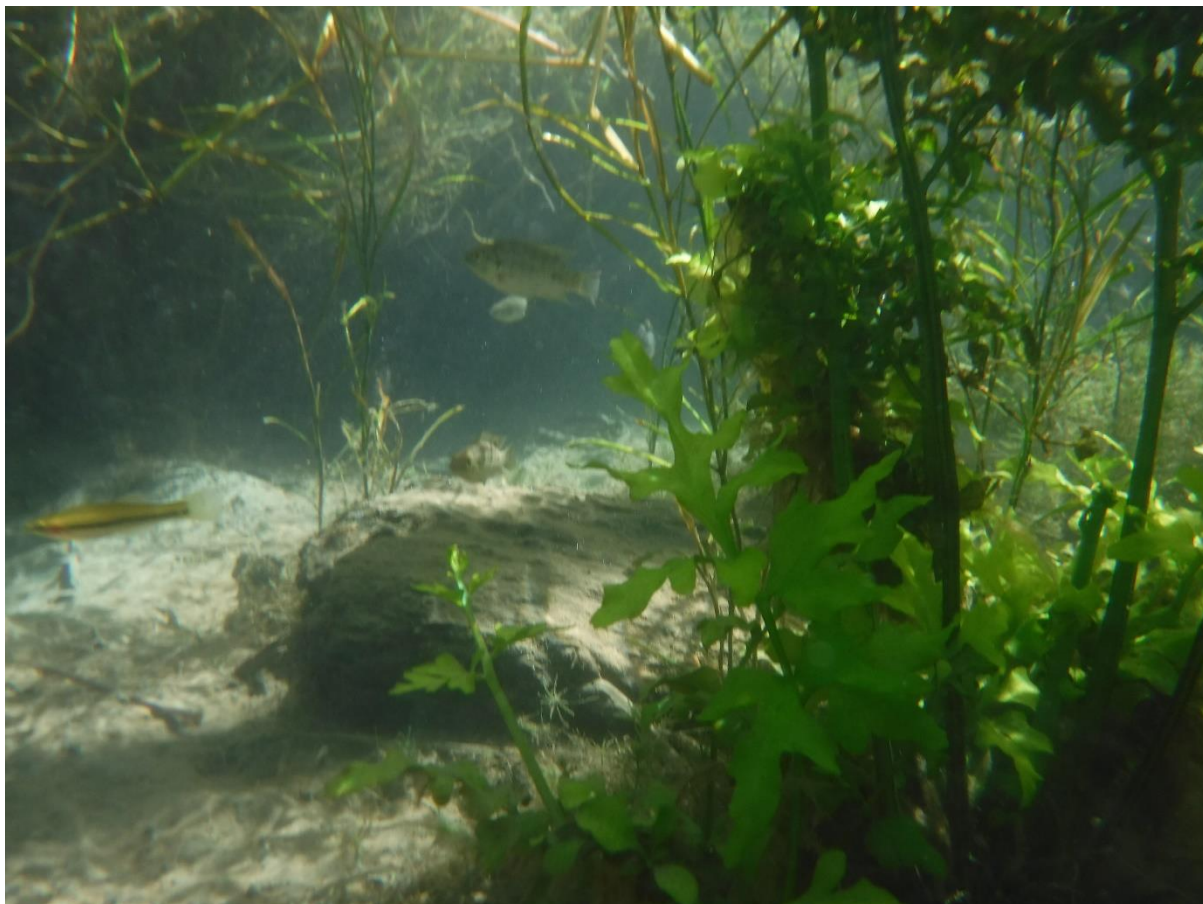


Mamara New Capital City Development – Phase 1 Environment Impact Statement (EIS)

Chapter 1: Non-Technical Summary



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1.0 INTRODUCTION

The non-technical summary of the Environment impacts Statement for Mamara was formulated as a requirement for those who do not fully understand some of the highly technical information in the EIS. It is expected to be a report for policy makers and ordinary public members who find the thematic reports highly technical. It is important to stress that the technical nature of the some of the reports cannot be over simplified and the efforts to make them non-technical may be an issue. This should read as a summary for each of the specialised reports and any issues that require further understanding will require reading the technical reports provided.

This report focuses on the approach and purpose of each thematic study areas, the baseline environmental conditions as observed from the baseline assessment and some of the findings for each report. The discussion on potential impacts and mitigation measures have also been highlighted in some sections but not all. It is highly recommended that this non-technical report is read and integrated along with respective technical reports for the EIS. The approach taken for the formulation of the environment management plan (EMP) is provided but efforts must be taken to read the EMP as a standalone document as it was not simplified in this report.

It is important to stress that the proposed development is just an addition to previous development that have occurred at Mamara over the last 100 years. The natural environment is highly modified and communities in the area have endured over 100 years of development activities and foreign ownership of the land. This understanding is the underlying fact that has been considered in the formulation of the EIS.

2.0 PROJECT LOCATION, DESCRIPTION, AND EIS APPROACH

2.1 Identification of the Project

The proposed Mamara Development Project covered under this EIS is a real estate development consisting of a residential, commercial and recreation construction and supporting infrastructure and utilities covering a total land area of about 100 Hectares. The development is part of a broad development plan known as the “**MAMARA NEW CAPITAL CITY**”.

The Mamara development proposal is a result of a development agreement signed by the Solomon Government and the Department of lands (Minister of land and resources) and Mamara Metropolis Pacific Limited (MPPL) on November 20, 1995. On March 1, 1996, the agreement was formally reviewed and approved by the national council and formalised under the agreement and subsequent legislation the ***Mamara – Tasivarongo – Mavo Development Agreement Act 1997***. The total area covers more than 1166 hectares.

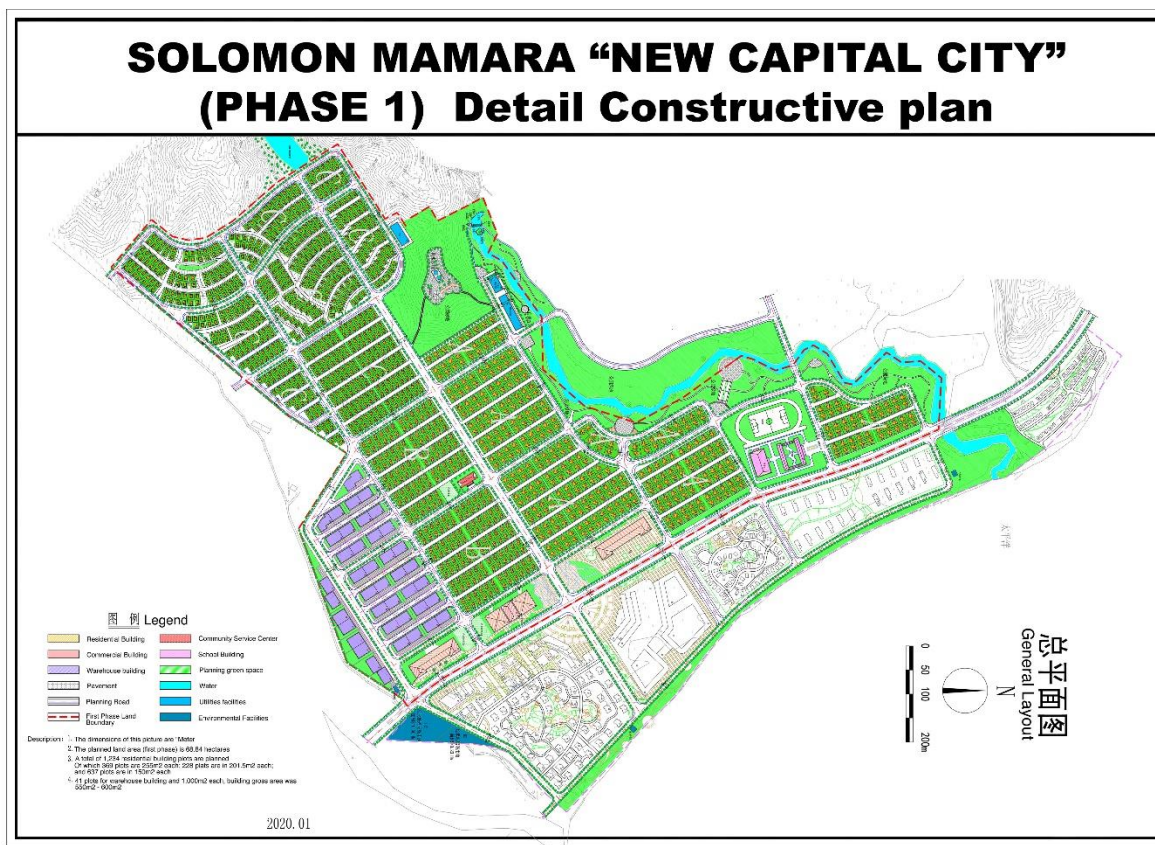
The Act allows for the land to be leased to the developer for 75 years as of 1995 and to date over 22 years have passed. The developer having lost some time due to recent civil unrest now has about 53 years remaining and are confident that it is enough time for them to develop the site.

The Act also established the Mamara- Tasivarongo Mavo Development Council that has seven members as follows;

1. Minister of Finance – SIG
2. Minister of Commerce (SIG)
3. Minister for Provincial Government (SIG)
4. Premier of Guadalcanal Province
5. Metropolis Mamara Development Ltd rep 1
6. Metropolis Mamara Development Ltd rep 2
7. Metropolis Mamara Development Ltd rep 3

The council is responsible for approval of major development within the area and has responsibility to ensure that it is in the interest of the country. The proposed development concept and design for which this EIS is prepared is approved by the council and supported by the Solomon Island Government.

Fig 1: Mamara Development Layout



2.2 Description of Location and Nature of the Project

The project is located on the northwest of Honiara city, 7 kilometres away from the administrative centre of the city centre and 15 kilometres away from Honiara International Airport. Honiara is the capital of Solomon Islands and is located on Guadalcanal Island, the largest island of the Solomon Islands archipelago. The city is located on the north-western coast of the island and is flanked inland by steep hills that have largely been cleared of forest

(UN-Habitat 2012). The boundary of Honiara City Council is approximately 11.5 km by 2.7 km at its longest and widest (total area is around 23 square kilometres), extending from 9°25'30.68"S, 159°54'52.88"E to 9°25'25.44"S, 160° 1'22.61"E.

The Mamara project site extends from southeast to northwest along the coastline, with a coastline of 8km. There are hills, two major rivers the Mamara river and Poha river on the side of the proposed development. In addition, there are also WWII shipwrecks of Japanese and American naval ships along the coastline of the proposed site.

The proposed development will cover 100 hectares of disturbed land from Poha river, bordering the LDA land and westwards reaching the Mamara river and then going for about 2 kilometres inland along both the Mamara and poha river. It also includes inland hills just above the Mamara river source eastward towards Poha and Porosughu village.

The proposed development does not include any intrusion into community or modification of waterways. However, it will involve significant excavation work of the hills for backfilling for the proposed development.

The proposed development as earlier stated includes;

1. Gravel extraction and reclamation
2. Road construction and buffers
3. Construction of residential and commercial buildings
4. Construction of a water treatment and bottling facility
5. Construction of a sewage treatment facility

Figure 2: Development Location - EIS Study Area



2.3 The Objectives of the EIS

- Comply with Solomon Islands legal requirements for the formulation of an Environment Impact Statement under the *Environment Act 1998* since the Mamara Development is a prescribed development under schedule 2 (section 16)

- Undertake baseline study of the environment and broad social condition at Mamara and the impacts of the development
- Inform the final design of the project regarding how to avoid or manage the assessed impacts
- Understand the social impacts and benefits of the project within the Mamara area.

The proposed site for developed is a highly modified environment and has been disturbed for nearly a century. This land has been subject to changes since the first explores, the colonial rulers, WWII, lever plantation and recently ownership and subsequently the Mamara Tasivarongo Mavo Agreement Act 1997.

The EIS study is therefore to understand the existing baseline conditions and how the proposed development will affect both the physical and social environment. The EIS assessment is undertaken in several phases.

3.0 LEGAL AND POLICY FRAMEWORK

The main legislations and polices relevant to the proposed development include the Mamara Tasivarongo Mavo Development Agreement Act 1997, the Environment Act 1998 and subsequent regulations and more specific regulations that will impact on some of the proposed development activities. These legislations include the Mines and Mineral Act 2008 on quarry development, The Rivers and Water Act, the Marine Pollution Regulations and Guadalcanal Provincial ordinances on nature resources management. Chapter 2 of this report provide details of all associated legislations and this section provides the most directly relevant legislation and policies.

3.1 Mamara Tasivarongo Mavo Development Agreement Act 1997- This is an agreement between the Solomon Islands Government represented by the Minister of Finance, the Commissioner of Lands and Metropolis Pacific PTE Ltd a company registered in Singapore. The agreement provides for the Commissioner of Land (PE holder) to lease over 1500 hectares of land to Metropolis Pacific PTE Ltd (FTE) for 75 years from 1995. This is with the objective of the developer attracting investment for the development of the land.

The agreement as stipulated by the Act is governed by the Mamara- Tasivarongo Mavo Development Council that has seven members as follows;

1. Minister of Finance (SIG)
2. Minister of Commerce (SIG)
3. Minister for Provincial Government (SIG)
4. Premier of Guadalcanal Province
5. Metropolis Mamara Development Ltd rep 1
6. Metropolis Mamara Development Ltd rep 2
7. Metropolis Mamara Development Ltd rep 3

The council is responsible for approval of major development with the area and has responsibility to ensure that it is in the interest of the country. The Agreement also provides for the development to generate its own energy and all utilities and can operate as an independent entity under the management of the council.

3.2 The Environment Act 1998 - was passed by parliament in October 1998 and came into force (gazetted) on the 1st of September 2003.¹ Its introduction is to provide a regulatory mechanism to address adverse environment impacts of major economic development projects in the country.

The Act emphasizes upon environmental management and protection, even at the expense of the development project.² The Act tries to address this through the application of environmental impact assessment (EIA) in order to include environmental considerations as a component of the project.³ The Act requires that an EIA should be carried out in the project planning stage prior to implementation.⁴ As a planning and management tool, EIA is very important for decision making processes.⁵

Any large-scale development pursuant to the Environment Act is a 'prescribed development'.⁶ 'Development consent' is required by the developer from the Environment and Conservation Division for operations to begin. The development consent is the permit given by the Director of the Environment and Conservation Division after a developer submits an EIS report and is approved. In the context of the Mamara Development, once the EIS is submitted and approved by the Director a development consent will then be issued for the development to occur. In 2008, the Environment and Conservation Division then developed the Environment regulations 2008 which outlines a set of criteria and specific guideline for the development of an EIS and a Public Environment Report (PER).

The Mamara Development Project is a prescribed development under schedule 2 (section 16) of the *Environment Act 1998* and therefore required the formulation of an Environment Impact Statement through the Environment and Social Impact Assessment Process.⁷ The EIS is required where a very large-scale development will be undertaken such as the Mamara Development.

3.3 The Mines and Minerals (amendment) Act 2008 - The section of the Act most relevant to the Project is for material extraction from the site to be used as building material for the Project construction. Part VIII of the Act states that a permit is required for extraction of building materials. Only the holder of such a permit may undertake mining or quarrying to obtain building materials. The Mines and Minerals (Amendment) Act 2008 defines building materials as "clay, gravel, sand and stone used for buildings, roads or other construction purposes"

3.4 The River Waters Act 1964 (1996 EDT)- The objectives of the Act are to provide for the control of river waters and for the equitable and beneficial use thereof. The Act, however, only applies to rivers that are specifically designated. The Act devolves all ministerial functions to be exercised by the relevant provincial ministers.⁸ The inspector's power however remains with the national (central) Government inspectors. The River Waters Act 1964 clearly stated that it is an offence to interfere with a river except in accordance with the terms and conditions of a permit.⁹

A permit may be granted for the following operations on a river:

- "by means of a ditch, drain, channel, pipe, or any other means whatsoever, diverts any water from a river;

¹The *Environment Act 1998* (Solomon Islands)

² *Ibid*

³ *ibid*

⁴ *ibid*

⁵ *ibid*

⁶ *Ibid* annex 1

⁷ *ibid* sec 16

⁸ *Rivers and Water Act*

⁹ *ibid*. s 5

- fells any tree so that it falls into a river or riverbed;
- in any manner obstructs or interferes with a river or riverbed;
- builds any bridge, jetty or landing stage over or beside any river;
- damages or interferes with the banks of any river; or
- contravenes any order made under section 4 of this Act".¹⁰ This means that a permit cannot be issued where a river is declared by order as being protected by the minister.

The legislation is applicable to the following rivers Mamara River, White River, Mataniko River, Lungga River, Ngilibiu River and Mbalasuna River.

3.5 The National Development Strategy (NDS) 2016–2035 - maps out a strategic direction for the future development of Solomon Islands. It presents a visionary strategy for the next twenty years, setting out a long-term vision, mission, and objectives. The NDS is intended to set out a *“framework for development of policies, priorities and programmes, providing a single reference point and common direction over the next twenty years that all stakeholders can follow. Government institutions and development partners can use it as a base for their support programmes. Other stakeholders including non-government organisations, churches and faith-based organisations, community leaders and individuals can adopt this common direction and find their own role within the Strategy.”*

The NDS specifies five key long-term objectives on which development should focus:

- sustained and inclusive economic growth;
- alleviation of poverty across the whole of the Solomon Islands, basic needs addressed and food security improved; benefits of development more equitably distributed;
- access to quality health and education for all Solomon Islanders;
- resilient and environmentally sustainable development with effective disaster risk management, response, and recovery; and a
- unified nation with stable and effective governance and public order.

3.6 The DCGA Policy Document – The current government’s vision under this policy is to empower all Solomon Islanders to attain a meaningful quality of life through social and economic reforms supported by stable and ethical leadership. The Democratic Coalition Government for Advancement (DCGA) will advance the progressive development of policies and programs to create a God fearing, peaceful, united and progressive Solomon Islands, led by ethical, accountable, respected and credible leadership that enhances and protects Solomon Island’s peoples’ spiritual, cultural, social and economic wellbeing.

The current has passed a cabinet paper in support of the Mamara development and designated the Ministry of Commerce through the Foreign Investment Division as the secretariat on behalf of the Government. The Government has established a taskforce the development with representatives from the government, two major SOES and four landowners’ representatives as follows;

¹⁰ Ibid.

Fig 3: Mamaro Tasivarongo-Mavo Development Taskforce

Mamaro Tasivarongo-Mavo Development Taskforce			
No	Key Gov't Ministry	Gov't Agency (Utility Service providers)	Landowner Rep (appointed through Tandai House of Chiefs)
1	PS-Ministry of Commerce (Chair) - MCILI	CEO SIWA Rep	Kasiano Kere
2	Director – Foreign Investment Division (MCILI)	CEO SIEA Rep	Mariano Mele
3	Director – Industry Development (MCILI)		Dominic Bua
4	Director – Immigration (MCILI)		Billy Kerepiniono
5	Registrar – Companies (MCILI)		Resele Puri
6	Labour Commissioner (MCILI)		
7	Director of Budget – (MoFT)		
8	Commissioner of Inland Revenue (MoFT)		
9	Comptroller of Customs/Excise (MoFT)		
10	Director of Infrastructure – (MID)		
11	Ministry of Police Rep (MPNSCS)		
12	Director of Peace/Reconciliation		
13	PS – Guadalcanal Province (GP)		
14	Commissioner of Lands (MLHS)		
15	Director of Tourism (MTC)		
16	Director of Provincial Gov't (MPGIS)		
17	Director of Environment - MECDMM (identified but to get appointment letter)		

4.0 CLIMATE AND DISASTER

4.1 Rainfall and Climate - From 1955 to 2011, Honiara Met Station recorded its highest daily rainfall of 251.8 mm over a 12-hour period on 30 January 2009. This record was later broken on 4 April 2014 when Honiara Met Station recorded over the same period 317.6 mm of rainfall. The highest monthly total rainfall for the period 1955 to 2011 was 955.8 mm in January 1972, whilst the lowest monthly rainfall was at 0mm in June 1987. The highest annual total rainfall was 2916.4 mm in 1967, whilst the lowest annual total rainfall was 1264.4mm in 1993 (Figure 4).

A total of 131 high-rainfall events (61.4 to 99.9 mm) were observed at Honiara from 1981 to 2010 period. February and March were observed with the highest occurrence of high rainfalls, whilst June and July were observed with the least high rainfalls (Figure 4).

On seasonal basis, of the total of 131, 83% of high rainfall occurred during the wet season and 17% occurred during the dry season at Honiara from 1981 to 2010 (Figure 4).

On annual basis, 1999 had the most occurrences of high rainfalls (11 events), whilst no high rainfall events were recorded in 1993 at Honiara from 1981 to 2010. There is an increasing trend in the annual number of high rainfall events at Honiara during the period 1981 to 2010.

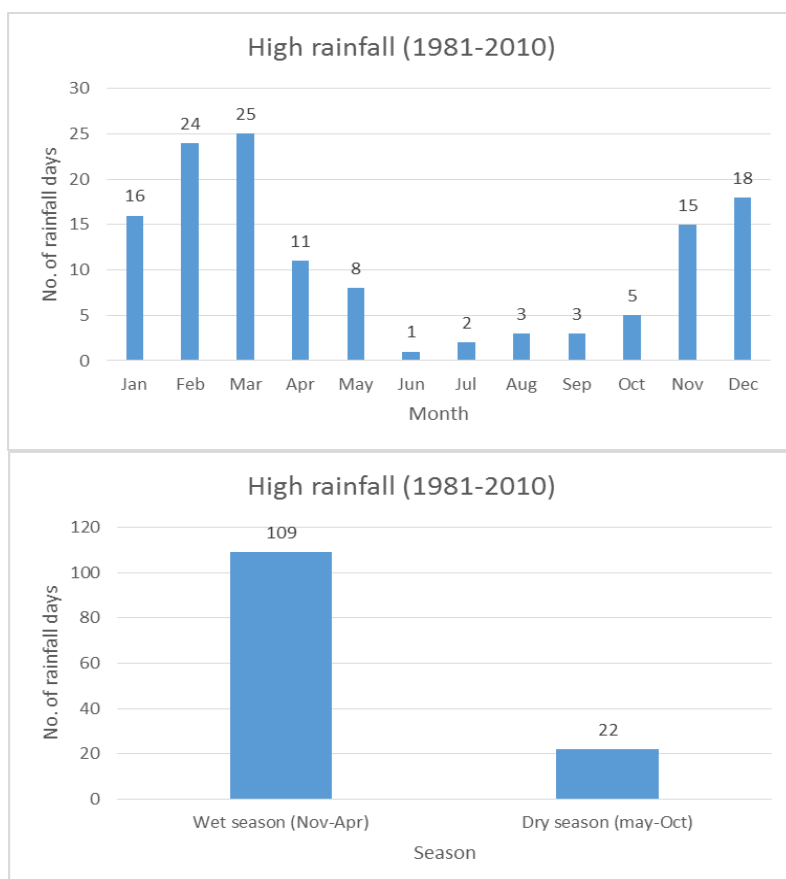


Figure 4-5: The number of high rainfall events (daily rainfall of 61.4mm - 99.9mm) per month and seasons for Honiara from 1981 to 2010

4.2 Earthquakes and Tsunami - results in various degrees of damage have been recorded on Guadalcanal. Direct damages have resulted from ground shaking, ground subsidence and liquefaction while secondary damages result from landslides on steeper slopes and by tsunami along the coastline. Mamara New City development is approximately 40 kilometers northeast of the San Cristobal Trench. This distance indicates that the proposed city is exposed to damages from ground shaking, ground subsidence and liquefaction. Damages from landslide and local tsunami are expected to be minimal as the site is flat and sheltered from tsunami waves. Recent earthquakes that generate tsunami waves and landslides impacting villages around Selwyn College and Visale in west Guadalcanal in 2019.

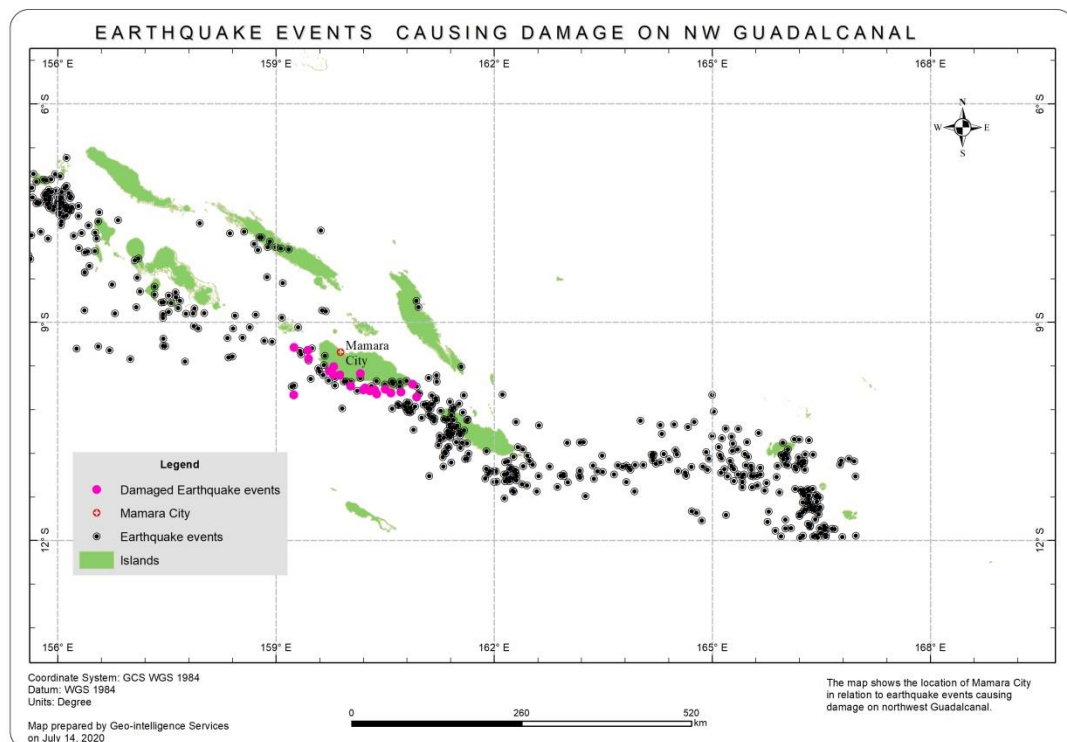


Fig 6: Recent Earthquake around Mamara and Guadalcanal

4.3 Flood Hazards and Levels- Three major riverine flooding events have occurred in northwest Guadalcanal between 1984 to 2014. The 2009 flood causes more damage to northwest Guadalcanal in terms of lives lost and properties damaged. The 2014 flood caused more damaged within north Guadalcanal including Honiara. The 1986 flooding event was also very destructive however, there is no aerial image available to determine the extent of the flood boundary.

Flood extent boundary analysis and mapping had indicated that the eastern section of Mamara new city development site is highly exposed to extreme flooding events. The area near the bridge is being flooded during the 2009 and 2014 flash flood events. The map (Figure 14) identifies these areas including the flood boundary of the two events. See Appendix 3 for the enlarge version of the flood hazard map.



Fig 7: Flood levels for 2019 and 2014 for the Mamara site.

4.4 Projected sea level rise - Projected sea level in the Solomon Islands will increase significantly in the longer term. This is due to the uncertainty regarding the contribution and speed of melting of the Antarctic ice sheet (PCCSP Country Report, 2014). Inter-annual variability has historically ranged 31 cm around the long-term average and is projected to maintain a similar range as the overall average of sea level increases. Impacts from projected sea level rise to Mamara new city development site is determined based on the emission scenarios or RCPs.

4.5 Development Impacts and Risk - This study provides descriptions of Mamara new city development site in relation to climate, geologic and hydrological hazards. We found that the vulnerability of Mamara new capital city to the assessed hazards differs. The site is highly vulnerable to heavy rainfall associated with Tropical Cyclones. Flash floods and landslides are secondary hazards linked to heavy rainfall triggered by Tropical Cyclones. All these factors must be taken into consideration.

Waves become larger from time to time to a point where they can cause erosion and inundation on the coastline once they occur in coincidence with spring tides. In addition, the coincidence of meteorologically induce surges and spring or even neap tide, can increase water level to an exceptionally high total water levels causing disastrous coastal flooding.

Geologic hazards because of earthquake and volcano would also impact the site but at a low to moderate impact levels. The difference can be attributed to the spatial distribution of hazards in relation to the geographic location of Mamara new capital city.

As the development will increase population and industrial expansion in area, the risk of damage from cyclones and earthquakes will also increase. Therefore, adaptation and mitigation measures outlined in section 5 of this report should be addressed at the different phases of development.

5.0 GEOTECH ASSESSMENT

5.1 Geotech Studies - Site inspection, site mapping and sub-surface investigation were undertaken in support of the proposed Mamara-Tasivarongo-Mavo development at Mamara, west Guadalcanal. The Geotech assessment includes visual field work assessment and inspections supplemented by machine borehole drilling. This involved drilling of 4no boreholes. Boreholes 1 – 3 were drilled for a total of 6.0m below existing ground surface (begs). Borehole 4 was drilled to 10m begs. BH4 was the first to be drilled, taking it down to 10m was necessary to assess the phreatic surface under static conditions as well as sub-surface conditions. The depths of the rest of the boreholes were adjusted accordingly to achieve sufficient information and ensure cost effectiveness.

All the boreholes were inserted with a Casagrande type piezometer. This is required to assess groundwater levels and allow sampling of water for lab testing. The pipes were slotted from 2.0m begs to termination depth. This is an attempt at reducing likely surface infiltrations and consequent contamination.

5.2 Geology and Soil of Mamara - The site is underlain by reworked materials in the form of Colluvium, Alluvium and Marine sediments. Sections of land near the southern topographic highs are anticipated to have sliver of colluvium and scree. The site is predominantly underlain by Alluvium transported to site by both the Poha and Mamara Rivers and seasonal ephemeral watercourses that are formed during the wet season, running between valleys.

The boreholes revealed Sand and Gravel predominate. BH2 was an exception in that Clay was encountered to termination depth of 6.0m begs. This is due to its location proximal to a body of stagnant water. The fine sediments points to an environment of low energy flow (fine material settling last) with a pre-existing surface depression. BH1 closer to the ocean is underlain by Marine Sand. BH4 revealed Honiara Coral Reef Limestone at 10.0m begs.



Fig 8: Drilling works on site for the Geotech assessment.

5.3 Use of natural aggregates - Natural aggregate consists of manufactured crushed stone and sand created by crushing bedrock, or naturally occurring unconsolidated sand and gravel (i.e. colluvium, river run gravel, boulders). The main origin of natural aggregates is from bedrocks such as igneous rocks, sedimentary rocks, and metamorphic rocks.

It is preferred for use as base and subbase materials as it is produced to form dense-graded materials, has high resistance to crushing, not water sensitive, and provide long lasting pavement support.

The development area is situated between Poha River and Mamara River where aggregates of varying sizes and shapes are found. It is common engineering practice to use river gravel as road aggregates. The Poha River aggregates are angular to sub-round as seen in the image below. The sizes vary from sandy to small boulders just greater than 200mm. Therefore, if these materials are used for the development, it is recommended they are tested for their suitability.

5.4 Stability and suitability of the site geology for development - It is noted that the site is underlain by a veneer of Topsoil which is in turn underlain by Alluvium and Marine sediments, further underlain by the Honiara Coral Reef Limestone at depth. We confirm from our assessment and analysis that the site is suitable for the proposed development notwithstanding recommendations outlined in this report.

The following are some recommendations to protect on-site works and minimise delays and provide some verification of ground conditions.

- Minimal clearance should be undertaken at the site for the water reservoir and the reservoir constructed not less than 10m from the edge of the slope. Slope stability assessment should also be undertaken at the design stage
- Aggregate selection (size) and treatment (crushing) is required for the subgrade formation to ensure the long-term performance of the roads
- Filling of site for roads and building platforms should consider compaction parameters for a given material type (lab testing to verify)
- Fill thickness must consider Flood base Level and Freeboard
- All earthworks should be independently verified to ensure the minimum design intent is achieved
- Trenching and excavation work on site should be undertaken during dry season,
- Provision should be made to shore side of excavations in the case of elevated water level
- The bottom layer of the foundation should be compacted; there should be no soft spots in foundation due to roots etc. Any soft/ defective spots should be dug out and filled with granular material and compacted
- Bottom of footing excavation should be inspected by a qualified Engineer prior to placement of reinforcement steel and pouring of concrete to confirm design intent has been achieved.
- Structural loads to be transferred to Marine Sand/Gravel or HCRL at depth or satisfactory compacted Fill platform
- Foundation depth and footing dimensions will need to be confirmed by Structural Engineer once structural loads become available
- A suitably experienced Engineer should be present during foundation excavation to confirm minimum design intent has been achieved
- Stormwater runoff from roofs and paved areas should be collected and piped to safe disposal points such as tanks and existing drains away from building foundation
- The developer should notify and consult relevant experts and authorities should be notified immediately, should ground conditions differ from reported observations on which this report is based.

6.0 WATER QUALITY AND SEDIMENTS

6.1 Assessment Approach - The water quality and sediment assessment objectives is to assess the present state of the environment conditions in the area, and to provide a basis for evaluating environmental impacts and mitigation related to preconstruction, construction and operation of the Mamara Tasivarongo Mavo development.

The study includes the following activities:

- Identify and prepare sites for water quality samplings. This includes recording GPS points of specific sites of interest;
- Conduct hydrometric flow measurement on Poha river and Mamara artesian spring source;
- Install boreholes for collecting Groundwater samples and to identify water table height;
- Collect water samples from each of the boreholes;
- Collect water samples from coastal surface waters;
- Collect surface water samples from respective sites at Poha River and Mamara spring source;
- Collect sediment samples from marine coasts and river beds for quality check; and
- Samples taken to National Labs for tests.

6.2 Surface Water baseline field survey on hydrology- The surface water quality of Poha and Mamara Rivers were tested with respect to the following parameters:

- E coli and coliform bacteria
- Nutrients: Sulphate, potassium(K), phosphorus(P), Nitrate (NO₃-N) and Ammonium Nitrate (NH₄-P)
- Physical parameters: Temperature, Atmospheric pressure, PH, Oxygen Reduction potential, Dissolved oxygen, conductivity, Turbidity, Total Dissolved solids and Salinity

6.3 Groundwater Hydrogeology - Four boreholes were installed at selected locations in the project area to study the level of ground water and its link to climate scenarios. Groundwater boreholes were labeled as: GW1, GW2, GW3, GW4, and GW5. The water quality parameters tested for ground water include the following:

- E coli and coliform bacteria
- Nutrients: Sulphate, potassium(K), phosphorus(P), Nitrate (NO₃-N) and Ammonium Nitrate (NH₄-P)
- Physical parameters: Temperature, Atmospheric pressure, PH, Oxygen Reduction potential, Dissolved oxygen, conductivity, Turbidity, Total Dissolved solids and Salinity

6.4 Coastal surface water quality- There were two sampling points for surface water quality along the coast, SW 5 and SW6. In situ parameters were tested and samples were collected at site SW5. The location was positioned near the Mamara spring mouth.

The water quality parameters include the following:

- E coli and coliform bacteria
- Nutrients: Sulphate, potassium(K), phosphorus(P), Nitrate (NO₃-N) and Ammonium Nitrate (NH₄-P)
- Physical parameters: Temperature, Atmospheric pressure, PH, Oxygen Reduction potential, Dissolved oxygen, conductivity, Turbidity, Total Dissolved solids and Salinity

6.5 Hydrology - The main water bodies that exist within the Mamara Tasivarongo Mavo vicinity are Mamara Spring and Poha River. Pockets of surface water bodies do exist in some parts of the area and were brought there through varied sizes of drainage systems that extends inland from the coast.

Poha River is connected to a large drainage system that extends inland through the mountainous region reaching the altitude of about 600m to the direction where it connects to the Lungga River catchment. It provides a body from which other surrounding rivers are fed from and the widespread catchment supports the sustainability of the of Poha River flow.

Mamara spring is characterized as groundwater based on its nature of source. The volume of water that it gives out is determined by its supply. It is being fed by the natural confined underground storage of water that depends on rainfall through surface water infiltration, from which replenishment of water is determined based on the rainfall distribution over the area.

Stream flow rate for Poha River is considered moderate and appeared to be declining in flow as less rainfall persists over time. Poha River appears to having more flow upstream than at downstream. This could be caused as a result of water sinking through the surface of the Poha River basin due to the geological formation of the region. Poha River could be one of the main sources of groundwater recharge that links to Mamara spring network of aquifers.

6.6 Surface water Analysis- In open channels and along the coast, temperatures ranges from 28-33 degree celcius. Temperatures for sites in Poha are higher because the river is not flowing and channel exposed to sunlight. Poha do have a low DO, conductivity, TDS and Salinity which indicate, the river system has been affected to certain extend. Algal growths are common in Poha river at locations where there are very low flow. Though life forms including fish are evident in the lower reach, the aquatic fauna are not diverse due to low DO levels. The Mamara River in general is healthy with diverse life forms including aquatic species the EIS team believed are yet to be discovered. The Mamara source pH is almost neutral and is rich in minerals, salts, metals, cat ions or anions as indicated by its conductivity and TDS.

6.7 Ground water Analysis - Four boreholes were installed to collect soil and water samples for Geo-tec and water quality studies. The control is an existing borehole near Poha used for washing by communities in the area. The insitu parameters by comparison are much higher than surface water results. The high DO, conductivity, TDS and Salinity are due to concentration of minerals, salts, metals, cations or anions leach from the soil profile. The nutrient test confirm the boreholes are high in P, S, N, K and NH₄ concentrations. The turbidity of the boreholes that are extremely high is believed to be from disturbance when the sampler was lowered into the boreholes. High salinity in the result indicate the water is hard water and may have the presence of Mg and Na.

6.8 Sediment quality - The bottom substrate of the rivers and coastline composed of sediments, cobbles, and debris. The geochemistry of these substrates are by origin from volcanic activities and mineralization of the bed and sedimentary rocks upstream. Poha volcanic and sedimentary substrates are seemingly round due to its large catchment and hydrology. Unlike Mamara, the bottom substrate is a mixture of clay and slightly irregular substrates. According to the Lab results, the concentration of elements found in sediments from the two rivers and coastline varies significantly. The results indicate the following elements are detected in the project area: Potassium (K), Sulphur (S), Chlorine (Cl), Calcium (Ca), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Copper (Cu), Zinc (Zn), Arsenic (As), Rubidium (Rb), Strontium (Sr), Yttrium(Y), Gold (Au), Zirconium (Zr), Niobium(Nb), Barium (Ba), Lead (Pb), Thorium and Uranium (U). All these elements are detected at Poha and Mamara except Au and U that are only detected at Poha. These

elements occur naturally and are important to the environment. Human induced activities have exacerbated the concentration of these elements in the environment and in many cases led to health impacts. Heavy metals are normally stored in the fatty tissues of animals and eating the same diet for example fish from an impacted river system overtime can be fatal.

6.9 Nutrient Analysis- The concentrations of K range from 6540-8792ppm, respectively. The distribution of concentration is almost the same for all measured samples. Relatively high levels of K in all samples in the river and along the coast can be attributed to the weathering of basic and ultrabasic igneous rock in the drainage area of the rivers. The range of minor elements were: Titanium 1564-2742ppm, Vanadium 42-67ppm, Chromium 104-173ppm, Manganese 433-845ppm, Iron 1.97%-3.44%, Copper 26-66ppm, Zinc 42.5-46.1ppm, Arsenic 2.3-5.7ppm, Rubidium 21.3-44.2ppm, Strontium 276-820ppm, Yttrium 7.5-9.6ppm, Gold (Poha) 5.8-58ppm, Zirconium 85-95ppm, Niobium 4.8-7ppm, Barium 358-434ppm, Lead 7-16.4, Thorium 5.4-15.4ppm and Uranium (Poha and coastline) 7-8.8ppm. The average concentrations of metals exceeded acceptable standards for sediment pollution with heavy metals. It is highly likely, that operation of the city will have significant impacts on the marine and aquatic environment.

The study of water and sediment concentration levels is important in understanding water and sediment quality and its link to past and current developments. Water and sediment quality is a significant environmental determinant of health. The test results indicate both natural and anthropogenic activities influence water and sediment chemical properties in the project area. Surface and ground water results vary due to mineralization, leaching of salts, metals, ions, cat ions. The nutrient and elemental concentration levels are high in comparison to World Health Organizations (WHO) standards. The Micro test for all sites remain high. The Mamara source test result indicate it is healthy and conducive for drinking and cooking. Soil nutrients for the five sampling locations are still tested in laboratory.

7.0 MARINE AND COASTAL ENVIRONMENT

The overall objectives of this marine survey assessment report between Poha River and Mamara River are to;

- describe and characterize the existing marine fauna aquatic environment, get a record of baseline of the marine, coastal and fisheries flora and fauna occurring that will be or has potential to be affected by the zone of influence of the project.
- Discuss the potential direct and indirect construction and operation phase impacts of the project to the marine and coral reef ecosystem
- Describe proposed mitigation and or management measures for protecting or reducing the impacts to the values of the marine ecology.

7.1 Coral Reef Survey- Three sets of transect was used per site surveyed. For a site, coral percentage composition cover of the following categories was estimated:

- Massive coral
- Branching coral
- Soft coral
- Algae
- Bleached coral
- Recently dead
- Rock, sand, or rubble

7.2 Benthic Invertebrates survey - The list of invertebrates' species is those important commercially and as indicator to coral reef health. For each site, the mean size and abundance of the following invertebrates were to be calculated:

- Trochus shell
- Crown of thorns
- Crayfish
- Clams
- Diadema Urchin
- Black lip
- Triton
- Sea cucumber species

7.3 Fish survey method- The fish species list are important food fish for food and commercial and some indicator species that can help identify the health of the coral reef system. The fish species on list for survey and included for assessment were;

- Parrot fish
- Groupers
- Emperors
- Sweetlips
- Wrasse
- Rabbit fish
- Snapper
- Surgeon fish
- Butterfly fish
- Trigger fish

In Guadalcanal only in Marau has extensive reef system, while most areas with minimal size reef system. With Mamara much of the intertidal coral is dead, at Poha coast at lower eulittoral for stratum of *Acropora* and *Montipora* (figure 9 c, d) rubbles characters of intertidal zone (Roe 1993) and less diversity of fish as well, as shown in the survey .The fish that dominates the healthier part of the coral reef Figure 10 a, b) is mainly black surgeon fish , butterfly and other small fish (sp). Inverts observed during survey were only 2 sea cucumber and 1 *tridacna* sp were sighted.



a



b



c

d

Figure 9 (a, b,c,d): The different types of coral cover along the Mamara to Poha river mouth

7.4 Marine Survey Analysis - The fish list surveyed is important food fish, commercial species, and coral reef health indicators. This does not mean that other fish species are not present. This result showed and reflects only one site of 50m x 3 transect tape from Mamara river mouth going east towards Poha river mouth direction (Figure 8). Other two sites marked star in figure 8 are sites where reef observations are done without using transect due to the high energy wave actions and high turbidity with very low visibility. As we recorded and analyzed, most food fish and commercially important fish are not found, and those present the fish sizes were small. This is may be due to the coral reef system area is within the reach of Honiara population for night diving and netting and deteriorating status of substrate habitat. The most dominant fish recorded were black surgeon fish. The fish resources are depleting in this zone also due to the status of the coral reef habitat and the exposure to high energy wave action most of the time with high turbidity. Secondly this area is exposed to high population influx for recreation from Honiara thus the pressure to reef fish resources.

As recorded during the invertebrate survey there was very low, almost no population of invertebrates' present. Only one tridacna clam shell (*Tridacna maxima*), one sea cucumber (*Holothuria atra*) which is important for food and commercial species respectively were found (figure 11 a, b). Blue Starfish (*Linckia laevigata*) and diadema urchin (*Diadema antillarum*) also present on the site that was surveyed.

The high exposure of the reef system to Honiara residents, as it was used for public recreation and settlers along the area is one of the reason for the depletion of the important invertebrate for food and commercial uses and also the nature of the substrate and exposure to high energy wave action is not conducive for some of these important invertebrate species.

7.5 Coastal Morphology - The coastal area of the project site at Mamara is a bay with mostly white fine sandy beach and coastal vegetation of vine known as morning glory (*Ipomoea pes-caprae spp*) and coastal tree shrubs and other coastal vegetation land wards. The coastal site is with high wave energy and showed indication of coastal erosion. Outlets from Poha River caused high sedimentation and siltation as a result there is high turbidity and very low visibility along the coastal waters. There was evidence of solid waste disposals coming out from both Poha and Mamara river outlets and ended up in the coral reef system

The mouth of the Mamara River down towards the sea was hard rock with live coral reef system at the depth between 1-4 metres. As you move from Mamara river mouth towards east side along the coast, the surface changes from live substrate with most of the reef fish to mostly fine sandy beach and patches of mixture of live and dead coral boulders along the sea

coast. There is not much healthy branching and *Acropora* coral species due to the exposure to very high energy wave action and high temperature during low tide most of the time.

There is a community of different individuals within the coral reef ecosystem along the reef system between Poha River and Mamara River. There are individuals of blue star fish (*Linckia laevigata*), sea cucumber (*Holothuria atra*), sea urchins (*Diadema antillarum*), tridacna clam shell (*Tridacna maxima*), varieties of reef fish of which surgeon fish (*Acanthurus bahianus*) is the majority and a number of butterfly fish (*Chaetodon vagabundus*) and corals species such as tabular coral (*Acropora hyacinthus*) branching corals (*Acropora digitifera*, *Acropora millepora*). The area is less diverse with regards to fish species and invertebrates. However, there are a community of live corals and fish in area opposite and along the Mamara river mouth. Along the coast towards Poha River, 70% of the coral reefs are dead and deteriorating due to exposure to high temperature and high energy wave actions and high temperature.

7.6 Development impacts- Project construction and operation activities will have an impact to the marine ecosystems as follows:

1. Increase turbidity because of Sedimentation due to excavation and reclamation
2. Run-off from construction of water way crossings, vegetation clearing, and earthworks due to road construction affects corals as they are sensitive to turbidity and high sedimentation.
3. Coral communities' reef front along coast for the Mamara and Poha River will be affected by high turbidity and freshwater run-off that will reduce the penetration of sunlight through the water column.
4. Spills of hydrocarbons (fuels) and other potential contaminants from vehicles in operation.
5. Increase in litter and solid waste into marine water will also degrade the water quality and negatively impact marine mammals.
6. Increase in Nutrient enrichment due to storm water run-off from wastewater (sewage) affects water quality.
7. Direct/permanent loss to marine flora and fauna due to land reclamation and dredging should there be any
8. Increase in noise vibration during excavation, reclamation and construction that threatens marine and coastal biodiversity such as coastal birds, dugongs, and turtles.
9. Increase in fishing pressure – increase in population from the development in the long term.
10. Invasive species, the introduction of exotic marine flora and fauna can threaten the natural communities that are present.

The proposed project site marine and coastal environment has gone through years of human and natural disturbances. Thus, the Coral reef ecosystem and the coastal environment have changed, adapted, and are still adapting and coping with both the anthropogenic and natural impacts. With that, the baseline description of the characters of the existing marine fauna, aquatic environment, marine, coastal and fisheries flora and fauna was recorded. It has been observed that the marine and coastal environment is highly vulnerable, modified and highly degraded due development over the years.

The reef system just in front of the Mama river is showing signs of resilience with good coral cover and good fish count observed. However, all fish species expected of a healthy reef have not been observed and the reef is adapting the changing conditions experienced over the years. Some keystone species such calms as shells and few soft corals have been observed with means that reef has potential to thrive if managed properly.

8.0 FRESHWATER BIODIVERSITY

8.1 Guadalcanal Freshwater Biodiversity – The Islands is known for its dense rain forest and has the most mountainous region in its interior that reaches to over 2000 meters above sea level (masl) creating a unique river morphology and biodiversity. This unique environment enables the island to host some of the endemic flora and fauna for Solomon Islands given its vast land features from its beautiful glossy seas, lowland rivers, and streams to the mountains.

The first recorded and published work on freshwater and brackish fish was done by Gray in the mid-70s (Gray 1974) which represents the Guadalcanal Island and the Solomon Islands as a whole. A second study on Guadalcanal for freshwater ecology and fish was conducted as a part of an ESIA study to fulfill government's environment safeguards. The study was conducted for the major mining development that took place at Gold Ridge, Central Guadalcanal plains.

Guadalcanal studies conducted for on freshwater ecology and fish were and reported and published from the Gold Ridge Projects, 1990, 1995, 2003 and 2006, Tina River System by Entura in 2010 and Tina River Hydro Development Project ESIA Report 2015). In September 2015, a study on mountainous freshwater ecology of headwater catchments were also conducted which documents a total of nine fish species that composed of two eel fish species, six goby species and a *Ryacichthys species*.

In 2016 a detailed study was conducted as part of another ESIA baseline water quality and aquatic ecology downstream of the Gold Ridge Mining. A total of 36 species from 23 genus and 14 families of freshwater fish fauna was documented from Metapona River, Tinahulu River, Kwara River, Chovohio River, and Charivunga River. Based on the freshwater fish fauna compiled from the recent studies and reports, a validating process was conducted to establish freshwater fish fauna of Guadalcanal as describe in a report by Boseto and Hevalao (2016).

8.2 Mamara Freshwater Study - Seven sites were selected and surveyed during this survey. Two survey sites on Poha River downstream due to the river dry season. Five survey sites on Mamara River. Sampling was conducted using dip nets and seine net were used to collect specimens. This style of sampling is restricted to use in areas of wading depth (to about 1.1 m). Apart from electro fisher the nest was also effective in riffles and snags, and under bank overhangs. Sampling tended to be concentrated in such areas and this will have influenced the species set collected at each site.

Most concerned from the local community is the risk the development might pose to their local livelihood. The community mentioned that most of their basic livelihood comes from the two rivers. For example, Mamara River is their water source, which. They had to travel several kilometers to fetch for water. At Poha River, small post-larval or fish juveniles locally known as *manda* on certain time of the year brings food to the table all this if not considered is really a concern.

8.3 Mamara freshwater habitats- The team observed various habitat on which freshwater are found present. Generally, this habitat affects fish composition within rivers. There are four (4) major habitats that were identified in the two rivers.

1. **Pool, depth of over 1 meter** - During the field trip the team observed that pool habitat of more than 0.5 to 1 meter are common in Mamara River. The velocity ranges from 0.2 to 0.5 m/s. Unlike Poha River it is undergoing its dry season cycle having some areas of the channel a completely dry. Rich fauna is also found in this habitat; eels, Tilapia, jungle perch and gobies. The substrate is quite diverse form dominated by gravel, muck muddy and silt.
2. **Riffles and running habitat-** It is common to find lengthy stretch of rivers have riffles and running river parts. This true for Poha River however, the normal cycle of dryness from mid-year to late November has demonstrated no riffles and running habitat. Mamara River due to its steepness and rapid change in its elevation has this habitat. This riffle and running habitat velocity ranges from 0.5 meters to about 1 meters/second. This habitat's substrates are dominated by pebbles, cobbles, and gravel, naturally shivered by the flow and gravity of water column. Mainly fauna found in this habitat were mainly of gobies, grunters, tilapia, and some marine juveniles of *Lutjanuas spp* and *Caranx spp*.
3. **Shaded holes and overgrowth habitat-** This habitat creates a range of microhabitat that fish, snails, and other invertebrates a found present. There is fauna found to prefer overgrowth and some to prefer exposed areas. This habitat has its velocity flow controlled and the temperature seems stable with little sunlight penetration. This overgrowth is from grass and legumes growing into the river side or growth of freshwater plants, water cress, water lily plants and aquatic plant species dominated the Mamara River. The substrate is mainly of muck muddy, sand-silt and gravels. The fauna found in this habitat are mainly, tilapia, eels, freshwater prawns, and freshwater crabs.
4. **Estuary habitat-** This is found at the lower reach of the rivers. The velocity of such areas is nearly to stilt due the influence of the ocean (where dense and less dense medium met). The salinity can more seawater and can be more freshwater depending on the steepness of either medium. Poha River has more exposed region of this habitat. The substrate is dominated by settling silts, clay, gravel and muddy. At Mamara River, the sandy areas are dominated by limestone sediments and coralline gravels. This area is very diverse and mostly dominated by large predators; eels, mullet, tilapia, crabs, and other marine faunas.
5. **Mamara/Poha under bridge habitat-** The bridges of Poha and Mamara are representation of artificial habitat. At Poha River the bridge the post within the river had establish an aggregating medium where fish, snails and crabs are found also. At Mamara River creates a micro-habitat of shady-dark, hollow and pool area where larger and mature fish find refuge in. As observed the team found mature and large tilapia, eels, grunters, jungle perch, freshwater prawns, and crabs.

8.4 Freshwater fauna endemism- Most of the fish species recorded from this survey are native species. Depending on their environment and aquatic morphologies the fish are nearly present in any streams in the Solomon Islands. Only one always confused with Tilapia

is found to be present in Mamara. The species is found throughout the Mamara River from the lower reaches to the upper reaches near to the source. There are other species interested to be compared in this study with the northern basin rivers of Guadalcanal. It is interestingly that some species like the *Lentipes Kolobangara* that is recorded at the upper catchment of Tina River (Mbeambea River-a tributary of Tina River at the altitude of about 750 meters an endemic species that is newly discovered in the Solomon archipelago especially on the islands of Guadalcanal, Kolobangara (Western Province) and Choiseul (Keith et al 2016).

8.5 Poha and Mamara River studies and documentation- Previous studies have provided a baseline data for the fish species documented on estuarine and freshwater systems in the Solomon Islands (Table xx). The studies on Gold Ridge rivers, the Tina River Catchment in 2010, 2013 and 2014 have recorded a total of 76 species from 35 genus and 18 families. The number of the fish species recorded were based on under water observations and fish photographic during snorkelling. Based on the in-depth literature and taxonomic reviews, a total of 20 valid fish species from 19 genus and 17 families were confirmed for the Poha and Mamara River.

8.6 Threats to aquatic habitat and fauna- It is obvious that physical and chemical alteration of the natural habitats and the physical conducive parameters will become a major threat to the freshwater fauna during the clearing and construction phase of the project. The clearing of trees and the removal of the topsoil will lead to high sedimentation entering the river system. Sedimentation and suspended solids will finally enter estuaries and into the sea.

It is already known that poor agricultural and land reclamation often result in erosion of soil and increased turbidity which may disrupt feeding success of fishes and other aquatic fauna (Gratwicke *et al.*, 2002). Such poor practices have been document in the tropical Pacific and the adverse negative effect on the aquatic fauna was shown to be extremely drastic (Boseto 2006, Haynes 1999 and Jenkins *et al.* 2010). Low bridges, blockages from high piles of wastes or weirs reduce or block flow to an extent of lower reaches of waterways can no longer support aquatic life and migratory species such as eels and amphidromous species resulting in loss of their migratory paths and cannot complete their life cycles (Berkamp *et al.*, 2000). Loss of aquatic habitat through development can cause a major loss to the biodiversity of the local area that has been affected. In this case the potential negative effect of high sedimentation runoffs will affect the habitats.

8.7 River morphology shift and changes- Loads of sediments disposed through runoffs or due to clearing of vegetation that controls such will change the riverbed and river structure. It is likely that sediments will settle on the riverbed covering food source for natural fauna growing on substrates in the river. This would mean no fresh algae for some fish to eat which will drive the aquatic life (fish, prawns, and snails) away.

Furthermore, sedimentation will cause water to become muddy and dirty and in turn will affect aquatic fauna in terms of their impairing visual, feeding and reproduction ability. Sediment loads over natural threshold capacity of rivers may also impact aquatic fauna by settling on the riverbed and other surfaces that are potential egg nesting sites. Finally, there is a potential for the river to dry up.

8.8 Water chemistry- The removal of topsoil and some core soil will lead to the introduction of new trace metal into aquatic systems. Eventually lower oxygen level of the

water increases dissolved salts from soil degradation, high nutrients content, expecting greenhouse emissions (methane and carbon dioxide) in addition to temperature and turbidity. Such will have significant impacts on the organism compositions. Other publications had mentioned that natural decompositions can take decades or even centuries to rejuvenate. In addition, the use of heavy machinery for digging is likely to result in excessive hydrocarbons leaching into aquatic systems which will greatly affect physical water parameters. Once water chemistry is altered by a certain degree it will affect the survival, breeding and feeding of any aquatic fauna that can lead to massive mortality (Jenkins, 2009) or algal bloom.

8.9 Introduced species - The introduced fish species *Oreochromis mossabmbicus* was recorded in river systems in Guadalcanal since the 70s. In this study *Oreochromis mossabmbicus* was found in pool and over shaded areas and towards the ocean. With such rivers being affected by uncontrolled or not monitoring programs, there will be a shift of fauna that will then affect livelihood of people depending on the rivers.

One thing for sure that despite any sort of threats that might cost losses to the native freshwater fish in the Tina catchment; the *Oreochromis mossabmbicus* will survive and populate the Guadalcanal river catchment. In the case of Tina River due to the depth, flow and gradient the *Oreochromis mossabmbicus* is far to present at the upper reaches, however if the flows are low (near to stagnant) and depth decreases there is high probability for this *Oreochromis mossabmbicus*, *Sarotherodon occidentalis* or other species (for example the mosquito fish, the *Gambusia affinis*).

8.10 Livelihood- Most of the aquatic species recorded from this survey form the basis of the food sources that the villagers in the surrounding villages depend on as their major protein intake. With growing dependency on easily available processed canned food Mamara communities will depend on processed food. From interviews about the consumption of fish per day it is estimated to be about 300 grams per person per day as most of the protein were subsidized by processed tin food and Chinese noodles. However, the Mamara river and Poha river remain an important source of food and income for the community around the Mamara area.

9.0 TERRESTRIAL BIODIVERSITY – FLORA AND FAUNA

9.1 Mamara habitat types - The various floristic habitats, that is, the different vegetation communities, which hosted the diversity of plant species within the project area included the followings:

- a. Coastal or beach habitat on the front line near the sea,
- b. The grasslands with randomly distributed medium size mixture of introduced legume Trees and shrubs, and coastal trees along the beach side of the main road,
- c. The riparian zones along the Mamara river buffer system,
- d. The freshwater swamps – ponds connected to the lower parts of both Poha and Mamara river system,
- e. The upland ridges invaded and covered by a diversity of grass species,

- f. The upper hills and midland-ridges, and valleys on the inland boundary with remnant primary forest tree species and old secondary forest re-growth.

The above main vegetation ecosystems were observed to be providing the natural but also modified distribution of the many plant species recorded during the survey. There is a clear distinction between these different vegetation communities. However, many overlaps on the composition and distribution patterns were noted. The flora diversity and status reflect the extent and degrees of severity of human and natural disturbances on the area and vegetation cover and the influences of soil nutrient, water, air, and sunlight to stimulate plant restoration within the area. Most of the area is very vulnerable to regular fire occurrence during dry seasons during the year which is very common on this northern part of Guadalcanal.

9.2 Typical dominant floral species - the coastal belt from Poha river mouth to Mamara river mouth includes these trees, *Barringtonia asiatica* (Fish poison tree), *Calophyllum inophyllum* (Beach Calophyllum), *Premna corymbosa* (Fire tree), *Morinda citrifolia* (Noni or Rotten cheese), *Milletia pinnata*, *Hibiscus tiliaceus* (Yellow hibiscus), *Terminalia catappa* (Beach Almond), *Cordia subcordata* (Kerosene wood), *Macaranga similis* and *Cocos nucifera* (Coconuts). Some introduced trees are *Broussonetia papyrifera* (Paper mulberry), *Mangifera minor* (Mango), *Delonix regia* (Christmas tree), *Samanea saman* (Rain tree), *Lucaena leucocephala* (Lucina), *Plumeria acuminata* (Frangipani) and *Ficus variegata* (Fig tree). Other shrubs, herbaceous plants, creepers, weeds and grasses are *Pandanus tectorius*, *Scaevola taccada*, *Bambusa blumeana* (Yellow bamboo), *Canavalia sp.* (Creeper), *Starchytapheta jamaicensis* (Blue rat's tail), *Mimosa pudica* (Sensitive or signal grass), *Mimosa invisa*, *Alpinia oceanica* (Beach ginger), *Passiflora foetida* (Sweet rope), *Ipomoea pes-caprae* (Beach morning glory), *Cassytha filiformis* (Parasitic vine).

9.3 Flora composition from the main road - to the areas above the coastal belt vegetation zone comprise mainly of mixed species of grasses and herbaceous weeds. They occupy the substrate floor level to about two metres vegetation heights. Also widespread within this zonation but occupying mid to higher canopy heights (3m to 10m) above the grasslands are the protrusion of some identifiable trees such as the Rain tree (*Samanea saman*), Christmas tree (*Delonix regia*) Lucina (*Lucaena leucocephala*), Paper mulberry (*Broussonetia papyrifera*), *Psidium guajava* and *Macaranga similis*. Near Poha River bridge on the eastern end are *Canarium indicum*, *Melochia umbellata*, *Macaranga similis*, *Merremia peltata* and *Trema orientalis*.

Pure taxonomically grass species found in the grassland flats and ridges in northern Guadalcanal are a mixture of *Pennisetum polystachyon*, *Themeda australis*, *Imperata cylindrica* (Mueller-Dombois 1998) and *Cenchrus species*. Many other minor grass species were noted as recent introductions into the surrounding areas.

9.4 Riparian flora upland and upstream of Mamara River – the catchment on the western portion of the project site was dominated by the following mixed species of trees, *Sterculia conwentzii*, *Erythrina sp.*, *Ficus virgate*, *Barringtonia racemosa*, *Theobroma cacao*, *Macaranga tanarius*, *Rhus taitensis*, *Pipturus argenteus*, *Ficus septica*, *Rhus taitensis*, *Spondias dulcis* and *Terminalia sp.* The famous useful endemic palm, *Metroxylon solomonensis* was planted on the upper part of Mamara river for its leaves while the famous

Betel Nut palm was planted to be harvested and sold for its complementary narcotic effects. Other shrubs, herbs, climbers and creepers, ferns and grasses recorded are *Sida rhombifolia*, *Solanum torvum* (Devil's fig), *Costus speciosus*, *Kleinhovia hospital*, *Merremia peltata* and *Dendrocnide inerme*, *Cassia alata* and several other grass species.

Also discovered during the field survey is the existence of four exotic aquatic plant species and three indigenous aquatic species of flora in the freshwater ecosystem of the Mamara river. The four introduced aquatic plants include two important vegetable crops, the Kangkong (*Ipomoea aquatica*) and the Water Cress (*Nasturtium officinale*) and two ornamentals are Water Lilly (*Nymphaea sp.*) and Water Hyacinth (*Eichhornia crassipes*). The three uncommon native aquatic plants are: *Ceratophyllum demersum* (*Ceratophyllaceae*), *Potamogeton sp.* (*Potamogetonaceae*) and *Ceratopteris sp.* (*Pteridaceae*).

9.5 Fauna Habitat and Species Composition -The presence of wildlife and different faunal groups throughout the overall project area was also considered during the survey. Plants and animals are inseparable because they need each other to thrive (Lavery, Pikacha and Fisher 2016). The much degraded and open nature of the grassland dominated vegetation determines the species composition, abundance and distribution of birdlife and other fauna species observed in the lower sites.

However, it was noted that on the coastal vegetation belt as in the grasslands, there were less fauna occurrences than on the upper ridges with large primary forests and on valleys having older secondary forests. More birds were seen and heard further away inland from the coast and main road where human presence and vehicle noises were very heavy. Birds are more active for feeding and interactions early in the mornings and late in the evenings. The high level of the presence of birds in the forested ridges and valleys were attributed also to the season of flowering and fruiting of many trees, shrubs, and herbaceous plants in the area. This was particularly noted on some trees hosting a lot of birds. One fig tree (*Ficus sp.*) with thousands of fruits is found to be infested with an estimated 30 to 40 individual birds from 3 or 4 different species. The timing of the survey and field visits did not allow a full and or complete assessment to be done at different times of the day and night to make good observations, counting and recordings. Bird identification was based on their call and songs and actual sightings while other animals, insects, etc. were physically encountered.

Apart from birds enlisted, many unidentified species of insects (grasshoppers, butterflies, moths, beetles, cicadas, dragon flies, katydids, ants), spiders, lizards and skinks, millipedes, centipedes, and snails were being observed. In the freshwater habitat, some fish species (*Kuhlia maginata*), Gobies, *Giuris margaritacea* (moro), *Oreochromis mossambicus* (Tilapia) and the famous mud skippers were noted. Along the beach shorelines, several species of crustaceans (crabs and hermit crabs were noted. These other organisms are fundamental to the health of the environment. They play important roles in regulating, supporting and provision of ecosystem services in the surrounding environment.

9.6 Biodiversity management for the proposed development - Based on the critical observations made during the rapid ecological survey, the following recommendations are intended for considerations to inform and guide the proposed project activities to take into account all possible measures as safeguards for harmonizing the environment, community and economic aspirations.

1. The forested ridges surrounding the water catchment area immediately above and below the water source of Mamara River must be accorded protection.

2. Protection of the Mamara Rive Nature Reserve will also cater for the existing needs of the wildlife (fauna) and biodiversity within this unique site to enhance an ecological balance of nature.
3. The upper part of the Mamara River has been used by the local communities to farm Water Cress vegetable for sale to earn income and for family consumptions.
4. The protection of parts of the coastal green belt vegetation cover along the shoreline and Mamara riverbank.
5. Outsource tree and plant seedlings from the Honiara Botanical Garden Nursery (Ministry of Forestry) for replanting in the upper watershed of Mamara River, along the coastal green space and in other selected sites for ornamental purposes.

10.0 BUILT ENVIRONMENT AND SOCIO-ECONOMIC CONDITIONS

10.1 The socio-economic assessment – the study was undertaken with information that is readily available and some of which have already been accessed as well as from suggestions and indications coming out from the social surveys and the community meetings and workshops that were held. Specific consultations with identified individuals were also made.

A one-day traffic survey was also carried out although a comprehensive traffic information including sets of data analysis are available from the Ministry of Infrastructure Development under the Project for Greater Honiara Transport Master Plan Study under which a Progress Report was published in January 2020. The entire process is part of public consultations, information gathering, and data generation efforts towards the formulation of the report.

Respondents and the participants alike have made very useful feedback from the surveys, including the individual consultations, and through interactions from the workshops. These are proven to be quite useful firsthand information as they provide for valuable assessments of the situation. They reflect the concerns and views of the affected population and the surrounding communities in order that a balanced view based on both quantitative and qualitative evidences can be presented, utilizing other information from the developer themselves and the government. The process offers an avenue to understand what may be at stake about current conditions and the overall development.

10.2 Community Workshops- A total of three community workshops were conducted on the 1st, 3rd, and 4th of July 2020 respectively at Lumbu (generally the Lela Beach), west Kakambona for two separate days and at Borosughu. Borosughu is located at the front ridges of the Poha communities at the western side of the river that borders the Mamara New Capital City land boundary.

In the meeting, there was general opinion that the government should have arranged for benefits in terms of dividends or percentage of shares to the original landowners. They further pointed out that the Agreement was done without knowledge of land-owning tribes and they hinted that perhaps responsible individuals and authorities should seriously investigate the

matter. At the THOC meeting it was appreciative to note that there were women representatives from the chiefly lines that were in attendance and gave voices.

The second day of workshop was also held at Lumbu and this time it was for ordinary community members within Kakambona and was open to women, youths, and the elderly and vulnerable. It was noted that some of the information presented in relation to what the developer has done so far were disputed, particularly in the case of compensation and repatriation. It was mentioned that there was no actual repatriation taken place but only compensation. And whereas the compensation rates for crops, for example were far below imagination, they explained.

On the third consultation that took place at Borosughu village, participants similarly expressed their appreciation for most of them have not known such important involvement in the development requirements under legislation. Most have expressed similar sentiments and again the issue that stood out was in connection with land. Some have claimed that the land boundaries under the development seemed to have been extended and now some of their built homes fall within their border. This happened only lately following a recent boundary survey by a contracted survey firm.

10.3 Surveys and Interview- Surveys were conducted from 27 – 30 June 2020. This covered areas from the Turtle Beach to the tiny plane in of Mamara, to Borosughu and Takilori and other nearby settlements, including those on the LDA (Livestock Development Authority) land. Over forty individuals of both sexes were interviewed. Besides obtaining household information, the questions to the respondents range from economic information in relation to livelihood and facilities used at each household, as well as household expenditure to labor and employment opportunities.



Fig. 10: Conducting household survey

It further sought for how it might affect women, children, the elderly, and people with special needs. And finally, it also allowed for respondents to provide their recommendation. The responses from the interview are being used in the various discussions that follow.

10.4 Women’s Participation- During the workshops there were several women that have attended. It was notable that one woman attended all the three community sessions and was an outspoken lady. In the first meeting she pondered with several questions, firstly in relation to benefits and she asked what some of the benefits to the communities within the vicinity of the development may be. She remarked with concern that the community or tribal representatives were never a party to the MTMD Agreement.

10.5 Current built environment – Mamara new capital city

1. Road and Bridge Infrastructures- The only road infrastructure that exists is the present tar sealed road from Honiara that passes through the development area reaching as far as

Lambi and which dissects the coastal section and the inland lots. The road was built many years ago and it is currently highly subject to wear and tear from usage compounded climatic and weather conditions. At different periods in the past the road has suffered maintenance problems. Most of these problems were attached to funding availability and contractor responsibilities.

2. Bus Stops and Vehicle Stop Bay - The only road infrastructure leading from Honiara has no proper bus stops and vehicle stop bays. The current practice for vehicles is to stop at anywhere convenient along the road. If it is a public transport it depends also on onboard commuters where they wish to get off. Once he or she makes the signal drivers seemed to make the stop at any moment of will. The installation of temporary market huts along the road causes passing vehicles to stop at those spots to buy products from these market sheds.

3. Building Structures - At present there are no completed permanent buildings erected on the site. The initiatives by previous contractors under the same proprietor could not proceed to completion for reasons only known to the developer. At least five structural frames of near completed two-floor residential homes under a previous plan were erected. After a spell, with no activity at all by the developer, vandals went in and loot the buildings, remove materials, and cause destructions and only the concrete body frames remain.



Fig 11: Temporary office sites for the construction, Mamara.

Currently work is underway to construct a temporary on-site office complex for operations during the entire construction phases. The complex is mainly of prefabricated modular materials brought in from China and erected on site.

The site was firstly backfilled with crashed porous limestone. Where buildings are constructed, concrete casts were first laid before rigid bottom plates are installed where all other sub-assembly components are fixed then on.

4. Electrical Power Lines- The current public electricity lines end at the eastern end of the Poha bridge and as such there are no standing power poles within the vicinity of the development site. Solomon Power which has jurisdiction over electricity production and supply for Honiara and other provincial centers confirmed that at present there are no immediate plans to extend the lines beyond Poha bridge, even if it's in the best interest of the utility supplier.



5. Water Supply and Sanitation - There are at present no water reticulation system within the entire development area and there are no proper sanitation facilities evidently available within the proposed development site. In terms of hygiene, majority of the communities use their natural way of defecation and other sanitary practices. They tend to use the surrounding environment and practice open defecation often. Currently all settlers and nearby communities fetch potable water from the Mamara River using containers and this seem to be one of the dominant issues amongst the affected communities during the consultations.

6. Jetty, Log Ponds and Ports - There are no jetty and port facilities within the development area except for an old log pond at the eastern side of the Poha river-mouth. There rests some old junks of log trucks and other equipment, rotting logs, and even an old tugboat which has been washed up the beach and rusting away. Such tugboats have been commonly used for towing and moving landing barges when transporting round logs onto cargo ships and when moving machineries.



Fig 13. Ariel view of the Poha riverfront log pond.

7. Communication Infrastructure - In the vicinity, there are no existing communication facilities or infrastructure installed. However, mobile phone networks are reachable and operational at the site. As such phone calls and internet service utilizing data packets are available. The closest telecommunication tower is known to have been installed on the hills above the Savo Market in the Tanaghai area west of White River.

8. Recreational Amenities- No recreational amenities exist in the area, recreational activities are confined to the beach and shorelines and amenities to accommodate basic sanitation needs are not there, though effort was made by very few who run beach parks with the use of temporary huts that fell apart only within a short period. Often these are unhygienic as they were not being well looked after. The Mamara River itself is a major attraction for those living in Honiara and the vicinity. On weekends the river gets packed with vehicles and people going for swim in the river. There are those from town that also bring their laundries for washing in the river.

9. Makeshift huts - mostly be found along the main road that members of the communities built for themselves to support their daily activities of selling garden/farming produce and other commodities. However, following the eviction exercise, most of these huts were being pulled down. One that is still standing is that at the entrance to the LDA. Most of the crops sold at the huts are grown on land around the development area as well as on nearby customary areas.

10.6 Land Use and Income - Land use practices and income are derived from the following;

- food gardening for growing different food crops
- betel nut plantations. These are mainly found in the inland areas at the footing of the hills and mountains behind the plane.
- Small household piggery
- small holder poultry farms by few settlers.
- water cress farming
- fishing, washing and for cooking and drinking.
- coconut plantation. There are no other known significant natural resources, except for the water source that provided water and livelihood nourishments and the soils for food gardening.
- Fisheries- the rivers are main sources different species such as freshwater fish and prawns. There are methods of fishing they use such as the gill nets, spear fishing and lines and lures. Fishing is mostly practiced on subsistence basis other than commercial. However, depending on circumstances people at times go to hunt and fish for consumption and at other times to get small income.



Fig. 14 Betel nut plantation

10.7 Watercress - is one crop that earns a lot of income for those households involved in growing it. As watercress grows only on damp and moist places and even on water, the Mamara River has been utilized commonly for this. They use a technic which is like anchored rafts where lines of beds are built on the water using floatable material such as bamboo. Tiny cresses and most importantly their roots are held on these beds. Their roots spread quickly and eventually newer suits sprout and over time the beds become filled with this salad crop. Watercress beds can be found in the upper section of the river towards the source spring. The Mamara River itself is more than a kilometer to the spring from its mouth. Watercress is produced at around 50 to 100 parcels during each harvest and sold at \$10 a parcel. Each parcel is estimated around 200-300 grams. So, for each harvest this equates to some total weight of around 10kg to 30kg which makes for overall income of \$500 to \$1000 per harvest.



Fig. 15 Watercress beds at Mamara River.

10.8 Betelnut - also stands out as an important source of income. Table 1 is an extract from the responses to sources of income in the questionnaire and where twenty households described the types of income gained from the commodity per week. Betel nut sale makes income for certain households which range from 400 - 5,000 dollars. There is a household that indicated a value of 16,000 dollars which may be treated as dubious, though it could happen if large amounts of bags are sold when demand is extremely high and the produce is low in supply and which often influence the market price to go high and could be just a one-off sale in a given period. Sales with such income also reflects the commodity being taken in from the plantation's sources from outside the development or the surrounding communities.

10.9 Tourism and Recreation - Settlers and the so called "keepers of the place" have cleared areas along the beach-lines to accommodate people and the public at large who frequent the western coastal planes for picnics and leisure, and those on sight-seeing.

They normally charge fees to enter the various picnic spots that ranges from \$40 to \$150, depending on the type of vehicle. They seemed to have been making fortunes to some scales. According to records obtained from one of the collectors at one point he collects over \$1500.

At turtle beach alone, which is part of the overall MTMD Agreement but not include in the current Mamara New Capital City development plan a number of families have organized themselves to collect fees from picnic goers and customers in the area on rotational basis. A household have provided their record of income over different periods. At occasions they collected the following sums at different periods: \$1,910.00, \$1,720.00, \$1,130.00, and \$1,320.00.

10.10 Poha Cave or Vatulumu Posovi - known in the local language used to be a tourist attraction. It got support previously from the Ministry of Culture and Tourism who built small infrastructure such as the walls of perimeter fence and graveled pathways and steps to the cave entrance.

Leaf huts for resting were also built within the cave area. Unfortunately, no information is available as to the income made from visitors to the site as currently it is non-operational due to disputes over management and ownership.

10.11 Other Income Generation - At the present the land is bear flat following some clearances that had happened earlier during the first construction efforts, and now with the current work to carry out all land preparatory work including the major task of backfilling the large area. No forms of other industry exist. However, in the past there used to be gravel extraction in the Poha River for road construction and whereby landowners make income from. Apparently, this is no longer the case and no information are available as to the fees and charges for such extractions in the area. Formal employment as such from other industries is not available within the whole area. Nevertheless, people have made efforts to make earnings.

In a simple analysis based on the conducted surveys of forty-four respondents who are assumed to be representing different households, twenty-four of them indicated their income to be above 2,001 dollars per week. Eight responded as having earnings between 1,301 – 2,000 dollars, while seven have shown income that ranges from 801 – 1,300 dollars and the rest with income at 800 dollars and below.

It is clear that the incomes are generally based on agriculture, betel nut sales and earnings from recreational. However, the case is only true for certain households and though a majority, there are those that find it difficult to make good earnings toward any improvement in their livelihoods.

10.12 Potential socio-economic impacts

- 1. Agriculture and livelihood-** In context of this phase, there are already some negative consequences to income generation. For example, there are no longer those installed makeshift huts for selling goods and agricultural produce and that they could no longer grow broiler chicken and feed pigs. The development has caused them increased cost on transport now that they must travel further distances if say travelling by taxi to their homes. Some of the settlers have shifted further inland while others just had to return to their original villages some of which were described to be in the Whether Coast of Guadalcanal. For those that must leave the place entirely it may be a total loss in terms of using that place to make incomes as compared to when they were not yet evicted.
- 2. Income and Wellbeing-** Those that make income from the temporary beach parks at the current development site have already encountered less or no income. The situation could develop into increases in dependency syndrome where in a broader scale the country continues to face and kindled by the infamous schemes such as the constituency development funds operated at the prerogatives of politicians. The rippling effects would include education of children becoming affected due to less or no money to support them to school and health could be affected as less income could cause hardships to get to clinics or hospitals and as a result welfares would become diminished.
- 3. Employment Insecurity-** There is evidence that current work to erect the temporary office complex employs a workforce of people other than those from the

communities. Large construction activity will focus on erecting one thousand, two hundred and thirty-four residential homes (referred to as the *1234 homes*) of three different designs at three separates but closely attached allotments. It will also involve the constructions of network of roads within the entire development land. There will be the installation of utilities such as water supply and electricity as well as the installation of water treatment facility to cater for sanitation and health requirements.

4. **Access to Amenities-** There will be restrictions and access to water especially the Mamara River source may be limited. The developer has planned to erect a perimeter fence to restrict by-passers or intruders to the construction areas. The developer, however, has pointed out intervals such as during lunch hour for example when workers will take spell and the access through the work area become available. The same is applied at the end of each day and at which time access to the water source is also permissible.

10.13 Potential beneficial impacts

- Job and employment
- Market access and entrepreneurship (for farmers and fishermen, businessmen and others)
- Increase in land value
- Improve transport services
- Access to utilities (electricity and water supply)
- Improved infrastructure (roads, bridges, and wharf, later according to plan);
- Operation of shopping malls and business centers
- Sport facilities
- Education facilities
- Health facilities
- Recreational areas, green space, and urban parks and more.

11.0 SOCIAL AND CULTURE

The Social Impact Assessment (SIA) for the Mamara New Capital City development at Tandai Ward in Guadalcanal Province, North West Guadalcanal is purposely to meet the Environmental Impact Assessment (EIA) as provided for under the Environment Act 1998. It comprises the social profiles within the project area and considerations are given to potential social effects that may emerge due to the development.

Community consultations were carried out at three (3) different locations.

The objectives of the community consultations workshops were to:

- Inform stakeholders about the project development

- To understand the roles of Tandai house of chiefs and the communities at large and how they might influence the project
- Opportunity to discuss the social impacts and potential benefits of the project development

11.1 Stakeholder engagement and consultation

Stakeholder’s engagements and community consultations have been undertaken at the project area as part of EIS for at least 3 weeks in June and July 2020. These include household survey, public discussion and meetings, community workshops and consultation meetings with the house of chiefs, (the Tandai House of Chiefs, Tandai Ward in North West Guadalcanal). Another community consultation was conducted with the Lumbu for the Kakabona communities and some representatives from the LDA community, the third consultation held with the Takilori, LDA, and Borosughu communities.

The consultation was conducted for over 20 days in June and July 2020 and the fundamental objective of the community meetings are to:

- Inform stakeholders about the project development
- Understand the roles of Tandai house of chiefs and how they can influence the project

Provide the opportunity to discuss the social impacts and potential benefits of the project development.

11.2 Community workshop –

Three consecutive workshops are organised and a number consultation over 2 weeks was undertaken. The first was with the Tandai House of Chiefs at the Lumbu community on 1st July 2020. The second was for the wider communities of Kakabona held also at Lumbu on 3rd July 2020, and the third was at Borosughu for the Takilori and LDA, community as well those from Borosughu.

Fig. 16. Interview process & community consultation



Interview undertaken at Mamara settlement



Tandai house of chiefs, Paramount chief (Tandai house of chiefs) giving welcome speech



Lumbu Chief Participants asking question



Borosughu consultation workshop

During the workshop consultation, a lot of grievances and disappointments were raised by the communities. The Table below summarizes the issues raised during the consultations.

11.3 Typical Houses and settlement in project area

The development has been perceived to affect people and settlements once work begins. To avoid risks as to injuries or other forms of impacts, logically the place must be clear. So, in view of achieving an amicable way forward with the settlers an assessment was conducted. Below are two examples of the how the assessment was undertaken. Unfortunately, no details were provided on how the infrastructures are going to be rated in terms of value for compensation. Examples are shown below;

Fig. 17. Typical properties of settlers

Name: Mr. Mariano Mele

Property Type	Unit	Remarks
Sleeping House	1	
Kitchen	1	
Pig Farm	Nil	
Market Place	Nil	

Site/Properties Pictures



Fig 18: Another settler

Name: Ms. Doris Mele

Property Type	Unit	Remarks
Sleeping House	1	
Kitchen	Nil	
Pig Farm	Nil	
Market Place	1	Main Roadside (Right Hand Side)

Site/Properties Pictures



11.4 Major source for drinking and domestic water uses

The main water sources providing drinking water for the current population at Mamara settlement, LDA, Poha upstream, Borosuhu, and Turtle beach areas is the Mamara River source.

- **Source of drinking water**

Mamara River is situated in the centre of the current real estate development site. It is located around 3 to 4 kilometers from the central city Honiara and is the primary drinking water source for communities within that vicinity such as the LDA settlers, Poha and Lumbu, the Takilori and Boroshuchu community people.

Fig. 19. Mamara River – mainly uses for bathing, children fetching drinking water



- ***Domestic water uses***

The Mamara water source used for;

- Drinking
- Clean water collection for preparing food
- Bathing
- Washing clothes plates and dishes
- Brushing teeth
- Watering garden
- Diving
- Recreation
- Agriculture
- Washing cars and even washing dogs

11.5 Watercress farming

The river at Mamara is also an important source for watercress farming earning families most needed income for their daily needs and wants. The watercress farms span the whole length of the river covering about 80% of it from the source. The nature of the river as a spring close to the road and accessible means that almost every family around the area have a plot of farm in the Mamara river.

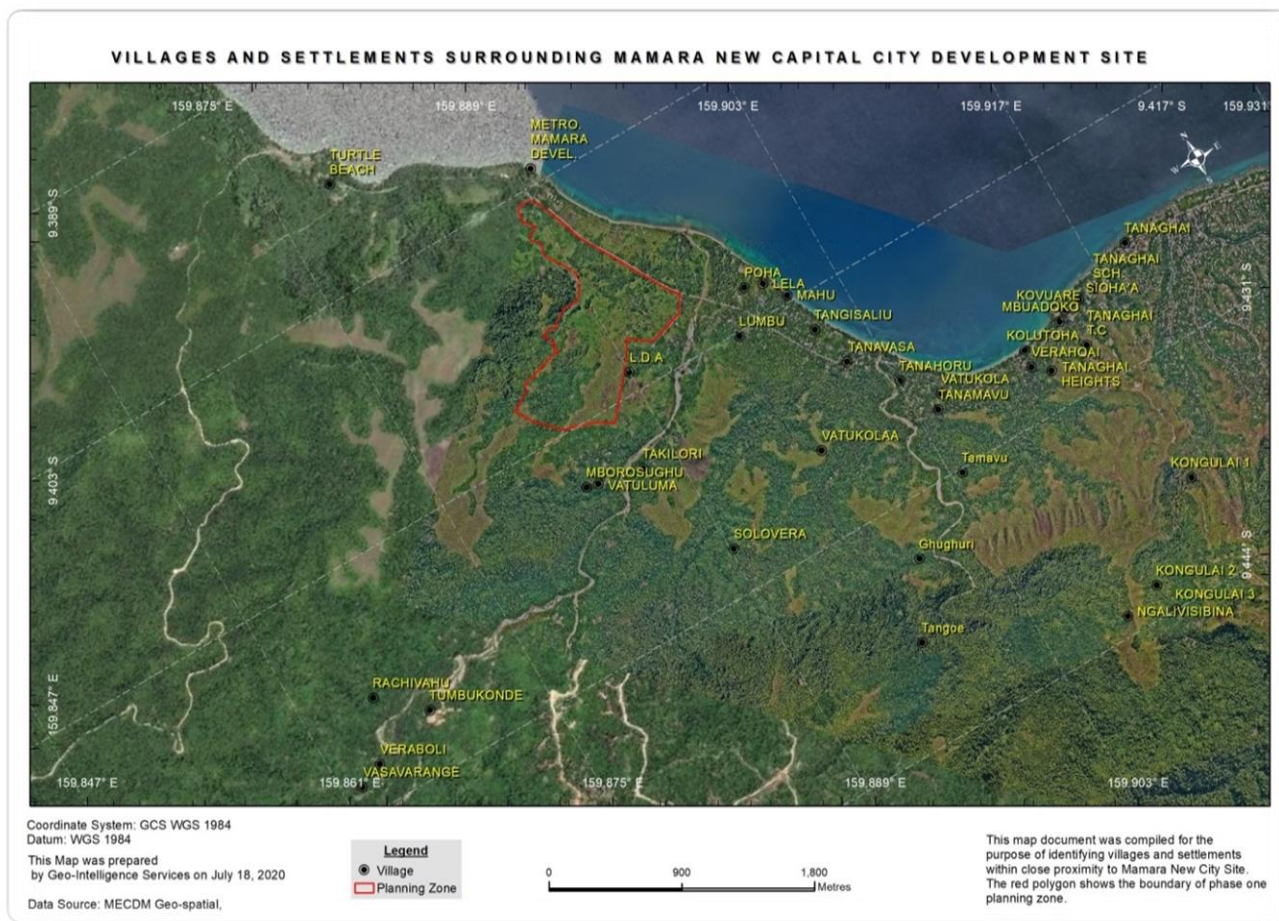
Fig. 20. Mamara watercress farms



11.6 Existing social issues and conditions

Nearby villages and communities

Fig. 21. Map indicating location of nearby villages to the Mamara development site



- **Kakabona villages**

Kakabona (Kakambona) is a peri-urban suburb on the fringe of Honiara, Solomon Islands, and is found 4 kilometers (2.5 mi) west of the centre and west of White River on the Tandai Highway. Kakabona borders the Honiara City Council ward of Nggosi. More like a centre village located between the city of Honiara and the current Mamara Real Estate development. Kakabona is an overall name of the entire village but as well have sub-communities consist of the Kakabona known as, refer to below table outline name of sub-villages, household, and total populations.

Fig 22. Kakabona satellites communities

N0	Name of sub- village	Household	Total population
1	Lumbu	34	156
2	Poha	11	47
3	Tangisaliu	16	58
4	Tanavasa	42	159
5	Vatukola	60	188
6	Marara	14	51
7	Verahoai	115	458
8	Tanahoru	36	163
9	Tanakobu	5	29
10	Huhuri	6	32
11	Tanakoko	5	18
12	Hohore	6	31
13	Tamaru	24	92
14	Uluviu	6	14
15	Kolotoha	122	566
16	Kauvare	87	285
17	Marara School	7	44
18	Tanaghai	37	144
19	Kauvare Heights	6	24
	Total	639	2,559

The village consists of about 19 sub-communities located along the coast and inland. The current population is about 2,559 and 639 households. Kakabona villagers speak the

language called Ghari (also known as Gari, Tangarare, Sughu, and West Guadalcanal) that is an Oceanic language spoken on Guadalcanal island of the Solomon Islands.

Fig. 23. Kakabona community along the main road towards Honiara



Verahoa showing the Floriculture stalls at Tandai Highway, West of Honiara.

Livestock Development Agency (LDA) settlements - LDA land located beside the Poha - River rightly attaches to the current Mamara Real Estate development area. This parcel of land (LDA) was presently claimed by the Government and once intentionally used for the livestock animals Development Agency (LDA) with the purpose of animals and piggery farming development.

There are 3 sub- satellites settlement located within the LDA areas such as Verahamosa/LDA, with 3 household and 16 people, the Choboharanga/LDA with 2 family household and 15 people and the high populated are settled within the LDA station with 23 family units and a total of 75 people. Therefore, within the LDA area itself a total of 28 households and 106 people resided after the ethnic unrest. It is believed that most of these settlers migrated from the weather coast, Poleo and Tangarare area mainly with the intention of livelihood opportunities.

Borosughu and Takilori village - The population at Borosughu and Takilori village, consists of 19 households and 80 plus population. Their daily main activities are more on subsistence farming, fishing, hunting, and other communal activities such as attending church activities, sports, and tribal meetings and wedding gathering. There is no clear indication of the main daily income but during interviews and workshops conducted respective community members expressed that their main income was on watercress farming, betel nut selling, and wild pigs selling and other agricultural crops.

Rachivahu and Tumbukondi/Veraboli - The Rachivahu, Tumbukondi, and Veraboli satellite communities are the inland communities from the Kakabona and Mamara coastal sea area. These communities are part of the Borosughu and Takilori village Takilori and Borosughu Village are located further upstream of the Poha River approximately 5- 7 kilometers inland from the development site. This community's main entrance to the coastal site is only through the Mamara whereby current development is undertaken, called in their language as Chachaba. Rachivahu, Tumbukondi, and Veraboli has 16 households and 71 populations. Their main activities are more on subsistence farming, hunting, diving, and other communal activities such as attending church activities, and tribal meetings and other social gatherings.

There is no clear indication of the main daily income except for the small scale of marketing of agricultural produce.

Turtle beach - Turtle Beach is located around 15 minutes' drive along the main road, west out of central Honiara towards Visale. It is one of the favorite beaches around the capital: a family-friendly, idyllic spot that takes hardly any time to reach by car. In contrast to other different beaches, this one (turtle beach) has a lot of sand, rather than simply coral, and there is no risky drop down to the water. It makes playing by the sea more comfortable on the feet and gives a real tropical island feel to the public outing.

Fig. 24. Beautiful turtle beach, a Peaceful hey



Turtle beach view towards Visale and even Savo Island can be seen far end.



The beach entry, someone will be at the end of the driveway to collect the visiting fee.

There are many of shady spots to set up your picnic blanket and places to park your vehicle. A couple of leaf huts are situated by the water on the off chance that it begins to rain. As described above, the current development is a direct threat to the prime beaches used for recreation. At present, 7 families with around 26 individuals were settled along the coastline and the beaches. One of the settler Mr. Niger Misi, who manages the turtle beach and expressed that the development will directly affect his family only sources of income and livelihood.

11.7 Community life and setting

- **Subsistence livelihood**

Subsistence farming is a major source of income and livelihood for the settlers and community around the Mamara project site. Gardeners use their small land holdings to produce enough for their family consumption, while the remaining produce is sold or exchanged for other foods

such fish and products in the shops. Some of the major crops include pineapples, bananas, cassava, potatoes, and, so forth. The current development will totally disrupt their livelihood as most of the people living there have reliable on produces from their gardens.

- **Security and safety**

The issues safety and security are a concern for the community. This as has been expressed during the workshops and interviews that their normal daily activities are gardening, diving, fishing, hunting and fetching water from Mamara River for domestic use. The development activities and subsequent new residential areas or new city will be a huge challenge the community will face. They concede that they normal life will disrupted and that they sense of security and safety will change significantly.

- **Privacy and remoteness**

The privacy of the community home village will also be affected by a sudden increase in population and interaction with new residence. Now communities remain seclusive and families, and youths enjoying their own private way of living and doing things in their own wish without disturbances

This is a human right issue as explained by the Icelandic Human Rights Centre, 2020 which further described the beauty of privacy and remoteness as important as it encompasses the right to protection of a person's intimacy, identity, name, gender, honor, dignity, appearance, feelings, and sexual orientation and extends to the home, the family and communication.

Customary land security - The demand for land coupled with the increase on population for new capital city will be a time bomb for the communities around Mamara. The meeting with Tandai house chiefs expressed that the same issues faced by the people of Mataniko, Barana, Kakabona, Tasahe and Titinge will occur. Many members of community will start selling customary land resulting conflicts, illegal settlements, and squatters around the new Mamara city. The lessons of Honiara city must be considered.

11.8 Development Impacts

Land related issues - Land has always been an issue in many development efforts. In the case of Mamara New Capital City development, the same applies. However, the land is legally registered as part of the entire alienated land in the Solomon Islands under the Commissioner of Lands. It was leased to the developer since 1995 and time has lapsed with no development taking place. The issue of the land under the Mamara-Tasivarongo-Mavo Development Agreement was highlight throughout the community consultations and surveys. Much relate to the approach and process taken by the government and the developer. They described it as being biased without any regard to the communities that may be affected, tribal authorities, and the original landowners. At least they should have accorded some courtesy to them. They have pointed out that in the established structural setup for oversight in the whole development landowner representative should be included and the Tandai House of Chief Representative should be part of it also. This came with the understanding that a task force was established to support the Development Council of the new city.

Daily disturbances- land clearing, excavation, and backfilling- The greatest social changes and disruptions to local lifestyles will come with the increased activities and population influx during the construction period. This is typical of all development projects around the world which are situated in populated areas. This is an issue that influences the normal routine for the daily lives of the people. Consultation with local people for the Environmental Health Impact Assessment showed that they valued their present livelihood and were uncertain about whether the Project would carry enhancements to their personal satisfaction. Specifically, they were worried about the environmental effects that the undertaking would have on the air, water, and land and the related effects on their way of life, food security, and long-term wellbeing. Local customs and traditional practices are also closely intertwined with the natural environment and land and water features.

Increase of traffic and movement - There will be positive and negative impacts associated with improvements to transport options and linkages to and from the main city to Mamara new Capital City. Improved transport options and linkages could also promote anti-social behaviours and criminal activities. Rascals are engaged in criminal activities, smuggling alcohol or drugs for sale may be tempted to travel to the other parts in Guadalcanal Island in search of new customers.

The development of a new city will result in an increase in traffic that will be very high compared to the current flow. The new road networks connecting all the new suburb is an undertaking that will be at scale not even close to currently conditions. The likelihood of accidents will increase for each of the development phase. The community adjacent to the project will need to prepare for this increase in traffic flow and understand traffic rules and laws. The new Mamara city council will play an important to ensure that there are clear road safety rules, notices, and guideline for the community.

Population increases and Urbanisation - The increase in population for the operation phase of the project is a major concern. Should increase population inflow happen because of the development, without appropriate mitigation methodologies there is the potential for the accompanying;

- overcrowding within existing communities
- temporary squatter settlements
- population imbalance associated with higher demand for a younger male construction workforce
- increased demand on social infrastructure
- a move away from local traditional lifestyle and cultural practices
- increased incidence of disease
- Social disharmony emerging from ethnic tension expanded anti-social behaviors and increased crime and savagery brought about by jealousy and disdain towards the people who have more cash or business possibilities, or towards those who intermarry with others from different clans or ethnic groups.

Expanded Population Leads to Increased pressure on social Services and

Infrastructure- Populace inflow especially from families of those employed on the Project or others looking for work can bring about important and unsustainable requests on local social services, for example, demand for schools, increases of diseases need higher demand for health centers/clinics, churches, and convenience facilities. Unsustainable demands for these services will likely result in a break down in service delivery. Strategies to expand social services whilst managing population arrival will be required to assist in mitigating this issue.

Anti-social behavior - Anti-social behavior will be one of the major challenges facing the Mamara new capital city development. Illicit activities are already high in the community with illegal drugs and liquor use already a challenge for many communities on Guadalcanal. The operation of a new city will result in an exponential growth of anti-social behaviors as people of different culture and backgrounds interact.

Anti-social behaviour comes in different forms and nature, many of them also relates to cultural issues, gender, conflict, and general nuisance. The issue of antisocial behavior related to drug abuse and intrusion into the nearby community is expected to increase, this will in turn lead gender and family related abuses and value decay. In addition, the increase in the influx of peoples into the Project Area is probably going to bring about increase frequencies of drugs and liquor use within the surrounding communities. Local women were concerned that this would become more prevalent overtime as the Project was implemented and people had more disposable income.

Loss of Existing access routes and garden areas at Mamara development sites -

Construction activities will create a number of issues associated with accessibility to land and waterways which are currently used for hunting, gathering, fishing, gardening, and other livelihood-based activities. Several villages are within proximity to all port sites, and so construction activities have the potential to intrude upon lands and waterways which are used for livelihood-based activities of local people.

11.9 Cultural and tabu sites

Vatuluma Poha Cave - The Poha Cave or Vatuluma Posovi as is known in the local language used to be a tourist attraction. It got support previously from the Ministry of Culture and Tourism who built small infrastructures such as the walls of the perimeter fence and graveled pathways and steps to the cave entrance. Leaf huts for resting were also built within the cave area. The cave is known to be very old. Anthropologists have made researches and found that early people who first arrived at the place dated back more than 6,000 years ago. In the cave, one can find in-scripts of images and writings. These can still be seen on the walls. Anthropologists were said to have also been able to identify fires places perhaps used for cooking, forms of tools, and even jewellery. Such can be protected and used for ecotourism purposes.

Kastom and tradition - Guadalcanal as referred to (Matea, 2015) stated that the massive coastal area of north Guadalcanal which stretches from Mataniko, Point Cruz in the west, to

Matango bordering Marau Sound in the east are the homes of the Lengo people. In this huge region with a tremendous population, scarcely come across to communities which hold to any traditional dances. Nangali communities in the Longgu area in East Central Guadalcanal and Tathiboko community on North East Guadalcanal are the only exceptions that still holding to the kastom dancing. However, in Guadalcanal, the men's traditional dances are called Silaru and Siokole and the women's dance was the rop'e. like another women's dance, is the Loloele. This was a ritual dance and it was performed only when the "üthuthu" operation was done on a young girl.

Intangible culture - The following components of the project have the potential to impact the existing cultural heritage values within and surrounding area.

- Through the immersion in sphere of western influence, particularly the cash economy, people may be drawn further away from their indigenous languages, patterns of settlement and livelihood.
- Housing Estate development activity within the respective area may act to further alienate the relationship of local people to their indigenous cultural world, a situation already initiated and developed in the past through the process of colonialism, missionaries, and logging activities.
- Such development which will introduce more outside business investors and foreigners to come in will bring in cross-culture which destroy the traditional culture that can pass through such as oral traditions, performing arts,
- Knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.
- Death of cultural knowledge, thus lead to a loss of Intangible cultural heritage includes oral traditions, performing arts, social practices, rituals, festive events, knowledge, and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.

11.10 Impact on tabu and heritage sites

- Permanent damage or disturbances of known cultural heritage site, whether tangible or intangible which may lead to the loss of cultural traditional sites
- Current Real Estate development in some way will increase the number of population and so possible for damages or disturbances or lack of respect to tabu sites such as graves or landmark
- This might lead to public intrusion to tabu sites such the hunting areas,
- Likely impact that will cause irreversible influences or harms of known recorded sites such as the Mamara River, which whether substantial or unclear, may prompt the loss in the cultural legacy in Guadalcanal, especially Tandai ward in North West Guadalcanal.

Potentially, there will be a direct impact on the cultural heritage, tabu sites such as burial site, places of adoration, archaeological remains, the Poha caves, traditional boundary symbols or markers, historical battleground, and even gardening lands and so forth. In this regard, the team has identified various areas as potential cultural sites during a survey of both surrounding and within the development vicinity.

12.0 HEALTH IMPACTS

12.1 Guadalcanal Province Health Status - The 2018, 2019 annual report and quarterly health report from the Guadalcanal Health Information System (HIS), stated that so far there is two health facility that have been closed. As a result, one maternal death was reported, four under-five deaths were reported in the first quarter of 2020. In terms of health supervisory delivery activity recent health report in 2019 stated that percentage of the supervised health delivery is 74.8 % and Unsupervised 25.2%. This means that a lot more effort needs to be taken to reach 2020 target 20% of unsupervised delivery compared to first-quarter report 2020. It further reported that nurses attended to women delivery or childbirth at 70.6 % in first-quarter 2020.

General Measles coverage for the province is 11.6 % first-quarter 2020, whereas the indicator shows the need to do more coverage to meet quarterly targets which are 22.5%. The Malaria incidence increased to 159.1 cases per 1000 populace in 2020 and perceptibly high in Marara, Grove, and Aola, and so, therefore, the total of 28 GBV cases by an inflicted intimate partner was reported for the first quarter in 2020

12.2 Mortality rate - The estimate of the degree of mortality based on information from 2009 registration of Population and housing recommend that newborn child death rate declined by 6 death for every 1000 births. This is expected to decline with improvement to access to health facilities.

12.3 Morbidity rate- Major health issues reported include Diabetes, Hypertension, Malnourished Children under-two (%), Malaria Annual Parasite Incidence rate per 1,000, Maternal Deaths Total, Measles-Rubella Vaccine Coverage (%), Outpatient Consultations Per Capita, Ari, skin diseases or Bakua, influenza. Generally, the percentage of diabetes cases present at a health facility increased in 2019 compared to decline cases was reported in previous years. This indicating there is a need to address the lifestyle disease at the community level about the risk factors of Non-communicable diseases. Marara, Avuavu, Grove, Maru, and Tangarare show a notable increased in the percentage of diabetes cases present at the health facility and lowest was observed for Aola in 2019.

12.4 Community water supply and sanitation- The strategic plan for rural water supply, sanitation, and hygiene 2015 – 2019 stated that over 652,858 people in Solomon Islands – 80% of the population live in rural areas whereas most people living in rural communities lack access to clean water and proper sanitation and do not practice proper hygiene behaviours. The primary water source for savouring for the Guadalcanal people is essentially from the gravity water supply, rain catchment water tanks. Many people living along the beachfront so like at the Guadalcanal plain, including the Mamara development catchment area, for the most part, utilizes water rain catchment tank and well (i.e. hand-dug man-made wells) that can be made of cement culverts, 44gallon drums sizes. These sources are vulnerable to contamination, particularly during stormy seasons; likewise, are additionally vulnerable to the dry season. In most of the villagers' water distribution system was either damaged or not working. Community settlement close by the Mamara development site fundamentally got their drinking water from the Mamara spring which will be directly affected by the development.

12.5 Sanitation - Most of the Guadalcanal island family units are without access appropriate sanitation facilities. This is according to the RWASH policy strategy 2014 which recorded that Solomon Islands has a very low coverage of sanitation with 18% a bit lower than water supply coverage. This indicated that most household private family units exploiting bushes or ocean for the purpose of defecation in the country. No accurate information

collected to update the current sanitation facilities on Guadalcanal Island however it remains a major challenge to be addressed.

12.6 Wastes management -For the local community, the household setting has normally disposed of solid wastes in their back yards while the nearby sea settlement uses the sea as the open dumping for most of the domestic wastes.

12.7 Health Infrastructure- The only Hospital in the Guadalcanal Province is the Good Samaritan Mini Hospital, although it still categorized as an Area Health Center but in terms of facilities and services provided it is quite advance and produce quality services compared to other facilities throughout Guadalcanal. The hospital is located at Grove in the central Guadalcanal political boundary Ghaobata ward and accommodated major clinical services such as the dental clinic, radiological, pharmaceutical, and medical and malaria laboratory, mini operation theatre.

All other preventable supportive services such as the Environmental health, health promotion, malaria, and nutritional/dietetic unit, HIS, and other health program administration are located at the provincial health headquartering Honiara.

12.8 Potential health negative impacts - The following health issues will need to be addressed because of the proposed Mamara new capital city real estate development. Diseases incidence rate (Non- communicable diseases) - The Mamara real estate involves many physical activities that require several laborers, and population increase. The access to new opportunities and finance means that communicable and non-communicable diseases would likely increase. Non-communicable diseases are a leading disease related to lifestyle that will require better health management system. Other diseases such as acute respiratory diseases (ARI), TB, Malaria outbreak, diarrheal, HIV/STI viral diseases and even teenage pregnancy are likely to also increase.

- 1. Occupational and health safety – accident and injuries** -Occupational safety and health issues from accidents and injuries, and deaths are likely to increase. Major construction will result in longer working hours that will affect lifestyle and families. All these factors will also be further compounded by work conditions and unsafe work environment if no proper enforcement is being undertaken.
- 2. Demand for additional health services-** The Mamara real estate development basically be building 1234 family houses. Given the SI context where an average household is about 6 individuals for each family unit, the approximate population potential would be around 7400 to 10,000 or more individuals. The associated demand for education and health facilities will increase as a result.
- 3. Nutritional change** - The development will affect the economic structure of the nearby communities as new opportunities emerge. The demand for processed food will increase resulting in new nutritional habits and lifestyle.
- 4. Exposure to dust and noise** - Development activities requires site clearing, transportation of gravel from the quarry site to the construction area purposely for back filling of the development site. This activity will generate dust and noise and is a threat to community health near the project area.

The quality of air within the proposed project area is typical of a rural setting in the Solomon Island. There are no air quality non-attainment areas in the vicinity that is

deemed an issue of concern. Construction and operation activities can be sources of dust pollution. There would be short-term dust impacts during excavation and reclamation work although this would be limited to fugitive dust emissions and emissions from machinery and vehicles used and dust control would be followed during construction. There would be no negative long-term adverse impacts on air quality during preconstruction and construction phases.

There are no noise standards in Solomon Islands, and as any noise generated by the subproject will be temporary (i.e. during construction) and intermittent, preparing a baseline of ambient noise levels for subsequent monitoring is not considered warranted.

Construction noise are generally intermittent, attenuates quickly with distance, and depends on the type of operation, location, and function of equipment. During the constructions, there will be a temporary impact due to the noise from construction machineries, especially when operations activities are carried out close to residents. Noise will become a concern during operation of the city from commercial and residential activities to name a few. The city council will enact by laws and guidelines to comply with international best practice. World Bank standard noise levels can be used as a guide¹¹.

5. **Exposure – solid, liquid, and hazardous wastes** - The development will generate solid wastes that comes from untreated wastes water, stormy water runoff, and hazardous wastes that may have an impact on the health population. Nearby communities are the most vulnerable as they will have to deal and address waste issues that they are not familiar with. There is also the possibility of wastes being discharged into the rivers, streams, and marine environment. The threat to health includes respiratory breathing problems, waterborne diseases, breeding sites for mosquitos, and other rodents.
6. **Threat from accident and injuries** - Phase 2 stage of the development will involve more heavy work that include concrete construction, digging for profiling of building, and all sorts of construction involvement. There will also be construction of township feeder roads, drainages, pathways, buildings, construction of septic tanks (powerhouse, wastewater treatment facility, and water bottling). The construction site could lead to possible occupational and health hazards to the workers, from accidents.
7. **Water contamination and potentially decreasing of water supply system (Mamara)**- Population increase from the development will lead to the contamination of the Mamara River and an increase in demand that could threaten the water source. Increased human activity during construction and the full operation will lead to pollution of the rivers, coastline and waterways threatening human health.

12.9 Potential health positive impacts - The master plan for Mamara development will also include health services such as a mini hospital, school facilities, and sporting facilities that will support the wellbeing of the community. Increased employment opportunity for skilled and non-skilled employee means improved community wellbeing and standard of living and the ability to afford better health care.

Major health threats from the development includes exposure to clouds of dust from heavy vehicle machines, excavation and transport of soil and gravel which can lead to Acute respiratory infections (ARI), clinical and presumptive diseases, skin diseases, ear infection,

¹¹<https://www.ifc.org/wps/wcm/connect/4a4db1c5-ee97-43ba-99dd-8b120b22ea32/1-7%2BNoise.pdf?MOD=AJPERES&CVID=ls4XYBw>

and Red eye and other air and water-related diseases. Accidents and injuries are also high risks and the increase in current prevalence of diseases on Guadalcanal such as diabetes, malaria, STI and common flue.

There is a strong correlation from the baseline studies population that live nearby township is more vulnerable to lifestyle diseases. It is highly like that will be an increase on non – communicable diseases and other lifestyle disease that affected all the nearby communities. The influx of new population during the operation phase means that new exposure to new disease for the community of Mamara and risk from anti-social behaviour that can lead to injury.

13.0 ALTERNATIVES, DISCLOSURE AND CUMULATIVE IMPACTS

13.1 Alternative technology and design

Gravel extraction- Phase 1 of the development includes extraction and reclamation. The method of gravel extraction is an open cut strip. This method normally used when the materials are found over a large area and relatively on the ground surface. The company will design and furnish all materials and equipment to be fully compatible with the open cut strip extraction taking it consideration the environmental conditions of the site.

Road network- The company will upgrade existing roads and build new roads. Existing road network can be upgraded to minimum road standards to facilitate movements during construction. New roads will be constructed to Ministry of Infrastructure and Development (MID) design standards and specifications. Minimum road cross section requirements include 8m carriage way, 1m shoulder and 1m drainages on both sides. A total of 10m road corridor. There is no indication from the developer at this stage to tar seal the roads, but it is important purposely to avoid surface erosion and migration of sediments.

Port Area- The proposed wharf will be a course way type. This indicate, the proposed facility would only allow landing craft with minimum load capacity. The developer's method of unloading and loading will be done using landings crafts. Decking of ships at the proposed wharf will be restricted and not allowed to avoid any unforeseen events such as wreckage and damage to corals. Loading will be carefully assessed and monitored to avoid any risk of accidents. The EIS team recommend the proposed wharf must be permanent, properly designed and climate proof. Otherwise to avoid further degradation to the marine environment, the developer can use the Honiara International port to unload its materials.

Landfill and Sewage Treatment Plant- Landfill and sewage treatment facilities are important components in any township development. The developer has identified an area for sewage treatment plant but is very near to the Poha River. It is important, the water treatment plant design takes into consideration the water bodies nearby. The design of the facility and sewage networks, however, are not available during this assessment. In addition to that, a landfill is yet to be identified. These facilities require detail studies and structural designs discussed thoroughly with relevant government agencies. The EIS team recommend, Landfill, sewage treatment plant and other structures come under separate EISs.

13.2 Alternative locations - It is not feasible to consider the other alternatives because of the social and environmental disadvantages.

- Why work must be carried out at the selected site:
- Developer has already acquired the site;
- Access to the main sealed road; and
- Repatriation programs have already commenced for informal settlers since 2013.

13.3 The No Development Option- The “No development option” implies not proceeding with the development rather choosing to leave the area as it is at the current state, which is certainly provided no alternative for the development. As a result, there will be no impacts on the physical and social environments. This eliminates all benefits from the development to the SIG, province, and landowners. It is equally important to consider the positive benefits of the development and in doing so there is also collective efforts to minimize the potential negative environmental and social impacts.

13.4 Disclosure and Consultations- The major stakeholders in this project include the MCILI, Ministry of Environment, Climate Change Disaster Management and Meteorology (MECD, MNUPR, Ministry of Finance (MOF), and Guadalcanal Province. All these agencies are important and perhaps they produce approvals and permits important for the project. Initial high-level consultations were completed by developer with government ministries. The consultation for the EIS were undertaken with the following stakeholders:

Fig 25: Consultation list

Stakeholder	Date	Officials/Participants	Discussion Issues
Environment and Conservation Division	22 nd June 2020	<ul style="list-style-type: none"> - Edward Danitofea - Rosemary Apa - Debra Kereseke 	<ul style="list-style-type: none"> - Discussion on the Mamara EIS TOR and report structure - Discussion on specifics and timeframe for the EIS
Metropolis Mamara Development Ltd	24 th June 2020	<ul style="list-style-type: none"> - William Ling - Lydia Hong - All experts for the reports 	<ul style="list-style-type: none"> - Discussion on the project design and activities involved. - Discussion on outstanding issues and reports.
Director Environment (MECDM)	11 th July 2020	<ul style="list-style-type: none"> - Joe Horokou - Edward Danitofea - Fred Siho Patison 	<ul style="list-style-type: none"> - Discussion on consideration to oceanography studies for later development - Discussion to focus on key components relevant to the Mamara development
Foreign Investment Division –	28 th June 2020	<ul style="list-style-type: none"> - Lonsdale Lungana - Sially Turanga - William Ling 	<ul style="list-style-type: none"> - Discussion on information to be provided by the FID including Mamara taskforce meeting minutes



Ministry of Commerce		<ul style="list-style-type: none"> - Fred Sih Patison - Dougla Yee 	<ul style="list-style-type: none"> - Provide all information, policy, and commitment from SIG to the development
Permanent Secretary Ministry of Commerce	15 th July 2020	<ul style="list-style-type: none"> - PS Riley Mesipitu - William Ling - Fred Siho Patison 	<ul style="list-style-type: none"> - Discussion on the Mamara taskforce and need for a benefit sharing considerations - Discussion for SIG commitment to issues raised by community of Kakabona, Tandai House of Chiefs, settlers and Poha communities - Discussion on SIG commitment for a development agreement for the new development.
Paramount Chief – Tandai House Chiefs	26 th July 2020	<ul style="list-style-type: none"> - Steve Ereinao - Paramount Chief Francis Pero - Ronny Sa'aohu - Fred Siho Patison - Douglas Yee 	<ul style="list-style-type: none"> - Discussion on key issues for the development - Concerns from the house of Chiefs - Discussion on role of the Tandai house of chiefs and recognition by the development. - Representation of project affected communities.
Chief Mariano	25 th June 2020	<ul style="list-style-type: none"> - Steve Ereinao - Douglas Yee - Fred Siho Patison - Ronny Saaohu 	<ul style="list-style-type: none"> - Development impacts on his community, properties, and settlers. - Concerns on properties such betel nut planation, watercress farms and gardening areas - Issues related resettlement and benefits from the project
Tandai House of Chiefs	1 st July 2020	List of participants attached	<ul style="list-style-type: none"> - Presentation on the project potential impacts - Concerns and issues arising for the development and history of the people of Tandai - Concerns for SIG consideration.
Kakabona Community	3 rd July 2020	List of participants attached	<ul style="list-style-type: none"> - Presentation on the project potential impacts - Concerns and issues arising for the development and history of the people of Tandai - Concerns for SIG consideration.

Borosugu Community	4 th July 2020	List of participants attached	<ul style="list-style-type: none"> - Presentation on the project potential impacts - Concerns and issues arising for the development and history of the people of Tandai - Concerns for SIG consideration.
Turtle Beach Care-taker – Nigel	27 th June 2020	<ul style="list-style-type: none"> - Douglas Yee - Steve Ereinao - Niger Michi - Fred Siho Patison 	<ul style="list-style-type: none"> - Information on the proposed development concerns from the potential impacts - Collect data on income from the beach recreations - Potential concerns on repatriation being paid to settlers
Mamara Tandai Settlers	27 th – 30 th June 2020	<ul style="list-style-type: none"> - Reginal Ereinao - Ronny Sa'aohu - Steve Ereinao - Jonathan Jesepe - Douglas Yee 	<ul style="list-style-type: none"> - Household survey - Information on development and concern they have.
Guadalcanal Province Lands Officer (Benedict Tova)	4 th August 2020	<ul style="list-style-type: none"> - Steve Ereinao - Benedict Tova - Fred Siho Patison 	<ul style="list-style-type: none"> - Confirmation on land rental sharing mechanism for the landowners - Guadalcanal Province commitment for a new township at Mamara

13. 5 Cumulative Impacts - The proposed site for developed is a highly modified environment and has been disturbed nearly a century by the colonial rulers, WWII, lever plantation, informal settlements and subsequently the Mamara Tasivarongo Mavo development. The montane and riverine forest upstream Poha were logged in 2018 and 2019. The same logging company established a campsite and log port at the Poha river mouth, east bank and continues to extract gravel downstream of the Poha Bridge. Adjacent to the proposed project site is the LDA, a cattle grazing and meat production company, however, was abandoned after the civil unrest in 2000.

The Poha River has been a gravel source for road base, reclamation, and bridge construction under MID lease agreement for over 20 years. In 2014, Kitano extracted gravel from Poha to construct the Kukum highway road. The proposed site was recently settled by mainly people from weather coast. These people lived in temporary shelters without proper water and sanitation. They have also farmed the area with varieties of root crops and vegetables. The Mamara River is common for water cress farming. The beach and rivers became recreational areas for picnics and have received visitors almost every day.

These developments and human activities caused degradation to water, soil, and marine ecosystems overtime. The developer will ensure its activities does not eventuate into negative impacts that will enhance existing environment and social issues/concerns at the proposed project site. Activities that contributes to cumulative impacts includes;

- WW2;
- Levers Plantation;
- Gravel Extraction;
- Logging;
- Subsistence farming activities;
- Settlements.

14.0 ENVIRONMENTAL MANAGEMENT PLAN

14.1 Environment Management Plan Objectives

Metropolis Mamara Development Ltd is committed best practices and Solomon Island standards to minimize the environment and social impacts through this Environment Management Plan. This include all the three phases of development which are excavation and reclamation, construction, and operation phases. The main objectives of the EMP are to;

1. Propose measure to avoid, reduce, restore, or compensate adverse impacts
2. Mitigate any significant impacts on biodiversity and ecosystems
3. Protect human health and safety
4. Inform development process on environment and disaster related risk for their design
5. Propose and plan management actions and monitoring for all potential impacts

14.2 EMP Structure

The EMP is structured based qualitative assessment from respective experts undertaking the baseline studies. These baseline studies provide data and information on existing condition and potential impacts from the development. The respective experts formulate mitigation measures that are further actioned in to the this EMP and synthesized based on the following criteria;

1. **Identify Potential Impact Sources** - identify the project actions or activities (impact sources) likely to affect environmental or social attributes. An impact identification matrix was used for this purpose.
2. **Assess Impacts** – assess each impact according to a set of impact criteria.
3. **Assess Impact Significance** - assess significance of each identified impact. (**High, medium, and Low**) based qualitative assessments.
4. **Management Actions** – identify actions to avoid or reduce negative or adverse impacts.

14.3 Grievance Procedure

It is expected that Metropolis Mamara Development Ltd will establish a Mamara city council that is expected to have in place community relations department that deals with people concerns. This department will address grievances under this EIS in the implementation of the

EMP. Any concerns will need to be addressed quickly and transparently, and without retribution to the affected person (AP)¹²

Most complaints arising during any civil work are expected to be complaints concerning siltation, safety, dust, health & safety, and noise should be brought to the attention of Metropolis Mamara Development Ltd staff. Affected people are in the first place to discuss their complaint directly with Metropolis Mamara Development Ltd and Ministry of Commerce through the Mamara taskforce Secretariat. The Mamara taskforce established will play an important in ensuring that all grievances are addressed.

15.0 CONCLUSION

The EIS undertaken for Mamara as required by the Environment Act 1998, has been undertaken with the minimum requirement in mind due to issues related to time and the notion that the site is a highly modified environment. The studies noted that Mamara has undergone multiple development over the last 100 years with multiple activities that effectively made this site largely degraded. The studies also observed a continuous pattern of contention over the rights of the land especially from the so-called customary landowners considering the land has been sold over to multiple owners and users.

It is the conclusion of the EIS studies that the Mamara baseline environment observed is not the natural environment as it uses to be over 100 years ago. The marine, freshwater, and terrestrial flora and fauna as those that those can adapt to changing conditions over time. It can also be easily assumed that with plantation and livestock development as the last development to occur. The current water and sediment quality baseline are probably higher compared to when the livestock development authority (LDA) was operational. As earlier alluded to the observed social impacts from the development will be significant but not new to communities around Mamara. They have endured over 100 years of foreign landowners' ownership and subsequent development activities.

The potential impacts from the proposed development as many of the previous development will be both negative and positive. It is therefore the collective responsibility of the SIG, Metropolis Mamara Development Ltd and the community to find meaningful outcomes by implementing the environment management plan (EMP) formulated.

¹²Affected Person (AP) refers to anyone affected by the development, can be an organization or government agency.

