Public Rental Board (PRB)

ENVIRONMENTAL MANAGEMENT PLAN (EMP) REPORT

FOR

PROPOSED RAIWAQA HOUSING SITES

(Bal. of LOT 4, DP 3482 & LOT 28, DP 4000)

- Final Report
- July, 2009

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I. EXECUTIVE SUMMARY

The Public Rental Board (PRB) is proposing to re-develop the old housing sites along Nairai Road at Raiwai (Lot 28, DP 4000) and the balance of land on Lot 4, DP 3482 at Raiwaqa, off the main Grantham Road to construct new residential flats to attract low and middle income earners.

The PRB, prior to this Environmental study have engaged contractors to carry out demolition works on the old 4 stories housing structures at the Raiwai site. The balance of land on Lot 4, DP 3482, Raiwaqa will be prepared for the development of additional housing sites. The land on this lot is overgrown with scattered shrubs and farming activities have been carried out by the nearby squatter settlements at Wailea. The Raiwaqa creek runs along the boundaries of this land and opens into the Vatuwaqa River towards the sea end.

The Public Rental Board has been advised by relevant authorities including the Department of Town & Country Planning and the Department of Environment to cease all works until certain conditions are met. This include an:

- Environmental Management Plan (EMP) study to determine potential environmental impacts and suggestion of practical mitigation measures to guide the developers and contractors during the construction and operational stages of the development.

The EMP team carried out an environment impact assessment of the two project sites on the existing environment. This study will cover the following areas as agreed and stipulated in the terms of reference (TOR) prepared by the Department of Environment (DoE):

- Adjacent terrestrial and aquatic species and habitats
- Community consultation and socio-economic issues
- Potential Impacts of the development on the existing environment
- Identification of appropriate mitigation and abatement measures

The study identified a number of potential impacts such as:

- Disturbance to exiting habitats (terrestrial & aquatic) during development & construction of buildings
- Waste Management during construction and operation stages
- Impacts on water quality and storm water if erosion control plans and drainages are poorly developed

- Socio-economic impacts arising from the pollution, traffic, influx of people, noise for stakeholders

As part of the mitigations and abatement measures, the study identified the importance of restoring the terrestrial ecosystem and preventing any environment damage. A summary of the suggested mitigation measures include:

- Rehabilitation of terrestrial areas and excavated/reclaimed sites
- Proper and efficient waste management practices
- Raising of the housing foundations at the Raiwaqa site
- Sediment and storm water control devises and creek bank protection system near reclaimed creek sites to minimize sedimentation/siltation of water ways
- Ongoing communication with all stakeholders during both stages of development and addressing of issues/concerns raised

Overall, the proposed development is aimed at providing new state of the art and affordable housing investments to the increasing demand from potential customers. The development is envisaged to reduce the problem of illegal squatters now rife on unused vacant lands. At the same time the proposed development is set to provide employment and services opportunities to individual and private companies, at the same time contributing to national infrastructure and economic development.

II. INTRODUCTION

The Environmental Management Plan (EMP) report is prepared by the Envi-Green Pacific Consultancy Ltd as one the conditions for the proposed housing developments at the Raiwai and Raiwaqa, Suva by the Public Rental Board (PRB). No further development work will commence on the proposed sites until the approval and endorsement of the EMP report is given from the Director of the Department of Environment.

(i) Statement of Need

The Environmental Management Plan (EMP) studies for the proposed development are carried out to guide the PRB during the land development and construction and operational periods to minimize potential environmental risks, personal health and safety and to ensure environment sustainability.

One of the PRB core function is to develop and produce affordable housing lots/flats and providing mortgage financing to potential customers with a special focus on low income owners.

Development of appropriate policy platforms is needed to address the squatter problem and to have in place a comprehensive programmes to relocate squatters to Government-identified and developed land. For too long the ordinary people, particularly those on the low income and the less privileged, have not been able to afford proper and decent housing.

Lack of these affordable opportunities has resulted in potent and undesirable social and economic side effects such as the increase in illegal squattering settlements with poor living conditions rife with criminal activities, poor morale and a general state of apathy and hopelessness – all of which were an anathema to self and national pride and a vital pre-requisite to nation building.

(ii) The current timetable for the development

The proposed subdivision development and housing construction is to begin after approvals is granted from relevant Government Departments and other relevant statuary bodies. This includes the endorsement and approval of the EMP report by the Director of the Department of Environment.

The project by the PRB is also awaiting the approval of a Chinese soft loan to fund the development. This is targeted for an anticipated commencement in the third quarter 2009 between the months of July-September. The timetable for the proposed development is outlined in table i below.

The duration of the development will depend on finance, resources and wearther:

Table i shows the proposed timetable for the development

Phase of development	Detail of Work	Time Line/Duration
1.Preconstruction activities	Demolition of old 4 story buildings by Raghwan Construction & Resettlement of the existing tenants	2007-2008
	Redefinition of topographic survey	
	Civil Engineering/Concept Designs- China Railway First Group	
	Geotech. Assessment by Taylor Tonkin (NZ)	July, 2004
	EMP study by Envi-Green Pacific Consultancy Ltd	17/06/09-16/07/09
2.Land Development and Preparation & infrastructures	Earthworks, Civil Engineering works, FEA, water and other amenities	July-September 09
3. Building Development and landscaping	Construction of buildings flats	

(iii) Background lists of all consents required/sought

The names of the people and authorities consulted for their consents for the proposed development are listed below in table ii:

Table ii shows the personnel involved in EMP preparation

Names	Relationship to EMP study	Institution
Anonymous	Board Members-approval for development/tender for works	Public Rental Board (PRB)

	Director-Water & sewage connections/availability	Public Works Department (PWD)
Town Clerk/Special Administrator	Consent of development	Suva City Council (SCC)
	Land Acquisition (bal of Lot 4, DP 3482 & LOT 28, DP4000	Director of Lands and PRB
Director	Approval for rezoning & subdivision	Department of Town & Country Planning

iv) People/parties consulted in the EMP preparation

The Department of Environment (DoE) provided a term of reference (TOR) for appropriate study undertakings to be carried out by the environmental consultants. Table iii outlines the list of names involved in the EMP preparation.

Table iii shows the personnel involved in EMP preparation

Names	Relationship to EIA	Institution
Patrick Veu	Property Manager	Public Rental Board (PRB)
Maikeli Ratuove	Development Officer	Public Rental Board (PRB)
Jope Davetanivalu	Scoping exercise for EMP TOR	Department of Environment (DOE)
		Scheme/Concept Developers
Epeli Nasome	Final Approval for EMP	Department of Environment (DOE)
Paulo/ Mosese/Atu	Consultants for EMP	Envi-Green Pacific Consultants Ltd.

(v) EMP Project team

Envi-green Pacific Consultants was engaged by the Public Rental Board (PRB) to carry out the assessment of the proposed development sites and draw up an Environmental Management Plan on June 17, 2009 after successfully tendering for the work. The study team consists of an environmentalist specialist, in the area of coastal processes and engineering, a terrestrial & marine biologist and drainage and geotechnical specialist.

Table iv shows the details of the project team and their areas of specialties.

TITLE	SPECIALISTS
Team Leader / Environmental and Hydrologist & Infrastructure	Paulo Vanualailai (PhD, Japan)
Subject Specialist / Ecologist and Terrestrial Biologist (Fauna & Flora)	Mosese Vuratoga Bati (BSc, S.Pac)
Geotechnical/Drainage & irrigation/Watershed Management	Atu Kaloumaira (MSc, New Castle, UK)

III PROJECT DESCRIPTION

(i) Project Overview

The proposed project is in line with the Public Rental Boards' (PRB) vision for providing decent and affordable housing for low and middle income earners. This vision is in accordance with Section 44 of the Constitution which relates to the provision of land and housing to Fiji Citizens. The PRB will be securing a soft loan from the Chinese Government to commence on the development proposal. Most of the work will be contracted out to private companies while the major development works will be carried out by the China Railway First Group.

The proposed housing development site for the Raiwai site along is approximately 3.5 acres (14,000 m²) in land area and is fronting the *Nairai* Road branching off from the main *Grantham* Road. The second site along the Grantham road, Raiwaqa has a land area of about 5 acres (20,000 m²). A total of 250 single and two bedrooms per site will be developed with the basic amenities (including water, sewer and power) will be developed and made available to the market.

(ii) Location Criteria (including constraints)

The location of the site is situated along the southeast coast of the island of Viti Levu the main island of Fiji (figure i) on the central division. The site, located within the boundaries of the capital city of *Suva* is accessible to all infrastructure developments, services and amenities including PWD water supply and sewage, FEA power supply and Telecommunication facilities. It is about 5-10 minutes drive to the central city area and is serviced daily by the *Raiwaqa* Bus Company Ltd. Both sites are connected by the main Grantham road (Figure iii)

The proposed site is located on the south-east of the central city area and west of the *Laucala* Bay Peninsular. The propose site at the *Raiwaqa* site is relatively on a flat low lying area about 2m above the mean sea level (MSL) while the *Raiwai* site is located on a slightly slanting slope.

Figure (i) Location of site along the Kings road, southeast of Viti Levu.

Figure (ii) Location of site in Suva City indicated by arrow. Rewa River is located east of site.

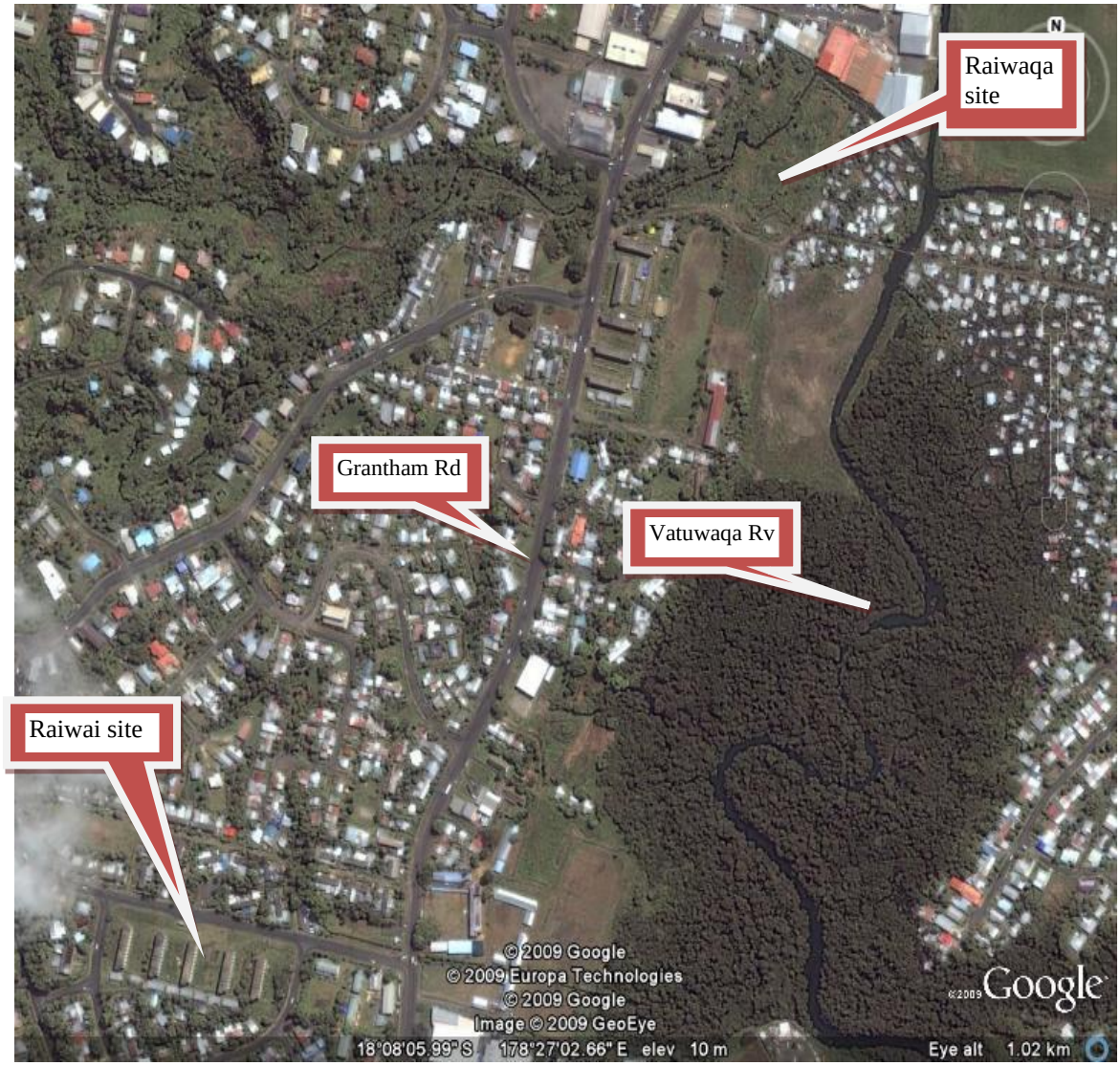


Figure (iii) Location of the two sites along the main Grantham road. Source: www.Google earth

(iii) General layout/Area of the land for development

The proposed land for the development is leased by the PRB from the Department of Lands for tenure of 99 years. The total land area for the *Raiwai* site is 3.5 acres (14,000 m^2) while the proposed site at *Raiwaqa* is 5 acres (20,000 m^2).

The general layout for the proposed site at Nairai road, Raiwai is shown below.

Figure iv: Layout of facilities, buildings and utilities

(iv) Pre-Construction activities

Pre-Construction activities on the two sites involved demolition of old 4 story buildings by Raghwan Construction, Redefinition of topographic survey, Civil Engineering/Concept Designs by China Railway First Group, Geotechnical Assessment to gauge site suitability by Taylor Tonkins and the EMP study by Envi-Green Pacific Consultancy Ltd.

The areas for the main residential building foundations will be cleared, filled and compacted for the proposed building foundations. The storm water drainages will be integrated with the existing *Suva* City Council's (SCC) drainage and engineering plans for the *Raiwai* and *Raiwaqa* sites.

Fill materials to be employed for raising and compaction will be sourced from nearby sources to ensure same soil materials are used namely alluvial and *Suva* Marl.

(v) Project Schedule

The project is scheduled to begin after the Chinese soft loan applied for the Public Rental Board is approved by the Chinese Government. Anticipated commencement is at the third quarter of the year 2009.

(vi) Staffing & Support

The PRB personals that will be employed on the site during the development stages is including the Property Manager and the Development Officer who will oversee the development works and contracts.

Each contractors and sub-contractors will recruit and employ their own staff and workers.

(vii) Facilities and Services

Basic amenities like water, sewage, FEA power and telecommunication will be provided for the developers to all its tenants. In addition, waste management will be provided for by the SCC three times a week to collect and dispose all solid wastes to the new *Naboro* Land Fill.

(viii) Operation and Maintenance Facilities

During the operation of the residential subdivision, the developer (PRB) will be responsible for maintenance work for the buildings, access road, all boundary and access drainages and the mowing of lawn along the boundaries.

(ix) Comparison of options considered most viable economically, environmentally and socially

The site at Raiwai previously accommodated three 4 stories (single flats) buildings with mainly tenants of low income earners. The flats were meant for only meant for a maximum of 2-3 occupants. However, over the years, the number of people living in these single flats has increased to 5-8 on average and has led to many socio-economic implications such as deteriorating living conditions, overcrowding and increase criminal activities such as drugs and break-ins. These have been some of the reasons why these flats have been demolished and tenants relocated.

The PRB now intends to improve in these problematic areas and will now create a more socio-economic and environmentally friendly concept to attract more responsible tenants from the low to middle income earners who will be carefully scrutinized before

their applications are approved. In additions, strict regulations will be enforced regarding the occupations of the flats to ensure privacy, protection and interest of all tenants.

The development of the balance of the vacant land at the Raiwaqa site Lot 4, DP 3482 adjacent to the industrial area and Wailea Squatter settlement is currently been used for subsistence farming activities for crops such as cassava, dalo and vegetables by the Wailea residents. The old Raiwaqa Sewage Treatment Plant is located adjacent to the east boundary. The creek surrounding the land is heavily polluted from the wastes emanating from the industries and the old leaking sewer pipes. The idea of developing the land into a well planned and landscaped subdivision will be of great beneficial economically and environmentally to the developers and surrounding settlements as it will involved the improvements to the drainage systems and waste management. At the same time, the project will help to provide affordable housing for to people seeking proper housing including those from the squatter settlements.

1.0 DESCRIPTION OF EXISTING ENVIRONMENT

This section provides the baseline environmental (biophysical) and socio-economic context to which the potential impacts from the proposed sub-division will be assessed. Where relevant, the baseline methodologies are detailed along with the findings of the study.

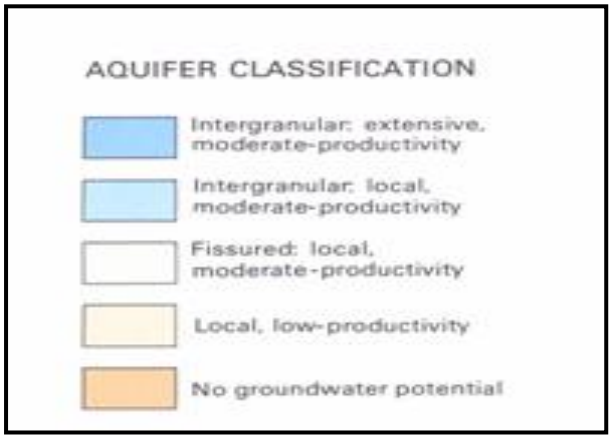
1.1 PHYSICAL ENVIRONMENT

The proposed site at Raiwaqa is approximately rectangular and covers an area of about 20,000 m² of land. It is bound to the west by a natural stream (Raiwaqa Creek) which connects to the constructed drainage channel on the north boundary. The site was formerly a PWD sewage treatment plant and has ceased operation with much of the infrastructures demolished. The area has been condoned off by way of fencing.

1.1.1 Geology and Groundwater Hydrodynamics

Geological maps of the area indicate that the site is underlined by the Suva Marl, a typically light bluish grey siltstone, with occasional band of sandstone (Figure 1).

Figure 1: Suva region show the dominant Suva Marl in brown shades. Arrow shows project site.



The proposed site according to surveys conducted by the Hydrogeological Department at the Mineral Resources Department (MRD) shows no ground water potential for the area (Figure on left).

In the trial pits and auger holes where the Suva Marl was encountered at shallow depths, minor seepages could often be seen along the contact between the soils and underlying rock reflecting a perched groundwater conditions. In the deeper trial pits along the eastern boundary, groundwater seepage was encountered in the organic silt/peat layers and underlying estuarine sands. Seepages and flows encountered during the course of investigations are summarized in table 1 below (Tonkin & Taylor, 2004).

Table 1: Summary of Groundwater seepages

Investigation Hole	Depth to GWL (m)	Geological Unit
TP 1	1.0	Fill
TP 2	1.2	Peat
TP 3	1.6	Estuarine sediments
TP 4	1.9	Alluvial

TP 6	1.2	Peat
TP 7	1.3	Peat
A3	1.4	Fill
A4	0.7	Organic Silt
A5	0.6	Organic Silt
A6	1.5	Organic Silt
A7	1.7	Alluvium

(Source: Geotechnical Investigation for PRB by Tonkin & Taylor, 2004)

1.1.2 Topography & Landscape

The project site at Raiwaqa is predominantly flat, with a gentle upward slope at the southern end. The northern part of this site is lower than most of the rest of the site. The proposed project site is located on the flat low lying flat deltaic areas west of the main Vatuwaqa River with an elevation of about 1-2 m above the mean sea level (MSL). This is equivalent to SS 3403 (SO 3708) MSL (Wood & Jensen, 2004).

The site at Raiwai is located on a gentle slope fronting the main Grantham road on the east side while the west part of the boundary rises to a relative height of about 21 m relative to the lower flat areas of Grantham road. This is equivalent to SS 34400 (SO 4344) MSL (Wood & Jensen, 2004).

1.1.3 Cyclone frequencies, meteorology & seismic activity

The southeast trade winds are the dominating wind pattern. At all seasons these are light or moderate, the most persistent being in the period from July to December. Strong winds are uncommon with the exceptional cyclones which generally occur in the period of November April.

About 10-15 cyclones per decade directly affect Fiji with on the average two to four causing severe damage. The cyclone frequencies as shown in Table 2 below, dated from 1998 to 2003 gives a more recent data and a clear indication that climatic condition are quiet constant.

Table 2: List of recent tropical cyclones from the 1998 to 2003 seasons

Year	Date	Details
1998	Dec 21-28 Max.wind 75 knots. Gust 100 knots	***Cora*** (hurricane). Minor. Approached Fiji from the Northeast. *Vanua Levu*, *Taveuni* and the Northern and central *Lau* Group placed under a Gale warning. The cyclone later brushed past these areas before intensifying into a hurricane. A very moist wind regime was left behind and nearly all the parts of the country received

		heavy rainfall.
2000	Jan 5- 10	***Iris*** (hurricane) Minor. Strong winds recorded around the *Mamanuca* Group, Western *Viti Levu* and *Kadavu*. The closest it passed Fiji was on the evening of the 10th, about 90km southwest of *Kadavu*, but at this stage the cyclone has weakened considerably. Rain was widespread and occasionally heavy.
2000	Jan 20-28	***Jo*** (storm).Minor. Strong gusty winds and flooding were experienced along the northern parts of *Viti Levu, Yasawa* and *Mamanuca* Groups and *Kadavu*. The winds gradually eased on the 26th although rain continued for a while longer.
2000	April 15-17	***Neil*** (gale). Minor. Evolved as a low-pressure system over the Eastern Fiji group. A trough associated with the cyclone caused rain and strong winds over most parts of the group. The direct impact of the cyclone was felt in the Southern *Lau* Group and *Kadavu*, which experienced gale force winds. Widespread flooding in *Vanua Levu* causing the loss of one life and leaving many homeless.
2001	Feb 25- March 3	***Paula*** (hurricane). Moderate. Passed Vanuatu and to the Southwest of Fiji. It was relatively intense with a life span of seven days and reached a peak intensity of 90 knots (10 min average). The accompanying storm surge caused major damage along the Southwest coastline if *Viti Levu, Kadavu*, *Matuku* and Southern *Lau* Group. One death reported. The resulting damage was estimated to be approximately $800,000.
2003	12-15 Jan	***Ami*** (hurricane) Severe. Formed near *Tuvalu* and tracked southwards passing over Vanua Levu and the Lau Group. It was relatively intense system with average winds of 80 knots and life span of 4 days. The cyclone affected the northern parts of *Vanua Levu, Taveuni* ad the islands of central and southern *Lau* Group. The accompanying torrential rain and the storm surge resulted in the widespread flooding in Labasa with 15 people being swept away by the floodwaters and 4 regarded as missing.

Rainfall is usually plentiful between the months of December to April. However, it may be noted that the while the 'dry zone' of the larger islands receive a mean annual rainfall (MAR) of between 1650-2290 mm, the wet zone' receives 3050-3450 mm.

Although southern Viti Levu is shown to have been affected by fewer earthquakes than the area to the north of the Fiji Islands, a significant number of large events have been recorded in close proximity to Suva. The National Building Code of Fiji preliminary earthquake risk zoning map of the Fiji Islands classifies Suva as being within the medium risk Zone 6.

Seismic accelerations to be resisted by a structure are dependent upon the stiffness of the underlying soil/rock. For Suva area the underlying rock is made of the *Medrausucu* groups. Soft soils have the potential to amplify ground accelerations, and allowance should be made for a higher seismic co-efficient. The proposed site at Raiwaqa should be assessed in terms of NZS4203, the site subsoil category for seismic

design actions should be taken as Category B-intermediate soil type (Tonkins & Taylor, 2004).

1.1.4 Current practice for wastewater treatment of surrounding industries

All surrounding industries are connected to the SCC sewer line to collect waster water from toilets including grey water for tertiary treatment at the Kinoya plant. All storm water is drained into the constructed drainage along the north boundary of the Raiwaqa site. The drain dumps contents into the Vatuwaqa River.

1.1.5 Current practice for solid waste disposal of surrounding industries

All solid wastes from the surrounding industries are disposed off by the SCC three times a week. Large waster management bins are provided for on the area for carting and loading purposes.

1.1.6 Water quality of surrounding water way (if any)

No natural water way is near the Raiwai site while the Raiwaqa site is bound to the west by a natural stream (Raiwaqa Creek) which connects to the constructed drainage channel on the north boundary. All industries, commercial and residents' storm water drainages systems end up on this creek.

During the site visit for field assessment, the water quality of the creek and drainages at the south end of the industries clearly shows poor and stagnant water conditions. Clearly visible on the surface are the black oil and greasy patches together with a dark greenish water conditions (plate 1). In-situ water testing on sites shows further evidences of very poor water quality.

The impact of the development of the subdivision will therefore not be solely responsible for any change in water quality of the River.

Plates 1: L-Drainage north of site and back of industries leading to Vatuwaqa River

One (1) on site water tests were taken during incoming tide at about 12pm along the creek to test for the existing physical, chemical & bacteriological state. The water quality was then tested at the National Water Quality Laboratory (NMQL) at Kinoya.

These baseline data are to be used for monitoring purposes during and after the development. The sites for water quality are mapped in figure i of the EMP Monitoring sites under section 6.0.

Table i: Results of the Raiwaqa stream tests on 29/06/2009.

Parameters	Unit	Sample	NWQL Adopted Standards
Temperature	ºC	28.7	25-28 ºC (Normal)
pH	(0-14)	7.29	7.0 (Neutral)
Conductivity	чS/cm	1077	0.01 чS/cm
Salinity	ppt	0.5	0.1
Total Dissolve Solids (TDS)	mg/L	664	-
Biological Oxygen Demand (BOD)	0->10	40	0-Unpolluted, >10 grossly polluted
Nitrate Nitrogen	mg/L	0.1	<0.05
Ortho-phosphate	mg/L	0.05	<0.05
Faecal Coliform	Col/100mL	14000	<350 (WHO*) <200 (USEPA*)

* WHO-World Health Organization * USEPA-United States Environmental Protection Agency

1.1.6.1: Detailed analysis of water quality

The water *temperature* measured was within the normal water range at room temperature ranging between 25.0 and 26.0 ºC. The *pH* levels indicate slight alkaline conditions i.e. 7.29. However, these pH ranges are near the neutral point (7.0).

The *salinity* (amount of dissolved salts/ions) is twice than most unpolluted fresh water creek in Fiji. The mean surface salinity measure was 0.1 parts per thousand (ppt) is normal.

Conductivity of the waters indicates dissolved ions in the waters. The conductivity result 1077 is much higher than the normal standards of 0.01 ч S/cm. This indicates different

possible sources of ions reaching the waters from industries brought down to the stream as runoffs and also drainages.

Biological Oxygen Demand (BOD) is a measure of organic pollution through the reduction in the oxygen concentration of a water sample from the bacterial decomposition of the organic matter present in the water sample. Higher levels of BOD therefore indicate a higher level of organic pollution present in the water. The BOD is the amount of oxygen that would be consumed if all the organics in one litre of polluted water were oxidized by bacteria (Tamata et, al 1992). Higher levels of BOD therefore indicate a higher level of pollution present in the water. The BOD level found was 40 and this is indicative of grossly polluted waters with high presence of organic matter in the stream waters. High BOD levels correspond to low level of dissolved oxygen to sustain aquatic life. The BOD level according to NWQL adopted standards for non-polluted water is zero.

Typical BOD values for various degrees of contamination in river water according to Clark, 1986 as stated in (Tamata et, al. 1992) are as follows:

BOD (mg/L)	Water quality in rivers
< 2	Unpolluted
3-5	Doubtful
4	Borderline
5-10	Polluted
>10	grossly polluted

Faecal coliform bacteria are used as indicators of the possible presence of pathogenic organisms resulting mainly from sewage seepages. Faecal coliform bacteria are used as indicators of the possible presence of pathogenic organisms resulting mainly from sewage seepages. Faecal contamination is measured by a count of the bacterium *Escherichia coli*. *E.coli* is not a pathogen but is always present human faeces (Tamata et, al 1992).The coliform count does not reflect the level of contamination, but itself is a good measure of the risk to which human population is exposed. The coliform count is the parameter used by the World Health organization (WHO) and other international agencies for setting water quality guidelines.

The result of the test showed high presence of faecal coliform for the stream water tested (14,000 organisms per 100mL!). The high presence of faecal coliform makes the water unsafe for human consumption as according to NWQL standards which sets zero (0) coliform for safe drinking. The greater threat from sewage contamination relates to increased risks of bacterial and viral infections in human beings, particularly through the consumptions of shellfish harvested from contaminated sewage water. Filter feeders such as oysters, clams and mussels tend to accumulate toxic chemicals and pathogenic

organisms such as *Vibro cholera*, *Salmonella* and hepatitis a virus in their tissues thus exposing man to a greater risk of infection (Tamata et, al 1992).

However, the WHO (1983) criterion for marine bathing water is less than 350 col/100mL while the United States Environmental Protective Agency recommends concentrations less than 200 col/100mL (USEPA, 1976) so the result implies that the water exceeds the safe limit for recreational use (including swimming and bathing).

1.1.7 Integration of the development in the existing environment

The residential subdivision with an estimated land area of 34, 000 (for both sites) about will comprise a total of 250 residential lots/flats per site. The plan provided for by the designers takes the advantage of the field and adopts the enclosing method with residential building groups of different sizes. The layout of the resident community is close, meanwhile, provides a rich sense of space; integral 'greenland' is combined with the landscape of the park.

The rest of the land will be landscaped with exotic plants to add to the scenery of the proposed project. The creek bank access reserve of 6m on the west of the Raiwaqa site will be re-vegetated with exotic palm trees to help stabilize the soil on the creek banks and acts as natural river water breakers in times of flooding.

Residential houses on the Raiwaqa sites are recommended to be two-three (2) stories high to reduce impact of flooding during peak storm.

1.2 BIOLOGICAL ENVIRONMENT

1.2.1 Existing Terrestrial flora at the site

The proposed land for development for the Raiwaqa housing sites relatively flat deltaic land is dominated by overgrown grassland (paragrass) with some scattered small and medium invasive shrubs. Few coconut trees (*Cocus nucifera*), Mango (*Mangifera indica*) and Jamun trees (*Eugenia jambolana*) and breadfruit (*Artocarpus altilis*) are found on the boundaries. The major land area has been farmed by the *Wailea* residents and crops include taro, cassava, banana and kumala (plate i).

Large mangrove vegetation including both *Bruguiera gymnorhiza* and *Rhizophora* species (*dogo* and *tiri*) is found to the southeast of the site along both sides of the Vatuwaqa River.

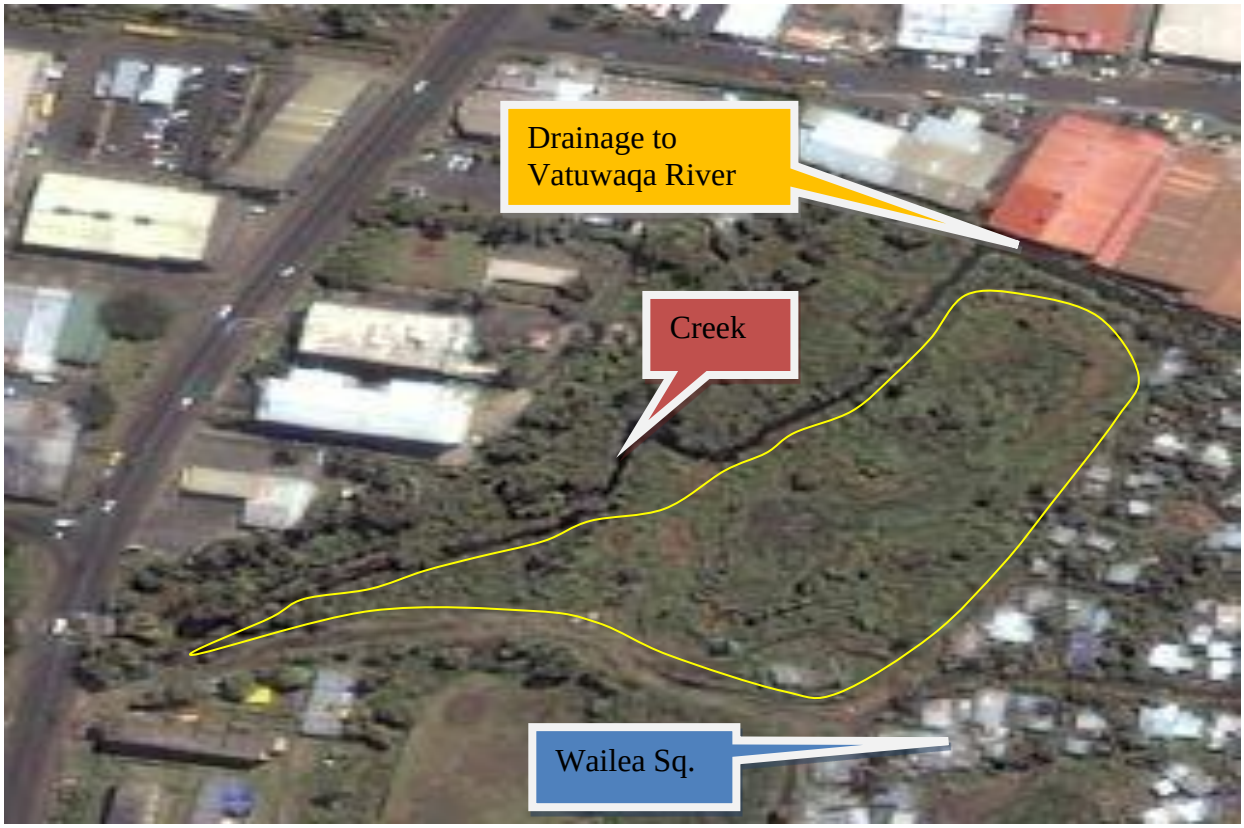


Plate i: Proposed Raiwaqa site off the main Grantham Road on the left

The Raiwai site, south of the Raiwaqa will be redeveloped after the demolition of the five (5) story buildings. The site is bare during the course of the EMP study with few large vegetation trees including the coconuts, breadfruit and mango found on the west and south boundaries.

1.2.2 Existing terrestrial fauna at the site

The common faunal communities found around the proposed site include common pests like mongoose (H*. auropunctatus*), cane toad (*Bufo marinus*) and the mynah bird species (*A. focus*). With minimal vegetation on the site, fewer habitats for avifaunal community are available. Since the area is exposed to disturbances from daily activities including farming, industries and traffic, biodiversity is relatively low.

1.2.3 Creek ecology

The creek that runs along the west boundary has been subject to changing physical conditions as a result of drainages of waste water it receives from residents, commercial and industries along the Raiwaqa areas. The water is in a stagnant condition with very little evidence of aquatic life. Algae dominates the slow running

part of the creek as a result of nutrient loading and as a result of aerobic decomposition, dissolve oxygen levels are too low to support aquatic life (plate 2).

Plate 2: Raiwaqa creek seen at high tide

1.2.4 Sensitive habitats and natural sites

Since the development of the area and surrounding places, the biological ecosystems of the area have seen major changes and alterations as a result of human habitations and ongoing developments. These include the cutting of many of the mangroves forest along the Vatuwaqa River for the expansion of the Wailea squatter settlement. Mangroves are important ecologically as well as acting as very effective coastal erosion and flooding control natural mechanisms.

The landowning unit (*Mataqali*) of *Vatuwaqa* of *Suvavou* village is the traditional fishing rights (*Qoliqoli*) owners of the *Vatuwaqa* River including these mangroves areas.

1.2.5 Species with potential to become nuisances, vectors or dangerous

Invasive species which have been found on the site include the African tulips, Jamun trees and the common sedge, *Mariscus javanicus* found in the lower flatlands boundaries.

Two of the common nuisances including the introduced Indian mongoose, *Herpestus auropunctatus*, cane toad, *Bufo marinus* are also considered invasive species due to their increasing presence in the area.

1.3 SOCIO-CULTURAL ENVIRONMENT

Both proposed developments (Raiwai and Raiwaqa) are within the boundaries of Suva City and are well known for many socio-economic problems as a result of the increasing population including the adjacent squatter settlements of Wailea and Bindhi. With the ever increasing urban movement of people into these areas from many rural parts in Fiji in search for employment and other opportunities, criminal activities and other social ills have been on the rise. The study will try to determine the areas of major concerns and will try to suggest necessary mitigation to help minimise some of these potential impacts.

1.3.1 Current Land ownership issues

The proposed land for development for the housing sites Lot 4, DP 3482 at Raiwaqa and Lot 28, DP 4000 along Nairai Road at Raiwai is leased by the PRB from the Government through the Department of Lands. The crown lease is for a 99 year term (Plate 3).

Plate 3: Adjacent land use around project site at Raiwai marked yellow above.

1.3.2 Quality of the living environment in relation to current land use

Most lands immediately adjacent to the site are under crown grant (freehold). A breakdown of the adjacent land use around the proposed site is given below:

- North (N) of site: Industrial area
- East (E) of site: Industrial and Wailea Squatter settlement
- South (S) of site: Raiwaqa & Raiwai residents
- West (W) of site: Market, Commercial areas

The proposed development site is located within the boundaries of Suva City under the jurisdiction of the province of Rewa. The most likely people who will be disturbed during the development and constructional stages are the Grantham road businesses, residents and the Wailea squatter settlement east of the site along the Vatuwaqa River mangrove areas. Impacts that will be felt during these periods (including the operation) will include increase noise, dust, traffic and disturbances from development activities and an influx of workers and new residents on site.

1.3.3 Demographic profiles and population numbers

According to the National Census carried out in 2007, the two main populous urban areas were Nasinu and Suva with population sizes of 86, 770 and 86,178 respectively. There was a significant population increase of 32,308 in the combined Suva, Nasinu and Nausori areas. The table i below shows the 1996 census of population and housing (about 10 years interval). This is taken as a reference to indicate the current demographic status.

The table ii and iii below shows the population census by Bureau of Statics in 2007 for Suva-Peri urban areas.

Suva	**Household**							
	1996				**2007**			
	Total	**Fijian**	**Indian**	**Others**	**Total**	**Fijian**	**Indian**	**Others**
City	No data collected				16,626	7623	6102	2901
Peri-urban					2054	1316	594	144
Total	**14,502**	**5886**	**5985**	**2632**	**18,680**	**8939**	**6696**	**3045**

Table i: 2007 Household numbers for Suva area

Suva	**Population**							
	1996				**2007**			
City	**Total**	**Fijian**	**Indian**	**Others**	**Total**	**Fijian**	**Indian**	**Others**

Peri-urban								
Total	**77,366**	**38,656**	**26,587**	**12,123**	**75225**	**40,300**	**22,768**	**9733**

Table ii: 2007 Population numbers for Suva area

***(Source: Bureau of Statics, 1996 census of population and Housing)**
***Pop-population, *Hhld-household**

The total population of the whole of Suva City in 1996 was 14, 503 households with a population of 77, 366. In the recent population count in 2007 there was a total of 16,626 households and a population of 75, 225 people. The population after a period of ten (10) years has increased by 2123 households, however there was a decreased by about 2141 in the total population.

1.3.4 Reclamation/earthwork links with public health & population related issues

The development of proper water ways in the proposed site will greatly improve the drainages of the water logged low lying areas. With the improve drainages and clearing of marshland areas, mosquito breeding sites will be minimized thus improving the public health of the nearby communities. Improved drainages along the proposed subdivision will also assist in minimizing the inundation risks during peak storm times.

The current state of existing environment surrounding the Raiwaqa site is unhealthy for human habitation especially to the nearby squatter settlement of Wailea. Many types of disease including water borne diseases have been referred to the nearby Raiwaqa Health Center. This is shown in figure 2 below. Most of these diseases have been related to the poor state of the nearby Vatuwaqa River and the leakages of sewer lines.

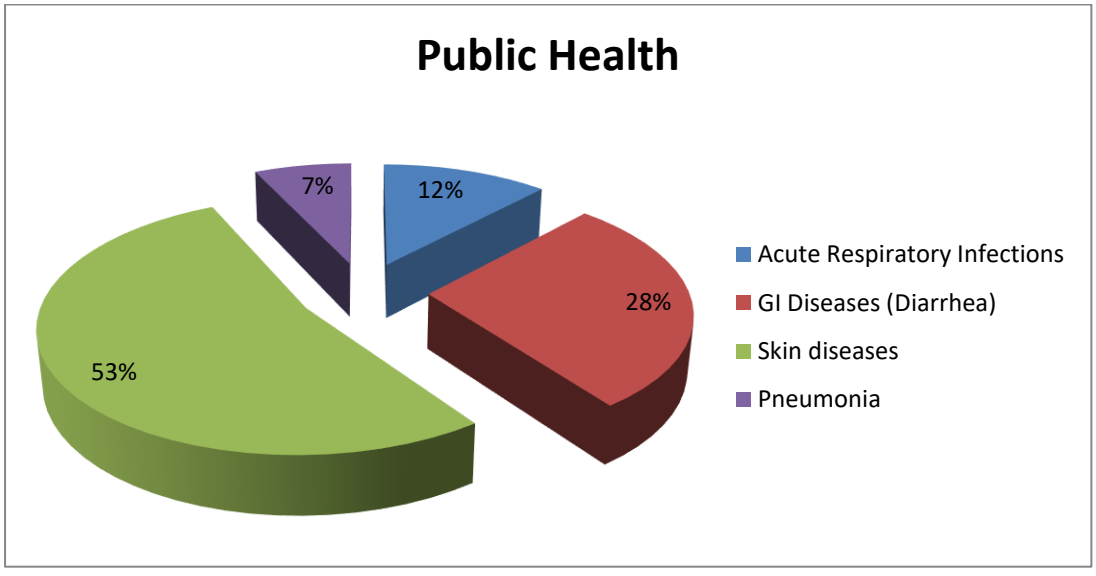


Figure 2: Public Health for stakeholders. Source: Raiwaqa Health Center

1.3.5 Existing infrastructures-access and transportation

The proposed site accessible as it is located along the main Grantham road which branches off the main King's high way connecting Suva city and Nausori Town. The existing infrastructures include FEA power and Telecom (Fiji) telecommunication lines, PWD water supply pipes from the central town areas and road areas.

In addition, Suva City which is about 10 minutes drive from the site provides many available services including hospital, education security and accommodates many government departments.

1.3.6 Source of water supply to support development activities & residential purposes

The development will used the use the existing PWD water supply system that is available in the greater Suva areas area during the construction as well as the operational phase. The area is also located on the leeward side of Viti Levu and receives a lot of rain during the year. Figure i shows approximately 3200-3400 mm of annual rainfall and this indicates a lot. For this reason, rainwater capture is another option that can be employed by the developer to use rainwater during both construction and operation of the warehouse facilities.

Water shortages in the area are hardly experienced by the existing residents and industrial developments. The area sources its water supply from the nearby Tamavua PWD Water Treatment Plant.

The expected number of people expected per sites is 1000 (4 per 2 bedroom flats) taking into account a total of 250 flats per site. If an average person uses 20 L per day, then the total water usage per day per site is an estimated 20, 000 L.

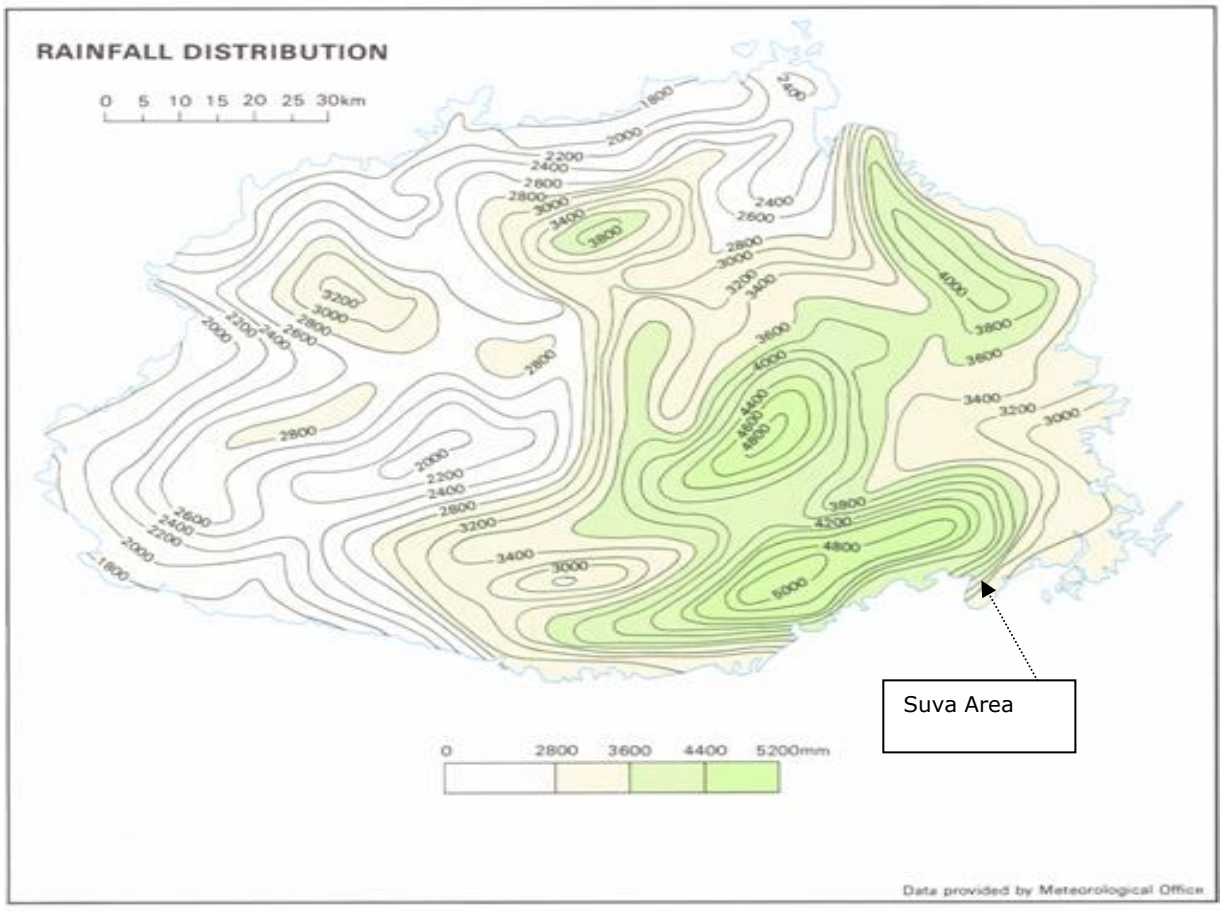


Figure i: Viti Levu Rainfall Data (Source: Mineral Resources Department).

2.0 POTENTIAL SIGNIFICANT ENVIRONMENT IMPACT

The objective of this section in the EIA report is to examine the potential environmental impacts of the proposed development and discuss techniques to control and manage these impacts.

2.1 DESIGN AND ENGINEERING

2.1.1 Compatibility with existing structural plans, site suitability

The major potential significant environment impact of the proposed development on the low lying piece of land at the Raiwaqa site would include:

- Sinking of foundation structure if buildings foundations are not properly compacted and soil poorly drained
- Storm water containment and drainages during heavy down pour
- Impacts of natural disasters such as flooding, cyclones and earthquakes and sea level rise

The structural designs of the proposed buildings is to conform to the existing topography and all engineering and building plans to be certified and approved by relevant governing authorities.

2.1.2 Sites Suitability & drainages

The underlying soils are composed of Suva marl soapstone, swampy and fluvial in nature. Suva marl is a proven solid base for building foundation purposes that allow minimal foundation sinking provided it is compacted and rolled.

The area along the *Raiwaqa* site bounded by the stream on the north side and the tidal Vatuwaqa River on the eastern side needs a detailed storm water management plan to reduce the risk of inundation of these areas during peak storm, spring high tide. It also needs to take into account the impact of sea level rise estimated for a further increase of 1 m in the next 50 years on a global context.

There is a need to design a drainage plan against storm water. Runoff directions and detailed calculations need to be done to estimate the sizes of the pipes and volumes and velocity of discharges and drainages directions needed to be employed for the drainages. This should also take into account the maximum water usage by the tenants on a daily basis. All storm waters will be led away to the stream and constructed drains on the west and north boundaries.

2.1.3 Geotechnical Investigations

Tonkin & Taylor International were engaged by Engineering Designs on behalf of the PRB to provide an on site geotechnical on the proposed site at Raiwaqa. Data provided by these findings will be assessed to gauge the site suitability for building purposes.

The uncounted geotechnical units may be summarized as follows:

- *Fill (Non-engineered):* cobbles and gravels of andesite, well rounded, with a sand matrix, brown grey, medium dense, or, cobbles and gravels of concrete and siltstone (Suva Marl) in a matrix of clayey silty sand, dark brown to brown, moist, loose.

- *Possible Fill (Suva Marl):* Cobbles and gravels of siltstone (Marl) within a matrix of slightly clayey sandy silt, moist, light grey or brown, medium dense, cobble4s and gravels fine to coarse, sub-angular.

- *Shallow Estuarine Silts:* Slightly clayey, sandy silt, brown with some fine shell material (juvenile gastropods), low plasticity, moist, stiff, sand fine to medium grained.

- *Organic Silt/Peat:* Slightly sandy silty peat, fibrous, dark brown, soft, saturated, strong sulphurous odour.

- *Deep Estuarine Deposits:* Slightly silty organic sand, with abundant shell material (whole bivalve shells both juvenile and adult). Dark brown to grey, loose, saturated.

- *Suva Marl:* Siltstone, slightly sandy in places, light grey becomes bluish grey with depth, very week to weak, may be weathered to a slightly sandy, clayey silt, of high plasticity, brown, stiff, moist.

Depth to bedrock (Suva Marl) varies across the site. In some places it is exposed at the ground surface, while other locations (SW end) it is found at over 4 m depth. Two cross sections, orientated NE-SW and NW-SE have been developed for the site, utilizing existing contour information and sub surface information from boreholes and trial pits (Figure 1.0).

In summary, the site is dominated by bedrock high which is positioned along the western boundary of the site. To the west the bedrock slopes off to form the base of the adjacent stream. To the east bedrock is present at progressively lower elevations. The low-lying Marl to the east has been covered in estuarine
silts and sands with organics, which upgrades into the peat. This in turn has been covered with a layer of Marl Fill, which appears to have been placed in a controlled manner. A top few hundred milliliters has been covered with a layer of fill placed on it, including construction debris, and some rounded andesite cobbles probably placed to improve trafficability. In the west, where the Marl drops away into the stream, a thin wedge of alluvial soil has been deposited against the bank. This has recently been covered in turn by debris and earth pushed during demolition of the plant (Tonkin & Taylor, 2004).

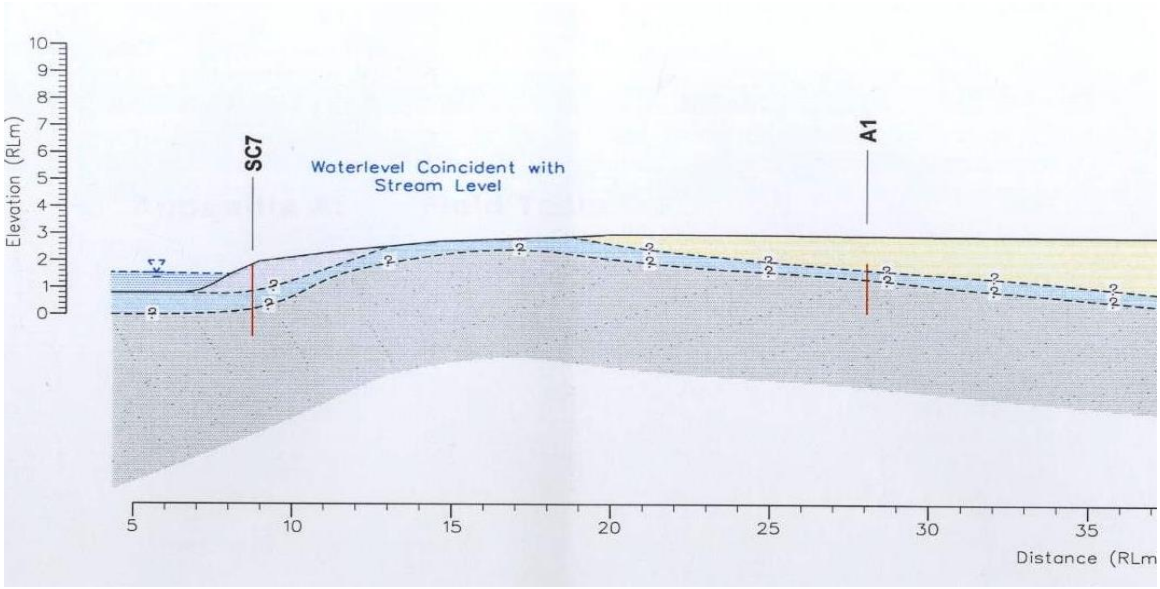


Figure 1.0-i

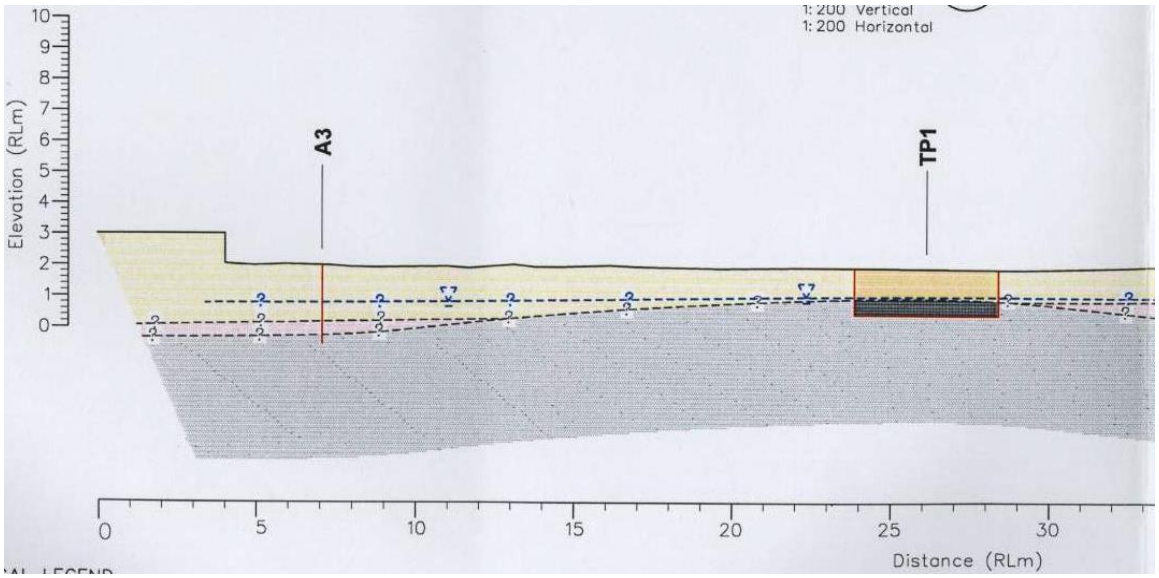


Figure 1.0-ii

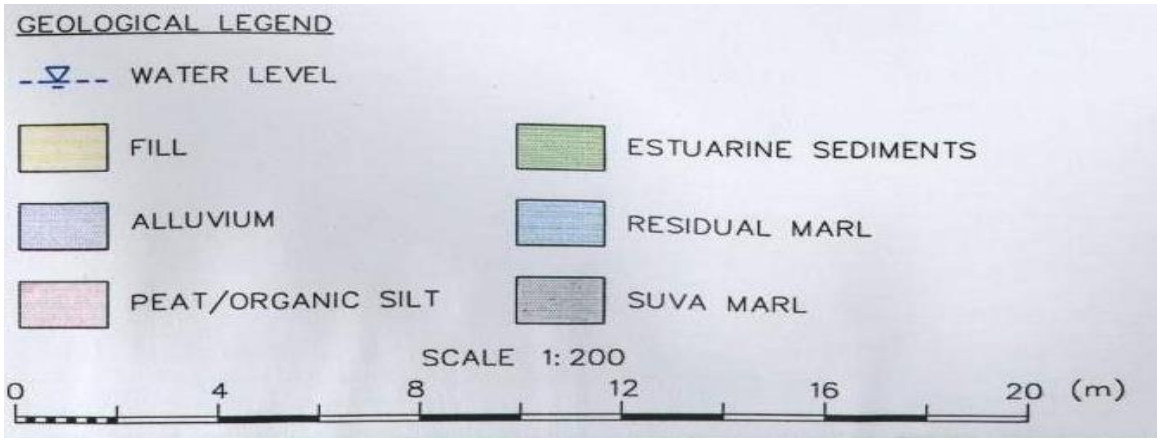


Figure 1.0-iii

2.2 CONSTRUCTION

2.2.1 Land take and site boundaries

Initial site survey plans to draw a scheme/layout plans for rezoning purposes have been carried out on both sites by the developer's surveyor, Wood & Jepsen Consultants in June 2008. Both lots (Lot 4, DP 3482 & Lot 28, DP 4000) are leased by the PRB from the Department of Lands. Lot 4 at the Raiwaqa site has an area of 5.0 acres (20,000 m²) while Lot 28 at the Raiwai site has an area of 3.5 acres (14,000 m²).

2.2.2 Site preparatory works

The main site preparatory works has been carried out at the Raiwai site prior to this study is the demolition of the old five 4- stories buildings that has been built in 1960s. The balanced of land at the Raiwaqa site is overgrown with weeds and shrubs with some farming activities. The demolished building materials from the Raiwai and Raiwaqa sites have been dump on this land and this stump materials will be reused as filled and compaction materials for the new proposed buildings.

Plate 1: Raiwaqa site from west end

Plate 2: Raiwai site from top west end

2.2.3 Effect of development on the local topography (via earthmoving)

According to development plans on both sites, limited earthworks will be required to provide level building platforms and proposed play ground areas.

For the Raiwaqa site, the northern part of the site towards the industrial sites is approximately 1-1.5m below the elevation of the remainder of the site. It is proposed

to have these areas raised by placement of engineered fill (crushed Marl). Placement of fill in this area is likely to cause settlement or sinking.

For the Raiwai site, the eastern part of the site towards Grantham road is approximately 14 m below the elevation of the top western part of the boundary. During demolition works carried out earlier before the EMP study, the cleared and cut soil from the west (top) has been used to fill the lower east end to level the building foundations (Plate 3).

Plate 3: Raiwai site along *Nairai* road looking from east (lower) end

To avoid long term, secondary consolidation settlements, it is recommended that the peat uncounted in the eastern part of the Raiwaqa site is sub-excavated. Existing Marl fill above the peat may be stockpile and reuse where appropriate. After sub-excavation is completed, the subgrade should be proof rolled prior to placement of new fill (Tonkin & Taylor, 2004).

For the filled section of the Raiwai site, compaction and proof rolling of these fill areas is to be carried out to minimise settlements and sinking foundations.

2.2.4 Soil stability and erosion

At present, vegetated natural slopes along the western side of the Raiwaqa site do not show scarps, cracking or other signs of slope instability. Under current conditions, failure of this material is likely to be triggered by erosion of the toe of the slope during

flood events. Given the proximity of the proposed structures to the stream bank, the geotechnical analysis by Tonkins & Taylor recommends the scour protection or armouring of the stream banks is considered during detail design to address flood erosion issues.

To the north side, the excavated drainage channel is within the Suva Marl at its base, with upper parts of the drainage channel banks supported by stone and mortar retaining structures.

For the Raiwai site, no natural stream or slope exist on the boundaries.

2.2.5 Excavation and disposal of surplus materials

All excavated materials from drainage works will be used for recycling purposes to fill the area for foundation purposes. No materials will be disposed off the site.

2.2.6 Erosion due to burrow and fill

For the Raiwai site so steep slope exist. Compaction and consolidations of the filled areas should minimise any risk of erosion. Improved drainages along side the boundaries will be put in place to drain away storm water and reduce or control erosion of filled soil material. Re-vegetations of the filled areas are a long term mitigation to reduce erosion during peak storm.

For the Raiwaqa site, recommended new fill should consist of crushed Suva Marl placed in lifts no greater than 200 mm (2 m) in thickness and compacted with suitable plant (Tonkin & Taylor, 2004). Compaction control and monitoring is required during the earthwork period.

2.2.7 Length and time expected in development/construction

The time table for all land development and construction works will be 18-24 months depending on the weather. The residential flats should be available on the market by mid 2011.

2.2.8 Waste water treatment & disposal

Waste water from land development and construction works could pollute and contaminate surrounding soil and the water ways. All waste water excluding those from temporary toilets will be led away into the road side drainages (Raiwai site) and onto the western stream for the Raiwaqa site.

Waste water from all construction works can contaminate surrounding soil and water ways.

2.2.9 Solid waste disposal

The impact of any solid waste disposed at the surrounding area will compound existing solid waste pollution and pest infestation to the nearby residents (including the squatter settlement) and other stakeholders along the *Grantham* road. All solid waste will be compiled near development site where they will be disposed off at the *Naboro* Land Fill at the expense of the contractors.

2.2.10 Traffic Impacts

Traffic volume and size along with dust, fumes and noise will slightly increase during the initial work phase and should decline towards the end of the phase.

Many pedestrians and vehicles use the busy *Grantham* and *Nairai* road everyday and therefore there will be risks from heavy construction vehicles carrying materials to and from the two sites. For the Raiwaqa site, the residents of Wailea settlement, including school children use the access road to the site as a thoroughfare daily

Traffic cannot be minimized but can be managed effectively through ongoing project communications with the local community and the other stakeholders including the Suva City Council and Department of National Roads. Notices and signages will be placed on strategic positions along the roadside to inform general public and motorists of significant traffic movements and peak work hours.

2.2.11 Siltation/sedimentation impacts on water quality

Siltation impacts will be minimal if work is confined to dry weather and sediment control devises are put in place fill surfaces and including scour protection or armouring towards the stream end of the west end site boundary for the *Raiwaqa* site.

2.2.12 Construction Methods (Detail)

The building contractors during preliminary site studies for the building of the structures at both sites have identified three major areas of concerns during

construction as a result of tropical climate conditions (temp, rainfall & wind) existing in the area.

These include:

1. Foundation constructions
2. Wet work of external work
3. Welding work of steel structures

The detail construction deployment is summarized in table i below:

<table>
<tr><th>Phase</th><th>Detail</th><th colspan="2">Construction Flow</th></tr>
<tr><td rowspan="3">Preparation prior to Construction</td><td>Deepening design of drawing</td><td colspan="2" rowspan="3">Purchase of materials⟶Construction of Sample house ⟶
Order/Manufacture/Fabrication of materials ⟶
Packaging/Delivery of materials to construction site ⟶ Construction of foundations</td></tr>
<tr><td>Detail of drawing</td></tr>
<tr><td>Technical Disclosure</td></tr>
<tr><td rowspan="4">Construction</td><td>Assembly of Light steel structures</td><td colspan="2">Assembly of external walls, internal wall and floor plates</td></tr>
<tr><td rowspan="2">Installation of doors and windows</td><td>Initial decoration</td><td rowspan="2">Outdoor relevant construction</td></tr>
<tr><td>Installation of wall & electricity</td></tr>
<tr><td>Acceptance & Delivery</td><td colspan="2">Maintenance</td></tr>
</table>

(* Source: Shanghai Construction Group)

The detail preparation phase of the Engineering Company is summarized below:

- Field exploration and market investigation
- Preparation of initial Constructions
- Handling Engineering procedures and relevant certificates
- Fulfillment of Persons, Machineries and Certificates
- Construction of temporary facilities
- Project Planning, Location & payoff, recheck
- Construction of earthwork
- Three suppliers & one leveling on site
- Location & payoff for single item and recheck
- Materials arrival on site
- Construction of Foundations
- Construction of Main work
- Construction of Roofing

2.3 OPERATIONS AND MAINTENANCE

2.3.1 Use/Disposal/reuse of surplus solid materials

The disposal of surplus solid waste material is to be categorized as environmentally non-degradable or hazardous substances. Operation and maintenance wastes will include mainly household wastes from the tenants. Maintenance wastes would include building repair (paints, grease), drainages works, and lawn mowing etc. These are to be taken to relevant waste management facilities at the approved *Naboro* Landfill that can store or recycle these solid waste materials.

It is recommended that disposing of such solid waste nearby the site will have to be discouraged. This is because such practices would increase the possibility of pollution overflow during storm waters and spillage of hazardous substances during onsite handling can cause pollution to the surrounding soil and water ways. Operational manual for onsite handling, storage, and disposal of solid and hazardous wastes is to be provided onsite where wastes are kept use in consultation with the health department at the Ministry of Health.

2.3.2 Use and storage of fuel

Fuel (including kerosene, benzene etc) spillage and leakage could pose grave dangers to the existing tenants, due to the close vicinity residents in the new buildings and other buildings along the Grantham road and greater Raiwaqa/Raiwai areas. The potential danger of this is fire breaking out during the dry weather spells could cause fire to spread across the vegetation around the area and nearby industries including the *Raiwaqa* Fuel Bowser and buildings on site boundaries.

2.3.3 Waste water treatment and disposal

The existing PWD sewer lines in the Suva City area will be employed to collect and disposed all waste water to the Kinoya Treatment Plant.

2.3.4 Deterioration of surface water quality from pollution/silt runoff

Deterioration of surface water quality by silts is to be minimised by employing sediment control devises along any cut soil edges and the retaining of most vegetations along the slopes to naturally filter all land liquid waste reaching into outlet drainages. Details of these are suggested on the mitigation section 4.0.

2.3.5 Chemicals and oil/fuel spills as relevant

The new subdivision will have minimal environmental risks from chemical and oil spills as the use of these toxic materials will be minimal during the operation and maintenance stages.

2.3.6 Visual impacts

The visual scene has drastically been changed from its former designs to a new state of the art concept with a touch of 'green' design.

2.3.7 Effects of project on discharge of storm water

The existing road side drainages for storm water along the *Nairai* road at the Raiwai site are located along the downward sloping pavement towards the main *Grantham* road (plate 3). Land clearing and vegetation removal will increase discharge during peak downpour so immediate rehabilitation work is necessary to reduce this impact.

An integrated storm water management strategy is proposed that takes account of future over land flow, hard standing and roof catchment storm water created by the development.

In addition in the operation phase, there will be larger storm water discharges from the paved surfaces, new residential roof catchments and compacted surfaces. Landscaping and replanting vegetations will aid in reducing rate of storm water runoffs. Building drainages at Raiwai site that will be connect to the main *Nairai* road drainages. For the Raiwaqa site all storm water drainages will be led to the lower stream on the western boundary where all existing SCC storm drainage for the area is located (plate 4).

The plan to minimise storm water runoffs during peak storm is to capture all runoff from buildings, store most and lead the excess runoffs to the drainages along the proposed buildings and into the boundary drains.

Plate 4: Road Culvert leading to stream, west of boundary

2.3.8 Effects of project on ambient noise levels

Traffic volume and size along with dust, fumes and noise will slightly increase during the land development and construction periods. This should decrease towards the end. However, ambient noise levels will increase with the influx of new residents into the housing sites.

2.3.9 Effects of project on water quality & current wastewater disposal

The Raiwaqa project will add to the further decline of the stream water quality as a result of construction wastes and leaching effects from waste stockpiles during rainy periods. The stream which connects to the Vatuwaqa River via the constructed drainages on the north boundary will be carrying more volume of water and associated solid waste that may be carelessly dumped by residents and nearby industries.

2.4 ECOLOGICAL IMPACTS

2.4.1 Loss or alterations of terrestrial habitats

The impact of alteration and degradation of habitats that will occur during the excavation stages will lead to the following ecological impacts;

- loss and degradation of potential habitats
- death of less adaptive species through exposure and physical changes
- migration of existing species to other areas
- erosion of slopes and loss of burrows
- loss of minerals from soil

Rehabilitation through re-vegetation work on the site will assist in recapturing the natural state and restoring biodiversity.

2.4.2 Effects of project on water quality

The impact of any new development on the surrounding water way is a decline in water quality through sedimentation and waste water including grey water seepages into the water ways. The effect of decline water quality should be minimal with proper Mitigative measures in place.

3.0 SOCIAL STUDY

Part of the EMP study was to conduct a survey to compile data on any concerns and issues that will or may arise if the proposal to develop the land for housing sites is given approval. This includes consultations with relevant stakeholders to show the PRB's intention and objectives and the addressing of the issues and concerns that were raised.

Prior to this EMP study, the PRB management board has presented the development concept to the Department of Town & Country Planning (DTCP) and other government departments including the Department of Environment, National Roads, PWD and other relevant stakeholders as part of their rezoning and subdivision applications for the new proposals.

3.0.1 Demographic profiles of current land use

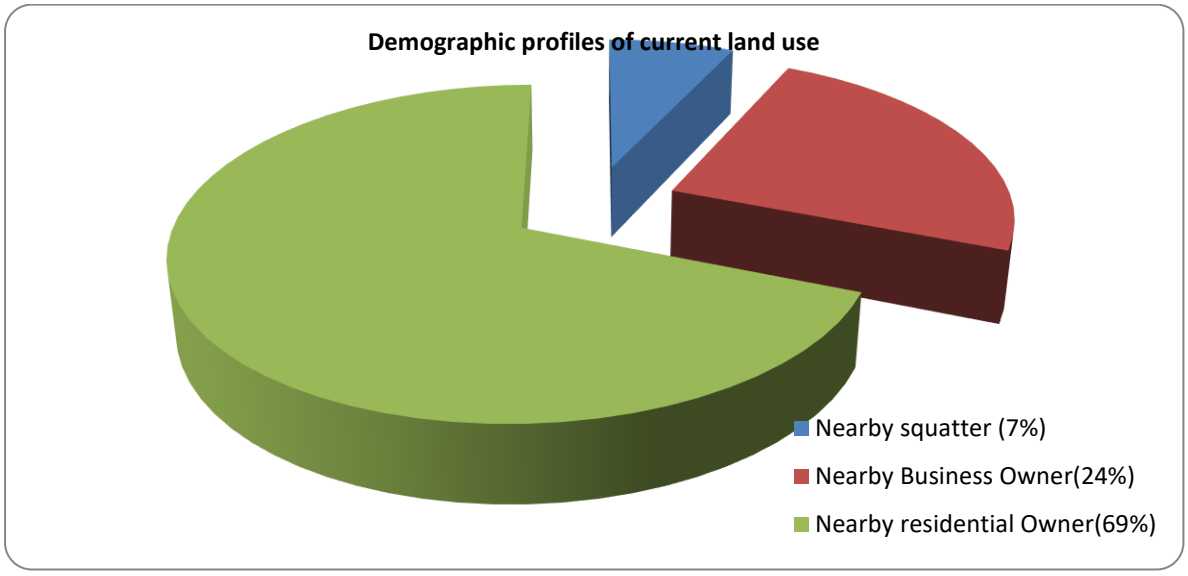


Figure 1: Demographic Land use

3.0.2 Impacts of project on human beings and their activities

The development of the proposed residential flats will have more positive then the anticipated negative impacts and so there will be some compromises to be made so that overall, a win-win situation is achieved between the developers and the local stakeholders within the 1km boundary of the proposed development.

The possible socio-economic impacts are summarized on table i below:

Table i: Summary of Positive and Negative impacts

Positive Impacts	Negative Impacts
Provides affordable housing opportunities with roper facilities including water, power etc. Reduces squatter settlements growth	Disturbance during construction period
Provides residential investment opportunities	Traffic impacts, risks esp. Thoroughfare for squatters
Increase in economic activities for nearby businesses (taxi, bus, shops market services)	Disturbance to terrestrial/aquatic habitats
Increase infrastructure development of the city	Increase in influx of people, values and cultures
Improves land development and visual image	Increase waste production (household etc)
Contribute to development of Suva urban areas and addition of new SCC rate payers	

3.0.3 Impacts of project on community values, life and social organizations

The proposed development of the sites at Raiwaqa will have more socio-economic impacts than the development at the Raiwai site. The development and construction work will have an immediate impact on the houses currently located on the boundaries of the land. At present, most of the farming activities carried out on the vacant site will cease as the land will be cleared. Further decline in water quality of the Vatuwaqa River will result in more deteriorating conditions water borne disease for the river uses (bathing and fishing). Figure 2 shows a survey of the types of diseases recorded by the nearby health centre at Raiwaqa.

From previous experiences during the occupancy of the old 4 story buildings, socio-economic problems were prevalent. Overcrowding and deteriorating housing conditions has led to unhealthy conditions and many criminal activities were reported.

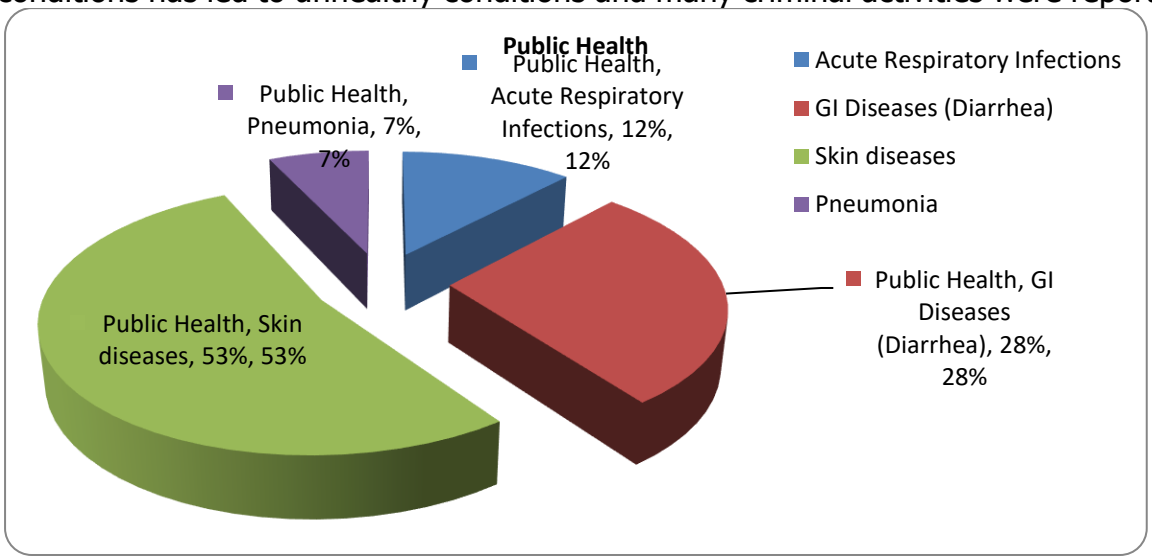


Figure 2: Public Health for stakeholders. Source: Raiwaqa Health Center

The proposed development is proposed on a crown grant land property so issues of land ownership are irrelevant. However, a public consultation meeting was been carried out by the EMP team with all stakeholders within the 1km boundary on July, 2009 to present the baseline findings of the study, potential impacts of the proposed development, issues of concerns to the stakeholders and discussion of possible mitigation measures to address potential significant issues regarding the proposal.

The minute for the meeting is attached at Appendix 8.4. The issues raised by stakeholders are summarized on table ii below:

Table ii: Issues raised and Mitigation measures

Issues/Concerns raised
Work hours/ period
Traffic impacts & risks during construction
Proper planning of work activities
Disposal of wastes (Waste management)
Increase in criminal activities and disturbance experienced before
Loss of land used for farming (squatters)
Further decline water quality (bathing & fishing)
New tenants to be scrutinised well

Further to this, questionnaires were given to other stakeholders to allow them to objectively comment on the proposal. These issues are discussed below.

A total of 54 questionnaires (Appendix 8.6) were randomly given to the stakeholders (18th of June, 2009) within the 1km boundaries of both sites where important issues pertaining to the proposed development were discussed on a one to one basis.

(i) Analysis of Questionnaires (Total: 54)

QUESTIONS				
1. Stake in the proposed development	**Nearby farm owner/squatter**	**Nearby business owner**	**Nearby residential owner**	
Total Number	4	13	37	
Percentage (%)	7%	24%	69%	
2. What kind of business are you involved with?	**Unemployed**	**House work/self employed**	**Civil servant**	**Small business**
Total Number	23	14	1	16
Percentage (%)	43%	26%	2%	29%
3. Duration of stay area	**< 1year**	**1-5 year**	**6-10 years**	**>10 years**
Total Number	4	18	11	21
Percentage (%)	7%	33%	20%	40%

4. Distance from proposed site	**<40m**		**0.5-0.1km**	**0.2-0.5km**		**0.6-1km**
Total Number	9		20	25		0
Percentage (%)	17%		37%	46%		0%
5. Method of solid waste disposal	**Bury**		**Burning**	**Town Council**		**Other**
Total Number				54		
Percentage (%)				100%		
6. Wastewater treatment	**Septic Tank**		**Sewer**			
Total Number			54			
Percentage (%)			100%			
7. Source of water	**Pipe**		**Water tank**	**Rain Water**		**other**
Total Number	54					
Percentage (%)	100%					
8. Shortage of water	**Yes**		**No**	**Sometimes**		
Total Number			29	25		
Percentage (%)			54%	46%		
9. Current source of power	**FEA**		**Solar**	**Kerosene**		
Total Number	53			1		
Percentage (%)	98%			2%		
10. Access to telecommunication	**Yes**		**No**			
Total Number	54		0			
Percentage (%)	100%		0%			
11. Access to health care	**Yes**		**No**			
Total Number	54		0			
Percentage (%)	100%		0%			
12.The proposed area known/use for	farm	Firewood	fishing	Herbal medicine	Archaeological significance	Picnic spot
Total Number	7	4	2			2
Percentage (%)46	25%	15%	7%			7%
13. Benefit from project	**Yes**		**No**	**Not sure**		
Total Number	36		7	**11**		
Percentage (%)	67%		13%	20%		
14.SCC benefits	**Yes**		**No**	**Not sure**		
Total Number	50		4	0		
Percentage (%)	93%		7%	0%		

(ii) Benefits of having development near to your place of business

The following responses were recorded on the questionnaires, note some responses are similar:

- Home investment opportunities available
- Service opportunities such as taxi, bus, shops etc.
- Increase value of existing private properties
- Contribute to development of Suva city

- Improve infrastructure developments, e.g. roads, drainages

(iii) Important issues that will arise if the project is approved.

The following responses were recorded on the questionnaires, note some responses are similar:

- Noise and traffic impacts during construction and operation stages
- Health & safety issues during land development
- Disposal of wastes

(iv) Ways which developers must ensure while the construction work is taking place to ensure minimal impact is felt by nearby residence

The following responses were recorded on the questionnaires, note some responses are similar:

- Work hours during day time only and weekdays (No Sunday work)
- Traffic impacts to be monitored
- Disposal of wastes
- Proper planning of work activities
- A good drainage system to keep land dry

(v) General view on the proposed housing development

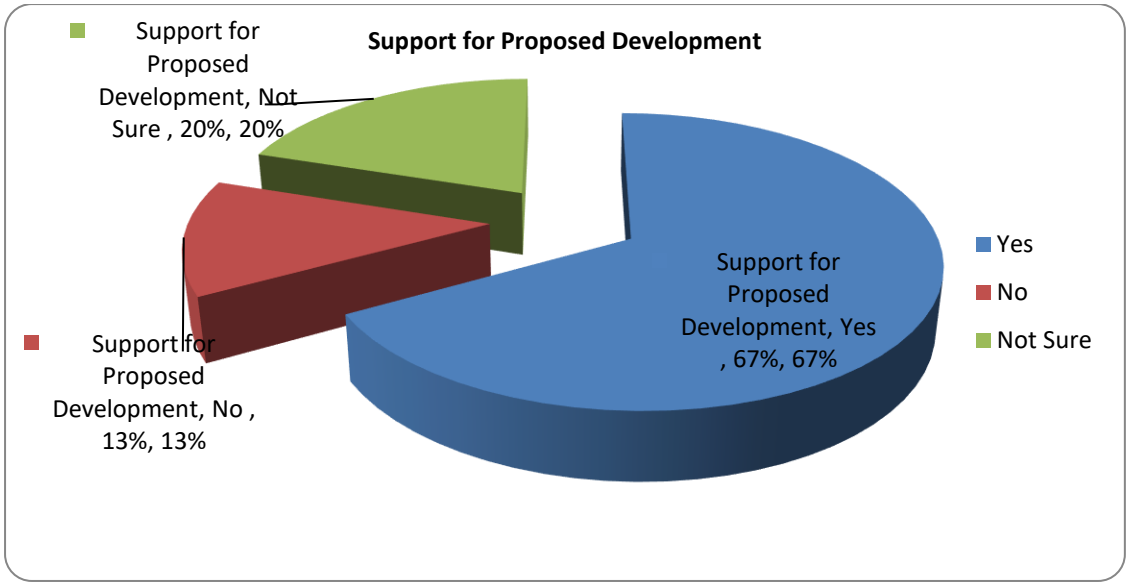
The following responses were recorded on the questionnaires, note some responses are similar:

- Add to development of area
- Employment & service opportunities
- Increase economic activities in the area
- Overcrowding of area

(vi) Conclusion from Socio-Economic Study

From the result of the analysis of the questionnaires and the consultation with the stakeholders within the 1km boundary, the following can be concluded:

- Most are aware of the environmental issues
- Most business people welcome the development
- Some have reservations on the social impacts from an influx of people
- Most (67%) interview supports the development with 20% not sure



4.0 MITIGATION AND ABATEMENT MEASURES

The ensuing potential impacts issues earlier discussed in section 2.0 are identified to appropriately mitigate against any possible environmental risks or disasters. The major five (5) areas of potential impacts identified generally for both Raiwaqa & Raiwai sites during both the construction and operational stages include;

- Design & Engineering (Land/ Foundation preparation, Drainages, Access)
- Construction (Buildings, Designs, landscape)
- Operation & Maintenance (Occupancy)
- Ecological Impacts (Terrestrial & Aquatic habitats)
- Socio-economic implications (including traffic, influx of people)

A detailed management plan is outlined in the Construction and Environmental Management Plan (CEMP) and Operation Environmental Management Plan (OEMP) of the environmental management plan under section 6.0 of this report. Summarized in tables i and ii below are the suggested mitigations and abatement measures for both construction and operational phases potential impacts.

4.1 DESIGN & ENGINEERING OPTIONS

Scour protection or armouring of the stream bank on the western side of the Raiwaqa site necessary while filling work is carried out in order to stabilize creek side and minimise erosion and sedimentation of water way.

Loose and cut Suva Marl is to be used for fill purposes to minimise import from external source and ensure that the same geological material is used. All filled surfaces are to be compacted and rolled to stabilize building foundations. For foundations purposes,

Taylor & Tonkins, 2004 consider that the proposed buildings be founded on shallow foundations founded on either on rock or on the proposed engineered fill (Suva Marl). Settlement of up to 80 mm may be expected after engineered fill, per loading of the engineered fill will be required to avoid undue differential settlements.

Strip footing or shallow pads are suitable and should be founded a minimum of 450 mm below the adjacent finished ground level. A design geotechnical ultimate bearing capacity of 450 kPa is recommended. This corresponds to factored (ULS) and allowable bearing capacities of 200 kPa and 150 kPa respectively.

Recommended fill height for the Raiwaqa site is about 1.5m above present mean sea level (MSL) since the surrounding stream connects to the Vatuwaqa River on the west of site experiencing daily tidal cycle.

Drainage and all outlet designs to control and filter solid materials. The proper development of deep drainages outlets will ensure the quick removal of storm water during periods of heavy down pour. Concrete v-drains are suggested to be laid along the new drainages to facilitate this. All engineering and civil plans to be certified according to approved national standards. All sizing of drainage structures and drains will be decided on proper engineering designs. Upgrading of road drainages is to be decided in consultation with the department of National roads, SCC and PWD.

4.2 CONSTRUCTION OPTIONS

Minimal disturbance to existing habitats including trees (coconuts, mango, breadfruit, Jamun) on the boundaries of both sites. Minimal earthwork is carried so that impact on the local topography is minimal. Cut, loose soil/Marl to be recycled for fills purposes. Proper disposal on construction wastes is a necessity to minimise pest infestation. All solid wastes are to be sorted on site and disposed off at the Naboro Landfill. Sediment control devises are put in place near the stream side to control loose sediments.

OHS regulations are to be adhered to during all construction works to ensure safety of all workers and personnel. Traffic Management plan, signages and notices are to be in strategic places to warn motorist and pedestrians using the Grantham and Nairai road.

All building designs are to be certified and approved by local authorities including the Suva City Council and the Department of Town & Country Planning.

4.3 OPERATIONS AND MAINTENANCE OPTIONS

The development will increase the source and quantities of waste that will be produced form each household. Waste management must be prioritized by the PRRB to ensure wastes are sorted and regularly removed from site. Organic wastes can be burnt while

food wastes are recommended to be composted. Proper waste management procedures are in place for all tenants. These include the appropriate storages and regular removal of all domestic wastes from all the flats by the regular authorities including the SCC.

All waste water from toilets including grey water is to be directed into PWD sewer lines for tertiary treatment at the Kinoya Treatment Plant. The rate of discharge of storm water runoff will be higher during the vegetation removal and increase pavement, buildings and other related structures so therefore an effective drainage plan is recommended to control storm water. Rainwater can also be captured and stored for lawn irrigations and for use during water cuts.
Grey water from kitchen, bathroom and sinks are to be directed to sewer lines to reduce further decline in water quality.

Maintenance works & related activities are to follow proper safety procedures to ensure safety of workers and tenants.

4.4 ECOLOGICAL MITIGATIONS

The best possible way to restore degraded habitats is by immediate rehabilitation of the bare land areas through re-vegetation works. Exotic plants and canopy trees can be planted on selected areas and boundaries to recapture site and restore biodiversity. Existing canopy trees on the boundaries such as coconut, mango, and breadfruit trees should be preserved.

4.5 SOCIO ECONOMIC MITIGATION OPTIONS

All construction works are to fall on normal working hours to ensure minimal disturbances to all stakeholders within the 1 km boundaries. Traffic management plan is put place to ensure safety of motorists and pedestrians. Occupational Health & Safety (OHS) regulations are enforced for all workers to ensure personal health and safety.

New tenants applications to be scrutinized in detail to ensure security of both parties. Tenants-Landlord agreement signed by successful tenants is to include conditions for occupancy (e.g. Maximum number of people per flat) and other regulations to ensure privacy, welfare and security of all tenants. In addition, setting up of committees will help the PRB to monitor/supervise tenants' activities, welfare and complaints or concerns.

4.6 SUMMARY OF MITIGATION OPTIONS

Table i: Summary of General Land Construction Activities & Mitigations

ACTIVITY	MITIGATION & ABATEMENT MEASURES
DESIGN & ENGINEERING	• Compaction and employment of sediment screen along filled edges • Compaction & rolling of all filled materials 1.5m above MSL • Sediment trappers, armouring placed at any exposed site to prevent loose soil washing during rain • Excavated materials to be recycled for fill purposes • Upgrade existing drainage systems • All outlets to the road to be structured. • Storm water diversion above stockpiles • Dust suppression using water sprinkling • Stockpiles to be stabilized and located more than 20-30m from any water way and main road. • Soils/ aggregate should be reused where applicable during • construction/development • Immediate replanting of grasses and short-lived, fast growing species to 'capture site'
CONSTRUCTION	• Strict monitoring during work by supervisors • Adherence to Fiji Safety Building code • Proper storage & disposal of solid/surplus wastes • Construction hours limited to 8-5pm • Transport vehicles to follow designated routes • Secondary treatment of waste water • Storm water runoffs are to be discharged into drainages leading to main road • employment of gabion baskets on filled areas adjacent to stream to hold the soil particles • Construction drains placed as needed. • In the fill area, drained water to be led away • Improve landscaping works • Regular removal/disposal of surplus wastes from site to approved fill site by Health Ministry.
OPERATIONS & MAINTENANCE	• Proper spill kits, spill procedures & firefighting equipments • Fiji Occupational Health and Standard (OHS) adherence • Proper storage of solid waste on site-Skip bins with lids • Sorting of wastes and reuse /recycle • Regular maintenance of drainages and water ways • Employment of filters on main outlet pipes to prevent blockages • Regular cleaning/clearing of drainages • Pest control mechanisms in place • Proper storage of solid waste on site • Regular maintenance work on drains/pipe lines for leakages • Regular removal/disposal of solid wastes from site • Regular mowing of lawn

ECOLOGICAL MITIGATIONS	• Rehabilitate by revegetation of project site boundaries • Selected removal of vegetations
SOCIO ECONOMIC	• Construction activities that will generate disturbing sounds should be restricted as possible to normal working hours (8am-5pm) • Signages and notice to placed on main road sides • Awareness on any proposed change in work/operation schedules. • Continuous communications with *Grantham & Nairai* road residents & stakeholders • Setting up of communication center for all grievances • Committee to be set up to represent tenants concerns & welfare & regular meetings with PRB officials • Landlord-Tenants Agreement to set out regulations regarding Occupancy

5.0 SUMMARY AND CONCLUSION

The development is part of a business venture by the *Public Rental Board (PRB)* to be carried out on two housing sites along at Grantham Road, Raiwai and Raiwaqa. The development and construction work to be done on the area will be carried out with a lot of good intention, thought and sensitivity as to keep the environment as naturally intact and sustainable as possible.

The immense potential of the project to the local people in terms of providing affordable housing investment opportunities is really a blessing to the increasing population on the Suva-Nausori corridor. In doing so, the project is in line with the Government's objective of providing affordable subdivided land in order to combat the increasing squatter settlements rife in the town and city areas.

The project will further boost the support business such as taxi and bus service, shops, municipal market and employment. In addition it will add to the ongoing infrastructure development and expansion of the city of Suva.

The result of the study is clear and transparent. We have identified some potential negative environmental outcomes from the proposed development. The major area of concern for the development is the flood prone nature of the area being located along the Vatuwaqa River deltaic flat lands. The EIA study has recommended the raising of the area at the Raiwaqa site, improve drainage and storm water system and re-vegetation of the stream reserve banks as the major proper management and mitigation measures to minimise the potential risks of inundation.

Finally, the EIA study supports the proposal and commended on as necessary in this assessment and recommends the Department of the Environment to support this local development initiative in providing well developed housing lots with related infrastructures including pipe water by the *Public Rental Board (PRB)*.

6.0 ENVIRONMENTAL MANAGEMENT PLAN

6.1 Introduction: Regular environmental reviews

Environmental evaluation and monitoring are all specific functions of environment assessments and reviews. It will part of the Envi-Green Pacific Consultancy Ltd to consistently monitor the development of the site during and after development. Under the International standard ISO 14004 and the EIA provisions given under the Environmental Management Act (EMA, 2005) the review will encompass the following:

- Assessment, control and reduction of the impact of the activity concerned on the various sectors of the environment
- Energy management, saving and choice
- Transportation, water management and savings
- Evaluation, control and reduction of noise within and outside the site

- Environmental performance and practices of contractors, sub contractors and suppliers
- Prevention performance and limitation of environmental accidents
- Contingency procedures in cases of environmental accidents
- Staff information and training on environmental issues
- External information on environmental issues

An Environmental Management Plan (EMP) is a site specific plan developed to ensure that all works including excavation, extraction, stockpiling and carting of gravel and boulders comply with the environmental conditions of approval for the project and that the environmental risks are properly managed.

6.2 Purpose of Environmental Management Plan

The purpose of the EMP is to:

- identify priorities;
- set objectives and targets;
- define performance indicators;
- documents strategies and time frames to achieve targets
- allocate responsibilities and identify the resources to enable realization of the overall plan;
- establish mechanisms to monitor, evaluate and report progress

The Environmental Management Plan for the proposed work includes two major components:

1. **Operational Environmental Management Plan (OEMP)**
2. **Environmental Monitoring Plan (EMP)**

6.3 Purpose of Operational Environmental Management Plan (OEMP)

The purpose of the CEMP is to identify and outline methodologies that will guide the **PUBLIB RENTAL BOARD (PRB)** during the extraction stages to control and minimise potential environmental impacts.

The OEMP is designed to set out control plans and principles to be applied to the project during the extraction activities. The OEMP also identifies Environmental Control Procedures and Environmental Monitoring Plan (OEMP) to which all workers are required to comply with.

6.3.1 Priorities

In line with the environmental policy acts, the following criteria will be used to determine the priorities for attentions:

- Impacts on the physical and biological environments
- Contribution to innovations and definition of best environmental practice
- Compliance with statutory requirements and other environmental commitments
- Availability of resources

The EMP also acknowledge the social and economic dimensions of responsible environmental management along side the biophysical environment to represent a holistic approach

6.3.2 Project Overview

The Public Rental Board (PRB) is developing land for the purpose of building new story houses for lower and middle income earners along the main Grantham road in the busy and highly populated Raiwaqa suburb areas.

The excavation, reclamation, stockpiling and carting work will see the employment of the following heavy machineries and worker per site.

6.4 Roles and responsibilities

This section describes the organizational structures and responsibilities of individuals involved with the implementation of the OEMP.

- **Table 6.4-1 Responsibilities of relevant parties/positions**

Party/Position	Responsibilities/Tasks
PRB	▫ Implementation, monitoring and compliance of the OEMP including the activities of the workers and Site Engineer or supervisor ▫ Reviewing the performance of the OEMP and adjustments to improve efficiency and application ▫ Reporting to DoE ▫ Compliance of constructional activities with the EIA guidelines and approval conditions
Project manager (s)	▫ Implementations all conditions/measures in the OEMP ▫ Preparations and implementation of procedures in OEMP ▫ Inspections and implementations of environmental performances ▫ Maintain all documents and environmental records in accordance with the OEMP and reporting to PRB
Site Engineer/Manager	▫ Working in accordance with the OEMP ▫ Make recommendations to PRB for improvements on the environmental management of site activities
All workers or any Sub-contractors	▫ Working in accordance with the OEMP ▫ Make recommendations to the contractors or Mr. Veu for improvements on the Environmental management of site activities

6.4.1 Procedure for Task-related OEMP

Each contractor is responsible for the development and implementation of the task-related CEMPS. Contractors have direct control over the machines, equipments, staff and resources employed on this project and therefore are best placed to plan, program, implement and monitor mitigation practices.

The OEMP shall include (but not limited to) the following:

1) Scope of Work
2) Introduction and Training in the CEMP
3) Work Practices and Procedures
4) Registers
5) Inspections and Monitoring of Performances
6) Emergency and incident procedures
7) Communications with stakeholders
8) Progress reporting

6.5 Environmental Risks

The EMP team identified the following key environmental effects that could result from the proposed constructional work on the proposed site.

- **Table 6.5-1 summaries the potential environmental risks areas**

Risks	Design and Construction
1. Releases to air	▪ greenhouse gases ▪ dusts ▪ vehicles emissions
2. Release to waterways	▪ leakages from machines/plants ▪ soil erosion and generation of sedimentation ▪ pollution sources ▪ flooding
3. Waste Management and Disposal	▪ extraction wastes ▪ litter/garbage ▪ contaminated waste handling and disposal
4. Contamination of Land	▪ runoffs from areas of contaminated land ▪ fuel refilling and storage
5. Impact on local Communities	▪ level of community communication ▪ access and traffic disruptions ▪ extraction noise (impacts on nearby settlements/farms) ▪ dust
6. Ecological/Heritage Conservation	▪ identification and protection of ecosystems ▪ noise impacts on conservation areas ▪ impacts on endangered species ▪ disturbance of flora and fauna ▪ identification and protection of features of heritage significance
7. Emergencies	▪ environmental incidents (e.g. spill) ▪ spill prevention control and counter measures plan ▪ emergency response plan ▪ evacuation plan/fire, flood, earthquakes

6.6 Minimum Environmental Standards

Table 6.6-1 to Table 6.6-6 set out the minimum environmental standards and that must be achieved by Contractors and PRB throughout the constructional stages.

- **Table 6.6-1: Top vegetation removal/Soil Placement**

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Loss of habitats form clearing of access to extraction site	Large canopy trees to be preserved	▪ re-vegetation of exposed area as soon as possible ▪ Minimal disturbance to habitat
Loss of endangered species	A reserved area on site to be allocated	▪ minimum disturbances during cutting
Generation of suspended solids from any clearing and runoff during heavy down pour	Bunding and screens to placed on river edges side to minimise seepages and runoffs Site activities to adhere to national standards Works to stop during periods of heavy down pour	▪ silt fences and sediment control devices (hay bales wrapped in geotextile) are installed before extraction ▪ Stock pilling of extracted materials to be at least 15-20m from river edges ▪ re-vegetation of edges as Soon as possible ▪earthworks and land clearance to be minimised ▪ storm water to be diverted around exposed area
Introduction of invasive species	Transported materials to be screened for invasive species	▪ machinery should be Cleaned prior to working & leaving site
Efficiency of control measures over time	Control measures should continue to work appropriately throughout the construction	▪ Control measures to be inspected and maintained in efficient operating conditions

- **Table 6.6-2: Material Stockpiling**

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Runoff of suspended sediments from stockpiles	Stockpiling activities should not give rise to storm water containing suspended solids	▪ No direct discharge of sediment laden water is acceptable ▪ Storm water should be diverted around stockpiles
Dust generation from stockpiles	Dust must not cause a hazard or nuisance to nearby residences/settlements along the road	▪ Stockpiles to be compacted to prevent exposure and any movement of particles

- **Table 6.6-3: Fuel Storage and Use**

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures

Pollution risk associated with the storage and use of fuels for vehicles.	No oil, lubricants, fuel or containers should be drained or dumped to ground or water ways	▪ Keep an update lists of all/amounts of fuels stored on site ▪ Storage in accordance with Regulations
	Accidental spills to be minimised and procedures put in place to clean up the environmental damage	▪ Keep the material safety data sheet of all hazardous materials ▪ Bunding to capture 100% of Fuel must be placed around Storage areas ▪ Spill kits and emergency procedures to be used and staff trained ▪ No deliberate discharge of oil, diesel or any hazardous materials to surrounding soil or water way

▪ Table 6.6-4: Archeological and cultural site disturbances

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Finding and disturbance of previously unknown sites	No sites shall be disturbed once identified	Museum be notified of any uncovered site. No work to be undertaken at that site until a resolution is reached between the concerned parties

▪ Table 6.6-5: General Extraction/Excavation Activities

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Noise of machinery associated with all extraction activities	Minimal noise impacts on nearby residence and settlements	▪ working hours are in accordance with the conditions of the consents and stakeholders requirements (no extraction work on Sundays) ▪ equipment kept in good repair and conditions ▪ noise suppression equipments used ▪ site workers and nearby residents not exposed to excessive noise ▪ use of complaints register and procedures to address issues as they arise.
Dust generation from constructional activities	Dust must not cause a hazard or nuisance to nearby residence and settlements	▪ areas of exposed earth minimised ▪ water sprays used to control dust ▪ raw materials loads on trucks covered before leaving sites

Increase sedimentation and altering of river flow regime	Minimal sedimentation on river water	▪ installation of sediment control devises ▪ extraction limited to dry deposit areas ▪ diversion of clear water away from disturbed areas using creek bunds
Increase traffic associated with carting of gravels and boulders to and from sites	No significant increase risk to nearby residence and settlements	▪ road upgrade, signages and ongoing re-grading works ▪ awareness on traffic activities to and from site ▪ use of complaints register and procedures to address issues as they arise
Pollution risk activities occurring on sites	Develop appropriate storage, transport and use practice	▪ Procedure in place for disposal process of each of the following (packaging materials, chemicals, redundant parts, oil and grease from machinery and other waste) ▪ Solid waste disposal taken off site ▪ Keep list of all contaminants

▪ **Table 6.6-6: Communities/Residential impacts**

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Monitoring	Monitoring shall be done to address the concerns of the stakeholders, residences and nearby squatter settlements	▪ A complaints record of all issues raised by concerned parties in response to all development & construction activities. The record including the responses by the contractors/sub-contractors shall be kept.

Issue	Key Principle/Mitigation Standard	Minimum Mitigation Measures
Heath and Safety risks from all constructional activities (traffic, heavy machinery operating)	Heath and safety risks to nearby residents are minimised	▪ Refer to the sections above discussing impacts from traffic hazards and extraction activities
	All residents to be informed of all potential hazards to health and safety	
	Communities have the expectations that the issues will be addressed and resolved by negotiation	

6.7 Environmental Monitoring

Monitoring of the surrounding areas is required during construction to enable the adequacy of the CEMP, assessment of any potential impacts and risks and to implement proper mitigation and abatement measures.

The monitoring requirements are important to measure actual performance (i.e. specified limits to pre-selected indicators of change). Parameters to include:

- Habitat Assessment
- flora and fauna
- Aquatic assessment

The contractor is responsible for implementing the monitoring program and the mitigation measures that may be required as a result of the monitoring results.

Table 6.7-1 provides the ecological habitat monitoring plans. Monitoring locations are shown on figure 6.17, figure i of the OEMP.

- **Table 6.7-1: Environmental/Habitat monitoring**

Phase in Project	Frequency	Sampling parameters	Sampling sites
1. Pre Construction	1 round	Flora and Fauna	S1
		Habitat assessment	S1
	Daily	Visual assessment of oil, grease & dust	S2
2. Sediment Treatment Devices	1 round, one month prior to construction		S1
			S2
		Habitat assessment	S2
	Daily	visual assessment of oil and grease and dust	S1 & S2

6.8 External Communications

6.8.1 General Communications Matrix

Table 6.8.1-1 sets out the lines of communications for landowning unit, potential employees, government stakeholders and other individuals in relation to complaints or enquiries during the construction of the scheme. Refer to Appendix 8.3 for the Complaints/Enquiries form.

- **Table 6.8.1-1: Communications Matrix**

Stakeholder	Main interest	Means of Contact	Key Contact
Residents, industries and squatter settlements along the *Grantham* road	Disturbance from constructional activities, environmental and social issues	Complaints/enquiries to extraction company and representatives	PRB
Potential employees/worker	Employments opportunities	Advertise key positions in local papers Maintain register of potential employees Recruitment of nearby residents at project site during initial constructional stages	PRB and workers
General public	General interest and concerns	Media updates-press release Complaints/inquiries	PRB
Government stakeholders	Environmental and socio-economic issues	Consultation Committee Envi-Green Pacific Consultants	PRB & EMP consultant

The following measures are proposed to be implemented to assist with communications between the communities and the Public Rental Board (PRB).

1.) PRB's agents to be located at the site for the entire project to address concerns assist with employment and communicate with the locals.
2.) PRB, together with the consultation committee will hold meeting on 'as- required' basis to inform stakeholders of information on the phase of the work to be carried out.
3.) Specific training or communications regarding key hazards including large vehicles on the road and other heavy machinery on sites to be undertaken by PRB and workers.
4.) Workers will be educated with regard to safety and occupational heath issues.

6.8.2 Complaints and Enquire Process

All complaints are to be referred to the site office. No team member is to discuss any aspect of any complaints with the complainant.

All complaints will be filled in the Complaints/Enquiries form (Appendix 8.7) will be filled by the Site Supervisor or Engineer.

6.8.3 Schedule of External Reporting

All external reports are to be submitted to external agencies through the key contacts in the communication matrix identified in section 6.8.1.

- **Table 6.8.3-1 Schedule of External Reporting**

Type of Report	Frequency of submission	Responsible Team Member	Submit to:
EMP	Prior to extraction	PRB and workers	DoE
CEMP updates	As required	PRB and workers	Holders of controlled copies
Changes in project activities	As required	PRB and workers	PRB, DoE
Incident report	Within 24hrs of incident	Site Manager	PRB, DoE
Habitat monitoring report	After completion of monitoring	PRB	DoE
Other Monitoring Data	As required	PRB and workers	DoE

6.9 Spill Procedures

Incidents and spills of potentially hazardous materials including solvents, paints, petrol, chemicals and gasoline need urgent attention and proper handling.

- **Table 6.9-1 Spill procedures**

Procedure	Performance Indicator (s)	Responsibility
▪ Spill kits to be readily available and Specifically designed for any hazardous materials that will be used and stored on extraction sites ▪ Inspection of site to ensure proper environmental controls are in place and operating effectively	▪ Emergency and proper Safety manuals are available and specifically located ▪ Spill kits are available and located where necessary	Site Manager or Supervisor
▪ Immediately contain contaminated material proper way to prevent contamination of surrounding soil and waterways ▪ Proper emergency procedure and Management of Incident, non compliance and complaints is followed by all staff including reporting to Site Manager if material harm is caused ▪ Site Manager to inform PRB within 24hrs for any contamination ▪ PRB to inform DoE within 24hrs if contamination of soil and water occurs	▪ Documented reporting is kept as a record with the proper actions taken. ▪ Spills have been contained as much as possible with minimal impacts on the environment	All staff Site Management PRB
▪ Remove all contaminated materials from site and dispose in accordance with recommendations from environmental consultants or the DoE	▪ No contaminated material is left on site and no visual damage	Site management

6.10 Incident Reporting

Reporting requirements are important for record keeping and auditing responsibilities for meeting environmental performance objectives and corrective actions to rectify any deviations from performance standards.

Record should be kept to allow auditing and to encourage the use of preventative action as well as corrective action following non-compliance.

- **Table 6.10-1 Incident Reporting**

Heading	Reported by	Recipient of report
Minor incident or near miss-no injuries or environment damage	Staff-verbal, immediately	Contractors agent-records on file
Minor incident-failure of performance measure in CEMP, can easily be remedied, little damage	Staff-verbal, immediately	Contractors agent-records on file Monthly report to Mr. Veu
Moderate incident-failure of performance measure in CEMP, breach of EIA approval Can easily be remedied, some damage	Contractor's agent-written report on demand by PRB agents	PRB representative
Major incident-one off or consistent failure of performance measure in CEMP, breach of EIA approval or EMA, 2005	Staff-verbal, immediately	Contractors agent-records on file
	Contractors agent-verbal, followed by written report	PRB representative
Not easily remedied, significant environmental damage	PRB agent-verbal, followed by written report	DoE

6.11 Capacity Development and Training

(a) Management and Operation of the OEMP

All those responsible for the management and operation of the CEMP should be adequately trained for their responsibilities. Evidence of training should be well kept for inspection and auditing purposes

(b) Construction, Maintenance and Monitoring of Environmental Protection and Discharge Treatment Devices

Staff shall be trained by an independent institutions/training centers (local and overseas) in areas of construction, maintenance and monitoring of environmental protection and discharge treatment devices.

All records of training should be well kept on site for inspection and auditing purposes

(c) Environmental/Habitat Monitoring and Interpretation of Results

Terrestrial habitat monitoring shall be carried out by qualified personnel and technical experts who can be sub-contracted should the contractors lack proper skills,

Various agencies and private companies exist in Fiji which can successfully carry out the work. These include private environment consulting firms, Institute of Applied Science (IAS) and Fiji Institute of Technology (FIT).

(d) Spill Management and Emergency Procedure

All staff and workers involved in the handling all of potentially hazardous materials must be trained in spill management and emergency procedure. Where training is not available locally, overseas experts can be hired by the developers and contractors to provide and facilitate training.

All records of training should be well kept on site for inspection and auditing purposes

(e) Department of Environment (DoE) Review

All monitoring shall be made available to the DoE on request. DoE will carry out auditing of results and duplicate monitoring at any time to ensure compliance with the CEMP as stipulated under the Environment Management Act (EMA, 2005) and any approvals issued.

6.12 EMP-MONITORING PLAN

The purpose of the Operation Monitoring is to monitor the adequacy of the OEMP during the operational stage, assess any environmental impacts and to implement appropriate mitigation measures. The plan addresses all relevant requirements identified in the EMP Report.

PUBLIC RENTAL BOARD (PRB), through implementation of this OEMP, will operate the scheme with due regard for protecting the natural and social environment. **PRB** is required to:

- Comply with the relevant environmental legislation as stipulated under the Environmental Management Act, (EMA, 2005).
- Fulfill all commitments in the OEMP
- Promote environmental awareness and understanding among employees and contractors through:
    - Regular training and awareness
    - Assignment of roles under this OEMP
    - Linking performance indicators of responsibilities to overall performance
- Foster a shared sense of responsibility for environmental performance among all project participants

- Monitor environmental performance and implement continuous improvement to meet the requirements of the OEMP
- Continue to liaise with stakeholders involved in the project including the DoE

6.13 Format and Function of the Monitoring Plan

Monitoring should occur through out the construction, operational and (where appropriate) decommissioning of all phase of proposal components to ensure that management commitments and licensing agreements are kept and to enable ameliorative measures are taken if unexpected impacts are detected and to facilitate best practice environment management.

Monitoring programs and management feedback systems should be part of the overall environment management system in place for the duration of the project proposal

6.14 Approval Schedule

- **Table 6.1.4 -1: Approval Schedule of the EMP-Monitoring Plan**

Task	Timeline
EMP-MP framework approval by DoE	EMP-MP lodged with approval within 21 days
EMP-MP finalized prior to operation and approval by DoE	EMP-MP lodge and its approval within 21 days
EMP-MP implemented	Through out the constructional and operational stages

6.15 Roles and Responsibilities

This section describes the organizational structures and responsibilities of individuals involved with the implementation of the OEMP, listed in table 7.0.1.2-1.

- **Table 6.1.5-1 Responsibilities of relevant parties/positions**

Party/Position	Responsibilities/Tasks
PRB	▫ Implementation, monitoring and compliance of the EMP-MP ▫ Reviewing the performance of the OEMP and adjustments to improve efficiency and application for the improving the environmental management of site activities ▫ Reporting to DoE ▫ Compliance of operational activities with the EMP guidelines and approval conditions
Habitat Sampling Sub-Contractor (s)	▫ Implementations all monitoring programs set out in the OEMP ▫ Reporting to PRB.

6.16 Environmental Risks

The major environmental risks during the operational stages include the following:

1.) Habitat changes around the proposed area and surrounding areas

2.) Socio-Economic impacts on nearby squatter settlements/residents/businesses

3.) Further decline quality of creek water

4.) Solid & liquid wastes management

6.17 Environmental Monitoring

Public Rental Board (PRB) is responsible for implementing the monitoring program and the mitigation measures that may be required as a consequence of the monitoring result. The work may sub-contract the monitoring and analysis to a third party including environmental consultants and local institutions such as IAS of USP, FIT and others.

Table 6.17-1 provides the habitat monitoring plan and figure i below shows the three (3) monitoring sites along the surrounding Raiwaqa Creek.

- **Table 6.17-1 Environmental Monitoring Program**

Location	Monitoring Sites	Monitoring Frequency	Parameters
S1 (red)	River water and vegetation on creek side	3 monthly	▪ Plant cover ▪ substrate analysis ▪ Conductivity ▪ pH ▪ Temperature ▪ Total Dissolved Solid ▪ Salinity ▪ Nitrate ▪ Orthophosphate ▪ BOD ▪ Coliform
S2 (pink)	River water and vegetation on creek side	3 monthly	▪ Plant cover ▪ substrate analysis
S3 (yellow)	River water and vegetation on creek side	3 monthly	▪ Plant cover ▪ substrate analysis

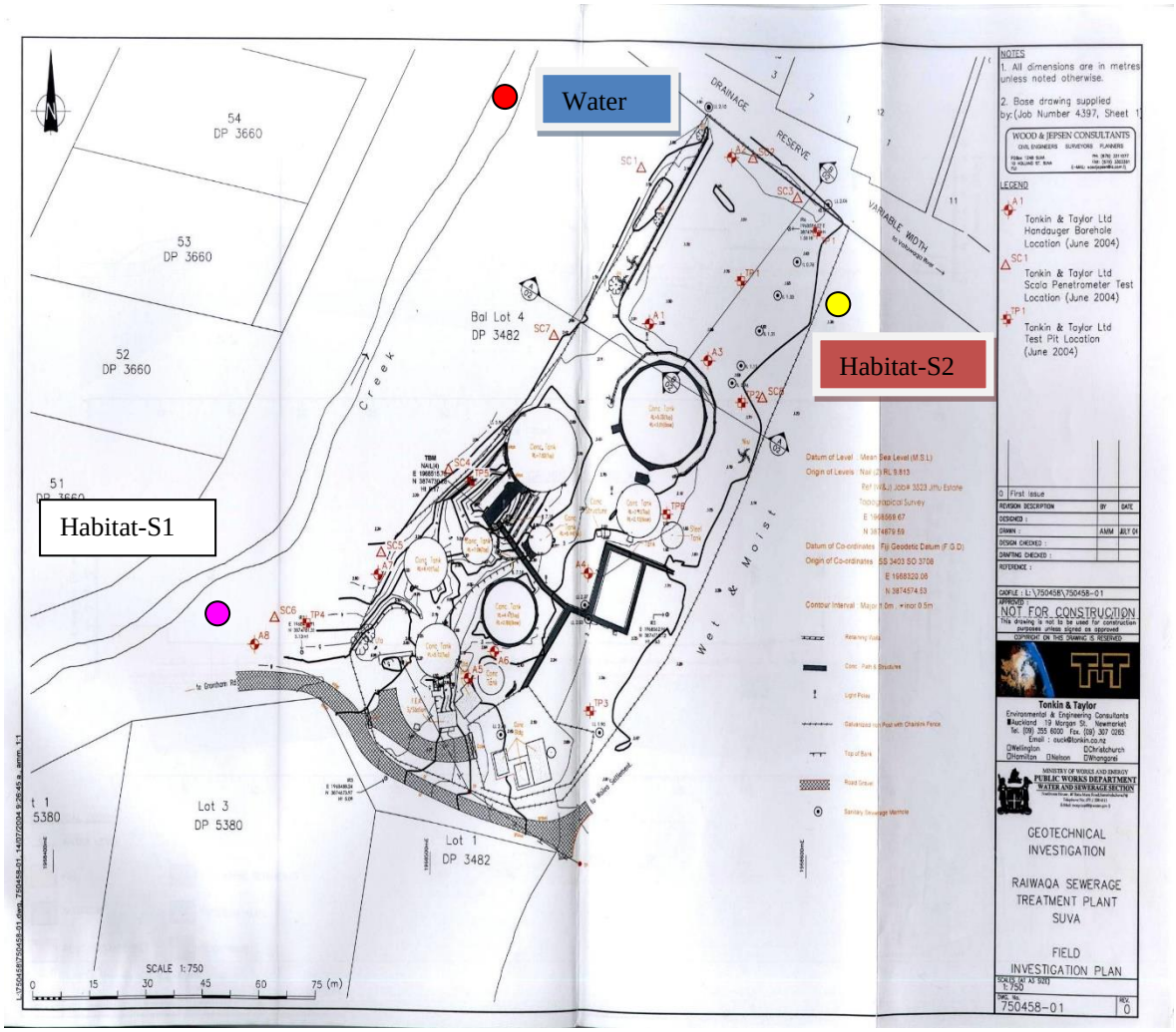


Figure i: Water & habitat monitoring sites for Raiwaqa

6.18 Reporting

All external reports are to be submitted to external agencies through the key contact identified in the communications matrix in section 6.8.

- **Table 6.18-1 Schedule of Reporting**

Type of Report	Frequency of Submission	Responsible Team Member	Submit To:
OEMP	Prior to operation	Manager, Operations	DoE
OEMP updates (including alterations in management/monitoring procedures	As required	Manager, Operations	PRB & staff DoE
Incident report (refer to incident procedures)	Within 24hrs of incident	Site Manager	Manager, Operations DoE

Habitat monitoring reports	After completion of exercise	Manager, Operations	DoE

6.19 Spill Procedures

Incidents and spills of potentially hazardous materials including solvents, paints, petrol, chemicals and gasoline need urgent attention and proper handling in order to reduce risks of injuries and environmental damages.

- **Table 6.19-1 Spill procedures**

Procedure	Performance Indicator (s)	Responsibility
▪ Spill kits to be readily available and Specifically designed for the hazardous materials that will be used and stored on site ▪ Procedure to handle oil and chemicals will Be agreed by PRB before installation on site ▪ Inspection of site to ensure proper environmental controls are in place and operating effectively	▪ Emergency and proper safety manuals are available and specifically located ▪ Spill kits are available and located where necessary	Site Supervisor
▪ Immediately contain contaminated material proper way to prevent contamination of surrounding soil and waterways ▪ Proper emergency procedure and Management of Incident, non compliance and complaints is followed by all staff including reporting to Site Manager if material harm is caused ▪ Site Manager/Supervisor to inform PRB Within 24hrs for any contamination ▪ PRB to inform DoE within 24hrs if contamination of soil and water occurs	▪ Documented reporting is kept as a record with the proper actions taken. ▪ Spills have been contained as much as possible with minimal impacts on the environment	All staff Site Supervisor PRB
▪ Remove all contaminated materials from site and dispose in accordance with recommendations from environmental consultants or the DoE	▪ No contaminated material is left on site and no visual damage	Site Supervisor

6.20 Incident Reporting

Reporting requirements are important for record keeping and auditing responsibilities for meeting environmental performance objectives and corrective actions to rectify any deviations from performance standards.

Record should be kept to allow auditing and to encourage the use of preventative action as well as corrective action following non-compliance.

- **Table 6.20-1 Incident Reporting**

Heading	Reported by	Recipient of report
Minor incident or near miss-no injuries or environment damage	Staff-verbal, immediately	Site Supervisor records on file
Minor incident-failure of performance measure in CEMP, can easily be remedied, little damage	Staff-verbal, immediately	Site Supervisor Monthly report to Manager Operations
Moderate incident-failure of performance measure in CEMP, breach of EMP approval Can easily be remedied, some damage	Site Supervisor -written report on demand by PRB agents	PRB representative
Major incident-one off or consistent failure of performance measure in CEMP, breach of EMP approval or EMA, 2005 Not easily remedied, significant environmental damage	Staff-verbal, immediately	Site Supervisor-records on file
	Site Supervisor -verbal, followed by written report	Manager, Operations
	Manager Operations-verbal, followed by written report	DoE

6.21 Capacity Development and Training

(a) Management and Operation of the OEMP

All those responsible for the management and operation of the OEMP should be adequately trained for their responsibilities. Evidence of training should be well kept for inspection and auditing purposes

(b) Environmental Monitoring and Interpretation of Results

Habitat monitoring shall be carried out by qualified personnel and technical experts who can be sub-contracted should the contractors lack proper skills.

Various agencies and private companies exist in Fiji which can successfully carry out the work. These include private environment consulting firms, Institute of Applied Science (IAS) and Fiji Institute of Technology (FIT).

(c) Spill Management and Emergency Procedure

All staff and workers involved in the handling all of potentially hazardous materials must be trained in spill management and emergency procedure. Where training is not available locally, overseas experts can be hired by the developers and contractors to provide and facilitate training.

All records of training should be well kept on site for inspection and auditing purposes

(d) Department of Environment (DoE) Review

All monitoring shall be made available to the DoE on request. DoE will carry out auditing of results and duplicate monitoring at any time to ensure compliance with the OEMP as stipulated under the Environment Management Act (EMA, 2005) and any approvals issued.

7.0 REFERENCES

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8.0 APPENDICES

8.1 Term of reference (TOR)
8.2 Title Reference
8.3 Scheme/Concept Plans
8.4 Engineering plans
8.5 Building Plans
8.6 EMP Complaints/Enquiries form
8.7 Socio-Economic Questionnaire
8.8 Public Consultation Minutes
8.9 Water Quality Result-NWQL

8.1 TERM OF REFERENCE (TOR)

8.2 TITLE REFERENCE

8.3 SCHEME/CONCEPT PLANS

8.4 ENGINEERING PLANS

8.5 BUILDING PLANS

8.6 EMP COMPLAINTS/ENQUIRIES FORM

8.7 SOCIO-ECONOMIC QUESTIONNAIRE

8.8 PUBLIC CONSULTATION MINUTES

8.9 WATER QUALITY RESULT-NWQL