.

Table 5-3 Noise attenuation at Epule Bridge*

Distance from source (m)	15.24	30	61	122	244	488	975
Number of receptors	0	0	1	7	20	25	25
Vibratory pile driver (dBA)	101	95	89	83	77	71	65
Concrete mixer truck (dBA)	79	73	67	61	55	49	43
Concrete pump truck (dBA)	81	75	69	63	57	51	45
Dump truck (dBA)	76	70	64	58	52	46	40
Excavator (dBA)	81	75	69	63	57	51	45

* Daytime (7am-10pm) maximum noise levels: Residential = 55 dBA; Commercial = 70 dBA

Source: U.S. Federal Highway Administration and IFC

The excessive noise of the machinery will require mitigations, including:

- Notification to all receptors. The Contractor will prepare a schedule of operations that will be approved by village chiefs and the Engineer. The schedule will establish the days, including identifying days on

which there should be no work, and hours of work for each construction activity and identify the types of equipment to be used

> Requirements in the CEMP and contract documents that all vehicle exhaust systems and noise generating equipment be maintained in good working order and that regular equipment maintenance will be undertaken

> Noise incurred by construction workers from construction machine is a workplace health and safety hazard. Workers will be provided with noise abatement personal protective equipment as may be required

> An integral part the EMP structure is the Grievance Redress Mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

Soils, sedimentation and erosion

288. The existing bridge is located about 800 m from the Epule river mouth which is a large tidal river and presently stands approximately 10 m above the river. There is a moderate risk for loss of topsoil from the agricultural soils as the area of disturbance around the approaches will be up to 800 m^2 on either side of the river. Soil erosion and sedimentation impacts will require mitigation by:

> The contractor being solely responsible for repairing the damage and/or paying damages if the contractor causes damage to agricultural land upstream and downstream of productive land or gardens,

> The side slopes of embankments, including the river bank areas surrounding bridges and approaches will be protected and designs used that protect soils as included in the project specifications in order to reduce erosion.

> Footings and new embankments and in-stream/river activities to be monitored during construction for signs of scour and if necessary measures with armour rock and geotextile bags would be placed as soon as possible

> Slope areas needed for access will be revegetated with fast growing species as, or other plants in consultation with the land owners and village chiefs, as quickly as possible after work in the slope areas has been completed;

> Random and uncontrolled tipping of spoil, or any material, will not be permitted with all sediment to be removed by private sector contractors.

Water quality

289. As noted above, the works is extensive and risk to water quality is considered high unless mitigated. Mitigating measures include:

> Separate, bunded area for storage of POL. The Contractor will be required to store chemicals in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material

> Sediment control measures including, sedimentation ponds, bunds and silt fences around the work areas whenever required to contain plumes of disturbed water from getting into water bodies. The site will be secured each day with sediment controls in place.

> A waste management sub-plan as part of the CEMP to address the issue of the old bridge structure and older previous bridge footings

b) Biological environment

Flora and fauna

290. The bridge works and approaches will be carried over an extensive area of up to 1600 m^2. However due to the existing agricultural use of the land in the proposed corridor, the risk to endemic flora and fauna is considered low.

291. Given that the scope of works is generally confined to the existing road corridor, there are expected to be very few trees removed during construction. The concept design shows that the only site where noteworthy vegetation removal will take place for the permanent works is at Epule Bridge. Detailed design will confirm.

c) Social environment

Public access and local mobility

292. No diversion of traffic will be necessary as the volume of traffic through the subproject is low and the existing bridge can maintain access until the new bridge and approaches can carry traffic. The approximate time of construction will be up to six months. The following mitigations will be required:

> Construction will be timed during the dry season to reduce potential for flooding issues in the river.

> Permanent traffic control will be required to slow traffic in the vicinity of the work site.

> After working hours, the traffic volume is low and any hazards will be appropriately protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> Disposal sites and haul routes to existing concrete batching plants and quarries will be identified

> The PWD will need to negotiate access and some possible acquisition with landowners as additional access and some land outside the road corridor is required. Offset land swaps may be possible with the old corridor.

Health and safety

293. The risk to these residents is considered low, assuming that standard mitigation measures are used. There is no proposed accommodation construction camp for the subproject. Some of these low risks and mitigation measures have been indirectly addressed above. To further mitigate these low risks, the Contractor will be required to:

> Provide adequate knowledge to construction workers on work safety issues and facilities management. Even though there is no plan to use a construction camp for temporary accommodation, the Contractor will conduct an STI and HIV/AIDS awareness program for the construction force and nearby villagers

> Develop a Safety, Security and Health sub-plan and Solid and Liquid Waste Management sub-plan as part of the CEMP. This document will address both community and workforce issues and include a layout and design of Contractor facilities. The sub-plans will cover typical issues such as:

- Septic tanks and solid waste receptacles to be set up at facilities. These will be required to be regularly cleared by the Contractor to prevent outbreak of diseases
- Solid waste and septage to be transferred to nominated waste disposal sites on a frequent basis
- Adequate signage and security are to be provided at the construction sites for prevention of unauthorised persons (including children) entering the construction sites.
- Provision for adequate protection to the general public in the vicinity of the work site, including advanced notice of commencement of works, installing safety barriers and signage or marking of the work areas will be carried out
- Provide an Environmental Safety Officer (ESO) and Community Liaison Officer (CLO) to address health and safety concerns and liaise with villagers

- Provision of adequate health care facilities including first aid, at the site. The Contractor will train construction workers in basic sanitation, hygiene and health care issues, health and safety matters, and on the specific hazards of their work
- Provision of personal protective equipment, such as safety boots, reflective vests, hard hats, gloves, protective clothing and goggles
- Capture of wastewater to prevent discharge to local water bodies
- Fit day kitchen facilities with grease traps to reduce odours and vermin infestation
- Provision of safe and clean facilities including sanitation and drinking water
- Store all POL inside a bunded enclosure and away from the frequent (annual) flood zone

Accidental discovery of archaeological resources

294. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

295. The CLO will establish the communications protocol between the Contractor and community in accordance with the Project CCP. The Contractor will have a dedicated member of their staff to be the liaison between the village chief and elders and the Contractor.

296. Should construction workers be permitted to go into villages for any reason, the Contractor will be responsible for their behaviour. In the event that there are complaints about the behaviour or conduct of construction workers, complaints will be dealt with using the GRM procedure.

2. Operations impacts

a) Physical environment

297. Operational physical impacts are considered to be low as traffic forecasts predict that traffic growth will be stable. If routine and periodic maintenance works are carried out effectively by PWD and community contractors, existing infrastructure is expected to remain suitable.

298. The risk of impacts on the bridge structure involves accumulation of debris from the frequent flooding incidents and regular maintenance is considered essential to maintain flows under the bridge, reduce channel changes and reduce scour and erosion around the abutments.

b) Social environment

Health and safety

299. The impact of the bridge will improve safety for pedestrians as there is no existing separate footway.

H. Tassiriki Road and drainage improvements

1. Construction impacts

a) Physical environment

Construction involves the following activities:

> Earthworks, excavation and stockpiling of materials for reuse

> Receipt of road base aggregates by truck from existing quarries in the Port Vila area

> Transportation of other construction materials such as sand, gravel, cement, drainage structures and geotextiles, components

- > Temporary stockpiling of small quantities of construction materials such as sand, gravel, cement
- > Construction of the drainage swales and contour banks on the northern side of the corridor in the adjacent park
- > Clearance and rebuilding of existing road side drains as required
- > Preparation and resealing of road surface
- > Establishment of site amenities (possibly to serve multiple sites) may be necessary (no accommodation camp)

300. Tassiriki is a more complex subproject. It is a three-kilometre long, urban road corridor improvement, with potential impacts during construction associated with a number of environmental components including noise, air quality, hydrological and land use impacts. The remaining risks, without mitigations in place, were considered moderate to high. These impacts are exacerbated by the narrow width along the roadside in the USP section and along the eastern section which limits road shoulder width and drainage options. The corridor traverses a diverse mix of land uses, including education (USP campus and Port Vila International School) residential, recreational, tourism, retail, light industrial (Pacific Supplies, Numbawan Wota) and other commercial uses. Another feature of the area is the Erakor lagoon system to the south of the residential area which is important to ecology, recreational use, livelihoods in Erakor and numerous resorts on the lagoon foreshore.

301. These different land uses interact with proposed road and drainage improvements which will require the Contractor to address the different needs of stakeholders under continued use of the corridor during construction. There will be detailed traffic management planning as part of the Construction Environmental Management Plan (CEMP), to effectively plan to inform the public, maintain vehicular and pedestrian traffic flow and maintain access to properties. To maintain traffic flow, works will take place under traffic control, where only one lane is open during working hours. Construction noise will be less of an issue for most residences, as most already experience the noise generated by this busy road and have substantial perimeter walls in place, adjacent to the road.

302. Air quality impacts will be a significant issue during dry periods and standard mitigations such as water spray trucks will be required. There is also the potential for turbid water flows during storm events. A construction stormwater management plan will be required, to plan temporary drainage to maintain separation of clean and dirty water, by diverting surface water around the working area and site runoff into management facilities in the adjacent park area, on the northern side of the corridor. Dependent on expected storm frequency, silt mesh should also be placed across the entry point to each small drainage catchment.

303. The Tassiriki subproject requires approximately 5000 m^3 of road base and aggregate to be transported from local quarries, leading to air quality, noise and road safety impacts, due to increased truck traffic. The volume of road base is expected to be delivered over a period of five weeks, at a rate of 15 trucks per working day. With standard mitigation measures and site specific management planning in place to address nuisance, drainage, traffic and safety issues, the risk level of these issues was reduced to moderate. Each of the issues is now discussed in more detail.

Air quality

304. The quality of air within the subproject area is generally very good but subject to some dust generation during dry periods around dry soak away areas near a roundabout informal market area.. During the day the main sources of pollution are from traffic exhaust from all types of vehicles and at night traffic becomes very sparse. The coastal location and the prevailing south-easterly winds also ensure excellent air quality. The area has a distinct dry season so dust impacts are considered a moderate risk as most construction activity occurs in this season.

305. During the construction phase the other activities that might have impacts on air quality are the machines used such as excavators and vehicles transporting materials on site. Some Sulphur Dioxide

(SO_2) and nitrogen oxides (NO) gases will be generated by these construction vehicles. Standard mitigation measures will be implemented and include:

> Construction equipment being maintained to a good standard. The equipment will be checked at regular intervals to ensure they are maintained in working order and the checks will be recorded by the contractor as part of environmental monitoring

> Prohibition of the use of equipment and machinery that causes excessive pollution (e.g., visible smoke) at the subproject site

> Ensuring that all vehicles transporting potentially dust-producing material are not overloaded, are provided with adequate tail-boards and side-boards and are adequately covered with a tarpaulin (covering the entire load and secured at the sides and tail of the vehicle) during transportation. Material stockpiles being located in sheltered areas and covered with tarpaulins or other such suitable covering to prevent material becoming airborne

> Damping down any exposed areas in the working area near the bridge under dry conditions

> Periodic qualitative air quality monitoring (by observation rather than testing) based on site weather conditions

Soils, sedimentation and erosion

306. This section of the road just off the corridor is located on shallow sandy coastal soils with recent underlying uplifted reef limestone geology. Provided temporary drainage is directed onto these soils, the risks of significant soil erosion and sedimentation were considered very low. Infiltration rates were measured in the geotechnical surveys and the soils in situ in the adjoining parkland were found to be well drained. Ponding in the and water logging in some areas of the parkland appear to be associated with the underlying limestone geology at varying depths from the surface.

Water quality

307. Some silt runoff from imported material stockpile can be anticipated. There is potential for spillages of POL and other chemical spillages and such runoff has the potential of degrading water quality. The risk to water quality is considered low but routine mitigating measures include:

> The works to be carried out in the driest period of the year to reduce risk to water quality

> Separate, bunded area for storage of POL. The contractor will be required to store chemicals in a secure yard and/or /compound away from the waterway, with a concrete floor, bund wall and weatherproof roof. Only daily storage in the laydown area will be allowed during use of products. Used oils and chemicals will be transported to approved, designated waste disposal site for hazardous material

> Sediment control measures including, sedimentation ponds, bunds and silt fences around the work areas whenever required before discharge to the sandy soli areas. The site will be secured each day after hours with sediment controls in place.

> A waste management sub-plan as part of the CEMP

> Material stockpiles (laydown areas) must be located outside the 1:1 year ARI flood zone (i.e. the annual flood zone)

b) Biological environment

Flora and fauna

308. The roadworks will be carried out within and adjacent to the existing road corridor and therefore minimal risks to endemic vegetation are expected. The work area and establishment of material stockpile areas, site amenities and off road drainage works for the works will require removal of introduced grass vegetation in the adjacent parkland area. Drainage swales edges and contour banks and affected parkland will be revegetated back to pre-construction condition or better.

309. Supply of construction materials will be carried out from quarries with valid permits with no additional vegetation impacts expected. Additional measures to be included to ensure protection of flora and fauna within the subproject area include:

> Approval by the Engineer for all sites for material stockpile areas and site amenities. These will not be permitted in any ecologically important sites or areas valuable for conservation (of which there are none near the subproject site)

> Minimise vegetation clearance during construction activities, especially of any small, endemic trees along the river banks and road side

> Stockpile vegetative cover and top soil cleared from the roadside for use in contour bank protection and re-vegetation works. Contractors will be responsible for re-vegetation in areas for their facilities

> The Contractor will be responsible for informing construction workers about general environmental protection and safety at weekly toolbox meetings, including the need to avoid unnecessary felling or clearing of trees or large shrubs wherever possible.

c) Social environment

Public access and local mobility

310. Disruptions to traffic will be necessary as the volume of traffic through the subproject is high particularly at peak commuter times. Road works will be built one lane at a time, to maintain a minimum of one lane open at all times. The approximate time of construction will be up to six months. The following mitigations will be required:

> Construction will be timed during the dry season so that local flash flood risk around the Korman roundabout is reduced

> Permanent traffic control will be required to operate the single lane and traffic controllers will be used to control traffic on a stop-go basis when trucks enter and leave the road

> After working hours, the traffic volume is still moderate to high and any hazards will be required appropriately marked and protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> Haul routes for truck traffic to supply road base and aggregate from existing quarries will be identified and hazard identification coordinated with police and community organisations

> The contractor will negotiate access with the Port Vila Municipal Council as additional access outside the road corridor is required and proposed drainage controls coordinated with the future land use strategy presently being prepared by the Council

Health and safety

311. The corridor is surrounded by urban uses with residential, commercial and retail land use.

312. The risk to motorised traffic residents is considered low, assuming that the traffic management mitigation measures are implemented. Some of these low risks and mitigation measures have been indirectly addressed above.

313. Safety risks to pedestrians in the western section of the corridor are considered moderate to high due to the number of pedestrian that use the presently poorly maintained roadside footpath to connect USP campus with the retail commercial areas at the existing market roundabout. The western corridor area is heavily constrained by narrow existing footpaths and perimeter walls of residences and USP on both sides of the road.

314. The following mitigations will be required:

> A temporary pedestrian route through the extreme western end of the section will need to be negotiated with USP, unless there is adequate and safe access possible through and within the construction zone. Such a route will require barriers and clear signage

Noise

315. Construction noise from machinery and trucks is considered a low risk for the new road construction even though there is the USP campus on the northern side of the western section and many adjoining private residences on the southern side of the entire corridor. It will be adequately mitigated by the presence of the solid masonry and brick walls which already provide noise protection from normal operating traffic noise. The pattern of intermittently generated noise for up to three months and the scale of construction is not considered to be significant enough to generate noise complaints. The following mitigations will still be required:

> The USP and nearby residences would be notified, at least one week in advance, of any sources of noise that may cause complaint in the immediate vicinity.

> An integral part the EMP structure is the Grievance Redress Mechanism (GRM) and will be responded to by the contractor in the CEMP. This mechanism must be fully disclosed to the immediate community. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards DDR

Accidental discovery of archaeological resources

316. Although highly unlikely, any site clearance, digging and excavation activities undertaken during pre-construction and construction can unearth archaeological sites or resources. In the event this occurs, work shall cease immediately and the authorities (National Museum of Vanuatu) will be informed. Activities shall not recommence until the authorities have agreed that the site/resources have been dealt with appropriately and that work may continue.

Other social impacts

317. The CLO will establish the communications protocol between the Contractor and community in accordance with the Project CCP. The Contractor will have a dedicated member of their staff to be the liaison between the local community and the Contractor.

2. Operations impacts

Hydrology and Water quality

318. The Tassiriki subproject is located generally upstream of the sensitive ecological area of the Erakor lagoons. On the western section the distance to the nearest lagoon is approximately 400 metres. On the eastern section, the Emten lagoon is approximately 50 metres from the road corridor. The land use along the edge of the lagoons is predominantly tourist related development. The most sensitive water quality indicator for this type of land use is turbidity and the lagoons are currently perceived as being transparent and promoting Vanuatu as a clean water environment destination.

319. The literature indicates that currently there are very limited direct discharges of stormwater into the lagoon system which is associated with the high infiltration rates of the local soils which are predominantly sandy. Consequently, the drainage flows from the road corridor is considered to be a high risk of affecting on- going lagoon water quality. It is recommended that that the drainage design optimise the use of soft swale drainage systems directed to side roads or open land to reduce the risk of the road corridor having negative effects on lagoon water quality during operation of the road and drainage system.

Soils and erosion

320. Excavation sites will either be filled in or stabilised during construction. Soil erosion from the road itself is not expected. Roadside drainage systems will be maintained by PWD with community based programs and this requires the removal of accumulated sediments or vegetation. If vegetation control is required in drains, this should be removed manually (by slashing) rather than excavated by machine which will leave behind a larger and an erodible surface.

Flora and fauna

321. Impacts on flora and fauna were assessed as a low risk as the road has already provided initial access to these areas. As the reconstruction works will mainly take place in the existing road corridor there will be no potential for adverse impacts that could arise from increased access to inland forests or other habitat areas. The areas where works will occur outside of the corridor are small and not heavily vegetated. New planted areas will require maintenance and watering to an agreed schedule with PWD, as part of the asset

a) Social environment

Noise

322. The area to the east of Port Vila has a growing population and ambient traffic noise levels will continue to increase in proportion with the traffic volume forecast. To date, private residences have built perimeter walls for both security and noise protection. No noise attenuation measures are considered necessary in public open space and retail, commercial areas.

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. National, provincial and community consultation

323. Following the process and procedures established in the Project Community Consultation Plan (CCP), consultations with government agencies and civil society including communities including women's groups, chiefs, businesses operators were conducted. These consultations with communities and stakeholders on the Efate Ring Road were undertaken during the feasibility study stage for Phase I, from August to mid-October 2016 and for Phase II, from February to April 2017. The purpose of community consultations at this stage are to:

> Foster partnerships with beneficiary and stakeholder communities

> Share information on the proposed works, its components and activities

> Communicate with stakeholders that their co-operation (and possible participation) in Project activities including surveys, site investigations, planning, feasibility and design, construction, monitoring, and maintenance is key to achieve the Project's 'building back better' strategy

> Develop the site options analysis, to inform the recommendation of a scope of work

324. Towards the above objectives, consultations were conducted for Phase II as shown in **Table 6-1**.

Table 6-1 Consultation for Phase II

Date	Groups	Participants	Response
15 February	Shefa Provincial Government Council	3 officers - Secretary General and 2 Area Council Secretaries	SPGC provided assurance that they will continue to work closely with Project through Area Secretaries.
17 February	Vaturisu Council of Chiefs	11 Office bearers and executive members of the Council	Vaturisu Council endorsed the Community Liaison Committee (CLC) mechanism and assured they will support and work closely with Project.
15 March	Port Vila Municipal Council	7 officers - Acting Town Clerk and Town Planning Officers	Acting Town Clerk will inform the Lord Mayor and Council of the development and Town Planning Unit to provide relevant documents for Tassiriki area. Municipal Council will assist where possible
21 March	Epule Community Emua Community Tanoliu Community	Chiefs and Community members Epule – 26 participants Emua – 26 participants Tanoliu – 26 participants	Chiefs and Community members support the Project and provided necessary information. Communities will work closely with the Project in all stages.

Date	Groups	Participants	Response
27 March	Tassiriki Community	Fresh produce Market vendors, Residents and Business houses at Tassiriki 14 participants	Composition and backgrounds of the participants was different to that of the rural communities however the response was equally positive. Those present provided further information both for social and engineering aspects
9 June	Waisisi and Mele chiefs	Cheifs and village representatives	Agreement in principle to allow works and to sign the MOU
	Sub-Total **Total Consulted People**	5 communities 3 government/NGO **120**	

325. The Phase II consultations commenced on 15 and 17 February 2017 with the Shefa Provincial Government Council and Vaturisu Council of Chiefs respectively. All attendees were made aware of the Phase II component of the project including objectives, scope of works and land requirements. This latter meeting the Vaturisu Council of Chiefs also included consultations on the establishment of Community Liaison Committees (CLCs) for the civil works.

326. Following this high level consultation, smaller teams of specialists including the technical, social and environmental safeguards team, and survey teams returned multiple times to visit the sites and consult further with the chiefs, landowners and leaseholders including the formal consultations conducted from 20 to 27 March 2017. This included consultation regarding the three sites that have an increased scope under Phase II. Over 100 community members and leaders (including 50% women) representing the six project sites, drawn from 3 villages[4] on the Efate Ring Road and from Tassiriki in Port Vila, were consulted (refer Appendix H of the feasibility study report). Ten (10) government and non-government representatives were also consulted during the feasibility study stage.

327. Consultations with the customary landowners and the Ministry of Lands for the agreements and signing of the Memorandum of Understanding commenced in April 2017 and expect to be concluded in May. Third Party Validators (the same as those engaged for Phase I) will be appointed to review the process and sign the MOU to confirm that it was an agreement that was clearly understood by the landowners and who freely provide consent.

B. Key information gathered

Information collected from the consultations included:

> Suggested safety improvements for the structures and facilities to be provided

> Suggested best way for temporary access during construction

> Suggested best way for notifying and conducting meetings with the community at Tassiriki urban area

> Involvement of community during construction and maintenance

> Criteria for selection of community liaison committee members, roles and responsibilities and quorum for CLC meetings

> In-principle acceptance of the Grievance Redress Mechanism outlined for the project

[4] Villages of Emua, Epule and Tanoliu

- > Perceived potential benefits to the community of the project (including for the elderly, women, children, disabled)
- > Chief's feedback on signing of a long term Memorandum of Understanding (MOU) with the landowners including questions on compensation to landowners
- > Various other non-project-related issues for communication back to PWD

328. The above information was used as input to the technical design, procurement, and operational stages.

1. Land ownership

329. All sites are on customary lands, some with existing leases. These leases are still being confirmed with the Department of Lands' survey section, pending updating of their land records after submission of As-Built Design document by PWD. There is a more complete description of these issues in the Due Diligence Report (DDR) on Social Safeguards.

330. To better understand the ownership of the river crossings and road development and the impacts which may be caused if land owners, claimants or operators of existing facilities interfere with the repair or replacement of the infrastructure, formal agreements (Memoranda of Understanding (MOUs)) are sought between MIPU, landowners, claimants, or their representatives. The MOUs are to allow long term access to sites, to carry out further investigations or studies, and for construction, maintenance, or future upgrades of infrastructure. These MOUs are regarded as formal documents respected by all signatory parties, and as evidence of support for the Project by relevant land stakeholders. Independent witness representatives acting as third party validators (TPV) will be chosen to witness the agreement process and the signing of each MOU. These will be people such church leaders or non-government organisation leaders respected in the communities and perceived to be without vested interests in the Project.

331. The MOU template to be used by this project is similar to the one used under previous ADB projects in Vanuatu. This was approved and endorsed by Department of Lands and the State Law Office for those projects. This approval also stated that the MOU template is acceptable as an evidence of consent from landowners and maybe used, if necessary, for the approval of Foreshore Development Permit for the relevant sites. The MOU consultation process is planned for completion in May, prior to any procurement process.

C. Disclosure

332. As with Phase I project documents, disclosure of this IEE will formally apprise the communities of the mechanism for GRM. It will be used as a starting point for open and meaningful communications with communities and landowners. Disclosure will take place when the EMP is finalised, following detailed design.

333. As described in the CCP, the DDR, and in particular the establishment of the GRM, will require face-to-face meetings with landowners and leaseholders and public disclosure of the GRM through community meetings for all Project communities. Also, signage with the Project name, contact person, and contact number for inquiries and complaints will be erected in public view for each of the Project sites. Moreover, a leaflet summarising the GRM will be disclosed on community notice boards, government and ADB websites.

334. The IEE will be disclosed on ADB's website and will be available at the DEPC office.

VII. GRIEVANCE REDRESS MECHANISM

335. A grievance redress mechsism (GRM) has been established for the Project and will be implemented for the sites under the additional financing. An integral part the EMP structure is the GRM which will be responded to by the Contractor, for the construction stage, in the CEMP. The GRM is for the project overall and is also included in the DDR and makes up an important component of the CCP.

336. During the course of the project, it is possible that people may have concerns with the project's environmental performance including the implementation of an agreed MOU. Issues may occur during construction and again during operation. Any concerns will need to be addressed quickly and transparently, and without retribution to the affected person (AP).

337. The following process will be used to address concerns quickly and transparently at Project level, based on the existing system for dispute resolution.

> In consultation with the Vaturisu Council of Chiefs and PWD, Community Liaison Committees (CLCs) were established in five villages, co-inciding with the Area Council geographies. These will operate as the key forum for airing and discussing resolution to grievances

> Any AP may discuss their complaint with the Chief in their village. The AP or both AP and Chief take the complaint to PWD (formally, the Director)

> PWD, through the DSC safeguards team, will record all complaints (date, details of complainant/grievance, attempts to resolve the complaint, and outcomes) and will have a maximum of one week to resolve the complaint and convey a decision to the AP

> If the complaint of the AP is dismissed, the AP will be informed of their rights in taking it to the next step. A copy of the decision is to be sent to next level of authority

> Should the AP not be satisfied with decision of PWD, depending on the nature of the complaint, the AP may take the complaint to the MLNR, who will appoint a representative to review the complaint in the case of alienated land or to a custom land officer (under the Custom Land Management Act) for customary land. The MLNR will have two weeks to make a determination. The determination by nakamal or custom area land tribunal will follow the timelines established in the Custom Land Management Act

> If a satisfactory conclusion cannot be obtained through this process (or at any time), the AP can take the matter to the courts (nakamal, custom area land tribunal, Island Court or Supreme Court). This will be at the APs cost but if the court shows that the government ministries have been negligent in making their determination, the AP will be able to seek costs

338. A draft flow chart, showing the proposed operation of the CLCs is shown in Figure

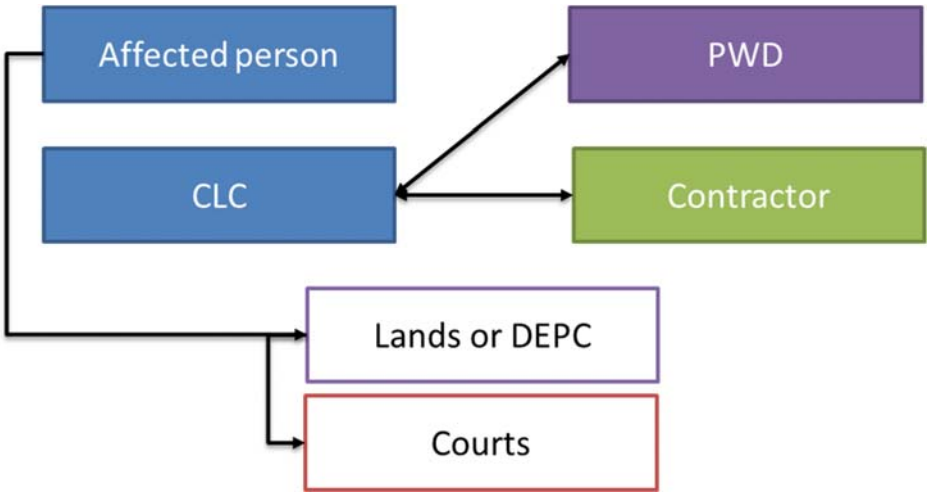


Figure 7-1 CLC flow chart

339. Through public consultations, APs will be informed that they have a right to complaint/grievance resolution. The record of the grievance redress mechanism will be the subject of monitoring.

340. During construction/implementation, a grievance register will be held at each Project site office, maintained by the site manager and monitored by the Project safeguards team. All complaints arriving at a site office are to be entered in a Register (by, date, name, contact address and reason for the complaint) that is kept at site. A duplicate copy of the entry is given to the AP for their record at the time of registering the complaint. The Register will show who was directed to deal with the complaint and the date when this was made together with the date when the AP was informed of the decision and how the decision was conveyed to the AP. The Register will be included in monthly progress reports.

341. The Register is then signed off and dated by the person who is responsible for the decision. The Register is to be kept at the front desk of the site office and is a public document. The duplicate copy given to the AP will also show the procedure that will be followed in assessing the complaint, together with a statement affirming the rights of the AP to make a complaint. For anybody making a complaint no costs will be charged to the AP.

342. In the event that grievances cannot be resolved at the local level, MIPU and MLNR will hold the compensation amounts in escrow or trust account. Compensation will be paid in full upon final resolution of the case in the courts or other forum, in accordance with the entitlements of the AP.

Table 7-1 Procedures for resolving grievances

Step	Process	Duration
1	Displaced Person (AP)/Affected Person (AP) takes grievance to the village chief/ then with village chief to PWD. This could be done after initial notification of grievance at Contractor's site office, or through the DSC (Resident Engineer)	Any time
2	PWD reviews issue, and in consultation with contractor (if appropriate), then records a solution to the problem.	1 week
3	PWD reports back to AP and gets clearance from complainant.	1 week
If unresolved		
4	AP take grievance to relevant government agency for resolution (MLNR)	Decision within 1 week
5	AP refers matter to public solicitor's office	2 weeks
6	National agency refers to an internal committee	4 weeks
7	National agency through reports back to relevant government agency/AP	1 week
If unresolved or if at any stage and AP is not satisfied with progress		
AP can take the matter to appropriate court.		As per judicial system

VIII. ENVIRONMENTAL MANAGEMENT PLAN

343. The EMP is the guiding document to provide direction to the implementation of the environmental safeguards component of the Project. The EMP included in this IEE will be updated during detailed design to reflect the more detailed and accurate information going forward. The updating of the EMP will also integrate the additional baseline information obtained during the stream flora and fauna studies to be undertaken in the next month. The EMP section and any additional provisions will be included in the bidding documents to which the contractor will respond.

344. The mitigation and management principles set out in the EMP establish the requirements and provisions each of the Contractors must follow when they prepare subproject site-specific construction environmental management plans (CEMP), which will set out the construction methodology (including site specific plans at each site showing laydown areas, extent of works, stockpiles, location of silt/sediment curtains, coastal protection, trees/vegetation to be protected, etc.) they will adopt to meet the mitigation requirements and reduce risk to acceptable levels, sites for obtaining materials and will be implemented in accordance with the relevant provisions of the Contract and any conditions placed on the environmental permit by the DEPC. Given that works not associated with the project are being undertaken at some sites, the contractor will be required to update the baseline as required to reflect actual conditions at the sites at the time of CEMP preparation.

345. The IEE includes the EMP that will be elaborated by the Contractor as the basis for the preparation of their site specific CEMPs. The EMP outlines the activities, impacts mitigations, costs and responsibilities basic management principles, the proposed design mitigations to ensure inclusion in the bidding documents, standard construction mitigation measures, monitoring and a proposed institutional arrangement for further implementation of environmental management during the construction phase.

346. The EMP details the implementation arrangements and the roles and responsibilities of each the main stakeholders, then goes onto discuss capacity building requirements to support the implementation, a grievance redress mechanism for community feedback and complaints.

A. Implementation arrangements

347. The key stakeholders in the implementation of environmental safeguards are as follows:

- The proponent is PWD of MIPU
- The safeguard operations within PWD, made up of PWD Staff (Environmental and Social Officers), supported by the DSC safeguards team
- The Contractor(s)
- Shefa Provincial Council
- The affected village communities
- The DEPC
- ADB

348. The proposed implementation arrangements are shown in **Figure 8-1**.

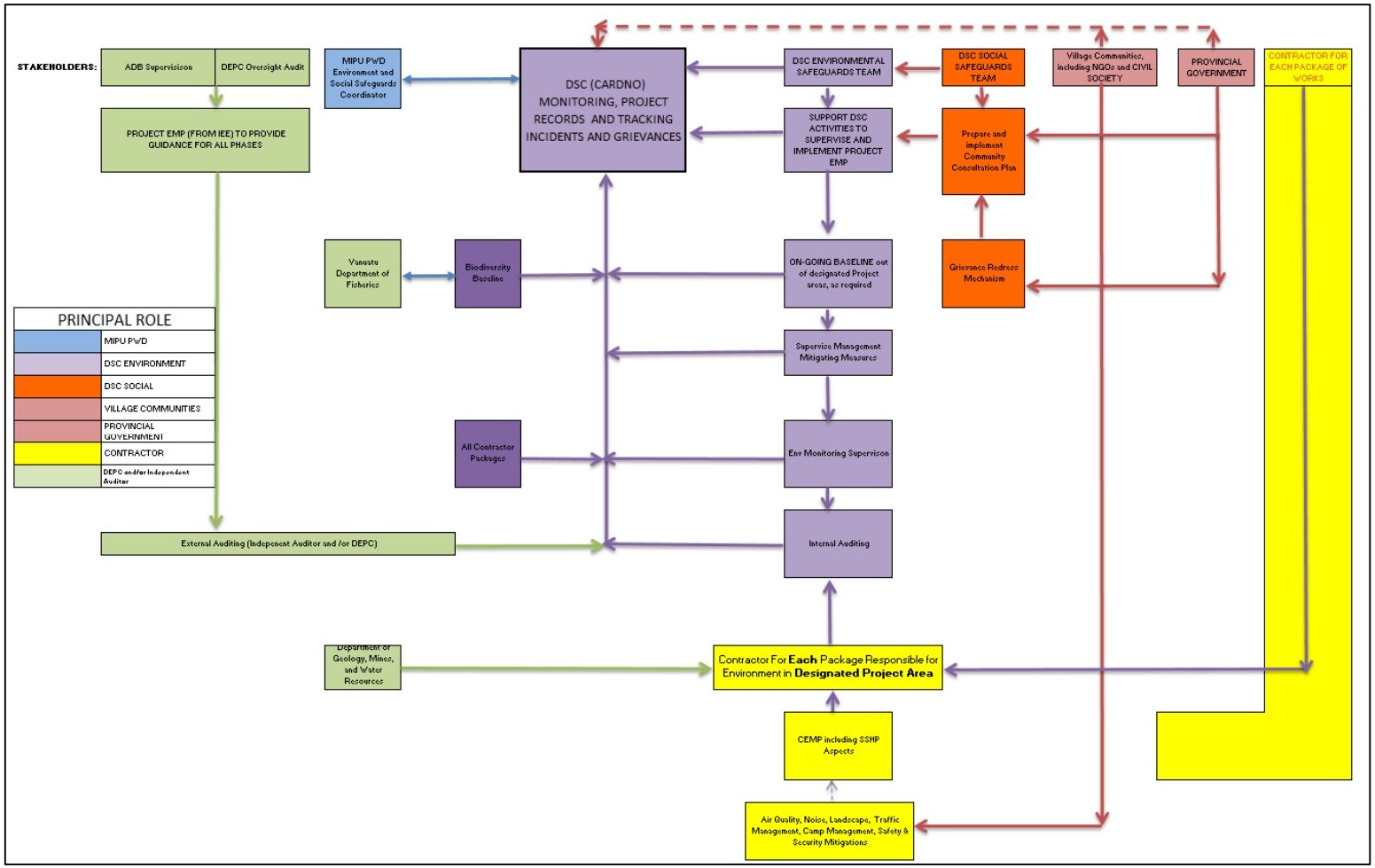


Figure 8-1 Implementation arrangements

B. Institutional roles and responsibilities

349. The role and responsibilities of the main stakeholders are set out in the table below and described in the text below. As shown in the table, the responsibility for preparation and implementation of the CEMP is the Contractor. The supervision, quality control and enforcement of contract provisions is the responsibility of the DSC project manager (Engineer to the Contract) and the Resident Engineer. A daily and/or weekly checklist will be required by the Contractor and a monthly report by the Contractor will incorporate these checklists, any issues relating to routine compliance and reporting of any incidents / complaints that have occurred and the progress of their resolution.

1. Ministry of Climate Change, Meteorology and Geo-hazards, Environment, Energy, and Disaster Management

350. The Department of Environment Protection and Conservation (DEPC) is responsible under the EPC Act (2010) to administer the Act which includes approval of environmental assessments. Since 2013 it has been part of the MCC. The MCC comprises four separate units or departments: Vanuatu Meteorology and Geo- Hazards Department; National Disaster Management Office; Department of Energy; and DEPC. The DEPC is legally responsible for monitoring of implementation of the Management Planning

351. The EIA Regulation 2011 sets out requirements for management planning and the document is referred to as the Environmental Management and Monitoring Plan (EMMP), which under the Regulations must: (i) describe, in respect of the project, proposal or development activity, the environmental protection measures that will be put in place by the project proponent if approval is given for the project, proposal or development activity; (ii) include an environmental monitoring and surveillance program of action; and (iii) provide for an environmental monitoring manager to be appointed by the project proponent, in consultation with the DEPC, to verify that the EMMP and protection measures are being fulfilled and adverse impacts of the project, proposal or development activity are documented.

2. Ministry of Infrastructure and Public Utilities

352. MIPU is the key government agency responsible for infrastructure development and the management of public works and is the implementing agency for the Project. MIPU comprises four divisions one of which is the PWD. MIPU, through PWD, administers infrastructure development projects and infrastructure maintenance.

3. Design and Supervision Consultant

353. Cardno is the design and supervision consultant (DSC) for the Project, supporting the PWD of the MIPU in detailed design preparation, construction supervision and monitoring and evaluation. The DSC specifically provides design and construction services for the following Project outputs:

> Reconstruction of roads and bridges

> Implementation of social and environmental safeguards, and where applicable, gender mainstreaming

> Updating the EMP based on detailed design and baseline studies and environmental permit conditions from DEPC; integrating updated EMP in the tender documents; assisting with bid evaluation regarding EMP aspects proposed by bidders; orientation and support on contract award prior to contractor preparing the CEMP; review and clearance of contractors EMP; inducting contractor to site, post CEMP approval; monitoring and auditing, reporting

354. Construction supervision of safeguards is the responsibility of the DSC which has an overall resident engineer responsible for supervision of quality control, performance including implementation and enforcement of safeguards and review of monthly reports and follow up. The role of the DSC safeguards team is to provide input to the project manager but its principal role with the DEPC is quality assurance

and auditing, in order to ensure that the agreed procedures are in place and being operated in a satisfactory matter and in accordance with the contract provisions.

4. Contractor

355. The civil works contractor(s) will be responsible for preparing the CEMP during the mobilisation phase of construction after contract award. The DSC environmental safeguards specialist will approve the CEMP before any construction work commences. The contractor will undertake its own monitoring and prepare an environmental section of the monthly report to the DSC. The contractor is responsible for implementing all environmental, health and safety actions included in the CEMP and relevant clauses in the bidding documents. The contractor is required to assign an environmental safety officer (ESO) whose responsibilities will include:

> Coordinating with the DSC during preparation and approval of the CEMP

> Ensuring that the contractor engages a suitable organization to undertake STIs/HIV/AIDS briefings and awareness raising amongst the contractor's employees and neighbouring communities' follow-up upon request

> Coordinating with PWD in respect of community consultation

> Participating in monitoring and coordinating with DSC to ensure that environmental management activities are reported as required

> Ensuring that the contractor does not commence construction activities until requisite approvals have been received from DEPC and/or other Government permitting agencies such as the Ministry of Internal Affairs, office of Physical Planning and Department of Mining responsible for quarries

> Coordinating and communicating with the contractor's Community Liaison Officer (CLO), as required, to facilitate consultation with the affected villages, various stakeholders, and ensuring smooth implementation of the subproject

356. The contractor and PWD, through the DSC, will be responsible for environmental monitoring during construction and post-construction. The DSC will also be responsible for verifying the monitoring undertaken by the contractor through audits and spot-checks. The outcomes of the monitoring will be included in the overall safeguards monitoring progress reports to be submitted to DEPC. These will also be consolidated and submitted to ADB for review on a designated time period as required.

5. PWD Operations and communities

357. PWD Operations is responsible for the administration and maintenance of all infrastructure and will be responsible for these activities during operations. Routine maintenance operations is normally carried out by nearby communities under contract to PWD. Village leaders and organisations will assist in arranging meetings, facilitating consultation and providing information about affected communities and environmental impacts of construction. Documentation of issues that arise is an integral part of the internal monitoring report prepared by the Contractor.

358. The consultation process was set out and agreed with PWD for the preparation of the CCP. If issues arise during construction the local communities can provide input and advice to the Contractor's CLO or use the GRM for issues and grievances which have not been satisfactorily resolved.

6. ADB

359. **Due diligence.** ADB's safeguard due diligence emphasises planning, environmental and social impact assessments and safeguard documentation. Through such due diligence and review, ADB will confirm (i) that all key potential social and environmental impacts and risks of a project are identified; (ii) that effective measures to avoid, minimise, mitigate, or compensate for the adverse impacts are incorporated into the safeguard plans and project design; (iii) that the borrower/client understands ADB's safeguard policy principles and requirements and has the necessary commitment and capacity to manage the risks adequately; (iv) that, as required, the role of third parties is appropriately defined in the

safeguard plans; and (v) that consultations with affected people are conducted in accordance with ADB's requirements.

360. **Health and safety**. The project will be required to provide workers with a safe and healthy working environment, taking into account inherent risks, any hazards in the work areas, including physical, chemical, biological, and radiological hazards. The SPS also requires that the government, through the implementing agency, will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work.

361. The ADB ensures that the project adheres to international good practice, as reflected in internationally recognised standards such as the World Bank Group's Environmental Health and Safety Guidelines.

362. **Monitoring and Reporting.** Both government and ADB have their own separate monitoring responsibilities. The extent of monitoring activities, including their scope and periodicity, will be commensurate with the project's risks and impacts. Governments, through the implementing agency, are required to implement safeguard measures and relevant safeguard plans, as provided in the legal agreements, and to submit periodic monitoring reports on their implementation performance. Monitoring and supervising of social and environmental safeguards is integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued.

Table 8-1 Roles and responsibilities of key stakeholders

Stakeholder	Main Role in Implementation of the EMP (EMMP)	Responsibilities						
		Decision maker, Policy Advice and Intergovernmental and Inter-Ministerial Co-ordination on Safeguards	Preparation of CEMP	Implementation of Mitigations and/or Management Programs in CEMP	Daily/Weekly Checklists and Monthly Reporting	Supervision/ Quality Control/ Enforcement	Consultation, Advice, Complaint, Feedback	Audit Quality Assurance
PWD	Proponent /Owner	Responsible for overall project implementation					Responsible for resolution of comments and grievances	Input
DSC Project Manager/Site Supervisor	Project Management, Supervision, Contract Management	Support PWD at meetings	Supervision and coordination of Quality control	Supervision and coordination of Quality control	Responsible For Supervision and coordination of Quality control	Responsible For Supervision and coordination of Quality control	Coordination	Support Implementation of QA Audit by DEPC Delegated authority to enforce if DEPC constrained by budget or personnel
DSC Safeguards Team	Support to Project Manager	Support PWD at meetings	Coordination of preparation and approval of document	Responsible for Implementation	Responsible for preparation	Input and Support	Preparation of feedback on comments and GRM	Implementation of QA Audit Delegated authority to enforce if DEPC constrained by budget or personnel
Contractor	Construction	Provides technical support at meetings on request	Responsible for Preparation	Responsible for Implementation	Responsible for preparation			Provides requested information form site visits
Provincial Government	Consultation and advice	Input to Technical meetings	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance	Facilitation of feedback to communities	Input
Village Communities	Consultation and advice	Provide Advice through CCP process	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance	Prepares comments and/or grievances	Input
DEPC	Monitoring of Compliance	Responsible for Safeguards Implementation Approve PEA and	Review of CEMP	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Responsible for review and enforcement of EMMP provisions

Stakeholder	Main Role in Implementation of the EMP (EMMP)	Responsibilities						
		Decision maker, Policy Advice and Intergovernmental and Inter-Ministerial Co-ordination on Safeguards	**Preparation of CEMP**	**Implementation of Mitigations and/or Management Programs in CEMP**	**Daily/Weekly Checklists and Monthly Reporting**	**Supervision/ Quality Control/ Enforcement**	**Consultation, Advice, Complaint, Feedback**	**Audit Quality Assurance**
		EMMP Provide Advice to DPW						
ADB	Due Diligence and Monitoring of Safeguard Monitoring Reports	Review of PEA and EMMP	Review of CEMP	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation

C. Capacity building requirements

363. Capacity building has been discussed briefly with the PWD and will be confirmed as part of the final design phase.

364. PWD has recently developed a social safeguards framework (SSF) through the Vanuatu Transport Sector Support Program (VTSSP). The VTSSP is financed by the Department of Foreign Affairs and Trade (DFAT) of the Government of Australia and is now in its second phase. The VTSSP includes support for social safeguards and other institutional strengthening within MIPU such as human resource management and procurement.

365. The SSF for VTSSP is currently being implemented by PWD. Implementation includes capacity development and training for PWD staff and local contractors in the provinces and was developed partly in response to challenges face in the first phase of the program. MIPU and PWD intend to apply the SSF to other infrastructure projects and PWD work programs over time however currently the focus is on the VTSSP. Environment is included in the SSF however understanding and capacity for environmental elements is relatively weak. The current emphasis is largely on social safeguards with only one out of the seven elements of the SSF being environment.

366. As the PWD is one of the few central government departments with line staff in the provinces (where DEPC has no operational staff) it was considered to be useful to improve understanding of environmental safeguards for PWD staff and contractors in the provinces.

367. A recent step towards strengthening CSS implementation is the PWD appointment of a Senior Safeguards Officer and also an Environmental Safeguards Officer. These are new appointments and these officers will be involved with this TA and the DEPC as it is progressively implemented in those areas of PWD work outside the VTSSP.

D. Environmental mitigation and monitoring

1. Mitigation

368. ***Section V*** described the potential impacts and risks of the six subprojects for all three phases of the project and also specified mitigating measures for some of the subprojects which are considered to have higher risks due to the more sensitive existing environment surrounding the subproject.

369. This section includes a discussion of agreed design mitigations that have been included into the design of the subprojects considered to require mitigation to address both cyclone damage. Mitigations were also required for the moderate to high risks assessed for the impact of the construction phase on the subproject, which is concluded to lead to the majority of more significant risks if unmitigated.

370. However, due to the localised nature of activities, the scale and duration of construction required and the relatively low population density in the vicinity of most subprojects, the impacts were generally assessed as being of low significance with mitigation. A minority of subprojects showed moderate to high direct or indirect impacts and required mitigation or management intervention.

371. It should be emphasised that for most subprojects the works will focus on reconstruction within existing corridors which were generally found to be highly modified due to the past operation of the ring road. For most subprojects, the road corridor does not traverse stream sections which include critical or natural habitats. Subprojects are not located in, or adjacent to, protected areas or conservation areas. The final design will include environmental enhancements to address cyclone damage with design mitigations to build back better.

Design mitigations

372. Design mitigations have been proposed to address any impacts rated high to moderate. A baseline study of a sample of freshwater streams is presently being undertaken for the stage 1 studies to identify flora and fauna which could require additional measures; the results of which will be integrated into the environmental management plan (EMP). The baseline study will form the basis for a restocking and/or conservation program for specific species in designated stream sections to further reduce risk.

Table 8-2 Proposed design mitigations

Subproject	Proposed Design Mitigation/ Management Program
Tanoliu and Ulei culverts	The culverts will be replaced with open box design and an additional culvert upstream, to maintain the tidal flow into the saltwater area. Any works with the potential to divert river flow will be timed at periods of low flow and also to avoid any endemic fish and invertebrate fauna spawning seasons. This information is currently being obtained from the fish biodiversity study
Tassiriki road and drainage improvement	The drainage flows from the road corridor are considered to be a high risk of affecting on-going lagoon water quality, especially turbidity. It is recommended that that the drainage design optimise the use of soft swale drainage systems directed to side roads or open land to reduce the risk of the road corridor having negative effects on lagoon water quality during operation of the road and drainage system
The freshwater stream at Ulei	A baseline biodiversity study of freshwater fish and invertebrates is presently being conducted in selected subprojects to promote selective restocking programs (Epau, Creek Ai and Ulei). Ulei freshwater stream has been proposed for inclusion in the baseline due to its importance as a village water supply and to check the species and abundance from the limestone spring source which was reported as lcsoll rare by the community. Also due to the sensitivity of the freshwater stream at Ulei it was reccomended that construction of the culvert only consider options which will accommodate traffic control measures within the corridor.
Road safety	Guardrails were improved at every site where guardrails were either existing or required. All existing guardrails at structures were either substandard in alignment, height, connectivity, length or a combination of these. There was no guardrail in several locations where guardrails should be present and these were provided in the concept design. Handrails and footways were provided to all new structures. Concrete footpaths, up to 25m long, were designed at the ends of a bridge footway (either existing or provided in the design). This improves pedestrian safety as it prevents vegetation growing on the approach to the footway. And it provides greatly

Subproject	Proposed Design Mitigation/ Management Program
	improved access for people with disabilities, contributing to the achievement of universal access provision. At Tassiriki, consideration is still being given to the opportunities to include pedestrian refuge islands at locations where pedestrians frequently cross the road.

Environmental management and mitigations

373. There are site specific noise mitigations required for Epule Bridge due to the need for the use of pile driving equipment. The noise impact analysis predicted for the duration of piling (6-8 weeks) there would be excessive noise in the nearby village area. The excessive noise of the pile driver will require mitigations including:

> Notification to all receptors and the Contractor will prepare a schedule of operations that will be approved by the village chief. The construction schedule will identify days on which there should be no work, and hours of work for each construction activity and identify the types of equipment to be used

> Restricting the hours of operation to agreed times

> Requirements in the CEMP and contract documents that all vehicle exhaust systems and noise generating equipment be maintained in good working order and that regular equipment maintenance will be undertaken

> Noise incurred by construction workers from construction machinery is a workplace health and safety hazard. Workers will be provided with noise abatement personal protective equipment as may be required

> Complaints regarding noise will be dealt with in accordance with the CCP which includes the grievance redress mechanism GRM, the contractor will elaborate the requirments of the GRM during construction in the CEMP.

374. For Tanoliu and Ulei, the need for temporary traffic diversions outside of the nominal road corridor was assessed as being of moderate significance for health and safety and also for potential ecological impacts at Ulei. Therefore, traffic diversions are no longer being considered at these two sites.

375. To manage the sensitivity and socioeconomic significance of the freshwater spring at Ulei, the Contractor will be required to enforce zones of no access for their workers, plant and equipment

376. At Ulei, the Contractor will be required to demonstrate a work method (documented in the CEMP) that adequately manages the habitat, movement and breeding cycle of the fish present. The outcomes and recommendations of the biodiversity baseline study at Ulei must be incorporated into the work method.

377. A quality assurance audit of Contractor practices will be carried out by the DEPC biodiversity officer and/or their independent representative before site works affecting the current flow regime

378. The adoption of the “build back better” principle led to the development of environmental enhancements (in addition to the mitigations) where risk to some elements of natural habitat could be reduced, damage to the natural environment from the cyclone could be restored and/or positive ecological and socioeconomic impacts could be maximised.

379. An EMP was prepared. This includes the proposed design mitigation measures in locations where areas of existing natural habitat were considered to require rehabilitation and/or enhancement. The EMP

also provides guidance to the Contractor for the preparation of the CEMP, with management and mitigation principles and a guide to the development of a monitoring system.

380. The complete environmental mitigation and monitoring matrix focused on the preparation of the CEMP for each construction contract, is set out in **Table 8-3**. It outlines the management and mitigation principles and provides guidance for the Contractor responsible for the preparation of a CEMP. It also provides guidance on the necessary monitoring program that will be required to ensure compliance with the EPC Act and ADB requirements during implementation of the subprojects.

381. An integral part the EMP structure is the grievance redress mechanism (GRM) and will be responded to by the contractor in the CEMP. The need and requirements for the GRM is established in the CCP and is detailed in the social safeguards due diligence report (DDR).

382. There are site specific noise mitigations required for Epule Bridge due to the need for the use of pile driving equipment. The noise impact analysis predicted that Epule village would be subject to excessive noise. The excessive noise of the pile driver will require mitigations including:

> Notification to all receptors and the Contractor will prepare a schedule of operations that will be approved by village chiefs. The construction schedule will identify days on which there should be no work, and hours of work for each construction activity and identify the types of equipment to be used

> Restricting the hours of operation to agreed times

> Requirements in the CEMP and contract documents that all vehicle exhaust systems and noise generating equipment be maintained in good working order and that regular equipment maintenance will be undertaken

> Noise incurred by construction workers from construction machine is a workplace health and safety hazard. Workers will be provided with noise abatement personal protective equipment as may be required

> Complaints regarding noise will be dealt with in accordance with the community consultation plan (CCP) which includes the grievance redress mechanism (GRM)

383. The need for temporary traffic diversions outside of the nominal road corridor was assessed as being of moderate significance for health and safety as there is a relatively high population density with potential for nuisance and land use impacts. Road diversions may be necessary for construction of the Waisisi culverts – a road diversion is currently in place (June 2017) for the current emergency works (by others) at the site. In order to address health and safety the following specific mitigations will be required.

> Construction will be timed during the dry season so that local flash flood risk is reduced

> Traffic controllers will be required to use traffic control when trucks enter and leave the road

> After working hours, the traffic volume is low and any hazards will be appropriately protected

> Designated construction zones will be marked and/or fenced with Keep Out and safety information signage and advance warning signs placed on the road

> Provincial authorities, the community and schools will be notified in advance of the schedule and duration of operation (refer Project CCP)

> Disposal sites and haul routes to existing concrete batching plants and quarries will be identified

384. There are further routine mitigations listed under each subproject to provide additional guidance to the Contractor when they prepare the CEMP. The project EARF also stipulates some design criteria for run- off management design as follows:

> Roadside storm-water drainage will include the following recommendations:

- Cross drainage using culverts will be carefully evaluated to ensure that systems do not fail from excessive discharge
- Where the road traverses ridges, side drains (off-takes) are required to direct storm water flows away from the road. These are to be established at 2 m vertical intervals (VI) where bare earth channels will be maintained. If a 2 m VI cannot be achieved, then consideration will need to be given to vegetated channels with a VI of 4 m or otherwise armoured with concrete or half round steel pipes.
- Where cross drains are required stable outlets will be provided that can carry the runoff safely to the disposal area. Culverts and drains must not be allowed to terminate above a disposal area without considering the possible effects on the stability of the discharge area
- All pipe and box culverts must have flared level outlets and be provided with a vertical cut-off wall at the end of the apron that extends at least 0.35m below the apron to avoid the apron being undercut
- All culverts are to discharge to safe (non-eroding) areas

2. Monitoring

385. The CEMP for each construction contract will detail the contents of the monthly environmental report which at a minimum will include:

> Routine non-compliances

> Reporting status for each level of non-compliance and proposed contract enforcement

> Incident and complaint classification with required reporting time-frames and status of resolution

> Reporting of the results of regular community update / progress meetings including use of local labour (gender disaggregated)

386. Site monitoring will be undertaken by the DSC on a monthly basis. This will be conducted in conjunction with PWD and DEPC where possible. The intent of the monthly monitoring is to ensure that all requirements of the CEMP and Project documents are being complied with. These will be summarised into the semi-annual safeguards monitoring reports.

387. Daily monitoring of routine environmental measures, will also be taking place by the DSC. Where necessary, these will be reported to the Contractor and rectified by the Contractor, as required under the contract.

E. Pre-construction and construction mitigation principles

388. This section highlights the routine mitigation measures that will form the basis for each CEMP and each measure will require monitoring and supervision. The proposed mitigations for the pre-construction and construction phase are set out in **Table 8-3**.

389. The table outlines the management and mitigation principles and guidance for the Contractor responsible for each Contract package to prepare a CEMP. It also provides guidance on the necessary monitoring program that will be required to ensure compliance with EPC Act and ADB requirements during implementation of the subprojects.

Table 8-3 EMP matrix

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
Pre- Construction Phase								
Vegetation clearance (Physical)	> Minimise vegetation removal to immediate corridor of works > Identify/mark out mature or special trees and areas of vegetation to be protected	Contractor	DSC Project Manager/ Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Area of vegetation; area of felled trees/vegetation removal Drawing/plan identifying trees and/or vegetation marked for protection	Visual inspection with Photos before, during and after	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Land use changes and restrictions (Social)	> MOU negotiation with landowning units	Contractor/ DSC and Village Elders	Customary Land Management Office (CLMO) for Custom Land and Lands Department for Leases	Incl in Contract ESO Site supervisor + two field assistants	Grievances from communities and Agreed Resolution	Third Party Verification	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> During consultation communities confirm they are willing to cooperate with a MOU to be agreed and signed	Contractor/ DSC and Village Elders	Customary Land Management Office (CLMO) for Custom Land and Lands Department for Leases	Incl in Contract ESO Site supervisor + two field assistants	MOU signed	Third Party Verification	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Non-land assets damaged to be compensated(e.g. trees, crops, yards, sheds and fences)	Contractor DSC	DSC MIPU MPW and Finance	Incl in Contract ESO Site supervisor + two field assistants	Compensation for any Damage foreseen for mobilisation and facilities	Compensation Paid before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Social disruption due to mobilisation of contractor, presence of construction workers, associations with local people **(Social)**	> Village protocols discussed; worker awareness as part of mobilisation	Contractor / DSC	MIPU Province Village Elders	Incl in Contract ESO Site supervisor + two field assistants	Complaints of incidents between workers and villagers;	Complaints of incidents between workers and villagers;	Contractor/ DSC MIPU MPW Coordinator	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Contractor prepares, and submits for clearance, CEMP which identifies protocols and construction work force elements. A separate Safety, Security and Health sub-plan will be developed as part of the CEMP: If Camp required Contractor to ensure workers actions outside camp/site are controlled and village rules, code of conduct observed	Contractor	MIPU Province Village Elders	Incl in Contract ESO Site supervisor + two field assistants	Complaints of incidents between workers and villagers;	Complaints of incidents between workers and villagers;	Contractor/ DSC MIPU MPW Coordinator	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> If Camp required Signage and security at camp i.e. prohibition on unauthorised people (esp.	Contractor DSC	MIPU Province Village Elders	Incl in Contract ESO Site supervisor + two field assistants	Number and effectiveness of signs	Signage Installed before Construction commences	Contractor Photo record and relevant Communications in Monthly Report to DSC Project	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	children) entering camp						Manager	
Public/ workforce health (Social)	A separate Safety, Security and Health sub-plan will be developed as part of the CEMP	Contractor	MIPU PWD and MOH	Incl in Contract ESO Site supervisor + two field assistants	STI/HIV/AIDS prevalence	Prior to construction - check contractor records, consultation with employees, Coordination with MOH	Contractor relevant Communications in Monthly Report with MOH to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Follow Up Evaluation before Construction Commences	Contractor	MOH	Incl in Contract ESO Site supervisor + two field assistants	Increased awareness about transmission and prevention	Randomised Evaluation Survey	Evaluation Survey Results	Random or Routine Audit by DEPC and/or Safeguards Specialist
Construction Phase								
Air quality (Physical)								
	> Prohibition of use of equipment that causes excessive pollution (e.g. generates smoke)	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visible Smoke or other Vehicle Emission	Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Vehicles transporting dust-producing material not overloaded, provided with tail-boards and side-boards, and adequately covered	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visible Dust	Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Material stockpiles located in sheltered areas and to be covered	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visible Dust	Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Damping down of access road during the dry season	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visible Dust	Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Noise emissions (Social)								
	> Construction vehicle exhaust systems and noisy equipment will be maintained to minimize noise	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Noise in Dba using hand held monitor at Standard Distance	Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Contractor will develop a schedule of operations with village chiefs and DSC to identify days of no work and hours for certain activities	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Schedule Delivered copy in MR	Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Limit noisy construction activities to day time hours, i.e. construction activities prohibited	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two	Agreed with Village officials by	before start of Construction	Contractor Daily Record Checklist and relevant Communications in Monthly	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	between 9pm and 6am			field assistants	Letter		Report to DSC Project Manager	
	> Agree on non-routine notice protocol with village leaders	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Agreed with Village officials by Letter	before start of Construction	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Water quality (Physical)								
	> Construction works in areas of rivers, especially riverbanks, streams and the coast to be undertaken with extreme care > A separate river diversion sub-plan will be developed as part of the CEMP	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Daily Start and Finish at site	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Use of silt control devices and sediment traps/fences during bridge and culvert works and extraction activities with regular cleaning and maintenance.	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Daily Start and Finish at site	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Temporary structures to minimize any reduction of river and stream flows	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Daily Start and Finish at site	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Temporary structures removed on completion of works and riverbed restored	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Daily Start and Finish at site	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Side slopes of embankments designed to reflect soil strength	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Verify design	Implementation completed	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> River training and scour protection as needed	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Verify design	Implementation completed	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Minimise size and duration of cleared areas and undertake progressive re-vegetation of cleared/work areas	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Avoid clearing activities during rainy season where	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	possible			field assistants			Report to DSC Project Manager	
	> Natural water flows in streams and rivers will not be interfered to the extent possible	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Use of heavy machinery in smaller more sensitive freshwater aquatic environments to be minimized	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Good design used in all construction activities to minimize need for changes to natural gradients	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> No discharges of POL to rivers and surface waters.	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Erosion and sediment control (Physical)								
	> Stockpile of suitable material always available and used in event of bank or channel erosion	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Gabion baskets or rock rip-rap to be used for embankments when suitable	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> No dumping of spoil in streams and rivers	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Spoils and stockpiles will not be located near or on slopes or within flood zone of rivers and streams	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Placement of diversion ditches around stockpiles	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
							Manager	
	> Abstraction from, or pollution of, water resources and coastal waters not permitted	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Land use changes (Social)								
	> Existing quarries will be used wherever possible and appropriate	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Letter	Verify before Construction Commences	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Extraction from ecologically sensitive areas (inter-tidal, swamp, or mangrove areas) or productive land is not permitted	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Verify	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist	
	> Sites for Spoil Placement to be identified in consultation with MIPU DPW, land owners and communities	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants		Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist	
Topsoil protection (Physical)								
	> Topsoil is preserved in designated storage areas and reused as soon as possible to promote and stabilise endemic species	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Endemic Species to be preferred unless there are technical reasons for using introduced species	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Letter	Verify before Construction Commences	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> After completion of works all areas edging streams to be restored to original condition as quickly as possible with suitable mix of trees and shrubs to promote stabilisation of soils	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Visual Inspection with Photo date	Verify within two weeks on work completion	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Hazardous materials planning (Physical)								
	> Detailed Emergency Response Plan (as part of CEMP) prepared by Contractor	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two	Report	Report Completed before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	to cover hazardous materials/oil storage, spills and accidents > A separate Solid and Liquid Waste Management sub-plan will be developed as part of the CEMP			field assistants			Report to DSC Project Manager	
	> Chemicals will be stored in secure containers.	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safe Storage practice	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Chemicals stored in bunded area or compound with concrete floor and weatherproof roof	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safe Storage practice	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Spills will be cleaned up as per emergency response plan	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safe Storage practice	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Signage for no go smoking zones	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Signage	Photo Verification	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Provide training workers on ERP procedures and equipment e.g. extinguishers	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	ERP training	Verify Monthly with weekly Tool Box follow up	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Incident reporting procedure (Social)								
	> Incident level to be classified by Type in CEMP	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Incident Tracking Procedures	Plan in Place before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Level 1 All human or significant widespread pollution with 24 Hours with Senior DSC and MIPU MPW Management Notified	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Incident Tracking Procedures	Plan in Place before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Incident recorded and Resolution closely Monitored	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Incident Tracking Procedures	Plan in Place before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
Sensitive ecosystems (Biological)								
	> Mangroves not to be felled, removed or damaged	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Loss of natural habitat	Plan in Place before Commencement	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Vegetation clearance to be kept to minimum, avoid felling of road-side trees wherever possible	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Vegetation Clearance	Photo before after	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Contractor responsible for information and sanctions regarding harm to wildlife and felling of trees (not requiring to be cleared)	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Vegetation Clearance	Contract Clause on Damage and sanctions	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Camp, equipment and stockpiles not to be located in ecologically important or sensitive areas	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Camp /Yard Location	Verify before Commencement of Camp Yard Construction	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Water depth to be maintained at bridges and culverts to allow migrating species to move up and down rivers	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Water Depth	Measurement before commencement and photo Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Progressive re-vegetation to be carried out in all areas disturbed by the project with fast-growing, native species if practicable	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Restoration of Habitat	Verify with Photo record of Installed landscaping in accordance with spec	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Chance find procedure (Social)								
	> Site will be properly demarcated collaboratively with the local community at the start of the construction.	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Chance Find of Artefacts or Site of Cultural Importance	Immediate stop work Level 1 incident Procedure	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Cease activity immediately if artefacts uncovered	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Chance Find of Artefacts or Site of Cultural Importance	Immediate stop work Level 1 incident Procedure	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Inform National Museum	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Chance Find of Artefacts or Site of Cultural Importance	Immediate stop work Level 1 incident Procedure	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	> Undertake all actions required by above	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Chance Find of Artefacts or Site of Cultural Importance	Immediate stop work Level 1 incident Procedure	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Traffic management (Social)								
	> Traffic management plan to be prepared by Contractor	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Notify villages in advance of schedule and duration of works	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Consultations and care taken to minimize disruptions to access	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Install temporary access to affected properties where required	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Spoil disposal sites and haulage routes identified in consultation with the local communities	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Safety Control and Signage to be used in vicinity of works	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Access through people's land will be negotiated with landowners and restored after works completed	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Safe access across work sites provided for the public	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Plan in Place before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Community awareness ascertain village concerns	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two	Traffic Control	Plan in Place before Commencement as	Contractor Daily Record Checklist and relevant	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	regarding traffic management matters (e.g. to determine if they need speed bumps in villages which are close to the road)			field assistants		part of CEMP	Communications in Monthly Report to DSC Project Manager	
	> Traffic Control Procedures in place at all work sites with warning at agreed distances with Stop/Go Monitor in place with radio if more than one	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Traffic Control	Photo Record Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Workforce safety (Social)								
	> A separate Safety, Security and Health sub-plan will be developed as part of the CEMP > Provide workers with noise abatement equipment (ear-muffs etc.)	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safety Clothing and equipment	Photo Record Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> All workers provided with suitable protective head, eyes, reflective clothing and footwear	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safety Clothing and equipment	Photo Record Daily	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Weekly toolbox sessions on Safety in the workplace	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Safety Clothing and equipment	Photo Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
Site security and camp management (Social)								
	> A separate Safety, Security and Health sub-plan will be developed as part of the CEMP□ > All work sites to be secure with workforce identification system	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Site Security	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Designated locked yards for machinery and POL storage	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Site Security	Verify Weekly	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Construction camp authorized access control	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Camp Management	Plan before Commencement as part of CEMP	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist

Environmental Impact (Physical, Biological or Social)	Mitigation Principles to be included in CEMP	Mitigation Responsibility	Supervision Quality Control Responsibility	Mitigation Budget Required For Environmental Staff and Field Equipment	Parameter to be monitored	Frequency and means of verification	Monitoring Responsibility	Audit Quality Assurance
	> Contractor to supply energy source to avoid use of local timber or felling of trees	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Camp Management	Verify Installation before Occupation	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist
	> Contractor installs package wastewater treatment plant and grease trap system with agreed effluent strategy	Contractor	DSC Project Manager/Site Supervisor	Incl in Contract ESO Site supervisor + two field assistants	Camp Management	Verify Installation before Occupation	Contractor Daily Record Checklist and relevant Communications in Monthly Report to DSC Project Manager	Random or Routine Audit by DEPC and/or Safeguards Specialist

390. The elements of the environment and a summary of the mitigation measure for each are:

Air Quality

> Prohibition of use of equipment that causes excessive pollution (e.g. generates smoke)

> Vehicles transporting dust-producing material not overloaded, provided with tail-boards and side-boards, and adequately covered

> Material stockpiles located in sheltered areas and to be covered

> Damping down of access road during the dry season

Noise

> Construction vehicle exhaust systems and noisy equipment will be maintained to minimize noise

> Contractor will develop a schedule of operations with village chiefs and PWD to identify days of no work and hours for certain activities

> Limit noisy construction activities to day time hours, i.e. construction activities prohibited between 9pm and 6am

> Agree works schedule with village leaders

> Provide workers with noise abatement equipment (ear-muffs etc.)

Water Quality

> Construction works in areas of rivers, especially riverbanks, streams and the coast to be undertaken with extreme care

> Use of silt control devices and sediment traps/fences during bridge works and extraction activities with regular cleaning and maintenance.

> Temporary structures to minimise any reduction of river and stream flows

> Temporary structures removed on completion of works and riverbed restored

> Side slopes of embankments designed to reflect soil strength

> River training and scour protection as needed

> Minimize size and duration of cleared areas and undertake progressive re-vegetation of cleared/work areas

> Avoid clearing activities during rainy season where possible

> Natural water flows in streams and rivers will not be interfered to the extent possible

> Use of heavy machinery in smaller more sensitive freshwater aquatic environments to be minimized

> Good design used in all construction activities to minimize need for changes to natural gradients

> No discharges of POL to rivers and surface waters.

> Alternative / upstream water sources must be arranged for rivers currently used by communities for water supply

Erosion and Sediment Control

> Stockpile of suitable material always available and used in event of bank or channel erosion

> Gabion baskets or rock rip-rap to be used for embankments when suitable

> No dumping of spoil in streams and rivers.

> Spoils and stockpiles will not be located near or on slopes or within flood zone of rivers and streams

> Placement of diversion ditches around stockpiles

> Abstraction from, or pollution of, water resources and coastal waters not permitted

Land Use and Permit Control

> Existing quarries will be used wherever possible and appropriate

> Extraction from ecologically sensitive areas (inter-tidal, swamp, or mangrove areas) or productive land is not permitted

> Sites to be identified in consultation with PWD, land owners and communities

> Preparation and implementation of extraction plan (with limits to volumes extracted from any one source) in accordance with guidelines

> Extraction from rivers will be identified by consultation with PWD, Chiefs and communities and according to approved extraction plan

> All extractions sites to be rehabilitated after use

Top Soil Protection

> Topsoil is preserved in designated storage areas and reused as soon as possible to promote and stabilise endemic species

> Endemic species to be preferred unless there are technical reasons for using introduced species

> After completion of works all areas edging streams to be restored to original condition as quickly as possible with suitable mix of trees and shrubs to promote stabilisation of soils

Hazardous Materials Planning

> Detailed Emergency Response Plan (as part of CEMP) prepared by Contractor to cover hazardous materials/oil storage, spills and accidents

> Chemicals will be stored in secure containers away from the coast, surface waters or rivers

> Chemicals stored in area or compound with concrete floor and weatherproof roof

> Spills will be cleaned up as per emergency response plan

> Prohibit smoking close to fuel storage areas

> Signs of no go smoking zones

> Training workers on planning and implementation

Incident/ Complaint Reporting Procedure

> Accidents reported to police and PWD within 24 hours Level 1

> Level Classification to be agreed with PWD

Sensitive Ecosystems

> If possible mangroves not to be felled, removed or damaged and if necessary be replaced

> Vegetation clearance to be kept to minimum, avoid felling of road-side trees wherever possible

> Contractor responsible for information and sanctions regarding harm to wildlife and felling of trees (not requiring to be cleared)

> Camp, equipment and stockpiles not to be located in ecologically important or sensitive areas

> Water depth to be maintained at crossings and culverts to allow migrating species to move up and down rivers

> Progressive re-vegetation to be carried out in all areas disturbed by the project with fast-growing, native species

> Contractor to supply sufficient cooking fuel to avoid use of local timber or felling of trees

Chance Find Procedure

> Site will be properly demarcated collaboratively with the local community at the start of the construction.

> Cease activity immediately if artefacts uncovered

> Inform National Museum

> Undertake all actions required by above

Traffic Management

> Traffic management plan to be prepared by Contractor

> Notify villages in advance of schedule and duration of works

> Consultations and care taken to minimize disruptions to access

> Install temporary access to affected properties where required

> Spoil disposal sites and haulage routes identified in consultation with the local communities

> Safety Control and signage to be used in vicinity of works

> Access through people's land will be negotiated with landowners and restored after works completed

> Safe access across work sites provided for the public

> Community awareness ascertain village concerns regarding traffic management matters (e.g. to determine if they need speed bumps in villages which are close to the road)

Workforce Safety

> Provide workers with noise abatement equipment (ear-muffs etc.)

> All workers provided with suitable protective head, eyes, reflective clothing and footwear

> Weekly toolbox sessions on Safety in the workplace

Site Security

> All work sites to be secure with workforce identification system

> Designated locked yards for machinery and POL storage

> Construction camp authorized access control

F. Environment monitoring and reporting

391. Monitoring is a component of impact assessment to reduce uncertainty about routine and unanticipated impacts such as spill incidents, to ensure mitigation measures are working and to reassure the public on the progress of the development. Progressive monitoring must accompany various stages of the subproject activities (pre-construction, construction and operational phase).

392. The Environmental monitoring plan is based on the potential impacts, significance of the impacts and mitigation approaches identified during the scoping and feasibility study. It is comprised of parameters to be monitored, frequency of collection, responsible authorities and cost estimate as per impact. The Contractor will be required to prepare a detailed environment monitoring plan based on the guidance set out in final revised EMP and outlined in **Table 8-3** above and which becomes part of the contract documents. Supervision is the responsibility of the DSC, responsible for monitoring compliance, review contractors monthly monitoring report and proposing ways to improve or strengthen mitigation approaches.

393. The DSC is required to:

- Review contractors monitoring plan based on specifications in the contract documents approve when requirements are met;
- Co-ordinate compliance monitoring programs

394. The Contractor is required to:

- Produce a detail monitoring plan and submit to DSC for review
- Implement all mitigations required under the contract document and contractor's CEMP
- Produce a monthly environment monitoring report to DSC; and submit quarterly monitoring reports with the DEPC and ADB

IX. CONCLUSION AND RECOMMENDATIONS

395. With the proposed design mitigation measures included and implementation of a CEMP with site specific and routine construction mitigation measures, the identified risks can be lowered to an acceptable level to satisfy ADB SPS requirements. As a result, an EIA is not considered necessary, but this will be a matter for determination by the Director, DEPC.

396. The Project is not likely to cause significant environmental, social and/or custom impacts. The mitigation and management measures that are being implemented will ensure that the risk of pollution is minimised as part of the works. Further, the Project will have a positive impact on coastal erosion for some subprojects due to stabilisation or embankment construction.

397. With the proposed design mitigation measures included and implementation of a CEMP with site specific and routine construction mitigation measures, the identified risks can be lowered to an acceptable level. As a result, an EIA is not considered necessary, but this will be a matter for determination by the Director, DEPC.

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APPENDIX A – IMPACT IDENTIFICATION AND ASSESSMENT MATRICES

Subproject : Waisisi Culvert O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
Pre- Construction Phase							
Mobilisation Equipment and Machinery Yard and Storage Area For POL	Air	O					
	Noise	_	Direct	Local	Temporary	Yes	Low
	Hydrology/ Water	O					
	Riverine Ecology	O					
	Land use						
	Socio						
Construction Camp Development Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	land use						
	Socio						
Construction Phase							
Bridge Construction includes Earthworks, piling, construction of abutments, deck placement with Crane	Air	_	Direct	Local	Short Term	Yes	Low to Moderate

Subproject : Waisisi Culvert O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
	Noise	_	Direct	Local	Short Term	Yes	Moderate to High
	Hydrology/ Water	+	Direct	Local	Short Term	No	Low
	Riverine Ecology	+	Indirect	Local	Short Term	No	Low
	Land Use	+	Indirect	Local	Short Term	No	Low
	Socio	+	Direct	Local	Short Term	No	Low
River Channelling Spoil Removal	Air	_	Direct	Local	Short Term	Yes	Moderate
	Noise	_	Direct	Local	Short Term	Yes	Moderate
	Hydrology/ Water	+	Direct	Local	Long Term	No	Moderate
	Riverine Ecology	_	Direct	Local	Long Term	Yes	Moderate
	Land Use	_	Direct	Local	Short Term	Yes	Moderate
	Socio	+	Direct	Local	Short Term	No	Moderate
Culvert Construction includes Earthworks, abutments, laying box culvert , surfacing	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						

Subproject : Waisisi Culvert O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
Road Repair Remove old pavement, Place new base material, compact , resurface	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						
Safety Access Enhancements Safety signs, pedestrian bridge or lane, Gender Access	Air	_	Direct	Local	Short Term	Yes	Low
	Noise	_	Direct	Local	Short Term	Yes	Low
	Hydrology/ Water	_	Direct	Local	Short Term	Yes	Low
	Riverine Ecology	_	Indirect	Local	Short Term	No	Low
	Terrestrial Ecology	+	Indirect	Local	Short Term	No	Low
	Socio	O					
Transport of concrete, borrow material from quarry and spoil removal	Air	_	Direct	Local	Short term	Yes	Low to Moderate
	Noise	_	Direct	Local	Short term	Yes	Low to Moderate
	Hydrology/ Water	O					

Subproject : Waisisi Culvert O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
	Riverine Ecology	O					
	Terrestrial Ecology	O					
	Socio						
Construction Camp Operation Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	land use						
	Socio						
Operational Phase							
Routine Maintenance Community Based		+	Direct	Local	Long Term	No	Moderate

Subproject : Tanoliu Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
Pre- Construction Phase							
Mobilisation Equipment and Machinery Yard and Storage Area For POL	Air	O					
	Noise	_	Direct	Local	Temporary	Yes	Low
	Hydrology/ Water	O					
	Riverine Ecology	O					
	Land use	_	Direct	Local	Temporary	Yes	Moderate
	Socio	+	Direct	Local	Temporary	Yes	Moderate
Construction Camp Development Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	land use						
	Socio						
Construction Phase							
Bridge Construction includes Earthworks, piling, construction of abutments, deck placement with Crane, pile driving	Air	_	Direct	Local	Short Term	Yes	Moderate
	Noise	–	Direct	Local	Short Term	Yes	Moderate to High

Subproject : Tanoliu Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
	Hydrology/ Water	–	Direct	Local	Short Term	No	Low
	Riverine Ecology	–	Indirect	Local	Short Term	No	Low
	Land use	–	Indirect	Local	Short Term	No	Moderate
	Socio	+	Direct	Local	Short Term	No	Moderate
Culvert Construction includes Earthworks, abutments, laying box culvert , surfacing	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						
Road Repair Remove old pavement, Place new base material, compact , resurface	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						

Subproject : Tanoliu Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
Safety Access Enhancements Safety signs, pedestrian bridge or lane, Gender Access	Air	_	Direct	Local	Short Term	Yes	Low
	Noise	_	Direct	Local	Short Term	Yes	Low
	Hydrology/ Water	_	Direct	Local	Short Term	Yes	Low
	Riverine Ecology	_	Indirect	Local	Short Term	No	Low
	Terrestrial Ecology	+	Indirect	Local	Short Term	No	Low
	Socio	O					
Transport of concrete, borrow material from quarry and spoil removal	Air	_	Direct	Local	Short term	Yes	Moderate
	Noise	_	Direct	Local	Short term	Yes	Moderate
	Hydrology/ Water	O					
	Riverine Ecology	O					
	Terrestrial Ecology	O					
	Socio	+	Direct	Local	Short term	Yes	Low
Construction Camp Operation Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						

Subproject : Tanoliu Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance
	land use						
	Socio						
Operational Phase							
Routine Maintenance Community Based		+	Direct	Local	Long Term	No	Moderate

Subproject : Epule Bridge Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance/Risk
Pre- Construction Phase							
Mobilisation Equipment and Machinery Yard and Storage Area For POL	Air	O					
	Noise	_	Direct	Local	Temporary	Yes	Low
	Hydrology/ Water	O					
	Riverine Ecology	O					
	Land use	_	Direct	Local	Temporary	Yes	Moderate
	Socio	+	Direct	Local	Temporary	Yes	Low
Construction Camp Development Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	land use						
	Socio						
Construction Phase							
Bridge Construction includes Earthworks, piling, construction of abutments, deck placement with Crane	Air	_	Direct	Local	Short Term	Yes	Low to Moderate
	Noise	_	Direct	Local	Short Term	Yes	Moderate to High

Subproject : Epule Bridge Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance/Risk
	Hydrology/ Water	+	Direct	Local	Short Term	No	Low
	Riverine Ecology	+	Indirect	Local	Short Term	No	Low
	Land Use	+	Indirect	Local	Short Term	No	Low
	Socio	+	Direct	Local	Short Term	No	Low
River Channelling Spoil Removal	Air	_	Direct	Local	Short Term	Yes	Moderate
	Noise	_	Direct	Local	Short Term	Yes	Moderate
	Hydrology/ Water	+	Direct	Local	Long Term	No	Moderate
	Riverine Ecology	_	Direct	Local	Long Term	No	Moderate
	Land Use	_	Direct	Local	Short Term	Yes	Moderate
	Socio	+	Direct	Local	Short Term	No	Moderate
Culvert Construction includes Earthworks, abutments, laying box culvert , surfacing	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						
Road Repair Remove old pavement, Place new base material, compact , resurface	Air						

Subproject : Epule Bridge Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance/Risk
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	Terrestrial Ecology						
	Socio						
Safety Access Enhancements Safety signs, pedestrian bridge or lane, Gender Access	Air	_	Direct	Local	Short Term	Yes	Low
	Noise	_	Direct	Local	Short Term	Yes	Low
	Hydrology/ Water	_	Direct	Local	Short Term	Yes	Low
	Riverine Ecology	_	Indirect	Local	Short Term	No	Low
	Terrestrial Ecology	+	Indirect	Local	Short Term	No	Low
	Socio	O					
Transport of concrete, borrow material from quarry and spoil removal	Air	_	Direct	Local	Short term	Yes	Moderate to High
	Noise	_	Direct	Local	Short term	Yes	Moderate
	Hydrology/ Water	O					
	Riverine Ecology	O					
	Terrestrial	O					

Subproject : Epule Bridge Type of Impact O- Benign + Positive Impact - Negative Impact							
Activities	Environment Component	Type of Impact	Nature	Area	Duration	Reversibility	Significance/Risk
	Ecology						
	Socio						
Construction Camp Operation Near Village	Air						
	Noise						
	Hydrology/ Water						
	Riverine Ecology						
	land use						
	Socio						
Operational Phase							
Routine Maintenance Community Based		+	Direct	Local	Long Term	No	Moderate to High