Environment Impact Statement for a proposed mining operation in Tuarana, Vulolo ward, Central Guadalcanal Constituency, Guadalcanal Province.

Win Win Solomon Islands Investment Ltd

Prepared for

Ministry of Environment, Climate Change, Disaster Management & Meteorology

MAY 7, 2018

WINWIN SOLOMON INVESTMENT LTD
P. O. Box 1650, Honiara Solomon Islands

None-Technical Summary

The Win Win Investment Solomon Ltd, is a foreign register business, and has been incorporated in the Solomon Islands- under the 2009 Company's Act, with its business number 201619166. The Win Win Investment Solomon Ltd main business interest in the Solomon Islands is mining. Been recently, established in the country (2016), the Win Win Investment Solomon Ltd, is heavily depending on its worldwide collective experiences in the area of investment, project planning and implementation, international trade, geology, rare gas geochemistry, geochemistry, volcanology and petrology of volcanic rocks – for its start-up phase in its intended mining investment area. Complementing these international experiences is the mobilisation strategy that able to mobilises local experts, staffs of relevant government agencies and local counterparts.

For this proposed mining operation, the Win Win Investment Solomon Ltd, is in the process of applying for a mining lease over an approximately 11 km^2 in Vulolo ward of Central Guadalcanal, near the village of Tuarana village along Chovohio River- a tributary of the Matepona River. The proposed mining can be best described as a scale up of past village based operation based on gold panning-hence could be descripted as an alluvial gold mining.

The proponent is currently applying for a mining lease, as the next step to the prospecting licence (NO.PL.01/17) that has been obtained on 12th of May 2017, and is valid till 12th day of May 2020. The proposed mining takes the footprint of a mining lease, (AM02/09), for the same approximate location and area.

Based on the prospecting result, the Win Win Solomon Islands Investment Ltd has increases its level of confidence and concluded that there is approximately an **ore reserve of 200,000 ounce of gold contained over 16.7 million cubic metres of ore containing alluvial gold that can be mined at Au @0.3g/m3**. The level of confidence is based on the considerable effort made during the prospecting, and the evaluation of its economic gold values, the geotechnical analysis and the style of the deposit modelling. The mine is estimated to last for 17 years of operation.

The proposed mining method for the operation is a **small retreating open pit,** which in itself has proven environmentally friendly, in sharp contrast to dredging or strip mining. Usually, **small retreating open pit** involves the opening of one side through digging ores and supplying them to the process plant. Simultaneously, tailings and overburden are placed into the lee side of the pit for backfilling and revegetation in the later stages. This approach allows new pits to be opened with minimal disruption to the operations and is essential to extract the high grade material early in the life of the mine, increasing early cash flow for the enterprise.

With respect to its capital and financial backing it has the support from shareholders and its financiers and future equity partners. To date, the company has attracted to its books Chinese multi- millionaires

with solid asset strength. All of them are self-made either owning or part-owning very profitable non-listed businesses.

For the proposed mining operation, the company is now applying under section (18) of the Environment Act 1989 to enable it proceed with its mining in its tenement area. The site is under a customary ownership and the Win Win Solomon Islands Investment Ltd has already entered agreement with the customary owners.

Gold mining, is integral and profound to any country's economic development, and hence is also fundamental to people's civilisation. The art of gold mining has been around for some century and play key role in the human economic and social enterprise. Nevertheless, at the rural level, artisanal gold mining is rampant within the locality of Tuarana, hence community elders and landholding groups see this as a viable alternative and a worthy business risk in partnering with foreign business entity, to extract their natural resources that have been sustaining their basic needs for sometimes.

At the national level extracting of natural resources contributes significantly to the foreign earnings and revenue base of the government of Solomon Islands. It follows that Guadalcanal provincial government's revenues are largely derived from large scale operation in the province particularly from **mining**, logging and palm oil operation. As merchantable forest is declining, it has been putting risk on the country's revenue collecting portfolios. **Mining industry** has been year marked as one potential revenue alternatives. In the 2017, the revenue earned from mineral exports was receipted at $133 million, which was mostly derived from bauxite exports.

The infancy stage of mining investment in the Solomon Islands provides the business prospect an exciting but risky business undertaken. The confidence for operating the mining lies in the well experienced Directors and highly oriented client reputations, bolstered by the demand for gold in the world market.

The project is a prescribed development under the Environment Act and it is a mining development. It is a key legal requirement for prescribed developments to undergo environmental impact assessment (EIA) in order to proceed with such a development. This Environment Impact Statement (EIS) fulfils this requirement and it follows a proposal application earlier submitted to the ministry of environment. The EIS enables relevant government agency (ies) in ensuring the project does not cause major environmental damage at the project site and/or beyond.

The method employed for the EIS relies heavily on secondary data obtained from literature review-been consolidated by **technical study** and a more general walked over observations. Baseline, information is also collected from questionnaires to deduce trends of natural features based on **experiential** observations (traditional ecological knowledge).

One key literature that is exclusively used for the study and has been used for providing the quantitative baseline study is '**Baseline assessment of water quality and aquatic ecology downstream of Gold Ridge Mine, Solomon Islands, February 2016'.** This study was conducted and lead by Simon Albert, on behalf of the Ministry of Environment, Conservation, Climate Change, Disaster Management and Meteorology in the Solomon Islands Government. The scope of the study covers a significant area that is directly relevant to the monitoring aspect of the project. The study has been adopted as the EIS feasibility study, hence the methods and including monitoring techniques has factored into the report.

The EIA study has able to elucidate and establish relevant environmental parameters that would necessitated the predicting of possible environmental impacts, leading to the possible recommendations for the mitigation measures, based on careful consideration of alternatives. The EIA considered a 10 km radial distance from the project centre.

It then identifies the necessary mitigation measures to avoid or minimise or compensate for these significant impacts. It has been recognized through the impact assessment that many of the impacts identified are not significant and can only be considered potential minor negative impacts. It follows that most of the impacts are localised except the accumulative impacts of pollution. Removal of overburdens (boulder) and the extraction of ore, including the movement of excavators during the excavation will subsequently increases the level of sediments and affecting water quality. Hence most relevant baseline data is the discharging rate for Chovohio into Metapona which is measured at 15.2 m^3/s and the discharging rate of the Metapona into the marine environment is **28.2 m^3/s.** The accumulate level of pollutant loads that is currently discharging into Metapona river is measured at **60 tonnes** per day. Indeed, relevant mitigation measure and management plans has been adopted to minimise longevity impacts, beyond the project lifespan. Apart from the negative consequences, the EIS also predicted positive impacts; (1) Employment opportunities; (2) Increase in the revenue by way of direct/ indirect taxes to the authorities; (3) Climate and disaster risk management. The table over page is an extract of a step-wise management plan adopted for the project.

Activity	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures (Alternatives)
Land clearing and preparation (Construction and operation).	-Change in land/soil formation -Slope instability -Storm water inundation -Sediment runoffs	✓ No increase of size for the mining operation, unless and until agreements is made with nearby landowners and approval from relevant Ministries and provincial government. ✓ Mined area (flood plain), to be replanted with native riverine species. ✓ Concrete culverts and manholes of appropriate specifications will be installed. ✓ Digging of the hill slopes will be designed to have a batter whereby the slopes retain a reasonable angle of repose and reduce slope lengths
Land clearing, removal of overburden, Stock Piling, backfilling	-Change in land/soil formation -Slope instability -Storm water inundation -Sediment runoffs -villagers are vulnerable to river flooding	✓ No increase of size for the mining operation, unless and until agreements is made with nearby landowners and approval from relevant Ministries and provincial government. ✓ Mined area (flood plain), to be replanted with native riverine species. ✓ Concrete culverts and manholes of appropriate specifications will be installed. ✓ Digging of the hill slopes will be designed to have a batter whereby the slopes retain a reasonable angle of repose and reduce slope lengths ✓ Excavated soil to be used in filling of and levelling of the mined area-flood plain. ✓ Lessen time between the activities (land clearing, removal of overburden and backfilling. ✓ Overburden or bolder laid along river edge to insulate villagers from incoming food
Hazardous waste	-Accidents due to hazardous material handling -Health Issues	✓ Hazardous materials such as (Diesel, engine oil, hydraulic oil, lubricant oil to be deposited in designated areas. ✓ Hazardous wastes to be disposed with approval from MECDM as required under the Environment Act 1998). ✓ First aid to be provided and made available for all injured workers and serious cases to refer to Number Nine Hospital or private clinics. ✓ Win Win Solomon Islands Investment Ltd will follow the OSHA standards for safety of health and environment.
Solid Waste	Land/ Water quality	✓ Provision and installation of waste receptacles at designated areas within the compound for cans, plastics and, papers for recycling due to visual impact; ✓ Timely collection of waste from generation points; ✓ Metal wastes will be kept apart from other wastes for disposal as appropriate;

		✓ Food and other biodegradable materials will be sorted in covered waste receptacles to prevent odour; ✓ Ongoing education about waste management be conducted to employees. ✓ Kitchen waste will be supplied organic farming processes (compost) ✓ Prohibition of burning of waste in the operation site (glary sites and stock pile sites).
Tailing and waste water	-accumulation of solid tailings -accumulation of procession water Water Pollution Sediment pollution ✓	✓ Tailings used for backfilling and reduces period from between processing and backfilling. ✓ Processing water pond regularly monitored and discharge with approval from ECD if required. ✓ The solid waste generated from various processes will be sorted and stored in demarcated area and will be disposed-off with assistance from MECDM. ✓ Excavated soil to be used in filling of and levelling of the mined area-flood plain.
Excavation, transportation of ores or construction materials	• Generation of dust • Vehicular emission • Noise generation due to; ✓ Operation of DG Sets ✓ Vehicles transporting ore and earthwork Diesel run engines of construction machinery.	✓ Springing of water in dust susceptible area during construction activities ✓ Emission control norms to be strictly follow to reduce the impacts from exhausts ✓ Building materials, excess earth excavated and construction waste will be transported in trucks covered with tarpaulins ✓ Pollution under Control (PUC) certified vehicles to be used for transportation of construction material. ✓ Periodical check up on transporting vehicles to remove accumulated dirt. **Noise** ✓ All noise levels to be maintained below threshold levels Personnel working in noise environments e.g. quarry area and stockpile area to be provided with earplugs, muffs, etc. ✓ Regular shifting of personnel to avoid health impacts. ✓ Acoustic enclosure for DG sets ✓ Maintain equipment, machinery regularly and using enclosures
Machineries and procession	-Generation of noise -Generation of dust -Equipment emissions -Exploitation of water resources -Increased turbid runoff	**Emission & Noise** ✓ Use of ear and eye protection devices, masks & helmets to workers ✓ Regular maintenance of equipment ✓ Appropriate silencers should be used for the equipment **Water Quality** ✓ Water shall be obtained from rain water and Solomon Water. ✓ Stockpile of materials located away from stream and is enclosed ✓ Sediment runoff shall be intercepted by hay bales or detention trenches ✓ Storm water drainage will be provided for entire facility including integration with the existing facility.

		✓ Wastewater generated from the toilets, bathrooms and other areas in the operation building will be led directly to the sewerage treatment. ✓ Monitoring shall be carried out at the quarry and stockpile area as per the monitoring schedule and results shall be submitted to Supervisor for action. ✓ Environmental expert shall be required to inspect regularly to ensure compliance.
Fisheries	Impact on rural fisheries due to construction and overharvesting due to increasing of visitors.	✓ Fishermen to be informed about the project activity ✓ Necessary marker buoys will be installed before commencement of mining ✓ Regulate and enforce fisheries rules.
Safety	Injuries and accidents Risk from Electrical equipment	✓ Protective footwear and protective to be used in all operation. ✓ Safety and compliance training, enforcements and monitoring of relevant workers' safety rules, as per the International Labour Organization (ILO) guidelines and applicable national laws. ✓ No under- age staff and work will include gender balance.
Labour Camp Management	Sanitation, health hazards, other impacts on the surrounding environment due to inflow of construction labours.	**Accommodation:** ✓ The Follow standard housing regulations as provided in the Solomon laws and Guadalcanal province Ordinances. **Potable water:** ✓ Sufficient quantity of potable water in every workplace/labour camp at suitable and easily accessible places and regular maintenance of facilities. **Sanitation and sewage system**: ✓ The sewage system designed not to contaminate ground water and pollute the river and the coastal environment. ✓ Toilets/bathrooms to be cleaned every day, with trainings given to labours on how to use them. ✓ Adequate water supply will be provided in all toilets and urinals ✓ Package treatment plants to be provided should be kept in a strict sanitary condition **Waste disposal:** ✓ Segregated garbage bins (biodegradable and non-biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the corporation plan. ✓ Kitchen waste to be used for compost and used in gardens. ✓ Comprehensive Solid Waste Management Plan approved by project supervisor and endorsed from relevant authority.
Camp and accommodation	Aqueous discharges in ✓ river (effluent)	✓ All wastewater to be treated before releasing into water body.

		✓ Wastewater generated from the toilets, bathrooms and other areas in the operation building will be led directly to the STP. ✓ Waste water collected from process shops/ areas, workstations will be collected separately through closed conduits and treated through Effluent Treatment Plant (ETP). ✓ The storm water collected from workstations will be diverted to ETP, in case workstations are in operation. ✓ Provision of fuel oil bunkering will not be provided in the ship repair facility ✓ Implement Contingency plan for handling accidental oil spills. ✓ The treated water will be used for gardening/ horticulture.
Operation of generators and machineries	✓ Air Pollution ✓ Noise Pollution	✓ Acoustic enclosed DG sets will be used as power backup. ✓ Cleaning of vessels may generate dust. Movable enclosures or specially designed equipment will be provided to minimize the generation of dust ✓ Periodic air quality monitoring will be carried out

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Chapter 1: Background

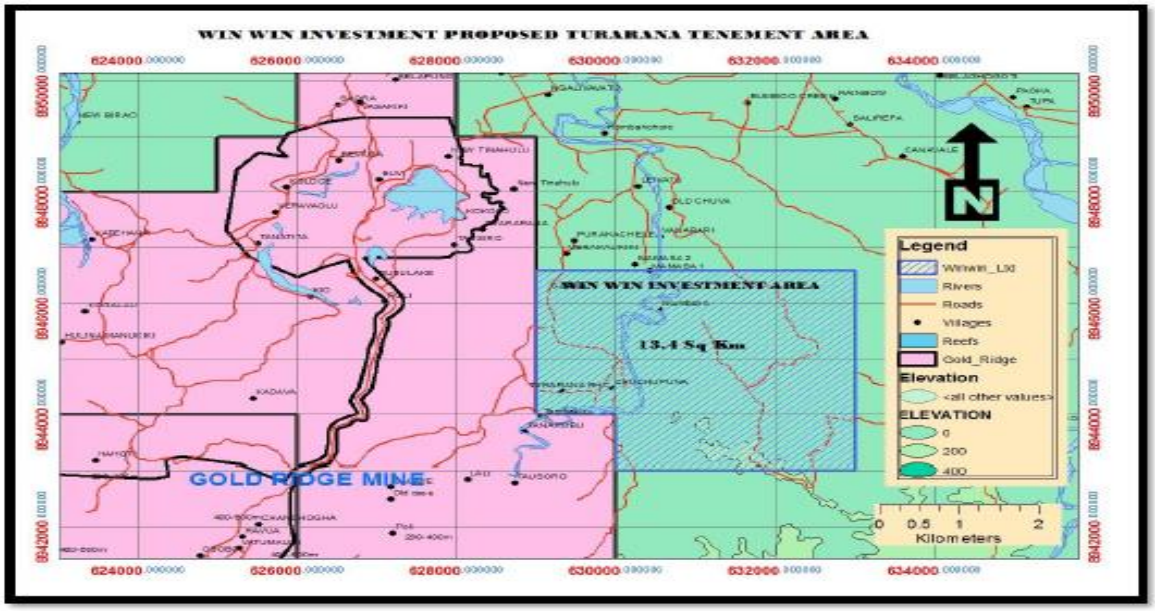
1.0 Introduction

The Win Win Investment Solomon Ltd, is a foreign register business entity, and has been incorporated in the Solomon Islands- under the 2009 Company's Act, with its business number 201619166. The Win Win Investment Solomon Ltd main business interest in the Solomon Islands is mining. Been recently, legally established in the country (2016), the Win Win Investment Solomon Ltd, is largely depending on its worldwide collective experiences in the area of investment, project planning and implementation, international trade, geology, rare gas geochemistry, geochemistry, volcanology and petrology of volcanic rocks- as a start-up phase for its intended mining related activities in the country. Complementing these international experiences, the Win Win Investment Solomon Ltd has already been mobilising local experts, staffs of relevant government agencies and local counterparts, for its indented operation.

For this proposed mining operation, the Win Win Investment Solomon Ltd, is in the process of applying for a mining lease over an approximately 13.4 km^2 in Vulolo ward of Central Guadalcanal, near the village of Tuarana along the river of Chovohio, a tributary of the Matepona river. As noted, the proposed mining, is situated along Chovohio River and can be best described as a scale up of past village based operation based on gold panning-hence could be descripted as an alluvial gold mining. The proponent is currently applying for a mining lease, as the next step to the prospecting licence (NO.PL.01/17) that has been obtained on 12th of May 2017, and is valid till 12th day of May 2020. The proposed mining takes the footprint of a mining lease, (AM02/09), for the same approximate location and area which was granted to Solomon Alluvial Mining Pty Ltd on 3rd April 2009 for a duration of 10 years by the Mines Department. The Solomon Alluvial Mining Pty Ltd has only partly implemented the project and allowed the Ministry of Mines to retain ownership of most of the resources developed during the prospecting period of the mine lease. Hence permission is granted to support the Win Win Investment Solomon Islands Ltd to substantiate its prospecting efforts and subsequently its application for the mining lease.

Based on the prospecting result, the Win Win Solomon Islands Investment Ltd has increases its level of confidence and concluded that there is approximately an **ore reserve of 200,000 ounce of gold contained over 16.7 million cubic metres of ore containing alluvial gold that can be mined at Au @0.3g/m3**. The mine is estimated to last for 17 years of operation. The level of confidence is based on the considerable effort made during the prospecting, and the evaluation of its economic gold values, the geotechnical analysis and the style of the deposit modelling. Following the commercial

discovery, the Win Win Solomon Islands Investment Ltd is taken the next step for applying for alluvial mining lease as it deems to be in the national and public interest.



Points	Easting	Northing
0	633000	8946600
1	633000	8943000
2	630000	8943000
3	630000	8944000
4	629000	8944000
5	629000	8946600

FIGURE 1: PROPOSED TUARANA TENEMENT AREA, AFTER PROSPECTING LICENSE (NO.PL-01/17)

The proposed mining method for the operation is a **small retreating open pit,** which in itself has proven environmentally friendly, in sharp contrast to dredging or strip mining. Usually, **small retreating open pit** involves the opening of one side through digging ores and supplying them to the process plant. Simultaneously, tailings and overburden are placed into the lee side of the pit for backfilling and revegetation in the later stages. This approach allows new pits to be opened with minimal disruption to the operations and is essential to extract the high grade material early in the life of the mine, increasing early cash flow for the enterprise.

With respect to its capital and financial backing it has the support from shareholders and its financiers and future equity partners. To date, the company has attracted to its books Chinese multi- millionaires with solid asset strength. All of them are self-made either owning or part-owning very profitable non-listed businesses. The Management of Win Win Investment Solomon Island Ltd is doing something outside the norm for traditional mining companies where a great deal of money is raised and then a

spending frenzy occurs until the money runs out and then either the company goes under or shareholders have to put hand in pocket again.

1.1 Project proponent Address

For the proponent's business addresses in Solomon Islands, their details are as follow:

Mr. Dan Shi, Managing Director

PO Box: 1650

Honiara

Solomon Islands

Email: goodshidan8@163.com

Telephone: 677 7744497

1.2 Project PER Consultant

The lead consultant who has undertaken the studies and prepared this Environment Impact Statement (EIS) is Mr. Francis Hoasiuhu. He has quite a wide range of experience in environmental management issues facing Solomon Islands. He has been involved with several projects executed by the Ministry of Environment, Climate Change, Disaster Management and Meteorology, regional organisations and non-government organisations in Solomon Islands in the recent past. Mr. Francis has a bachelor's degree and master's degree in environmental management from the University of Auckland, New Zealand. He operates under this consultancy service, with these details:

Francis Badii Professional Consultancy Services

P O Box 2371, Honiara

Solomon Islands.

Mobile phone: 7476529

Email:fbpconsultancy@gmail.com

1.3 Location and Nature of the project

The proposed mining site, is located along Chovohio River, a tributary of the Matepona River. The Tuarana village is located in the tenement and served as the main village for start-up phase as has already used during prospecting phase. Tausord village is located downstream and in the proposed tenement and Mamasa village is located upstream. Several temporary shelther and hamlets are also present, as the resting place for accessing gold through gold panning along the river. These villages are all located in ward 19 (Vulolo) of Central Guadalcanal Constituency. As already noted, the area covers approximately 13.4 km^2 and took the footprint of The mining lease, AM02/09, which has been

granted to Solomon Alluvial Mining Pty Ltd on 3rd April 2009 for a duration of 10 years by the Mines Department. The operation ceased and most of the resources regarding the shape of the rivers, alluvial flats and surrounding terraces, have been utilised for the mining lease application, hence this Environment Impact statement.

However, the tenement has recently adjusted following a court ruling and has reduces the area to 11 KM2.

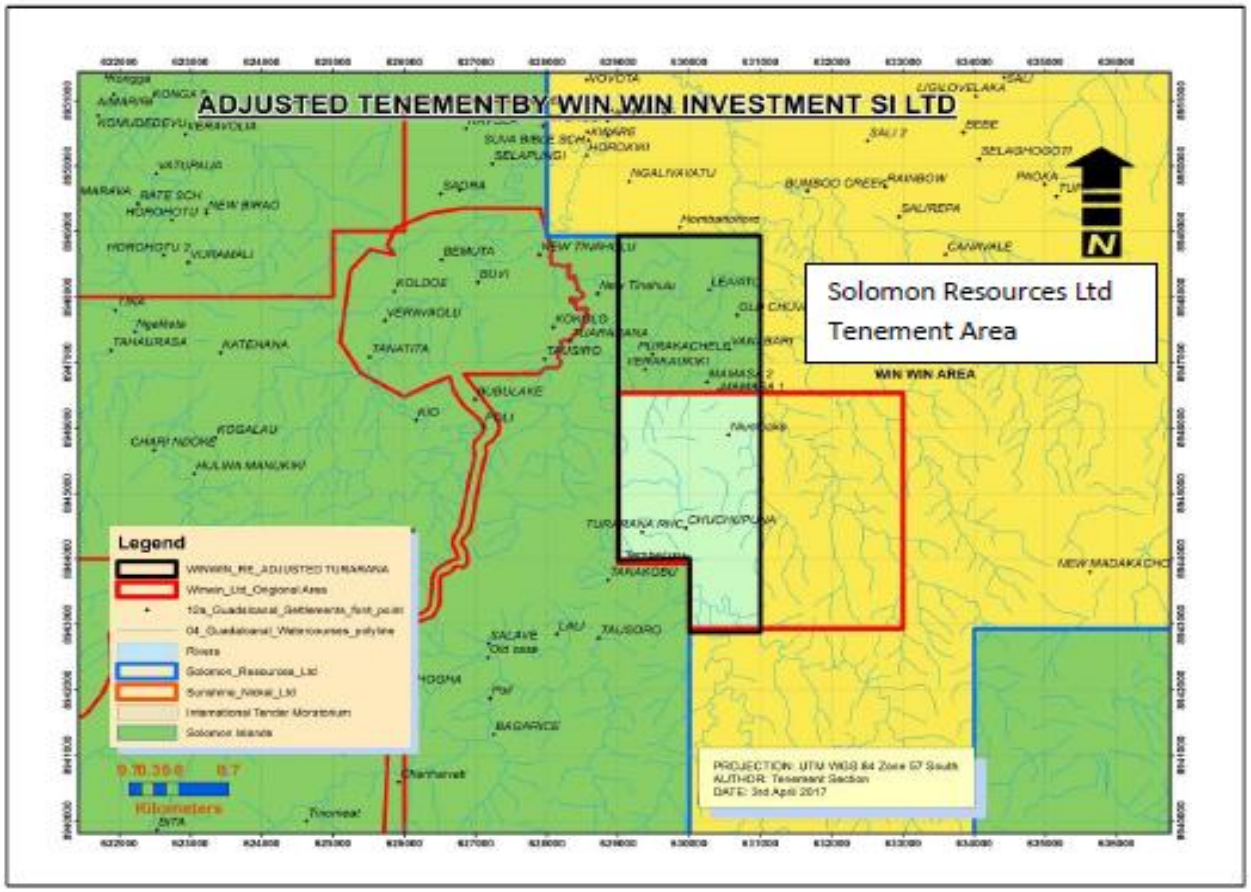


FIGURE 2: READJUSTED MINING LEASE, WIN WIN SOLOMON ISLANDS INVESTMENT, 2018.

Points	Easting	Northing
0	629000.000	8948940.000
1	631000.000	8948940.000
2	631000.000	8942875.000
3	630000.000	8942875.000
4	630000.000	8944126.000
5	629000.000	8944126.000

Table 1: Coordinates of re-adjusted mining lease, Win Win Solomon Investment Ltd

The tenement is under customary ownership, hence relevant arrangements have been entered with the land right holders to ensure operation is operating within the statutory legal frameworks and the community norms.

Historically, the Chovohio River alluvial gold deposit, is one of the main sources for household income, through the traditional method of **gold panning**. Hence, the abundance of gold through the current gold panning practices also continue to convince the Win Win Solomon Island Investment Limited to scale up operation using a more sophisticated **machinery** as already proposed in the mining lease application.

1.4 Justification and Need for the project

Gold mining, is integral and profound to any country's economic development, and hence is also fundamental to human civilisation. The art of gold mining has been around for some century and play key role in the human economic and social enterprise. Solomon Islands took its place during the Gold Ride mine first operation in the 1980s. Other also argued that this gold mining art has dated back to 1500s when Mendana landed in Solomon Islands, and consequently named the country when he found gold along the Matanigo River.

Nevertheless, contemporary Solomon Islands, is a country dominated by rural population, with approximately 86 per cent of the country's total population living in rural areas- largely dependent on the subsistence sector. With very limited economic opportunity and, with meager and unreliable cash income from sale of agricultural products and marine resources it can be a major challenge to get basic household necessities and afford school fees for children. The increase in cost of living with rising price of basic food items has led resource owners to explore other alternative sources of income from their resources.

As gold mining is rampant within the locality of Tuarana, community elders and landholding groups see this as a viable alternative and a worthy business risk in partnering with foreign business entity, to extract natural resources that have been sustaining their basic needs through artisanal gold panning. The possible outcome of generating income for their communities and respective families, through royalties, access fees and other spin off economic and social benefits has compromise with possible risk associated with the mining operation. Henceforth, the primary need for the proposed mining operations, has stemmed from the resource owners' aspiration to improve their socio-economic wellbeing and put their natural resources into productive uses by allowing Win Win Solomon Island Investment Ltd to extract golds from Chovohio River and its adjacent alluvial plain. As has noted, the artisanal gold panning along the river has been taking place for some decades and the proposed mining is viewed as an alternative scale up-where all villager can benefit. Artisanal gold panning only directly benefited those that are actively engaging in the activities, and is said to be

inadequately supporting community services such as the upgrading of schools, road services, health services and water supply services, to name a few.

At the national level extracting of natural resources contributes significantly to the foreign earnings and revenue base of the government of Solomon Islands. It follows that Guadalcanal provincial government's revenues are largely derived from large scale operation in the province particularly from **mining**, logging and palm oil operation. In the recent years, the logging and timber industries have been the major source of income for the government and the country at large, in contrast to other sectors such as mining, fisheries and agriculture. As merchantable forest is declining, it has been putting risk on the country's revenue collecting portfolios. Mining industry has been year marked as one potential revenue alternatives. In the 2017, Central Bank Quarterly Report (2017), the revenue earned from mineral exports was receipted at $133 million, which was mostly derived from bauxite exports-operating in Ren-bel province. According to the same report there are six (6) mine company registered in the country. With no doubt, the Win Win Solomon Islands Investment Ltd were one of the six mining company.

FIGURE 3: A VILLAGE YOUTH UNDERTAKING PANNING IN TUARANA.

The Win Win Solomon Islands Investment Ltd continues to lure supports from relevant government agencies through strategic coordination. Active participation with other private sector has been also recognized as essential for the successful implementation of the proposed mining. As already noted, the government of Solomon Islands has given top priority to the development of the mining sector, hence the implementation of the project will enhance the national governments efforts to diversify revenue generation portfolios for supporting its basic services to its people. The improved security situation in the country also plays a key part in making this investment decision by the proponent, irrespective of the risks.

In terms of labour in the province, the labour market in ward 19 do not cater for its growing population, with very limited jobs on offer. Unlike the public (government) sector with constricted labour market, more investment in the private sector should provide the panacea for job creation. At

the same time, mining is viewed as an enabling industries for knowledge transfer and provide space for linking private-public participation and the enrichments of economic and cultural dynamics of the country. Finally, the Win Win Solomon Island Investment Ltd interest, to generate revenue and profits for its shareholders is indeed paramount, and formed an integral part of the mining business operation.

1.5 Scope and objective of Study

Under section 17 of the Environment Act 1998, it is a statutory requirement to produce and submit either a public environment report (PER) or an environment impact statement (EIS) to the Director of Environment before carrying out any 'prescribed' project. Based on the proponent proposal application**, an instruction** was made for the proposed mining to develop an Environment Impact Statement (EIS). As **'mining'** is a prescribed development, the Win Win Investment has commissioned the preparation of this EIS. **The EIS was carried out in May 2018**. The EIS and the '***development consent'*** should also formed a requirement for the submission for application for a Mining Lease for the proposed mining.

The main purpose of this EIS, is to describe and assess the likely environmental impacts of the proposed mining development and associated infrastructure assemblages on the surrounding areas, communities and institutions. Further, the report helps to identify and put in place certain measures or safeguards to deal with the potential negative environmental impacts expected from the project. Among others, the report looks in detail at the following subjects:

i. Describe the prescribed development in summary form, including its objectives and any **reasonable alternatives** to it;
ii. Describe any aspects of the prescribed development having or likely to have a substantial or important impact on the environment;
iii. Describe the environment likely to be affected by the prescribed development and any reasonable alternatives to it;
iv. Indicate the potential or actual impact of the prescribed development on the environment and of any reasonable **alternatives** to the prescribed development, including any enhancement of the environment;
v. Outline the reasons for choice of the prescribed development; and
vi. Describe and assess the effectiveness of any safeguards or standards intended to be adopted or applied for the protection of the environment;

In line with the scope outlined above, there has been more emphasis placed on specific areas during the **baseline studies** and **impact assessment** contained in this report. A lot of effort was concentrated on understanding the characteristics of the physical and social environment at the project site; the

potential adverse effects of the proposed development including their characteristics and; the means of mitigating the environmental effects or the mitigation strategies. It is particularly important to ensure crucial information to expedite decision-making is readily provided in the report.

1.6.0 APPROACH AND METHODOLOGY

1.6.1 Approach of EIS Study

The status of the environmental scenarios of the project site relies heavily on secondary data obtained from literature review- been consolidated by **technical study** and a more general walked over observations. Baseline, information is also collected from questionnaires to deduce trends of natural features based on **experiential** observations (traditional ecological knowledge). This information is mainly collected from those living within the vicinity of the project sites (see annex 2).

One key literature that is exclusively used for the study and has been used for providing the quantitative baseline study is '**Baseline assessment of water quality and aquatic ecology downstream of Gold Ridge Mine, Solomon Islands, February 2016'.** This study was conducted and lead by Simon Albert, on behalf of the Ministry of Environment, Conservation, Climate Change, Disaster Management and Meteorology in the Solomon Islands Government. The scope of the study covers a significant area that is directly relevant to the monitoring aspect of the project. Hence, permission is showed from the right holder, as it is useful and mandatory for integrating the proponents monitoring approach into the larger framework of the Solomon government approach. Only relevant aspect of the data has been utilised particularly within and immediately around the tenement with few sites selected as control. This report is particularly adopted and interpreted as it's the feasibility study, as a key component for marrying the Win Win Solomon island Investment limited and the statutory authority oversighting environment safe quite. It should also provide the basis for uniformity in environmental monitoring and auditing that are likely to be carried out them. By adopting this as its feasibility study, the method of the study was customised into the future monitoring aspect of the project. The report can be download from this web given below.

(https://info.undp.org/docs/pdc/Documents/SLB/Gold%20Ridge%20Aquatic%20Baseline%20Report%20MECDM-UQ%20February%202016.pdf).

The EIA study has able to elucidate and establish relevant environmental parameters that would necessitated the predicting of possible environmental impacts, leading to the possible recommendations for the mitigation measures, based on careful consideration of alternatives. The entire EIA study is carried out on the basis of the applicable environmental legislations, regulations and guidelines as provided in section 1.5 and further elaborated in section 1.8. The EIA considered a

FIGURE 4: EIA STUDY AREA AND SURROUNDING LAND USE PRACTICES, FOLLOW MINISTRY OF LANDS AND HOUSING

10 km radial distance from the project site. The environmental similarities across the Solomon Islands archipelago permitted the data from other provinces relevant to the study development been utilised. The specific methods for data collected under each subject area have been provided bellow.

The geology, topography and seismicity of the study area are collected from available reports and literatures. Information related to **soil quality, hydrology, water and sediment quality are primarily derived from the key literature mentioned above.**

Climate, weather and air quality data consisting of parameters like temperature, relative humidity, rainfall, wind speed and wind direction, and weather phenomena were collected from relevant literatures and have been analysed. To establish the ambient **noise** scenario in the study area, EIA from other studies has been utilised.

Flora and fauna data are obtained from existing literature with particular relevance to important conservation species and those species that support fisheries.

The detail of environmentally sensitive areas, like sanctuary, wetlands, mangroves, important lakes, within 10 km of the project site are also collected from literature review and discussions with those living within the vicinity of the project.

Social and rural livelihood characters are collected from questionnaires and interviews and literature review particularly the Solomon island 2009 census.

Other Features such as the distance of the project site to Honiara is also established from current literature.

1.6.2 Public Consultation

The need for public consultation and engagement with relevant authorities or agencies has been given great emphasis during the EIA study. Generally, public consultation helps in resolving conflict and easy identification of problems, needs and important values. There are two levels of consultation held with stakeholders and, of course, with series of follow up meetings as part of the project planning. For the first consultation round, only certain key government agencies at the national and provincial level and landowning groups had been consulted. The primary goal of undertaking the consultations has been to identify those groups that have jurisdiction and claim ownership over the project area and ascertain its availability for development purposes.

Efforts in this endeavor by the developer has led to a series of meetings with representatives of Guadalcanal province and a particular tribal group who claimed ownership of the tenements. Since the tenement sits and lies adjacent to various customary lands, their owners and management too had been included in this consultation round. The scope of this public consultation is highly restricted and very limited.

The next level of consultation was quite extensive and numerous agencies, organizations and, individuals were involved in the process. For the project to commence, various statutory consultees were approached for their approvals. The planning division of Guadalcanal has been approached and relevant licenses are already obtained from the Guadalcanal Provincial Government. The lodging of mineral lease application and minerals and board meeting and hearing are also coming up. Although these application are mandatory under the statutory law, it also formed essential part of the company's public relationship strategy. Key allegiant agencies consulted are listed below. Some of the

agencies consulted has no direct interest of the area, particularly NGOs, who's their operations are more locality specific.

Environment and Conservation Division, MECDM
Climate Change Division, MECDM
Tourism Division, Ministry of Culture and Tourism
Guadalcanal Provincial Government
Registrar General Office, Ministry of Land and Housing (MLH)
Ministry of Rural Development (MRD)
Ministry of Forest and Research (reforestation section)
Environmental Health Division, MHMS
Ministry of Finance and Treasury
Ministry of Infrastructure Development
Staff of Win Win Investment Solomon Islands Limited
Customary Land owning group
Downstream residences
Households heads living close to the project site

TABLE 2: SUMMARY TABLE OF ORGANIZATIONS CONSULTED

Alongside, the above statutory requirement, it is also required that without a development consent, realization of the project can also be problematic. In this regard, a couple of meetings were held with relevant staff of the ministry of environment mainly for guidance around the development consent process. A proposal application as such has been produced from these meetings, which forms the basis for this Environment Impact Statement. Information gathering for this ESI is equally inclusive although affected groups and interested individuals were the primary targets for the source of information. The importance of public consultation to the EIS preparations are outlined below:

- Helps in determining the scope of the impact assessment to reduce waste of resources;
- Provides expert, pertinent and timely knowledge about the project site;
- Assists in evaluating relative significance of likely impacts of the project;
- Assists in defining proposed mitigation measures to reduce or prevent or compensate for the adverse impacts;
- Ensures the EIS is objective and complete because of the validity of the data used;

Finally, public participation is factored as key activity under component six (6) of the project- the **corporate and social responsibility component which** comprises of the companies' networking with national government stakeholders and None Government agencies including other business in areas directly related to the mining operation. Strategically public consultation is tied with other activities such as public and community awareness and network, institutional networking, community work and implementation and supporting of key development agenda for communities. Strategically, this activity can materialised the network between the proponent and the Solomon Island Government to provide empirical data for creating tools for implementing statutory requirements.

1.7.0 Structure of report

The report is structured as much as possible to show resemblance with the format prescribed by the Environmental Regulations 2008 (*Form 3 – PER or EIS Forms*). It follows the guidelines prescribed in Form 1 as specified in the Environmental Regulations (*Guidelines to Assist in Preparation of Public Environment Report or Environmental Impact Statement*).

Based on the above guidelines, the information gathered as part of the baseline studies and subsequent impact assessments are organised and presented as shown, beginning with a section on non-technical summary and followed by the chapters. An overview of the chapters is as follow;

Non-Technical Summary- A non-technical summary is provided in the executive summary

Chapter 1: Introduction - Provides a background to the project, the project proponent, and the process of the Environment Impact Statement.

Chapter 2: Provide the relevant legal and policy instrument relevant for the operation.

Chapter 3: Description of Major Project components and activities -covers the description of the project components and activities, and project implementing schedule.

Chapter 4: Description of Environmental Setting - describes the background environmental characteristics and potential impact under each subsection.

Chapter 5: Description of Socio-economic Environment –provides the socio-economic characters and the potential impacts anticipated during project implementation.

Chapter 6: Environment Assessment & Mitigation Measure -The identified major impacts both adverse and positive are predicted and the consequent mitigation measures are provided in this chapter. The impacts are identified with respect to the present environmental baseline conditions provided in Chapter 3, 4 and 5.

Chapter 7: Environmental Management Plans and Monitoring Framework- provides the Environmental Management Plans to mitigate the adverse impacts of the project. The monitoring framework is also provided in the chapter.

References: provides list of literature consulted for the EIS development.

Chapter 2: Legal and Policy Framework

2.0 Introduction

This chapter, focuses on those statutory requirements that the proponent must comply and operate within. It also provides relevant development instruments of which the proponent is contributing, particularly towards achieving of the development need of the Solomon Islands, Guadalcanal Province and the communities.

The Environment Act 1998 and the Environment Regulation 2008 provide the overarching legal framework for the development of the EIS. The proposed development isprescribed under section 16 of the Environment Act 1998 and comes under the **NON-METALLIC INDUSTRIES** category 3(c), namely **extraction of minerals and mining (see section 1.5)**.

At the same time, the Mines and Minerals Act 1990 provided the legislative instructions for the proposed alluvial mining operation**. The objective of the Mines and Minerals Act 1990 (Principle Act)** is 'To provide for the development of mining in Solomon Islands by prescribing appropriate procedures for the grant of licences, permits or leases, for the establishment of a minerals board to regulate and control mining, to repeal the mining act and for matters connected therewith or incidental thereto'.As noted in section 1.5, the EIS is tailored to ensure that all possible impacts of the proposed aggregate mining are clearly identified, with possible alternatives been provided and mitigation measure and management plans in place to minimise significance negative impacts. This provision also include the assessments of elements provided for under the provision of section four subsection (2) that states;

> Reconnaissance, prospecting and mining are prohibited in or on-
>
> (a) any village, place of burial, tambu or other site of traditional significance, inhabited house or building, except with the consent in writing of the owner or occupier thereof, and within such distance as may be prescribed by the Minister;
>
> (b) any cultivated land or land rendered fit for planting and habitually used for the planting of crops, except with the consent in writing of the owner or occupier thereof;
>
> (c) any land designated as town land, under the Lands and Titles Act, except with the consent in writing of the owner of the surface rights; Cap. 133
>
> (d) any state forest or controlled forest within the meaning of the Forest Resources and Timber Utilisation Act, except with the consent in writing of the Commissioner of Forest Resources and subject to such terms and conditions as the Commissioner may impose; or Cap. 40
>
> (e) any land used for public purposes.

It follows that under part Part V of the Mining Act 1990, the Win Win Investment Solomon Islands Ltd as the holder of prospecting licence (NO.PL.01/17), is submitting its mining lease application in the

prescribed form. The operational plan has also attached to this application, and hence the EIS provide information to surport their application. Special emphasis of the report is put on sections (4), clauses (h) on the need for conducting an environmental assessment, with a detailed programme for -

(i) tailings and waste disposal;
(ii) the progressive reclamation and rehabilitation of lands disturbed by mining; and
(iii) the monitoring and minimisation of the effects of such mining on air, land and water areas;

And once the project is up and running, the Win Win Solomon Islands Investment will develop relevant report as required under section 68 (1) (d). The time frame and method of assessments for developing of the environment monitoring reports as required under the Environment Act is provided in the monitoring framework outlined in the last chapter of the report.

2.1 Other supporting Legal Instruments

Protected Areas Act (2010) and Protected Area Regulation (2012) - The Act provided for the establishment of a protected area system and to conserve biological diversity. Under the revised NBSAP (2016), and its relevant action plan (PoWPA), Mt Popomaniseu has been year marked for protection. The home ranges of key endangered species of the proposed protected area e.g. Mt Popomaniseu and those in the informal community based managed area, may overlap with the tenement. Relevant impact assessment under the Act is provided under the biodiversity section.

Wildlife Protection and Management Act (1998) & Wildlife Protection and Management Regulations (2008) - The Act, provide for the regulating of endangered species and wild fauna and flora in compliances to the Solomon Island's obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Regulated species under the Act have been assessed for potential occurrences in the project site and hence management measure in place for their protection and promoting of public awareness.

Constitution of Solomon Islands 1978 -The supreme law of Solomon Islands has recognises customary laws as part of the modern law system. It implies all natural resources vested in the interest of Solomon Islands and its people. To ensure adequate recognition of those people living within the vicinity of the project and to ensure these people are directly receiving maximum benefit from the project e.g. employment.

Land and Titles Act-The Land and Titles Act contains provisions about the tenure, acquisition and registration of land. The project is situated on customary land and relevant agreement has been entered with the owners of the customary land. The project may also put impetus on the need for

registering of the land under the current customary land registration programme under the Ministry of Land, Housing and Survey.

Environmental Health Act—The Act has its objective as the ensuring the maintaining of environmental health. Its regulation prohibits people from causing nuisances including the prohibiting of discharging of noxious matter or waste from premises. The Act provide the supporting legal framework for the proponent to develop a waste management strategy. It also provides the legal framework for supporting the social-economic need of the community, where the proponent is anticipating to assist the upgrading of the health facility within and the vicinity of the tenement area.

The Fisheries Management Act (2015)- The Act has its objective as ensuring the long-term management, conservation and sustainable use of fisheries and marine ecosystems for the benefit of the people of Solomon Islands. The project design will ensure the minimum negative impact of the freshwater biodiversity and including marine resources and fisheries.

Biosecurity Act (2013)- Ensuring the regulating of the entry of plant and animal pest including diseases. The project will ensure current invasive species such as African snail are removed from moving vehicle – hence contained their spread. The ensuring of quarantine measure for avoiding of pest and diseases into the project is viewed very crucial.

Provincial Government Act (1997)- This Act alongside the Devolution Orders provides the legislative power for provincial authority to develop relevant ordinances over its resources. Ensure payment of fees owed to provincial government, is up-to-date and other relevant laws observed and those devolved elements such as preservation of culture and environment is maintained.

River Waters Act 1996- The River Waters Act provides for the control of river waters and for its equitable and beneficial use and other matters connected to it. The social economic dynamic of the project has provided in the EIS.

Stockholm Convention on Persistent Organic Pollutants (POP Convention)-Ensuring the protecting of human health and the environment from persistent organic pollutants. A waste management strategy to ensure elemental composition of POP is adequately addressed in the project.

United Nations Framework Convention on Climate Change UNCCC- Ensuring the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Ensure that those machines used are efficient and emits low carbon dioxide. Encourage natural infrastructure as mitigation measures against climate change related events.

Waigani Convention-Ensuring ban imposed on importation of hazardous and radioactive wastes and to control the trans-boundary movement and management of hazardous wastes within the South

Pacific region. Ensuring that hazardous and radioactive wastes are properly managed and to be checked by relevant authorities.

2.2 Supporting Policy Instruments

National Solid Waste Management Strategy and Action Plan 2009-2014 - Ensures Solid waste management plan is developed, adopted and implemented in the operation.

National Environmental Management Strategy- The National Environmental Management Strategy (NEMS) provides the strategic approach and blueprint for sustainable environmental and natural resource management and conservation in Solomon Islands. A wide range of strategies and programmes has been identified in the NEMS to address the problem of environmental degradation in the country.

Integration of environmental considerations with policies and economic development projects was among the top priority areas identified to control and manage environmental issues faced by the country. The requirement to submit an environmental report as part of the logging operations to address the environmental and social dimensions of the project is consistent with this priority.

National Biodiversity Strategic Action Plan (2016-2020)-The revised and updated NBSAP (2016-2020) was developed with the provisions of the Convention of the Biological Diversity. The document constitutes the national policy instrument on biodiversity. Fourteen priority areas are identified in the current NBSAP. While all other priority area deemed relevant to the need for conducting EIA, the priority on governance, compliances and enforcements is explicit and provided for the provisions for improving EIA and its enforcements. Certain areas in the Solomon Islands has year marked for protection under the priority of protected area. Climate change mitigation is a key concern for defining development such as mining that also takes the vulnerability of the community – once the natural system has been altered.

National Development Strategy 2016-2035- With the overall vision of 'Improving the Social and Economic Livelihoods of all Solomon Islanders, mining formed an element of the productive sector envisioned to promote the achievement of inclusive economic growth of the country. Hence the proposed mining also fulfilled this provisions at the project site.

Chapter 3: Project Descriptions

3.1.0 Introduction

The proposed mining along Chovohio River can be best described as a scale up of the current artisanal gold panning. The mining can be best described as alluvial mining and hence the proponent is applying for a mining lease, as a next step to the prospecting licence (NO.PL.01/17) that has been granted to them on 12th of May 2017, and is valid till 12th day of May 2020. The readjusted tenement covers approximately 11 km^2 in the ward 19 in the hinterland of Central Guadalcanal, along the Chovohio, a tributary of the Matepona river. The proposed mining takes the footprint of a mining lease, AM02/09, for the same approximate location and area (see figure 1 and 2). The Win Win Solomon Island Investment continue to found viable gold reserve along the river and continue to pursue its application for mining lease.

3.1.1 Estimated Gold Reserve

Based on the prospecting result, the Win Win Solomon Islands Investment Ltd has increases its level of confidence and concluded that there is approximately an **ore reserve of 200,000 ounce of gold contained over 16.7 million cubic metres of ore containing alluvial gold that can be mined at Au @0.3g/m3**. The mine is estimated to last for 17 years of operation. The level of confidence is based on the considerable effort made during the prospecting, and the evaluation of its economic gold values, the geotechnical analysis and the style of the deposit modelling. Following the commercial discovery, the Win Win Solomon Islands Investment Ltd is taken the next step for applying for mining lease as it deems to be in the national and public interest.

3.1.2 Mineral Potential of Guadalcanal

Guadalcanal Island is the largest of the major islands in the Solomon Islands group and has been the most actively explored for both base metal and precious metal deposits. Gold Ridge gold mine, is located at central Guadalcanal hosts a world class epithermal goldsilver deposit. The geotectonic model, past exploration history has placed Guadalcanal as a key island target by many investors in search for both base and precious metal deposit.

There are a number of key target mineralisation located on Guadalcanal Islands. This area includes: -

Simiu mineralisation is targeted for copper sulphides, associated with oceanic tholeiite. The Western Guadalcanal area is targeted for low grade disseminated sulphide deposits associated with andesitic and high level porphyry target for copper and gold mineralization. Poha dioritic intrusive contributed significant to the occurrences of porphyry copper mineralization at Western Guadalcanal.

Lower grade disseminations and metamorphosed equivalents of the Ghausava Ultrabasics and other intrusive related volcanic episodes are target for copper sulphides deposits in these areas. Ghausava

ultrabasic host nickeliferous laterites and copper sulphides mineralization. The island has undergone a geotectonic uplift from the south of Guadalcanal giving rise to steep slope at the southern end result in the formation of large meandering river systems flowing in a northward direction. There are various key potential areas that have potential for future gold mining in the Solomon Islands including Guadalcanal Islands.

Kavahambe Prospects has similar geological significant to other alluvial gold deposit like the Sutakama Prospects that also commences it first alluvial gold mine constructions. Kavahambe Prospects has been identified to host potential alluvial gold by the previous owners during the course of their mineral exploration (Zanex Report 1986). Kavahambe alluvial gold prospects has been target to have accommodated significant alluvial gold deposit that has been transported from upper sources of mineralised volcanic rock that host the Gold Ridge gold deposit. Gold Ridge Mine is an example of a medium scale epithermal gold deposit.

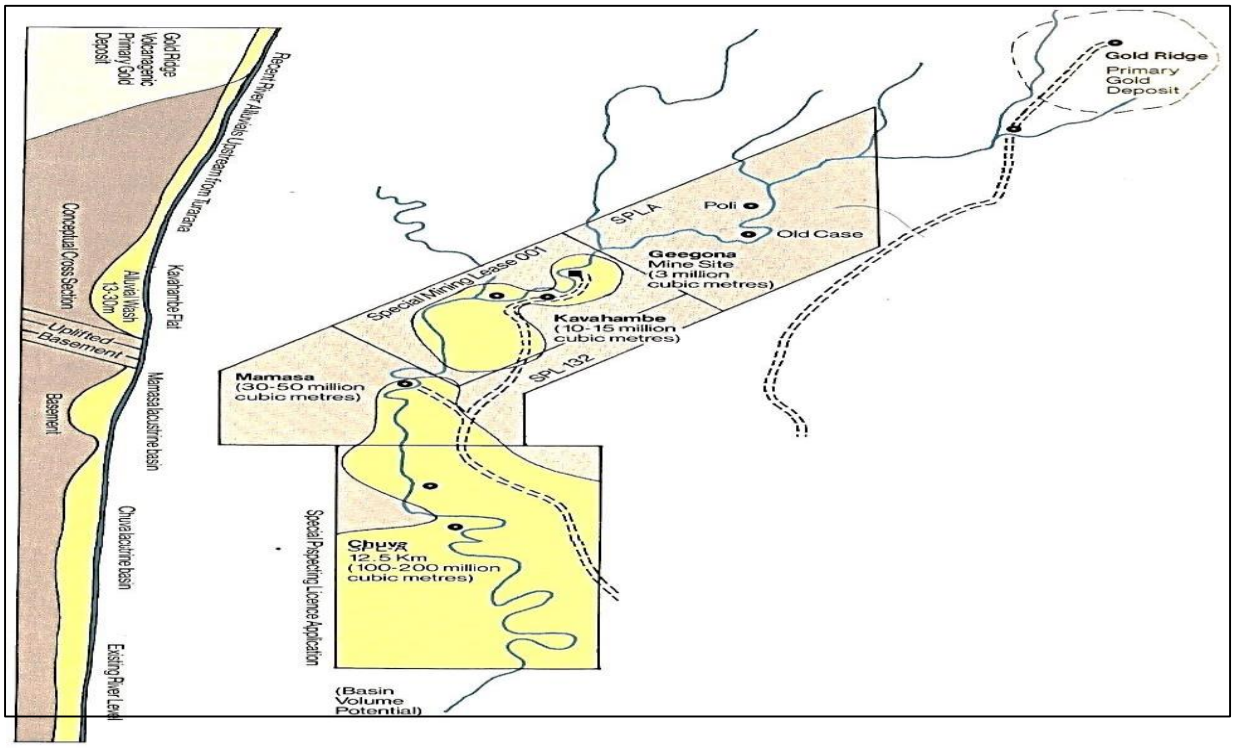


Figure 5: The placer resource and geological cross section of the Chovohio river, After Zanex, 1986

3.1.3 Kavahambe Gold Deposit

A previous owner of the Turarana or Kavahambe Tenement has only managed to mine fifty (50) metres of river bed at Chovohio River within its three (3) months of its 12 months' operation. Some key factors that contributed to the closure of the operation are lack of technical experience in alluvial mining and the company faced financial crisis. This company ran into a various issues related to their company and closed its operations. The Prospect is located within the Chovohio river system. The Kavahambe alluvial gold was transported from sources of mineralised volcanic rocks and the Gold

Ridge Volcanic (located 4km SE of the prospects) target as one of the main sources that distributed alluvial gold along the Chovohio River systems. Chovohio and Charivungga River cut the mineralised Gold Ridge volcanic and drain into Matepono River. TheWin Win Solomon Islands Investment Ltd through vigorous geological investigations concluded the following tabulated results (see Table 4 and Table 5) that forms the basis of the prospecting evaluation, findings and discovery.

TABLE 3: PROVEN PLACER GOLD IN THE TURARANA AREA

Prospect	Length (M)	Width (M)	Area (M^2)	Appr Depth (M)	Volume (M^3)	Grade Au@g/M^3	Gold (Oz)
Kavahambe	1372	640	878,080	15.2	13,346,816	0.3	129,000
Perched Terraces Crossloya, Geejona, Tenacorbu, Lusu, Vurahoba, Namo ade ade, Tausoro			106,250 37,500 6,250 15,000 15,000 10,000 7,500 15,000	10	1,062,500	0.7	23,900
River Gravel (Tausoro - Chariveha Confluences)	3000	70	210,000	5	1,050,000	0.5-0.75	23,700
Turarana			70,000	10	700,000	0.3-0.5	8,974
Kokoilo	250	250	62,500	10	625,000	0.7	14,100
Total reserve					**16,784,316**	**0.37**	**201,214**

TABLE 4: THE FORECAST OF PLACER GOLD MINING FOR TURARANA

Prospect	Volume (M^2)	Grade Au@g/M^3	Plant Capacity (M/hr)	Operational (M^3/yr)	Duration Mining
Kavahambe	13,346,816	0.3	300	1,200,000	11 years
Perched Terraces Crossloya, Geejona, Tenacorbu, Lusu, Vurahoba, Namo ade ade, Tausoro	1,062,500	0.7	100	400,000	2.25 years
River Gravel (Tausoro - Chariveha Confluences)	1,050,000	0.6-0.75	100	400,000	2 years
Turarana (with Kavahambe)	700,000	0.3-0.5	300	1,200,000	7 months
Kokoilo	625,000	0.7	100	400,000	1.25 years
Total reserve	**16,784,316**	**0.37**			**17 years**

3.2.0 Project Components, Activities and Schedule

A camp has already established during the prospecting exercise. The camp is currently staffed with few local staff serving as the security. The camp was located close to the Chovohio river, and just opposite of the Tuarana

FIGURE 6: Current Camp used during prospecting

Accordingly, the camp will be relocated to new site once operation start. Major facilities to support the mining operation will be established within the tenement as shown in figure 6 A (details are given later in the section).

For the purpose of reporting, this mining project has dissected the operation into six major components for easy evaluation and monitoring into the future. These includes; (1) Administrative component (2) Construction component (3) Operation component (4) Rehabilitation and post mining component and (5) Environment Management and monitoring component and (6) Corporate and social responsibility component.

The **administrative component** constitutes of activities such as the administrative duties of the company, compliances roles undertaken to ensure the smooth running of the project. It encompasses planning, feasibility studies, researches and environment assessments. The **construction component** comprises of establishing of those enabling infrastructure activities such as the construction of roads, camps, utilities, preparation of loading areas, preparation of waste management systems and etc. The **operational component** comprises of the actual mining activities and the systems associated therewith. **Component Four** (4) is the rehabilitation and post mining component that also intertwined

with component five (5) the **Environment Management** and **monitoring component.** These components are mainly premised on the Environment Act and Mining Act requirement for post mining planning and development. Component six (6), the **corporate and social responsibility component** comprises of the companies' networking with national government stakeholders and None Government agencies including other business in areas directly related to the mining operation. It includes the role of the company in fulfilling national, provincial and community aspiration to meet their development challenges. Strategic activities under these component include public and community awareness and network, institutional networking, community work and implementation and supporting of key development agenda of the communities, province and the country. This component is closely intertwined with component one, and is implemented concurrently.

Bolstering of institutional network is necessary as this component falls under multiples of government agencies functional mandates. This include the Ministry of Forestry and Research (MFR), the Ministry of Agriculture and Livestock (MAL), Ministry of Fisheries and Marine Resources (MFMR) and other related stakeholders that may have stake for the people of Guadalcanal province and the country as a whole. The following subsections describes in detail each of the components and their specific activities.

3.2.1 Administrative component

The administrative component comprises of enabling activities particularly the administration requirement to ensure the company's compliances to Solomon Islands national laws, Guadalcanal provincial Ordinances, the customary owners' norms and practices and including in adhering to best mining practices. At the same time the component also ensures the enhancement of public relationship and undertaken of researches required for proper articulating of the specific operational design during the mining operations.

The activities that are covered under the component are;

- Application for Foreign business registration and company's in cooperation (Business Name)
- Prospecting licence application
- Prospecting activities
- Land agreement, profit agreement and others
- Mining Lease Application
- Environment Consent Application (This Environment Impact Statement)

Items/Activity	Implementing Agency	Responsible Ministry/Department	Status
Registration under Foreign Investment and Incorporation of Company	Win Win Investment Solomon Ltd	Ministry of Commerce, Industries, Labour & Immigration (Company House)	Valid: Foreign investment registration number: 3187 Certificate of Incorporation: **201619166**
Prospecting Licence Application	Win Win Investment Solomon Ltd	Ministry of Mines, Energy & Rural Electrification	Valid NO.PL-01/17
Mining Lease Application	Win Win Investment Solomon Ltd	Ministry of Mines, Energy & Rural Electrification	Application and pending decision
Minerals Board Meeting and Hearing	Minerals Board	Ministry of Mines, Energy & Rural Electrification	Scheduled
Environment Consent	Win Win Investment Solomon Ltd	Ministry of Environment, Climate Change, Disaster Management & Meteorology	Application in progress

TABLE 5: SUMMARY OF ACTIVITIES UNDER THE ADMINISTRATION COMPONENT

3.2.2 Management

The Win Win Solomon Islands Investment Ltd is 95 % by Dan Shi and 5 % by Charles Meke. The Board of director of the company comprises of these two individuals. Currently, the operational management is directly oversighted by Mr Dan Shia, a Chines national, who has an excellent investment project planning and implementation with strong planning and execution capabilities analysis, excellent designers and consultants, team organizational skills to master a variety of new technologies and techniques. He has gone through the whole process of China's development, and has a wealth of international trade and setting up of factories.

The setup phase is also benefited from international consultants who are helping with specialised mining areas. The company is also hired a full time accountant who also takes the place of the director during his absence.

The initial financial backing of the company is mainly derived from its shareholders and its financiers and future equity partners. To date, the company has attracted to its books Chinese multi- millionaires with solid asset strength. All of them are self-made either owning or part-owning very profitable non-listed businesses. The Win Win Solomon island Investment Ltd will not operate on a Chinese mining model and as such money raised from shareholders will be spent wisely and under strict controls and limits.

Hence, the Management of Win Win Solomon Islands Investment Ltd is doing something outside the norm for traditional mining companies where a great deal of money is raised and then a spending frenzy occurs until the money runs out and then either the company goes under or shareholders have to put hand in pocket again. Management does not want unpleasant surprises for Win Win shareholders and have been frugal with spending to date.

To complement the Win Win Solomon Islands Investment Ltd's management arrangements, the land owners has also formed land owners board of directors to form a governance mechanism for ensuring smooth running of the project. The land management board should act as the mechanism for addressing grievances and redress during the mining operation (see annex 3 A). To demonstrated the strong support towards the proposed mining, the Koehoto landowners association has submitted an objection letter to the Ministry of Mine and Rural Energy for the inclusion of their customary land into the Gold Ridge mining (see annex 3B.

3.2.3 Employment

An operational readiness training programme will be prepared during the period when equipment arrives. On job training will be performed by professional trainer who is an expert in mine training with 30 years mining experience in roles ranging from equipment operator, trainer, supervisor and superintendent within a diverse range of mining environments including in China and Papua New Guinea. He will be used for the initial period prior to commissioning and then on a regular basis each year to ensure that all operators are well trained and perform to a safe and high standard.

When the operation is in full production 43 Solomon Islanders are expected to be employed, see month 8 and0. Prior to full production the numbers are less as construction is minimal for this operation and is made up of personnel supplied by the OEM. The numbers below exclude locals employed in the region and assistance given to others that will be assisted into micro business ventures. The total figure below is expected to have a substantial multiplier effect since all goods, food, and building material will be sourced locally where reasonable and possible.

Table 6 Solomon Islands personnel employed. Month 8 represent fully operation mine and plant.

	Orders placed			Equipment arrives		Commissioning		Thereafter
Employment area	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8
Mining	0	0	1	6	7	13	13	19
Process	0	0	0	0	0	2	2	4
Maintenance	2	2	5	8	12	20	20	20
Total	2	2	6	14	19	35	35	43

3.2.4 Trainings

An operational readiness training program will be prepared during the "order placement" period to ensure that a plan for training local workers is in place well in advance of commissioning and ramp-up. Prior to the

commencement of operation, a training program will be implemented to provide Solomon Islanders with the skill required for the mining operation.

Training and development will be an on-going component of mine operations for the life of the mine. An annual training plan and schedule will be prepared and cover inductions, OH &S training, cultural awareness, skills training and behavioural training designed to optimise performance and teamwork.

This is a relatively small operation and as a result one local trainer will be employed as a full time position, generally supporting human resources at the site. As previously stated an external trainer will also come to site for the initial training period at commissioning and thereafter at yearly intervals or whenever deemed necessary. The commissioning training period has SBD138,000 allocated and each year SBD200,000 is expected.

3.2.4 Procurement of Equipment

Materials including machineries for the mining project, will be procured through normal business standard of the Win Win Solomon Islands Investment Limited. Some machineries will be procured from overseas, and it has been planned as a start-up by procuring the process plant within 6 months of placing orders for the mine and plant components. The orders will be placed after all the permits are issued by the relevant institutions in the Solomon Islands. These machineries include; excavator, loader, gold scrubber, vertical centrifuge, dressing table and static melting furnace (see list of machineries below and their layouts in the operational section). The company is also planning to procure machineries for communities to enhance their local produces to support the mining operation. These includes a tractor for market gardening. Other machineries will be procured locally

FIGURE 7:PICTURES OF MACHINERIES TO BE PROCURED FOR VARIOUS ACTIVITIES OF THE OPERATION

such as caterpillar equipment and Massey Ferguson tractors. All oils, hydraulic fluids, coolants, filters and consumable parts can be supplied from Honiara. Additionally, regular lab analysis and assays are required by the mine and there are several locally based laboratories which can fulfil this requirement.
List of facilities with assemblages of equipment

- **Process plant and other facilities Equipment**
    - ✓ Grizzly
    - ✓ Hopper
    - ✓ Vibrating feeder
    - ✓ Scrubber trommel
    - ✓ Trailings conveyor
    - ✓ Tailings hopper
    - ✓ Tailings scavenger sluice
    - ✓ Knelson Concentrators
- Gold Room:
    - ✓ Vibrating table
    - ✓ Smelting furnace
    - ✓ Laboratory equipment
- Workshop facilities
- Parts and spare storage
- Bunded fuel storage
- Diesel generator
- Administration office
- Tailings water settling pond for water reuse to plant
- Water pump and pipe

3.3.0 Construction Phase

The **construction component** comprises enabling infrastructure such as the construction of roads, camps, utilities, preparation of processing plant areas, preparation of waste management systems and etc. Since, the operation is relatively small the construction phase is also relatively small requiting a limited amount of time –at least it will only take half a month. The process plant and some site buildings are prefabricated and will only require to be assembled at the specific sites by the personnel from the original equipment supplier (OEM). For the purposes of the EIS, the activities anticipated are discussed below.

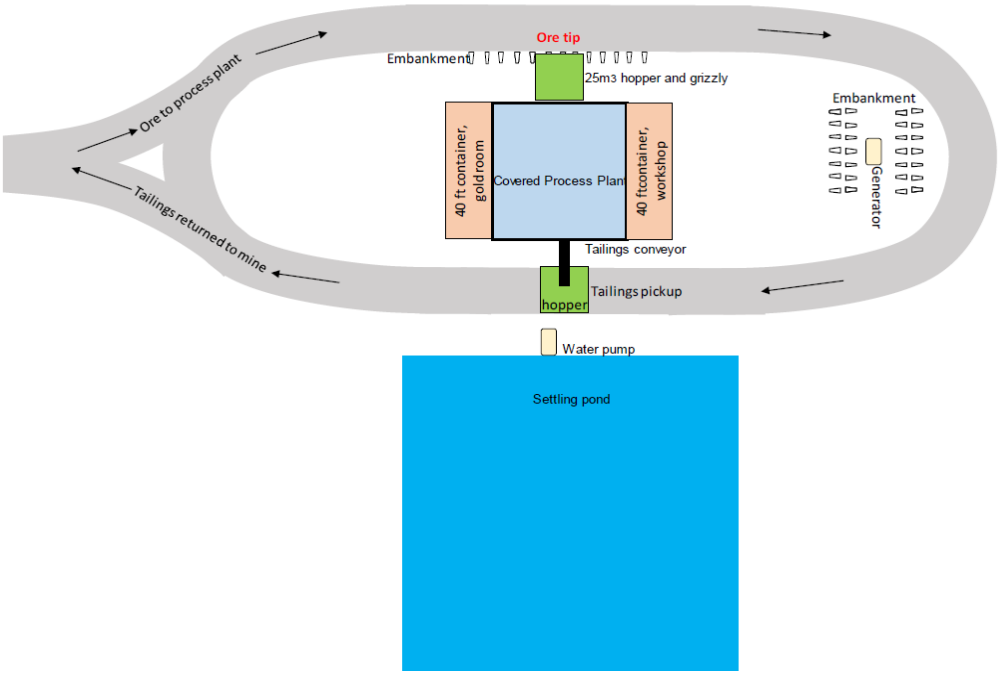
FIGURE 8: PROPOSED MINE LAYOUT AND VILLAGE LAYOUTS

2.3.1 Processing plant and tailing movement plan

The plant and associated infrastructures, is going to be housed in a 12M X 12 M protected area to keep off the weather. Either side of the plant area are two fitted out 40 feet containers, one for the gold room and the other the workshop and spares. The generator is separated from the plant to reduce noise in the working environment of the plant, it has a noise reducing and weather proof housing.

Ore is dumped into a hopper at one side of the plant and tailings collected from a hopper from the other side. The water component of the tailings is settled in a settling pond near the plant.

FIGURE 9: PROCESSING PLANT AND TAILING MOVEMENT LAYOUTS



3.3.2 **Accommodation & Communal area**

The proposed layout for the accommodation and communal area is shown in the diagram bellow (see figure 9). The accommodation blocks include a **communal area**, **kitchen and sleeping quarters** where 3 persons are allocated to each hut constructed in the traditional manner with timber and leaf where possible. More than 50% of the workforce is expected to be from the local villages and not require accommodation. This is the worst case scenario and a realistic number can only be ascertained after recruitment at the start of construction and commissioning.

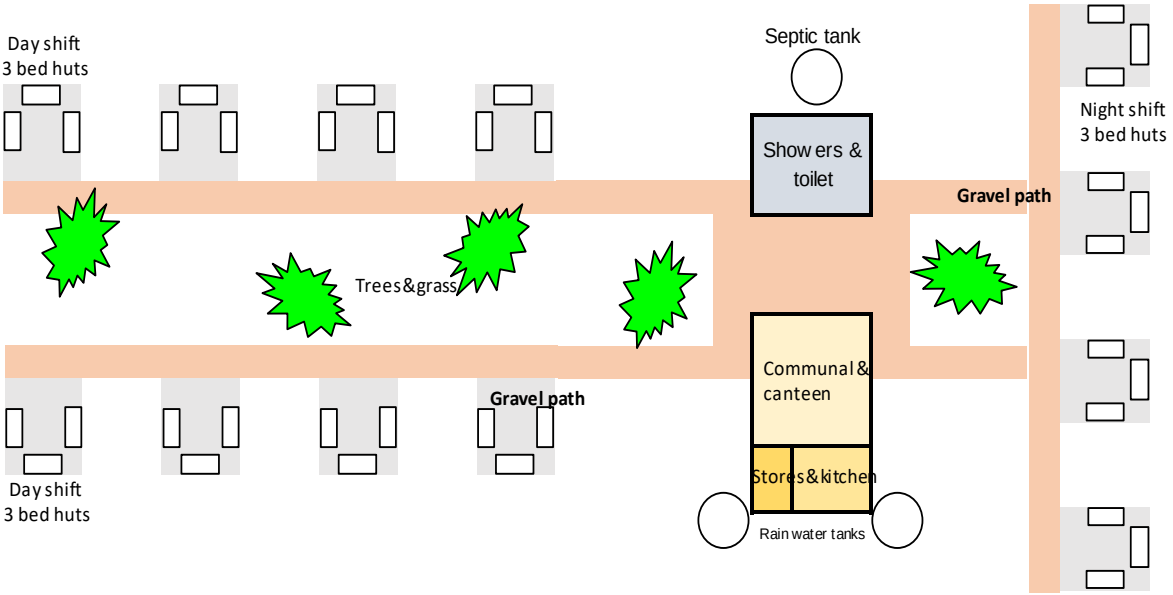


FIGURE 10: ACCOMMODATION & COMMUNAL AREA

3.3.3 Materials for Accommodation and Communal area

As noted in above, most of the materials for accommodation and communal areas will be sourced locally and in particular from local materials that will be obtained from the landowners. For timber extraction portable saw mill operator will be used where timber will transport to the construction site by truck, using the maintained roads or shoulder to the site where they are required. As already noted the harvesting of trees will resemble sustainable harvesting practices and their adverse impact on the natural environment will be cautioned to be minimised. Disturbed forest will be left for natural recovering. The noise from portable saw mill will only last for few days and will be located away from the residential villages. Regulated tree species will be avoided and ecological damages to conservation species to be kept at minimum.

As also noted, 50 % of the workers will be sourced from local villages hence reduces footprint at the accommodation and camping site. It has also noted that alongside the process plant, some site buildings are prefabricated and are only required to be assembled by the personnel from the original equipment supplier (OEM).

3.3.4 Access Roads

The kukum highway is branched through the Gold Ridge feeder road leading via spurs to the Tuarana village where the mining site is located. The existing physical infrastructure (Gold Ridge road) is about 1KM from the project site and links very conveniently with the area. The developer needs not build further infrastructures but only take advantage of the existing facilities to allow for mobility of goods, people and all necessities for the development. The improving the access road to the village and mine

FIGURE 11: MAP SHOWING ACCESS ROAD TO BE UPGRADED

site has been anticipated. The spur was started by SAM during the previous mining campaign, but the 2014 floods has damaged parts of the road now requiring resurfacing with road base. The mining employees will be engaged to construct roads as soon as the earth moving equipment arrives and they have completed their induction and/or training. For time been the road is also under the Central Guadalcanal Constituency work schedules and the Win Win Solomon Islands Ltd is also supporting the project by providing fuels.

These spurs have already established, hence there upgrading is only likely to impose minor changes to the landscape particularly the quarries. Quarries are established close as possible to these road networks to reduce cost of haulage. Gravels borrow areas have been identified in various areas including those extracted from the tenement. It follows that there will less or no damage to the village gardens and the access, or permits usually required in other operation is not required.

Operationally, the cost for upgrading the access roads has been costed into the capital costs for the present operation.

These access roads will then also help villagers to access the mine site to sell their local produce and the main Honiara Market (see the social-economic chapter). There is a possibility to collaborate with the Guadalcanal province to adopt the feeder road into their systems for future maintenances.

2.3.5 Machineries

Numbers of diverse mechanical handling equipment will be used to support various components of the mining operation. For the construction component, excavator, frontend loader and dump truck are the most likely to be the main machineries to use. The use of these machinery and equipment and when they become available onsite will be determined on the basis of the activities at hand and being implemented. During construction phase heavy machines will be stationed on safe allocated areas that are located far from the river to avoid accidental fuel spills to river (also see section under procurement and machineries under operation).

3.3.6 Electric Supply

With respect to electricity, the Win Win Solomon Islands Investment will be relying on generators to provide power required for the mining operation and the accommodation. The construction phase only requires minimal energy, to keep the camp with sufficient lights and other uses. The energy requirements will be boosted once the operation scaled up and goes into mining. The generator will be stored and kept in an allocated generator room that will able to supply the followings;

- ✓ General power requirement for lights, fans, ventilation, cooling, and miscellaneous electrical equipment to be used for water supply, communication etc,
- ✓ maintenances of equipment.
- ✓ Plant, machinery that requires power supply.

- ✓ General service and security lights.

The generators are diesel based, hence fuel area is designated and properly enclosed to avoid fuel spillages that could damage environment including water resources. The diesel fuels will also supply machineries for the construction phase and during mining operation.

3.3.7 Fresh Water System

Fresh water line shall run through all the camp and adequately supplying of the plant process. Water supply to workshops and processing plant would be made available by pipe line. The water from the river will be directly pumped to the processing plant. Water supply at the camp will be relying on both rainwater catchments in tanks and piped water from nearby streams. Ventilated improved pit toilet is expected to be constructed at the camp for all employees. The proponent also plans to support village with piped water. Currently, people are relying on the streams for drinking, cooking and other household uses.

3.4.0 Operational component

3.4.1 Mining Plan

The proposed mining method will be developing small retreating open pits where one side is dug supplying ore to the process plant at a nominal rate of 200t/h. Overburden and tailings are placed into the lee side of the pit for infilling. This approach allows new pits to be opened with minimal disruption to the operations and is essential to extract the high grade material early in the life of the mine, increasing early cash flow for the enterprise. Rapid deployment of new pits reduces risks associated in having only one pit where pit wall failure and other unexpected problems halts production for many months. The disruption time for opening a new small pit is as long as it takes to tram the excavator to a new site.

Top soil removed by the FEL like excavators and dozers will be stored near the pit. Ongoing rehabilitation of the tailings will be a few months after infill avoiding extensive rehabilitation work at the end of the mine life.

This is a great improvement over open pit mining which result in a large pit left at the end of the life of mine for future generations to live with. Rehabilitation in this situation is only possible on tailings dumps built on and above the existing landscape, again leaving an eye sore for future generations. Whereas the mining method to be used by Win Win Solomon Island Investment Ltd results in no tailing mounds or long term dams as all tailings are deposited into the pit only a few months after the ore has been extracted by the excavator. Other advantages over conventional open pit mining includes lower tailings disposal costs, safer and more environmentally friendly.

It has been assumed that wet weather, from and including January to April will hinder the mining. The solution is to only mine the flood areas during the dry season when the water table and river is at its

lowest, whereas the elevated areas are only mined in the wet season. This is possible as the mined pits are dug rapidly and are relatively small. A maximum inflow of 2,000 m³/hour will be tolerated.
The mining sequence is as follows:

- ✓ A FEL removes the top soil and overburden ahead and simultaneously of the small open pit being dug.
- ✓ An excavator using a tyne breaks the compacted alluvial sediment in the pit
- ✓ The excavator changes to a bucket and loads 20t trailers hauled by 100HP tractors
- ✓ The ore is hauled to the process plant and dumped into the ore hopper
- ✓ The haulage unit picks up 20 t's of tailings from the tailings hopper at the process plant
- ✓ The tailings are hauled back to the small open pit and dumped into the unused end of the pit, away from the working excavator.
- ✓ The haulage unit trams a short distance to the excavator for reloading and the cycle is repeated

The haulage unit is never tramming empty as the tailings are returned to the pit, unlike open pit and underground operations. Extraction of the ore is predominantly by a 47 t excavator and the haulage to the plant by 3 or 4 haulage units each capable of 20 t. As mining occurs in and near a river and the annual rain fall is greater than for Honiara (3.5m) a selection of large diesel water pumps are required. When the maximum capacity is reached mining transfers to higher land above the water table and this approach reduces the need for larger expensive water pumps.
A 24.8 t front end loader and 17 t bull dozer on tracks is required for various mining activities including removal of topsoil and over burden prior to the excavator removing the ore.

3.4.2 Transportation

The transportation of ore between the deposit and the processing plan is design to ensure the closest distance as best as possible (see diagram). Part of tailing materials will also use for maintenances of road networks that leads to GIPOLL or the schools and clinic that are allocated above the mining site.

3.4.3 Mining process and assemblages of equipment

As noted in the procurement subsection, numbers of diverse mechanical handling equipment will be used to support various components of the mining operation. In fact, the plant and mining facilities are designed to maintain a nominal production of 200t/h, similar to the previous lease owners.
The diagram bellow shows the machineries to be used during the mining operation, hence reflected the level of possible footprints the operation is likely to impact on the surrounding environments.

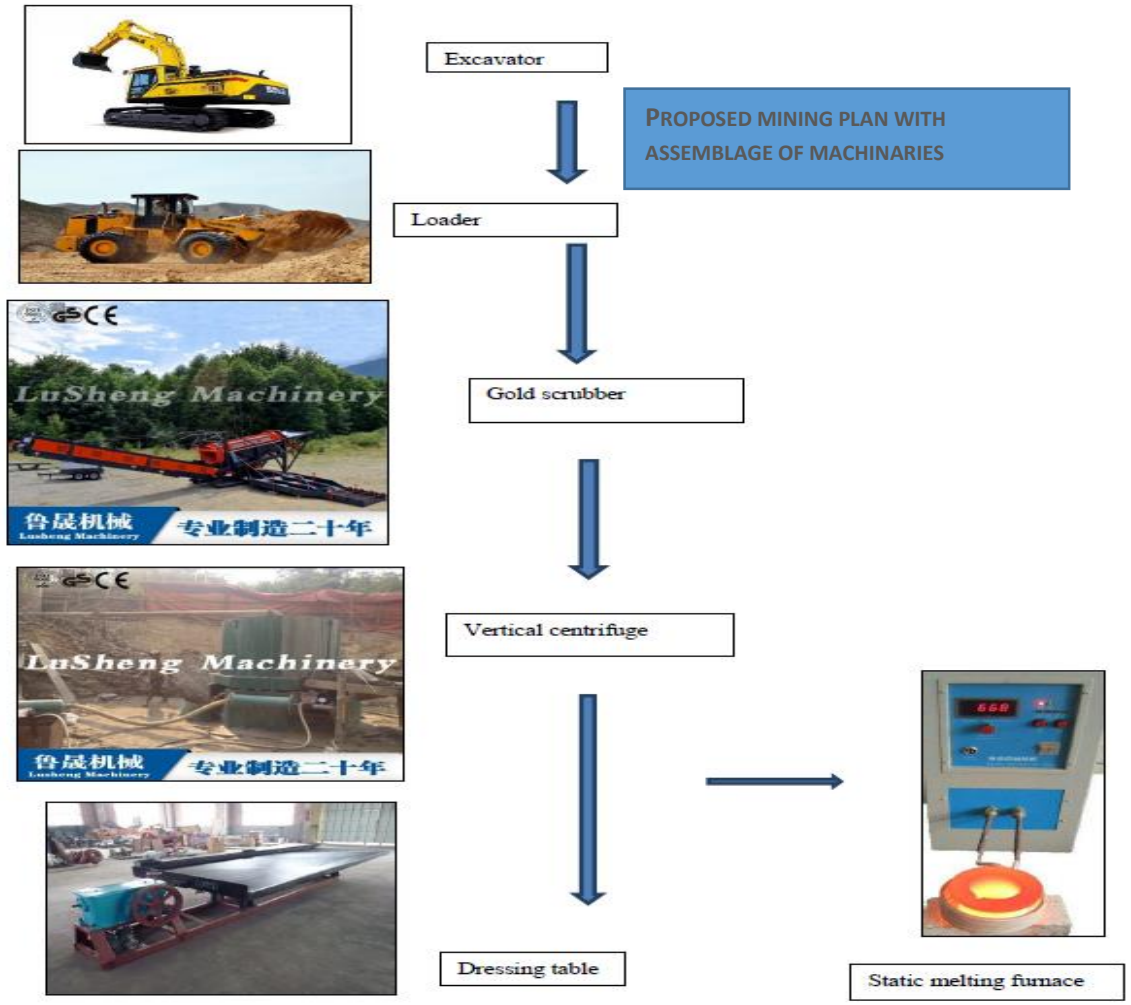


FIGURE 12 EQUIPMENT USED DURING

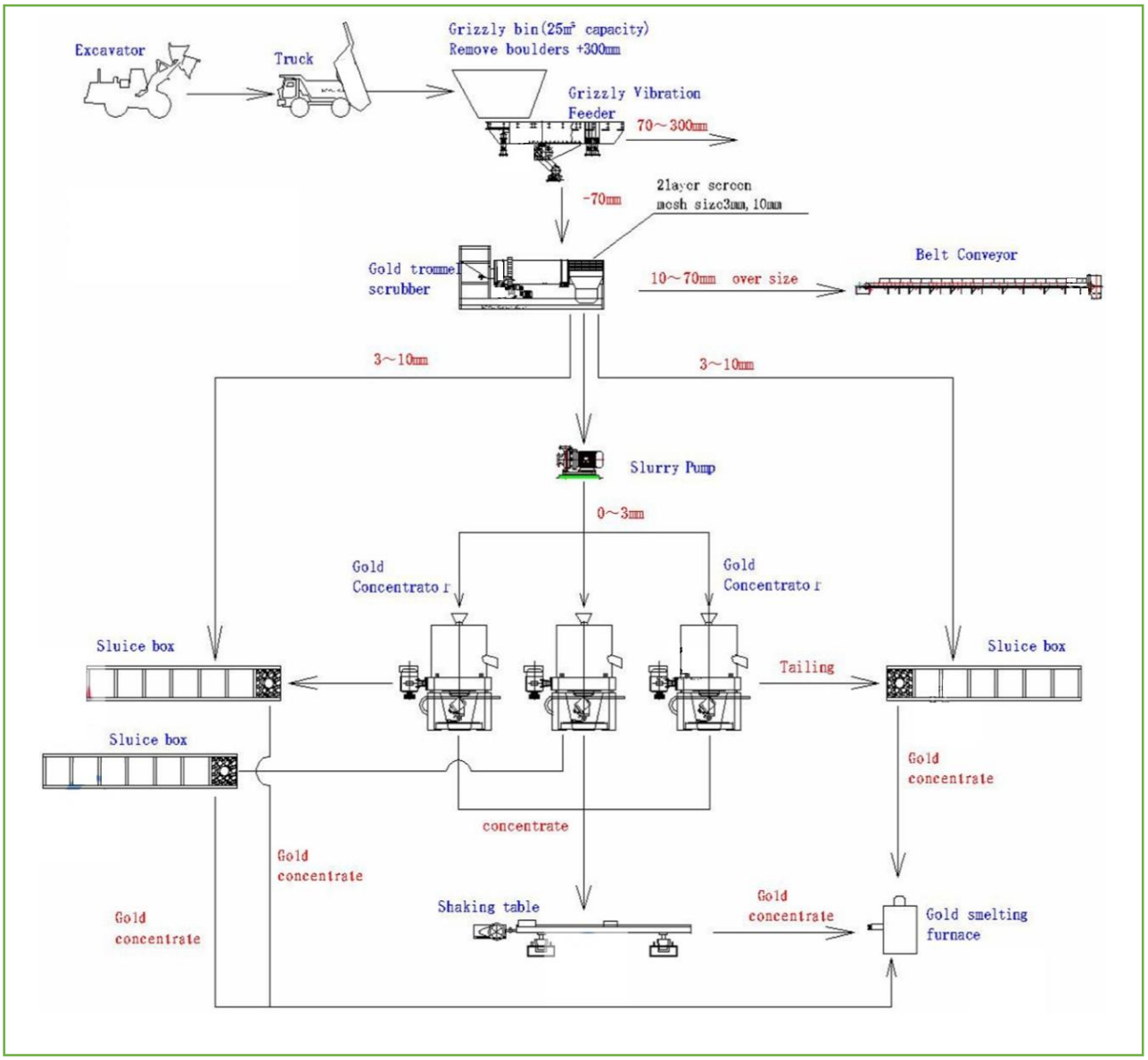
Figure 13: SAMs plant for processing river gravels.

With respect to the mining, excavator, frontend loader and dump truck are the main machineries to use. The use of these machinery and equipment and when they become available onsite will be determined on the basis of the activities at hand and being implemented. Below is a table of the equipment types including the number of units required for the operation.

Depending on the project schedule, it is possible that certain equipment will not be used on certain days during project life. Optimization and maximization of the use of vehicles in particular the dump trucks are important project management issues so does restricting vehicle movements only to favourable weather condition.

3.4.5 Processing plant

The main concentrator used is the Knelson centrifuge. The recovery is dependent on operation and specifically the feed size where limiting the upper end of the particle size range increases recovery.



The generally accepted recovery for the Knelson is +95%. As the feed size is limited to 3mm it is reasonable to expect 98% recovery. This compares to 90% for jigs and +75% for sluices. The later increases to 95% on particles +1mm. For this reason, a sluice is utilised for gold nugget recovery from the 3-10mm trommel tailings fraction. Zanex did report a significant amount of gold in this size range. See **Error! Reference source not found.** for the process flow sheet.

3.4.6 Tailings, and waste system

The waste management system and including tailing is designed as integral part of the operation. Hence space required for tailing and the process involves in the whole mining process are ensured to have minimal environmental damages during the construction and operation of the mining. For instance, **tailings and overburden** will be used for filling up of pits before levelling and subsequently revegetation. According to the facility design plant water will be allowed to flow into settling ponds near the plant where the sediments settles and the water is skimmed for return to the river or reuse by the processing plant.

Other waste from the plant and accommodation quarters will be small in quantity and can be dumped in suitable sites as agreed with the landowners and recommended in the EIS. As no chemicals are used in the operation toxic waste is not an issue, only vehicle and earthmoving oils and fluids require disposal a regular interval. As this is a small operation this is expected to be within the capacity of Honiara waste disposal agents.

For human waste, the Win Win Solomon Islands Investment Ltd has planted to develop well establish septic tank system for human waste (see accommodation and communal area layout).

TABLE 7: LIST OF HAZARDOUS WASTE

NO	Item
1	Diesel
2	Engine Oil
3	Hydraulic oil
4	Lubricant Oil
5	Paint
6	Thinner

For **hazardous waste**, they will be collected and stored temporarily, in a storage designated area before the disposal on an approved place. Solomon Islands, does not have any proper place for disposing of harzadous waste as yet. Hence there is a possibility to work along the Guadalcanal Provincial Government with possible oversight from the MECDM in developing of area for hazardous waste disposal, that are coming from the mining operation.

With respect to **solid waste**, it is anticipated that some quantity of solid wastes will be generated and the likely sources are metals, plastics, papers and domestic household wastes such as discarded food and other biodegradable materials. The waste incurred during the operation is likely to be easily managed by the company and should be of the sanitary landfill type among others, which does not pose hazards to ground water pollution in any case. Containers containing chemical and other

chemicals of possibly harmful nature should not be sold outside and after proper washing should be disposed in an environment friendly manner.

It is a common occurrence in the Solomon Islands for PET bottles (mineral water bottle, schweppes bottles, lemonade bottles etc), aluminum cans and, biodegradable wastes to be haphazardly discarded. As an immediate measure, proper waste receptacles will be placed at convenient locations within the development site where they can be easily accessed by the public and workers, for collection and disposal. This is to ensure household and municipal wastes are not discarded on roadside and in backyards. Within the compound, separate disposal facilities will be made available for the different wastes, for instance, one for cans and one for plastics. In the medium term, employees will be introduced to the concept of the three R, namely Reduce, Reuse or Recycle.

3.4.7 Storm water drainage

Proper storm water drainages are designed for the accommodation layouts including the associated infrastructures. Storm water drainages will ensure the avoidances of rain water entering into the workshop facilities during heavy rains. Technical specifications for the storm water drainage to reduce inundation of surrounding properties will be part of a network of drainage system being designed for this project, at the mining site including the tailing.

3.5.0 Rehabilitation component

The pre-concept of the rehabilitation component embodies the need to maintain the pits of the mining sites to maintain its original topography and compositions. As provided in the mining plan layout, where over layers and tailings are placed into the lee side of the pit for reclamation, at least the disruption time for opening a new small pit is as long as it takes to tram the excavator to a new site. Top soil removed by the FEL like excavators and dozers will be stored near the pit. Ongoing rehabilitation of the tailings will be a few months after infill avoiding extensive rehabilitation work at the end of the mine life.

This is a great improvement over open pit mining which result in a large pit left at the end of the life of mine for future generations to live with. Rehabilitation in this situation is only possible on tailings dumps built on and above the existing landscape. No tailing mounds or long term dams as all tailings are deposited into the pit only a few months after the ore has been extracted by the excavator. Other advantages over conventional open pit mining includes lower tailings disposal costs, safer and more environmentally friendly.

As tailings are dumped in the lee side of the mined pit as it progresses through the resource tailing dumps and environmental damage will not persist at the end of the life of the mine. The top soil retained nearby will be spread over the tailings with a few weeks or months from the time it was

removed as ore from the pit. Due to the short period of storage the top soil seed bank will contribute to the rapid vegetation growth on the reclaimed lands.

The rehabilitation of the mining will be done in consultation with the landowners for the purpose of creating a landform that is according to their wishes, where reasonable and possible, using selected species that are native to the area for the river bar and bank stabilisation and flood control.

For the river dredging, the size of the mining area (pit) falls well below the compliance requirement (0.5 square KM), it could be assumed that the progressive rehabilitation by natural courses (flooding to recover removed gravel and sand deposits at the mining site) is also possible (see detail water behaviour in chapter 3). In maintaining this possibility, the proponent adopted method of stream mining of ore deposits are excavate using truck and shovel technique mainly of heavy machines including excavator, frontend loader and dump truck is traditionally compatible and favours easy natural reclamation of the mined area. The depth is also significant, although it could also encourage the flowing water remain stabilised. Nevertheless, medium scale mining i.e., alluvial mining of river bed by using truck and shovel technique is adopted as one of the progressive rehabilitation approach as required by mining standards.

This has also puts the context for the project closure plan and the post mining projection. On a longer term there is no future plan for developing of the mining site into other business that could warrant the need for post mining plan. Given this context, the project closure plan and the post mining projection has sufficiently anticipated and articulated within the context of the stage-wise-management plan and the impacts that are anticipated as adequately described in chapter 3, 4 and 5.

3.6.0 Proposed schedule for implementation

The proponent plans to implement the project according to the work schedule provided below and under the relevant laws and best mining practices as already discussed. It should be noted that prospecting mining has already taken place and have already commenced since the Win Win Solomon Island Investment Ltd has securing its prospecting licence. lesson learned during the prospecting has adopted accordingly into various plans for the mining activities. Nevertheless, mining during prospecting includes activities like;

- ✓ Dredging of the target areas
- ✓ Field reconnaissance
- ✓ Geochemical sampling
- ✓ Trenching
- ✓ Social and environmental studies including implementation of monitoring programs as a priority obligation of the company.
- ✓ Mine plan and facility scope studies.

For this mining phase, the operation should set in motion/continue once all the administrative and compliance standards have been met including the acquiring of the Environment Consent certificate. It has been anticipated to begin in July 2018 and running into 2018 for a total of one-year period, until and when necessary application for renewal of the building material permit.

TABLE 8: IMPLEMENTING SCHEDULE

Year / Components (Activities)	2017				2018				2019				2020			
Administration																
Land agreement, profit agreement and others																
Prospecting Licence Application																
Mining Lease Application																
Environment Consent Application																
Procurement of equipment																
Construction																
Road/transportation																
Camp and accommodation																
Processing plant and tailing movement plan																
Utilities/Electric Supply																
Fresh Water System																
Operation																
Mining (ore extraction)																
Stockpiling/tailing																
Transport																
Storm water drainage																
Tailings, and waste system																
Rehabilitation																
Progressive rehabilitation and post mining																
Market																

3.7.0 Project alternatives

It is a brownfield project and the mining area Chovohio River is a site that is currently undergoing artisanal gold panning by the land owners. The Win Win Solomon Islands Investment Ltd has entered agreements with land owner for the proposed mining. It follows that the company as the mining prospect holder, is taking the next step for applying for its mining lease. Hence, the EIA study is carried out for pre-set layout alternative.

Considerable activity alternatives are considered under each component based on careful analysis to ensure the efficient and effective running of the project. Environment safeguard and the people's wellbeing are integral part of the analysis to produce the overall layout of the project.

The Win Win Solomon Islands Investment Ltd has increases its level of confidence and concluded that there is approximately an ore reserve of 200,000 ounce of gold contained over 16.7 million cubic metres of ore containing alluvial gold that can be mined at Au @0.3g/m3. And this has persuaded to proceed on with the project on the identified sites. The current location also seemed to have met all criteria in terms of its socio-economic and bio-physical environment settings.

Chapter 4: Description of Environmental Setting

4.1.0 Physical Environment

Chapter 3 describes the regional environmental setting in terms of its physical, biological and hydrology characters, hence evaluate the potential environmental impact of the projects within a 10 km radius of the project site. Scenarios under natural disaster and climate change and their likely potentials impact on the environment with or without the proposed activities is also considered.

4.1.1 Geology, topography and soil type

Lying along the south-western border of the Pacific Ocean, the Solomon Islands is said to be predominantly compost of andesitic affiliates, mainly lava and volcanically derived sediments. The oldest rock (basement schists and plutonic rocks) has been dated back to the mezosoic and are found in Guadalcanal, alongside other islands like Santa Isabel, Choiseul, Nggela and San Cristobal. These basement schists and plutonic rocks are usually overlaid by volcanic deposit in the lower tertiary age. Volcanic rocks are composed predominantly of olivine-poor basaltic pillow lavas and subordinate andesite lavas and basaltic and andesitic fragmental rocks.

Overlaying the volcanic unit, is an extensive layer of Tertiary Sedimentary rocks dated to Eocene to Pliocene age. In eastern Guadalcanal the Miocene sediments goes deep as 6,500 feet. Pleistocene hornblende bearing andesites is well represented in Guadalcanal, Vela Lavella, Kolombangara, Central, Choiseul and Western province. Others are mainly characterised by reef limestone and back reef sediments.

Hackman (1980) has adequately described the geological map of Metapona catchment, and represented in figure 14. Hackman (1980) continues to said that these alluvial plain comprises of dioritic intrusive that has manifested hornblende and andesine composition of the river bed and to some extend some composition of quartz and biotite appearing as tonalitic variety. The soil formation is then comprising of succession of arenites and wackes that are derived from volcanic sources, with subsidiary conglomerates, mudstone and andesitic lava flows. This formation has covers over three-quarters of western Guadalcanal. The tectonic behaviour that impacted on the Guadalcanal geological make up is also characterises by the southern San Cristobal Trench- an active subduction zone – the north-easterly dipping subduction zone of the larger descending northern edge of the Indo-Australian Plate and the Ontong Java Plateau (Kroenke, 1984). This subduction zone has been active since latest Miocene times about 8 million years ago (Coleman and Kroenke, 1989). The tilting and uplift of the vicinity of Honiara by the attitude of

reefal limestones, marls and volcaniclastic sandstones of the Honiara Beds - in part, the same age as the sediments underlying the Lengo platform and shows a clear manifestation of the impact of the tectonic behaviour.

From a tectonic point of view, the tilting of Guadalcanal, has resulted in most river catchment of Guadalcanal migrating towards the south, with the net result showing the Metapona River (including its tributaries) and other large rivers of Guadalcanal draining towards the northwards (Hackman, 1980).

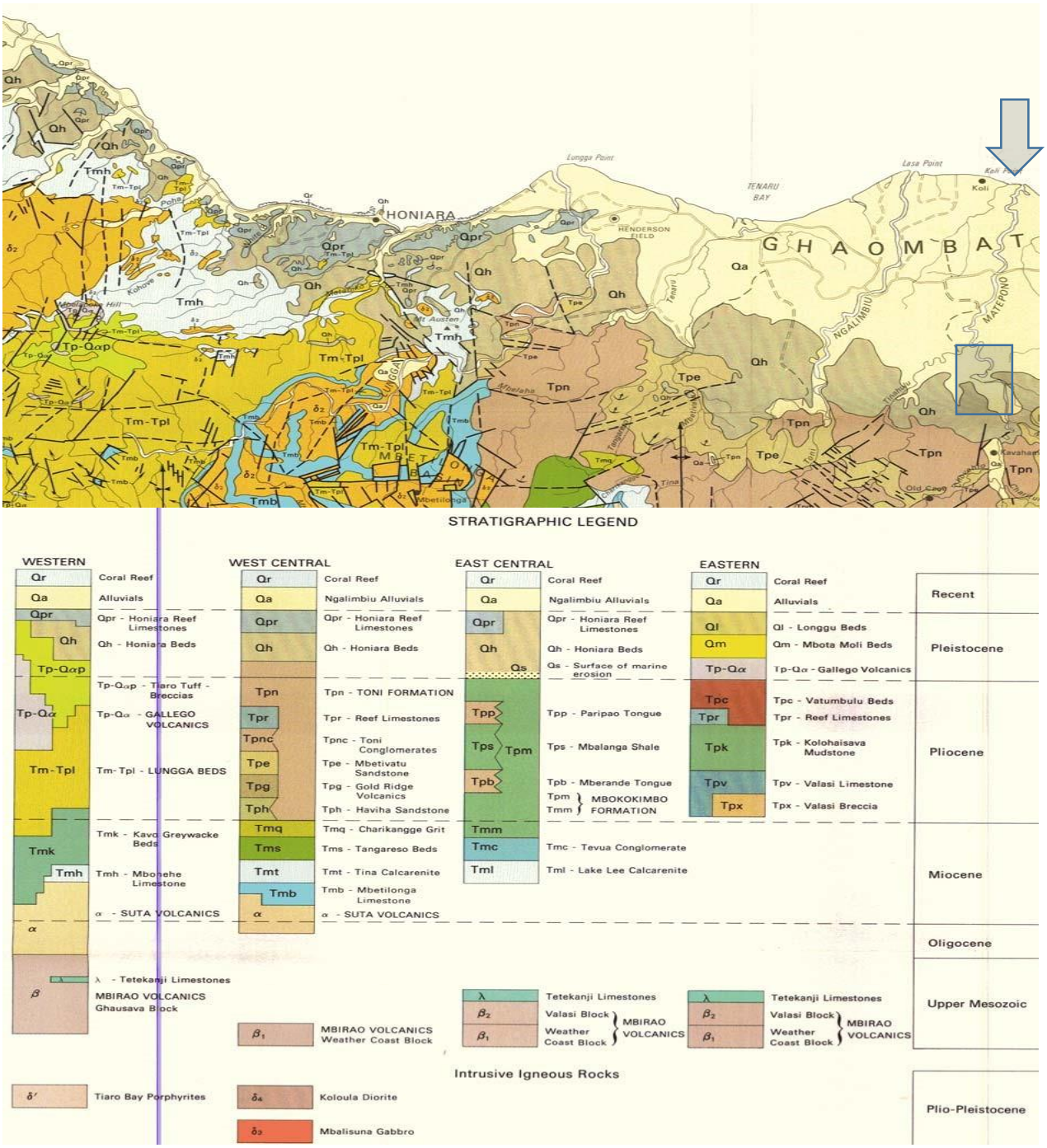
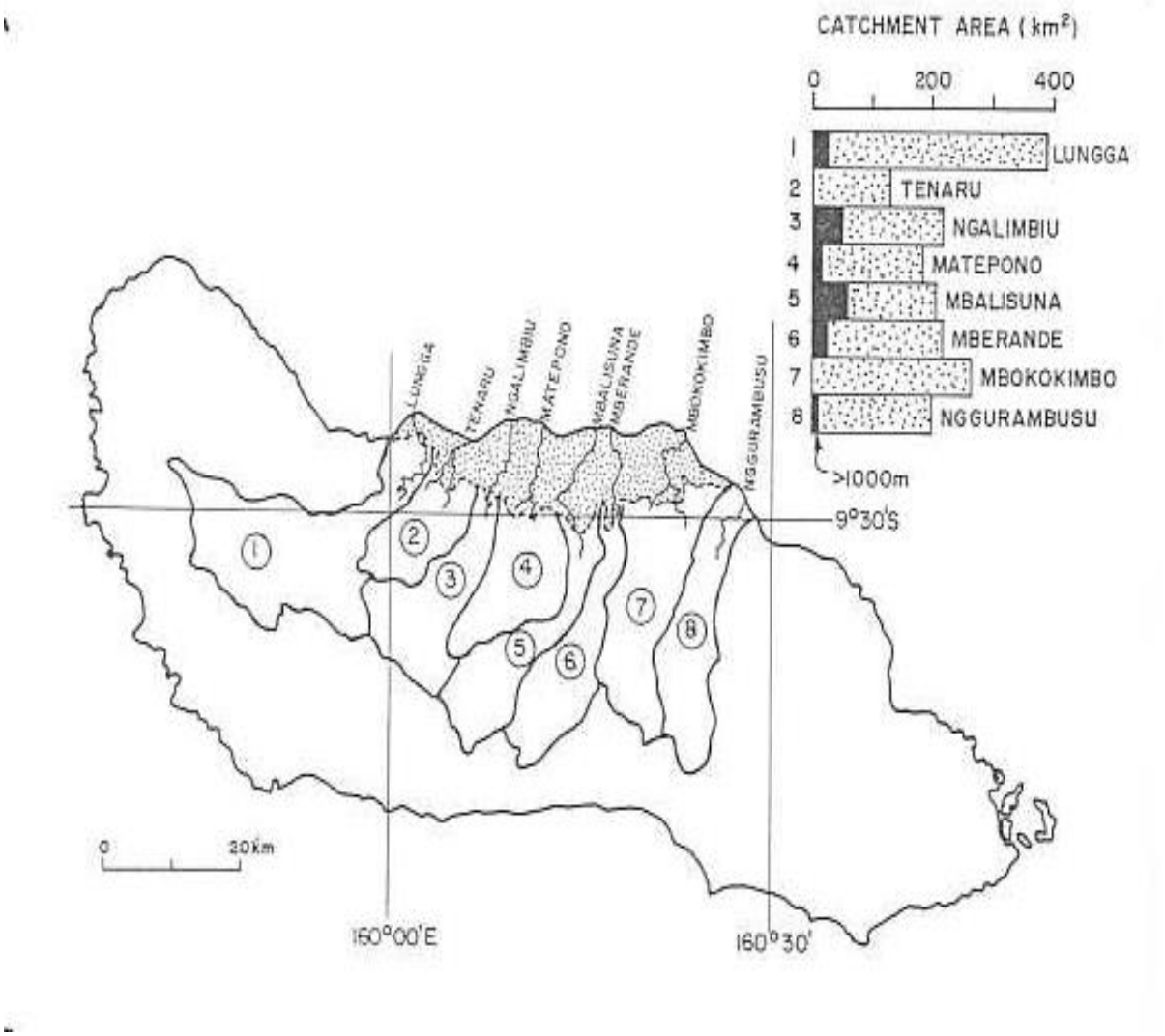


FIGURE 14: GEOLOGY OF RIVER CATCHMENTS CLOSE TO HONIARA, WHERE HUGE POTENTIAL SOURCES OF AGGREGATES OCCUR (SOURCE: HACKMAN, 1980).

4.1.2 The interaction between the Metapona River and the Alluvial Coastal Plain

The fluvial sedimentation of the Matepona River in general, is characterised-not only by the parental geological composition and the tectonic behaviour, but also underpinned by the flowing speed of the River. The Metapona River catchment as estimated by Hackman (1980) covers a total area of 186 square kilometre. Together with Tenaru, Ngalimbiu, Matepono, Mbalisuna, Mberande, Mbokokimbo and Nggurambusu, they are amalgamated to form the northern coastal plain, measuring 470 km^2 (47 KM in length and up to 10 km wide). As noted above this coastal plain is said to be underlain by more than 1000 meter of reefal and volcaniclastic sediments of Quaternary age (Hackman, 1980), a source

FIGURE 15: RIVER CATCHMENT OF GUADALCANAL NORTHERN PLAIN



that have been a dominating the aggregate interested for those aggregate miners. Other general characters of Metapona River catchment including other close by river is listed in table 8.

TABLE 9: GENERAL CHARACTER OF METAPONA CATCHMENT AND COASTAL PLAIN

River properties	Lungga	Tenaru	Ngalimbiu	Metabona	Mbalisuna	Mberande	Mbokokimbo	Ngguram busu
Catchment areas (km) Valley gradient	388	129	221	186	210	221	268	205
(1 steep-8 gentle) high ground	7	1	3	2	5	6	8	4
>1,000 m (km)	23	0	43	14	55	26	2	11
River type	B	A	B	A	A	B	A	B
Historical channel mobility (1 mobile-8 stable)	1	8	2	7	4	3	6	5
Annual delta accretion (x 1,000 m)	155	57	166	49	75	131	420	
Area of coastal plain segment (km)	15	64	52	62	61	50	68	<10
Percentage of coastal plain cleared (%)	87	46	m	68	60	(25)	(20)	(20)
Logging in catchments (km) c. 1970-1986	29		6	46	36	21	40	11

4.1.3 The Chovohio catchment and behaviour

Chovohio river is a tributary of Metapona River. Simion Albert in 2016 has able to delineate the Metapona catchments into its sub-catchment, hence puts closer look on the water property of

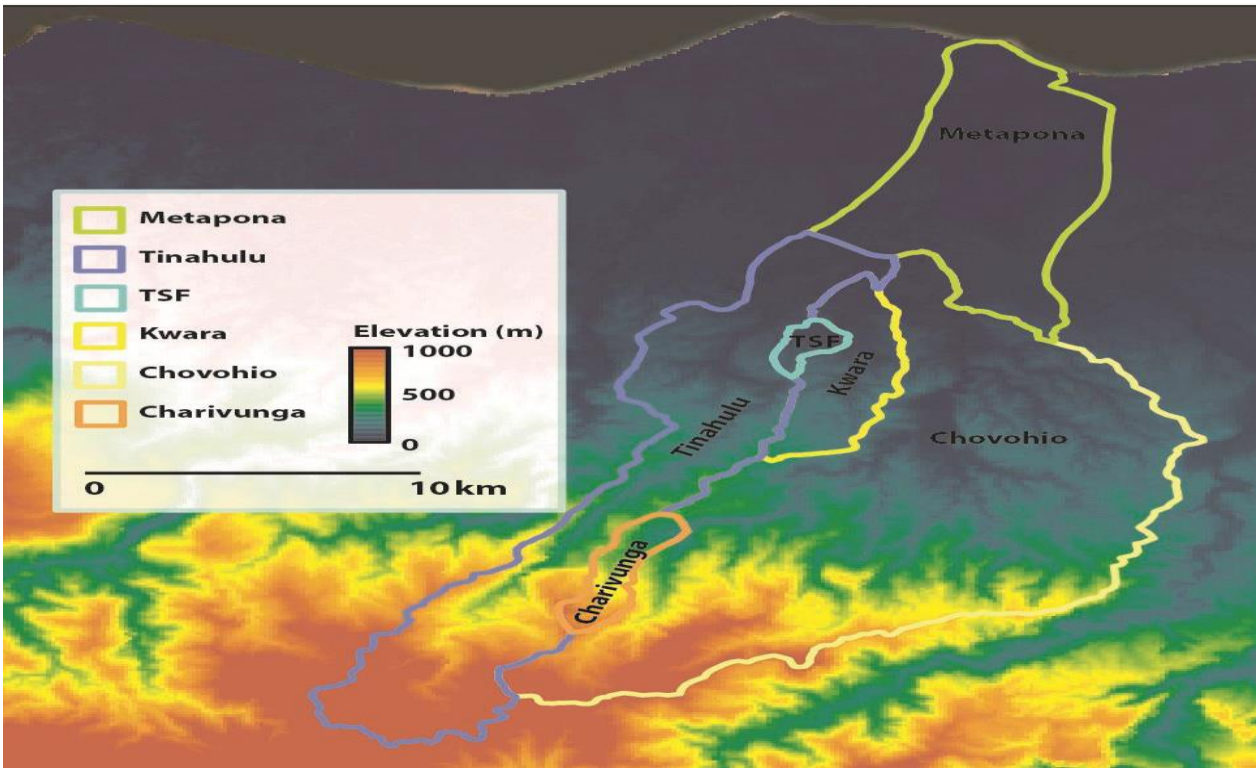


FIGURE 16: TOPOGRAPHIC MAP OF THE METAPONA CATCHMENT, AFTER SIMION ALBERT ET AL, 2016;PP 8

Chovohio river and other tributaries of Metapona catchment. As noted in the subsection of the method, this study is integrated into the EIS and hence its methodology and results has been adopted as a feasibility study. Nevertheless, according to this study, the

River	**Catchment area (km^2)**
Tinahulu	50.9
Charivunga	4.53
Chovohio	102.9
Kwara	10.90
TSF	1.67
Lower Metapona	35.7

TABLE 10: SUB-METAPONA CATCHMENT AFTER SIMION ALBERT ET AL, 2016

Chovohio catchment has been estimated to cover 102.9 KM^2. Other tributaries include, Tinahulu, Charivunga, Kwara, TSF and Lower Metapona (see table 9).

According to the study, the, *e Chovohio River has a far less catchment disturbance with limited industrial mining and waste rock exposing less than 1% of the catchment area. Informal alluvial panning occurs within the stream bed upstream of the Chovohio and Charivunga River confluence'. 'The lower Metapona River is highly modified by large plantation agriculture (oil palm) and smaller scale subsistence agriculture across the fertile alluvial plains'.*

In relevant to the study conducted by Simion. A, *et al.,* 2016, the EIS has adopted three sample areas that will continue to be used for future monitoring. These sites include reference point SIG2, SIG17 and SIG14. These reference points are data collected during their study and commissioned by MECDM, hence since this EIS also part of the MECDM functional mandate the use of the finding is important for their future monitoring and environment auditing of the company's operation. Relevant findings of the data under each subject area is provided bellow.

4.1.4 Water quality

The Chovohio River is visually muddy and the study that was conducted by Simion. A, *et al.,* 2016 has provide a comprehensive quantitative measure of the water quality. The table below is an extract of the result taken from SIG2, SIG17 and SIG14. While the field assessment provides a baseline data for the Metapona catchment, these selected sites will be used as the reference point for the temporal monitoring for the project. Additional sites will be included once operation start. Simon. A, et al 2016, described Chovohio River catchment and the Metapona River of having low water quality in comparison to its neighbouring rivers. Water temperature within the vicinity of the project is measured at 25.5°C. The site is said to have low conductivity (<200 µS/cm) and slightly alkaline pH (7.9). Turbidity and Total suspended solids (TSS) is measured at (58 NTU, 46 mg/L). Ammonia, Nitrite and Nitrate concentrations were low (<0.1 mg/L) (see Table 10).

TABLE 11: PHYSIOCHEMICAL WATER QUALITY OF CHOVOHIO AND DOWNSTREAM METAPONA, FOLLOWING SIMION. A, *ET AL.*, 2016.

Description	Lat	Long	TEMP (°C)	SPCOND (µS/CM)	TOTAL ALKALINITY AS CACO3 (MG/L)	PH	DISSOLVED OXYGEN MG/L	TURBIDITY NTU	TSS (MG/L)	AMMONIA AS N (MG/L)	NITRITE + NITRATE (MG/L)
Chovohio (UPS)	-9.56453	160.15768	23.5	111.2	74	8.7	8	94	24	0.01	0.06
Chovohio DS	-9.48894	160.17644	25.5	118.4	64	7.9	7.7	58	46	<0.01	0.07
Matepono	-9.45564	160.1851	23.3	133.1	74	8.1	7.9	103	188	0.01	0.08

According to the Simion. A, *et al.,* 2016, result and with respect to the **Dissolved and Total Metal Concentrations**, the concentrations of dissolved Arsenic is said to fall below detectable levels (<0.001 mg/l) and hence also falls below the World Health Organisation drinking water guideline (<0.01 mg/l) (Figure 11).

Description	Arsenic		Aluminium		Antimony		Copper		Lead		Nickle	
	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.	Total	Diss.
Chovohio (UPS)	0.016	0.006	2.48	0.07	<0.001	<0.001	0.006	<0.001	0.001	<0.001	0.001	<0.001
Chovohio (DS)	0.01	0.005	3.17	0.3	<0.001	<0.001	0.007	0.001	0.008	<0.001	0.004	<0.001
Matepo	0.007	0.004	2.53	0.09	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	0.003	<0.001

TABLE 12: TOTAL AND DISSOLVED (DISS.) METALS (MG/L) IN FEBRUARY 2016, FOLLOWING SIMION. A, *ET AL.*, 2016.

With respect to the Aluminium concentrations they are also lower (0.06-0.3 mg/l). Concentrations of Antimony were below detectable limits (<0.001 mg/l). For copper concentrations was moderate and the dissolved copper was <0.001 mg/l. For lead, the total lead concentrations were below the ANZECC guideline (0.034 mg/l) and there is no dissolved lead. For Nickel, total and dissolved Nickel concentrations were below ANZECC guidelines. And of course the study also has not detected any form of Cyanide (Total, Free, weak-acid dissociable) in all the selected reference (<0.004 mg/L).

4.1.5 Discharge rates

Simon. A et all 2016, has also characterised the discharge rate of the study area and for the the discharge rate for Chovohio was measured at 15.2 m^3/s. This was taken at reference point SIG17, the discharging point of Chovohio to the Metapoana system. The downstream Metapona River discharge rate ranged from **14.2 m^3/s** to **28.2 m^3/s** at the river mouth. Temporal comparison showed that these discharges rate also varies throughout the month and hence the rate reflected the discharge during February. And as noted in the study, the report has also alluded that whilst a focus of water quality

monitoring programs and guidelines is often on the concentration of contaminants and metals within river systems, the parameter that varies most in tropical systems is **stream discharge.** This has also forms a considerable parameter for designing the monitoring system for the mining operation. Simon. A et all 2016, continue to estimate the load of pollutants based on these identified parameters.

4.1.6 Estimating of the Load of pollutants

The loads of various elements delivered from the river system is assessed by multiplying the concentration by flow rate to yield load on a kilogram per day basis. The study has estimated **60 tonnes** of suspended sediment delivered from Chovohio into the Metapona River per day. Consequently, the Metapona River is exporting **over 95 tonnes of suspended sediment per day into the marine environment**. Out from this 60 tones that Chovohio discharge into the Metapona River, over 13 kilograms are Arsenic of which 4.6 kilograms is sourced from the Charivunga river system. The main source of the metal contents comes from the artisanal panning and the Gold ride mine site runoff.

Table 11: Load of suspended sediment, copper and arsenic from various tributaries into the Metapona River system, After Simion. A, *et al.,* 2016.

		Concentration (mg/L)			Load kg/day		
	Flow rate (m3/s)	Suspended sediment	Copper (total)	Arsenic (total)	Suspended sediment	Copper (total)	Arsenic (total)
Charivunga	0.52	298	0.028	0.102	13,451	1.26	4.60
Chovohio	15.23	46	0.007	0.010	60,538	9.21	13.16
Kwara	0.63	13	0.003	0.0005	704	0.16	0.03
Tinahulu	8.19	23	0.005	0.002	16,274	3.54	1.42
Metapona	28.25	39	0.018	0.012	95,179	43.93	29.29

4.2.0 Sediment quality

4.2.1 Sediment Metals

In terms of Sediment metal content, Simon. A et all 2016 has noted that the Chovohio/Charivunga river sites containing relatively high arsenic, copper, lead and antimony in comparison to the Kwara and Tinahula river sites (Table 12). However, the Chovohio/Charivunga river contained relatively low aluminium sediment content. As one can predict, the metal content of sediments of lower Metapona River reflected accumulative loads from all upstream catchments-with aluminium, arsenic, copper, lead and antimony values lying between those found in the upper catchment. Sediment arsenic and copper content exceed trigger levels in the Chovohio/Charivunga and Metapona River sites, whilst trigger levels for nickel were exceeded in all river systems (Table 12).

TABLE 13: METAL CONTENDS IN SEDIMENTS, AFTER SIMION. A, *ET AL.*, 2016.

Site	Aluminium mg/kg	Arsenic mg/kg	Copper mg/kg	Nickel mg/kg	Lead mg/kg	Antimony mg/kg	Total CN mg/kg
Chovohio							
SIG2	10 800	182	65.5	20.5	9.8	1.3	<1
SIG17	17 500	40.9	38.4	27.1	2.9	0.3	<1
SIG13	19 800	20.8	36.4	24.4	2.1	0.2	<1

4.2.2 Sediment particle size and composition

According to Simon. A *et al*, 2016, the sediment particle size and composition of Chovohio/Charivunga sites containing smaller particles and higher mud content. This is a reflection of the artisanal gold panning along the Chovohio river.

TABLE 13: PARTICLE SIZE: % MUD, SAND, GRAVEL OF THE RIVERBED SEDIMENTS OF CHOVOHIO AND DOWNSTREAM METAPONA, AFTER SIMION. A, *ET AL.*, 2016.

System	Site	Fine sediment particle size (µm)			Sediment composition		
		D10%	D50%	D90%	Mud (%)	Sand (%)	Gravel (%)
Chovohio	SIG2	12.2	357.4	723.8	17.5	76.9	5.6
	SIG17	164.2	300.0	491.0	5.5	94.5	0.0
Metapona	SIG13	2.0	16.6	186.8	76.1	23.9	0.0

Simon. A et all 2016, also noted that the lower Metapona River sediments contained relatively small particles and high mud content with the exception of the river mouth. Simon. A et all 2016, continue to said that the lower content of Metapona river sediment may be a result of the highly dynamic nature of water flow at the site river outlets, with wave energy, tidal and river inflow currents, results in continual resuspension of smaller sediment particles. Evidence to support this is the relatively high water column turbidity values found at this site.

TABLE 14: METAPONA RIVER MOUTH, EXTRACTED FROM GOOGLE MAP

4.3.0 Climate and air

Rainfall for Solomon Islands varies year round from January to December. From December to April there is always a lot of rainfall whereas from May through October the rainfall tends to be lower, with more sunshine. There are also some variations in the number of rainy days per month for the entire country. However, most rain falls in the wet season rather than the dry spell. For Guadalcanal province, the average annual rainfall ranges from 3500 mm in low areas to more than 6000 mm on the mountain peaks, with most areas receiving around 4000 mm (Wall and Hansell 1974). Rainfall is said to be highest during the northwest monsoon which is prevalent towards the end and start of the year, in the wet season. Cyclone activities are mainly associated with this period due to the warming of lower atmosphere from evaporation. Cyclones come around and attack the island during the rainy season.

Table 15: Climatic data at Honiara International Airport, After JICA, 2006

Month / Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total/Average
Precipitation	142	226	185	154	77	104	113	53	64	193	172	152	1 ,518mm/yr.
No. of Rainy day	15	19	18	15	13	15	15	10	11	15	14	16	176days/yr.
Hours of sunlight	6.2	5.6	6.3	6.4	6.9	6.6	5.6	6.7	6.2	7.1	7.0	5.8	6.4hr./day
Temperature	27	28	28	28	28	28	27	27	28	28	28	28	27.8℃

Source) Precipitation, number of rainy days: from averaging the five year data (2001-2005) by the Climatic Observatory at the Airport Hours of sunlight, temperature: from Meteorological Service Head Quarter

Unlike **rainfall**, the **air temperature** for the entire country is almost consistent all year round. Mean daily temperature throughout the year ranges from a minimum of 23 degree celsius and a daily maximum of 30 degree celsius. For the most part, the temperature averages at 30 degree celcius throughout the year. Humidity level is higher with south easterlies while air is also drier around this period. Conversely, air tends to be moist with the onset of monsoonal season.

As noted Natural disaster especially cyclone is prominent during rainy season and under the today phenomenon of climate change, cyclone, tsunami, earth quakes and others are now becoming frequent. The project is located in a disaster risk zone, and hence the changes of local landscape during project implementation is in significant to impact that is likely to be caused by a magnanimous disaster such as the cyclone Namu that was occur in the 1989.

3.3.1 Potential impact

According to the respondents from the village interviews, there has been an increasing number of climate events such as heavy rain and flooding, and villagers often opted to move onto higher ground for safety. As noted, the operation will create some form of insulation from the village been

swallowed by flooding, by first creating stone walls along river edge, increasing the depth of the river bed and repatriating and encouraging regenerating of native trees along the river edges. The increasing level of dust is only localized hence the mitigation measure provided is sufficient to curb the local negative impacts caused by the moving vehicles.

4.4.0 Biological or Ecological Environment

Solomon Islands vegetation are classified into five vegetation type, and these are all found on Guadalcanal Island. Guadalcanal is characterized by high rugged mountains where the highest tip ascends to 2249m, emerging two climatic conditions - the southern "weather" coast which often experiences frequent and high rainfall and the Northern plains which is situated in the rain shadow, sheltering from the prevailing winds. The later climatic conditions allow for the emerging of lowland forest and grassland on the ultrabasic areas, and on the high cloud-capped mountain peaks. The island is therefore dominantly compost of Hill and mixed forest.

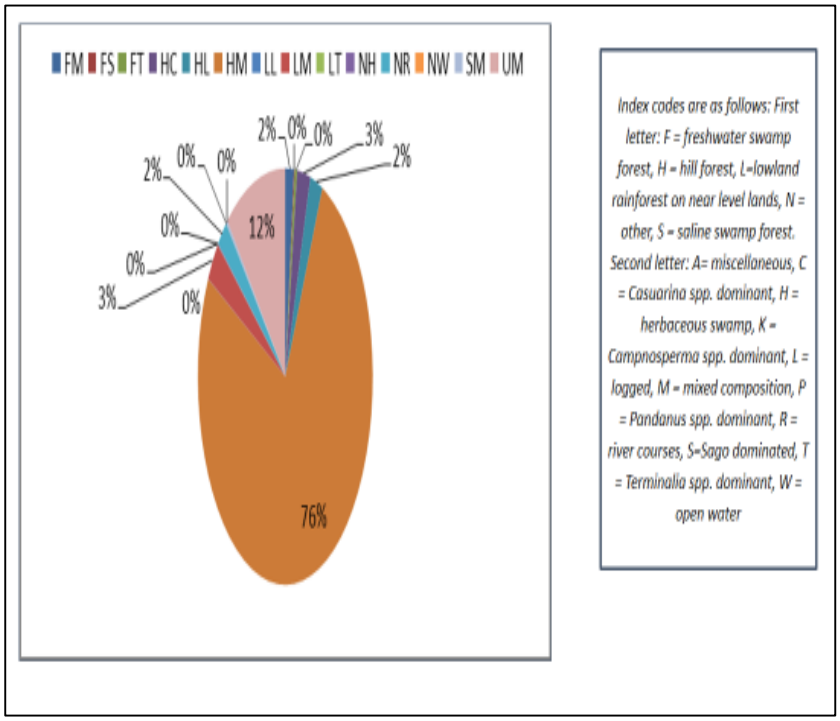


TABLE 16: VEGETATION COMPOSITION OF GUADALCANAL, FOLLOWING KOOL, ET AL, 2011.

As noted the project site, is predominant lowland forest. Hill forest is present on areas rising up to 400m altitude. The presence of *Terminalia brassi, Campnospermum brevipetiolatum*, *Eugenia tierneyana* and *Ficus* are obvious on the river valleys. The role of secondary vegetation covers in contributing to the variation in surface run-off within the area is much of significant. Inland the surface run-off is moderately low, as trees and soil absorb water during rainy days.

Historically, the Guadalcanal coastal plain was covered with rainforest, including areas a moderate coverage of natural grassland. Since the reign of the protectorate, between 1944 and 1944 – 1984 almost 68 % of the Metabona catchment has already cleared for plantations (coconut, oil palm and rice). Likewise, 46 % of the merchantable forest been logged especially in the flood channels. Logging has been carried out commercially in Guadalcanal for a number of decades. Leases cover much of the

island, however, Government policy restricts logging to the lower foothills below 400 m and to slopes less steep than 300 (T. Nolan, Forestry Division, pers. comm., 1986). Inevitably however, logging practices impact on the natural forest environment and in some cases may contribute to erosion, landslides and the build-up of loose timber in the water courses.

Guadalcanal and in particular areas within close vicinity of the project has a significant coverage of grasslands. This grassland has believed to be expanding as most of the land has been converted into agricultural uses. It has been believed that these grasslands also harbours endemic species of quail and rail-birds that have evolved in grassland habitats (G. Dennis, pers. comm., 1986). The grassland provides for a ground orchid which is used for floral arts and usually sold in the market.

With respect to **terrestrial fauna**, Guadalcanal Island is said to be homing some 102 species of birds. Three are endemic species are found on the islands- the monotypic honeyeater genus, *Guadalcanaria inexpectata*, the honeyeater *Myzomela melanocephala* (Doughty et al. 1999), and the thrush *Zoothera turipavae* (BirdLife 2007). Three other species are confined to montane forest which includes *Pachycephala implicata*, *Rhipidura drownei* and *Actenoides bougainvillei*. The former two appear to have healthy populations (BirdLife 2007) while the latter species is suspected to be declining (BirdLife 2007). Other notable Restricted Range (RR) taxa include *Ducula brenchleyi* which were found in the foothill forest and lower montane forests of Guadalcanal. *Charmosyna meeki* and *C. margarethae* also inhabit the hill and montane forests. RR species have unique subspecies on Guadalcanal (e.g. *Pachycephala implicata*, *Actenoides bougainvillei*, *Rhipidura drownei*). Due to the exceptionally disjunct nature of these distributions (species are functionally living on isolated islands of montane habitat separated from any similar habitats by intervening lowlands as well as extensive sea barriers.

A recent desk review has found several of these endemic birds are listed under the Solomon Islands Wild life managements Acts. This review provided an overview of the important species that may require closer attention during project operations, particularly in the areas of public awareness.

Table 17: Birds of conservation importance includes endemism, with known species either listed in the Wildlife Management Act and/or with IUCN.

Category	Ecosystem Zone/home range	Common Name	scientific Name	Conservation importance: [1] Endemic, IUCN threatened list of species	Protection schedule under Wildlife Management Act i-prohibited export ii- Regulated and Controlled Species
Plant		Red Sandalwood	*Pterocarpus indicus*	VUL	II

[1] * Endemic to Popomaniseu-Tina, ** Endemic to Solomon Islands

Bird	montane forests	monotypic honeyeater	*G. inexpectata*	*Endemic, LC	I
	"	honeyeater	*Myzomela melanocephala*	*Endemic, LC	
	"	Trush	*Zoothera turipavae*	*Endemic, VUL	
	"		*Pachycephala implicata*	*Endemic, LC	
	"		*Rhipidura drownei*	*Endemic, LC	
			Actenoides bougainvillei	VUL	
	"		*Megalurulus whitneyi,*	NT	
	"		*Ducula brenchleyi*	VUL	
			Collocalia orientalis	DD	
			Charmosyna meeki	NT	
			C. margarethae	NT	
			Micropsitta bruijini	LC	
			Turdus poliocephalus	**Endemic, LC	
			Phylloscopus poliocephala	**Endemic,LC	
			Petroica multicolor	**Endemic, LC	
			Eurythrura trichroa	**Endemic, LC	
	lowland forest	Woodford's rail	*Nesoclopeus woodfordi*	NT	I
			Centropus milo	LC	
		Yellow-legged pigeon	*Columba pallidiceps*	EN	I
		Yellow-bibbed lory	*Lorius chlorocercus*	LC	II
	Northern grassland	sub.sp. of button quail	*Turnix maculosa*	LC	
			Acrocephalus stentoreus	LC	
			Gallirallus philippensis	*Endemic	
Bats	montane	monkey-faced bat	*Pteralopex pulchra*	**Endemic	II
Frog (5)	tree frog vulnerable		*Littoria lutea*	**Endemic	I

4.4.1 Potential impact

A general observation of the tenement during the field visit, has shown that the tenement has primarily covered with secondary shrubs and forest where more than 50 percent are covered with introduced species such as raintree, paper-mulberry (*Browsonaetia papyrifera)*, wild egg-plant (*Solanum torvum)*, mile-a- minute (*Mikania micrantha*) including usible plants such as betel nut tree, sago palm, coconut tree, banana and etc. The vegetation covers in itself does not encourage the above concerned species to reside in the area. It has been planned for revegetating of pits with selective native

species that could encourage the homing of the species. Otherwise, relevant public awareness is important as restoring of the native vegetation and encouraging these species to reside in the area could add some value to the operation. At the same time the company is contributing to national efforts toward conservation.

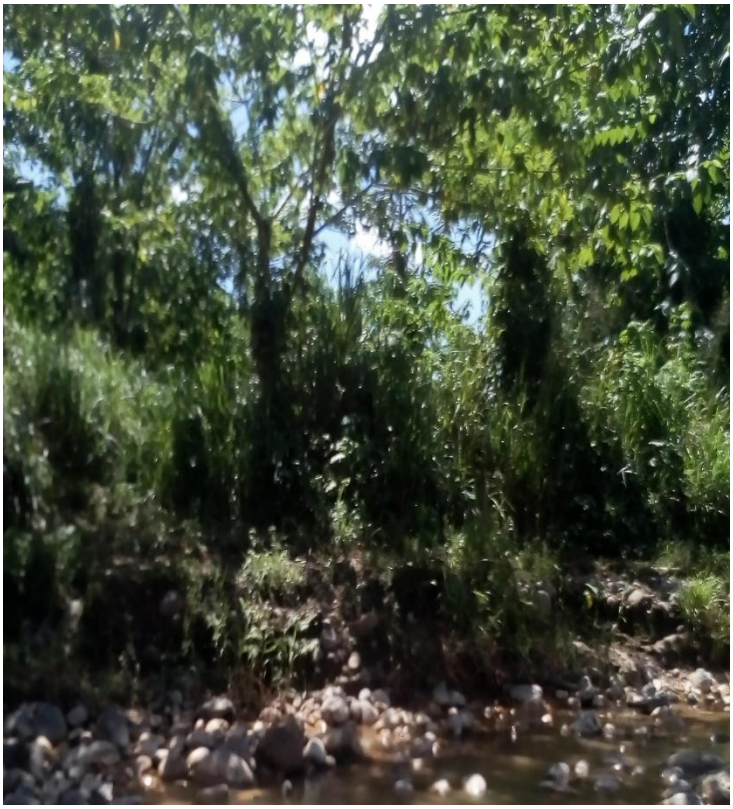


FIGURE 17: VEGETABLE COVER OF THE TENEMENT

The operation could also encourage the increasing number of individuals of invasive species. It has been learned that some of the invasive species such as the African snail is already present in the area, hence the disturbances of the vegetation and vectoring individuals through moving vehicles could allow for the population of African snail to increase dramatically, and threatened biodiversity and people's livelihood. Hence relevant measure is in place to ensure their entry into the site is discouraged and to intervene in population growth. Stakeholder participation is a key mechanism for addressing potential entry and controlling of invasive species in the tenement.

4.4.2 Fisheries, fresh water, and coastal biological diversity

The project is located in the hinter-land, hence the importance of freshwater biodiversity is more important than the marine biodiversity. However, fresh water biodiversity has little research attention in the country than its marine counterparts. According to the literature review for this EIS it has been noted that a 'baseline assessment of water quality and aquatic ecology downstream of Gold Ridge Mine by Simon Albert et al (2016) and was commissioned by the Solomon Island government has provided a comprehensive and relevant detail appropriate for this EIS and the management measure adapted here. The finding of the study has been used primarily for the baseline information and continues to set the indicators for measuring changes caused by the project and its intervention programmes.

Polhemus et al (2008) have recorded Gobioid fishes (Rhyacichthidae, Eleotridae, and Gobiidae as dominant species in most water system in the Solomon Islands. This has also been confirmed by two recently baseline study for Tina hydro project development and the assessment conducted by Simon

Albert 2016. Out of 36 species found on the studied river, 21 fish species are found on the Chovohio river. However, none of these species are said to be locally or regionally threatened. Additionally, two introduced were also recorded and two eel species- Anguilla mammorata and the Giant mottled eel. Accordingly, respondent during interview confirmed that villagers continues to havest eels and there is an increasing level of hardship to find these pretentious freshwater fish-most properly because of population increase. The fact that fresh water fish is also absent in local market could also suggested that fishing is mainly for domestic uses.

The study conducted by Albert Simion and other (2016), has also confirmed that there are 41 species of invertebrates. According to the village based interview, respondents claimed that fresh water prawn, fresh water shells are important source of food. Today, these edible animals are now becoming rarer as a result of over harvesting and those impacts caused by high water sedimentation. Unfortunately, there are no management plans or any similar instruments to ensure the continuity of food supply or the replenishment of their population. The study also noted that there are six species of dragonflies within the Metapona catchment.

Besides, the **professional services** provided by the Chohovio River other ecosystem services are also very important such as source for drinking and house hold uses and a structure that helps in creating social structure. In particular, for with respect to water supplies, the Tuarana villagers' main sources of drink water and house hold uses is the Chari river a tributary of the Chohovio river. The tenement is outside of the Chari river, and hence the operation is not likely to have impact on the river, as the operational site is downstream. However, it has also been learned that people living downstream of the river are also directly using the river for household use. Current status of visual turbid could implied that the river is no longer safe for household use and this is also true of the Chari river (see chapter of social economic character).

With respect to coastal and biodiversity, Solomon Islands is said to be very rich in marine fauna, owing to its diverse coastal environmental setting. This has been confirmed by a study conducted by TNC in 2004 that has revealed 485 coral species from 76 genera, found on 66 sites in the Solomon Islands. Coral reefs are classified into; narrow fringing, lagoon, patch reef and atolls.

With respect to fisheries, nineteen species of sea cucumber, four main species of crayfish, six giant clam species, and three species of pearl oyster, trochus, and green snails are found in the coastal water of the country. Solomon Islands is also home to an estimated 1019 coral reef fish species, several species of marine reptiles (including turtles, marine snakes and a single species of crocodile). Marine mammals stood at 9 species of dolphins, 8 species of whales and a single dugong species.

From a conservation point of view, marine species endemism is very low in the country, hence biological importance with respect to conserving of gene pool is minimal. As inferred endangered

species or fish of conservation significance is low in the entire country and hence given the insignificance of the localized ecosystem on the project site left the project proposal with minimum risk imposed on the coastal ecosystem. The same conclusion can be made for macro-invertebrates where their presence was very limited and lacking any fisheries importance and commercial value. Let alone other marine invertebrates that are driving well in disturbed environment of the outlet of Metapona. According to Simon. A, *et al* (2016), they have also sighted two species (*Aguilla leptocephalus* and the goby fry) at the Metapona river mouth.

4.4.3 Potential impact

With respect to marine, coastal habitat and fisheries, the preliminary assessment shows that there is no potential risk requiring special attention, except for pollution during the mining. This has been adequately addressed under the waste and pollution management section. Likewise impacts to fisheries is potentially minimal as the site has already impacted for the past ten years or so through the use of water pump for gold panning. However, with respect to water quality the proponent through its social and community responsibility component will provide villages with water supplies and improvement of sanitation. This will also require private-public participation and stakeholder engagements.

4.4.4 Protected Areas and Community Based Marine Managed Area

With respect to marine conservation status on the island, Guadalcanal island is one of the islands with little conservation or protected area interventions. Like many of the provinces active conservation practices is on the coastal area which include Marau which was set up by the FSPI. These protected areas are located miles away from the project site.

With respect to the terrestrial protected area, Botanical garden is viewed as the most active protected area and is currently managed by the MoFR. The Queen Elizabeth Park situated east of Honiara has long been abundant. Next to Queen Elizabeth is a proposed Park – the Mambulu Nature Park situated in a customary land adjacent to Queen Elizabeth. Besides protection, as a consequence of difficulty to access resources (particularly mountain forest) ecological representative designs of protected area is currently under plan under the MECDM- FAO project. The ridge to reef plan for the Solomon Islands provides a comprehensive ecology target to ensure forest representativeness on the islands. The project site fall outside these marked area. The current Terrestrial Protected Area in Guadalcanal is summarized in the table below.

TABLE 18: DESCRIPTION OF PROTECTED AREA ON GUADALCANAL ISLAND

Name	Established Date	Key ecosystem/ranges	IUCN Management Category	Current activities and comments
Komarindi	1994	Guadalcanal Water Shed 24 Tree species	Category V – managed landscape and seascape	This area lies adjacent to the Tina Catchments. It is still under some form of protection, and could be a viable options for restoration activities (discussions)
Honiara Botanical Garden	1965	-Grassland dominated by Imperata cylindrical.	?	Under MOFR management
Queen Elizabeth Park (Guadalcanal)	1954	Pometia pinnata and Vitex cofassus, paper mulberry and grassland	IV Habitat/species management area	This area could be developed as part of the Central Government commitments, particularly restoration. There are evidence of illegal squatters in the area
Mount Popomanaseu-Itina	New	Guadalcanal Water Shed	Ib Wilderness area	A historical site and a common property of all Guadalcanal and Solomon Islanders. It has 4 main entry points, through the Tina and Gold ridge Area, Kuma, Itina and Aola (discussions)
Tina Catchments	New	Guadalcanal Water Shed	IV Habitat/species management area	A 12 hector of proposed protected area close to the Tina hydro project and including further 13 hectors going up the Mt Popomanisiu and above the Ngalibiu River. Because of the current situation between the landowners and the government such objective will be a distant goal (see minutes). The USP has undertook biodiversity exhibition that should allow time for protected area initiative.
Mount Gallego	New	Guadalcanal Water Shed	IV Habitat/species management area	Mt Galego is located to the west of the project site and was recommended for protection to ensure forest representativeness on the island.
Tavaroha	New/informal	Guadalcanal Water Shed	IV Habitat/species management area	Administered under the Tarvana CBO as a marine protected area counterpart of Naro
Nabua and	New/Informal	Guadalcanal Water Shed	IV Habitat/species management area	An informal protected area site adjacent to the Popomaniseu –Itina catchments on the Weather Coast.
Pineaple Hill	NEW/Informal	Guadalcanal Water Shed	IV Habitat/species management area	An informal protected area as an offset to the Gold Ridge Mining development and is also observed as taboo area.
Tavisho land	NEW/Informal	Guadalcanal Water Shed	IV Habitat/species management area	An informal protected area site adjacent to the Tavaroha.
Lauvi lake	NEW/Informal		IV Habitat/species management area	The site lies along the same coastline with Nabua and provide a useful ecological representation of terrestrial protected area.

4.4.5 Potential impact on Protected Area

While conservation species could be affected during the operation particularly with respect to their mobility and home ranges the operation does not endangered or risk the current protected area effort that should serve as refugees for the species of concern. The role of biodiversity in insolating communities from disaster such as flooding is also recognized and hence the operation will be also mindful of all mitigating measures to reduce climate change impacts once the landform is altered during operation.

CHAPTER 5: SOCIAL-ECONOMIC ENVIRONMENT

5.1.0 EMPLOYMENT SECTORS

Solomon Islands' economy depends heavily on productive sector, most specifically the forestry sector, agriculture and fisheries. And it is in these sectors that most employment opportunities in the country have been provided followed with public sector organizations. This means high number of employment in the country is dependent on global market conditions, as their performances are quite often subject to the fluctuating global commodity prices.

The good news however is, even if most of the employment generating activities in the country is subject to international situation, more and more high labour intensive industries are establishing in the country. Such high labour demand services industries include, construction services, transportation services, communication and many other smaller services sectors that helps absorb the labour market in the country.

In 2015, the labour market showed an increase of 4%, this can be attributed to activities in the services sectors including public sector, wholesale and retail trade, transport and storage, construction, real estate as well as renting and manufacturing. Although there is high mobility of employment across all sectors including temporary employment mode by service providers, it is expected that any sustained growth to be experienced in 2016 and beyond can only come from the productive sectors, agriculture, forestry and **mineral developments** with support from services industries.

With respect to Guadalcanal, it has been estimated that 16.5 % of the population are living in urban area (Honiara catchment). It follows that the combination of urban development, tourism, logging and fishing appeared to create the province much more independence than other province. This has been bolstered by subsistence life and reliable local markets such as those in the urban centre. According to the Solomon Islands census report 2009, the the unemployment rate for Guadalcanal was 1.8, where unemployment rate for males is slightly higher (2.1%) while females (1.4%). The report continues to said that these unemployment is highest for the youth population aged 15-24 years.

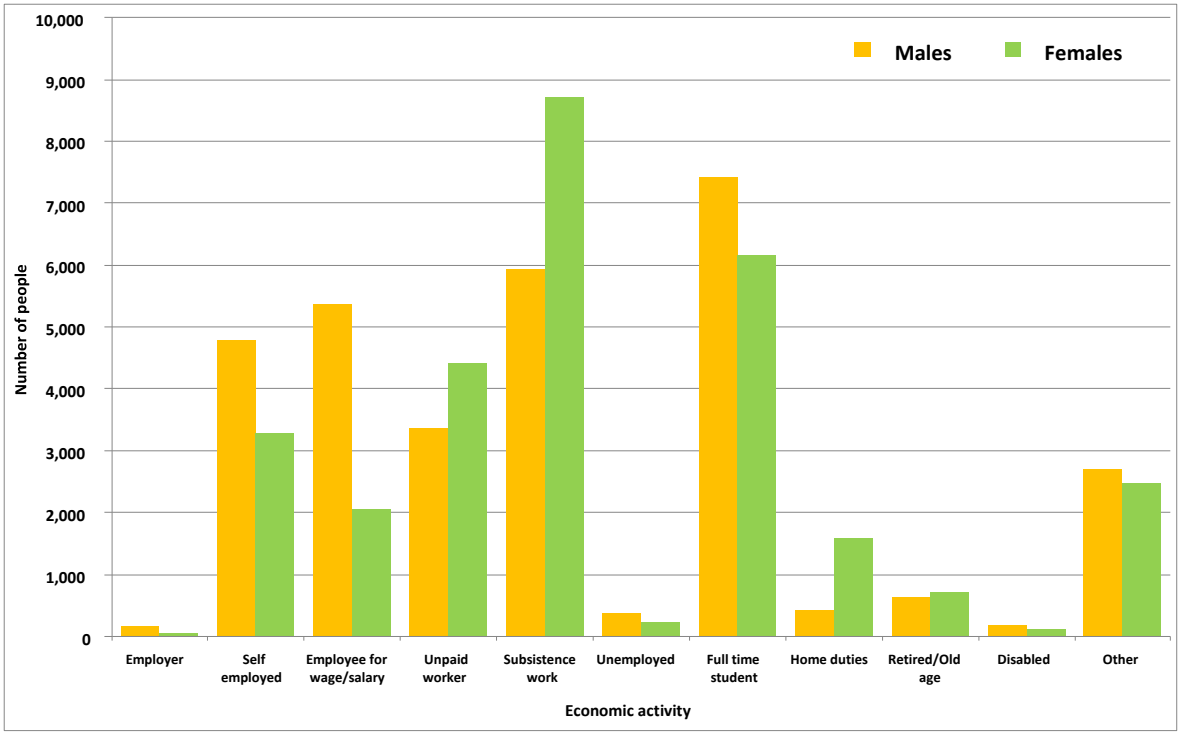


Figure 18: Population 12 years and older by sex and labor market activity, Guadalcanal: 2009

With respect to the project site vicinity, particularly in the Central Guadalcanal constituency, there are several large cooperative businesses been already established. These business are the main sources of employment for the people of Guadalcanal. The most popular is the Guadalcanal Plains Palm Oil Limited (GPPOL) which utilises large proportion of Guadalcanal plain for oil palm planation. The GPPOL is owned by NBPOL. The plantation has been a major source for employment for people in the area including the Solomon Islands since its establishment in 1973 by Solomon Islands Plantations Ltd (SIPL). SIPL at that time was owned by the Solomon Island government. SIPL has come to stand still in 2000, because of ethnic tensions until it was reopened again in 2005 under the new management of GPPOL as it took over the estate. The operation is operating under a joint venture arrangement between NBPOL (80%) and Guadalcanal Plains Resource Development Association (20%) (Landowner Association). This makes the business modal more unique and appropriate to landowners' institution of resources arrangement and ownership as landowners takes ownership and holds major share of the business. For the main operation, the GPOLL is currently operating approximately 7500 ha (inclusive of 10% smallholders). The oil mill runs a 45 t/hour where average yields have been increasing over the years to be estimated to reach approximately 25t.FFB/ha/year. It has also received RSPO certification in 2011 and ISO14001 certification in 2013. The smallholder or out grower is a growing business modal that greatly enhances household employment for the people around the area. The business arrangement also maximises the GPOLL contribution to the Guadalcanal provincial government.

Unfortunately, the respondents from the field visit, has denied (or only a few) from the Tuarana villagers been employed by GIPPOL. Neither, there is oil palm out grower plantation in the village. For this mining operation, there remains opportunity to collaborate with GIPOLL and to introduce out grower as part of its rehabilitation programme for the post mining.

Just above the village was the disbanded Gold Ridge mine, which was developed in 1997 by Ross Mining and was closed down in 2000 prior to the civil unrest. It has reopened again by Allied Gold in 2011 before it closed again in 2014 due high operating costs and local tensions and severe weather. This operation has been one of the key employer for the Taurana villagers, particularly males. Progress towards efforts for the reopening of the mine has reached a status where the Gold Ridge Investment bought all the legal liability from St Babara (the holder of the mining lease). Both the local business entity and the Solomon Islands endeared relevant agreement with AXF group-An Australian-based chines firm. The reopening of the mine will also show many of the people living with in the tenement to be employed by the Gold ridge mine operation. Interestingly, the Gold Ridge Investment holds 30 % of the share hence a potential modal for future mining business arrangement-where land owner becomes a key player in the operation.

It has been also confirmed that several logging operations, are currently operating above the Tuarana village. Although these logging operation are contributing to employment to the central Guadalcanal population, none of the Tuarana village is said to be employed. Artisanal gold panning within the streambed is the main source of self-employment and major source of income.

It has been learned that at least more than 7 people from the villages are directly employed by the government in the sector of teaching, nursing, carpenter and plumber. There is a well-trained people in the villages that have relevant skills in mechanic, heavy plant and others that can be utilised in the proposed development.

5.1.1 Impact on Employment

The contribution of this proposed mining project toward employment in the Central Guadalcanal Region catchment is viewed as a very beneficial that will continue to contribute to the reducing of unemployment in the rural area within the vicinity of the project. As noted under the employment subsection (chapter 3), 43 Solomon Islanders are expected to be directly employed in the operation once mining start. While the Win Win Investment Solomon Islands Ltd, has its employment protocols to improve efficiency and effectiveness to maximises production, there is a potential privileges given to the land owners with relevant skills and those who are willing to learn in the new mining environment.

5.2 INFORMAL ECONOMY

The majority of the Solomon islanders are self-employed; either they are engaged in subsistence agriculture or harvesting of wildlife for consumption with surplus used for exchanged for cash to meet basic need for household uses, school fees, and others. A few people have dedicated their time in trading such as operating trade shops, cooking, betel nut selling and so forth. Income from these sells became the main sources of food for the family. Others who are fortunate found themselves on full time jobs in the government, NGOs and or private sectors.

With respect to Guadalcanal province, including the ward 19 people, they mainly participate in income generating activities through sale of small scale agriculture products like sale of cassava, potatoes, ripe bananas and etc. Some depend on marine and fisheries resources as well as fresh water fish that are used exclusively for domestic consumption. The GIPOLL is a key trading area for these people.

Nonetheless, in general, the most important stable foods, in order of importance, are purchased rice, cassava, sweet potato, yams, pana and taro. Traditionally, taro (*Colocasia esculenta*) was the main staple, but it was replaced by sweet potato following a prolonged decline in taro yields caused by pest and disease problems.

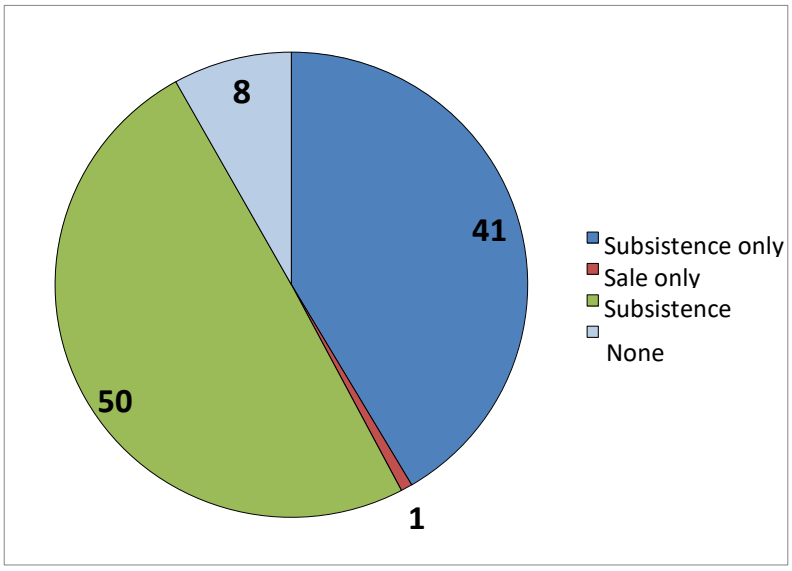


FIGURE 19 HH BY USE OF GROWN CROPS (%), AFTER SI CENSUS FOR GUADALACANAL, 2009

As noted, selling of produce is also a significant part of the rural economy, and these products are usually exchanged in the village or in the urban centres. It was noted in the Small holder agriculture study 2006, the most common items for sale at markets are seasonal root crops, vegetables and fruits, plus betel nut, marine products and fish all year round. With respect to commercial crops such as copra and cocoa, they are also produced in large quantity, but there are no such plantations in these areas. Livestock also forms an important component of rural livelihoods in Guadalcanal Province like every other province.

5.2.1 Impacts on Rural Economy

Nevertheless, according to the field visit, respondents from Tuarana mostly engaged in gold panning as they main sources of income. In general, the same house hold character typical in Guadalcanal is

also found in Tuarana. Most of the livestock particularly piggery is free range and this in itself already brings some health hazard issues.

As noted in chapter three, the Win Win Solomon Islands Investment Ltd will support small community based farming through supplies of equipment's to enhance production and produces sold to employees for the mine. In this way, village rural livelihood practices including subsistence farming is in cooperated into the business modal. In additional, those who are artisanal gold panning are given appropriate spaces for employment in the mining operation.

FIGURE 20: PIGS FOUND FREE RANGE IN TUARANA VILLAGE

For livestock, because of the location of the project and the size on which the area this mining will be carried out, this proposal will not have any risk to livestock and any livelihood activity in the area to local people especially in any livestock rearing they may have around the proposed mining site.

5.3 INFRASTRUCTURE FACILITIES: TELECOMMUNICATION, ENERGY, WATER AND SANITATION AND TRANSPORTATION.

5.3.1 Telecommunication and Energy

Infrastructure development in the outskirts of Honiara is quiet advanced and rapidly growing to cater for a fast growing population. The telecommunication sector maintained its growth momentum in 2015 reflecting continued improved operations and customer service delivery by the two telecommunication operators in the country, Solomon Telekom Limited and Bemobile/Vodafone. Not only are they improving communication in peri-urban centres but throughout the country in rural areas as well. Hence, the proposed mined site has a good coverage for both Bemobile/Vodafone and Telekom. Villages close to the project are said to enjoying some of these modern technology. However, coverage remains remorse as only few spots are able to receive telecommunication coverages.

In Energy, under the Electricity act, only the Solomon Power is mandated to provide reliable electricity to Honiara and all of the country. Thus Solomon Power has been working hard to fulfil this requirement

in Honiara and all the provinces. Provision of power to rural Solomon Islands is still a challenge as it is perceived as uneconomical for Solomon Power to run power grid to remote places in rural areas.

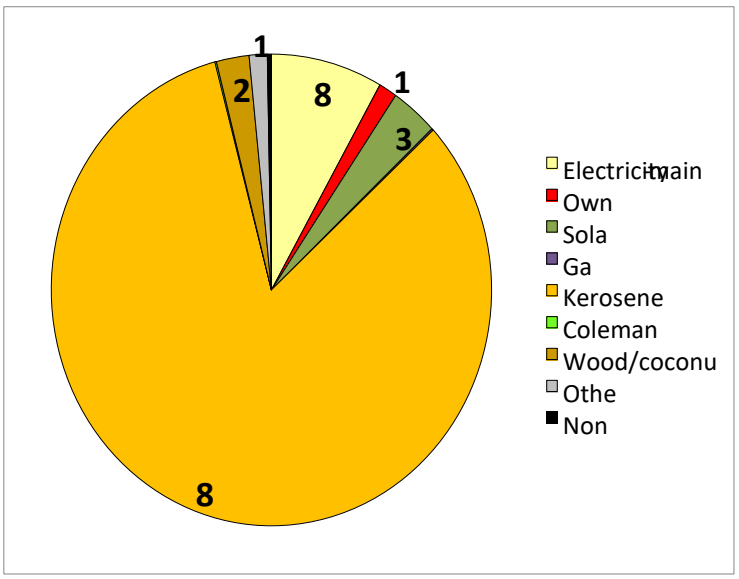


FIGURE 21: HH BY SOURCES OF LIGHT (%), AFTER SI CENSUS FOR GUADALCANAL, 2009.

Solomon power has two main diesel powered generation in Honiara, one in Lungga and the other at Point cruz. These two stations maintain power capacity of over 20MW, enough to meet the peak load in the city which is about 14MW in any normal business days.

As have been noted, all power generation operated by Solomon Power including provinces are 100 per cent diesel-based[2] and about 80 per cent of the Solomon Islands Electricity Authority's operational costs are spent on diesel fuel.

With respect to **electricity in Tuarana**, the majority are using solar system. Most are donated from their Honourable Member of Parliament for Central Constituency.

5.3.2 Impact on Telecommunication and energy

The Win Win Solomon Islands Investment Ltd, is proposing to use diesel based generators, and therefore does not provide alternative to the diesel based pollutants. There is no anticipation for the light to supply household in the villages as this will likely to incur uncontrolled use of energy. However, money earned by communities as direct or indirect result from mining operation could provide opportunity for purchasing of private solar system and generators. With respect to telecommunication, the project has no potential impact (both positive and negative) although people can purchase their own handset as the result of money earned generated from the company.

5.4 Water and sanitation

Most people of Guadalcanal are using water pipe and river and streams as their sources of drinking water. A handful of people are also using rain water tank for their sources for drinking. A significant number of people in the peri-urban Honiara are also accessing water and according to the SI-census the proportion of population using SIWA accounted for 6 %. For the Tuarana village the main sources

[2] World Bank. (2006). Project Information Document Concept Stage: Solomon Islands Sustainable Energy Project.

of drink water and house hold uses is the Chari river a tributary of the Chohovio river. This means river and streams are prominent in the Tuarana village and nearby villages. As noted, earlier, Chari is the main sources for drink and other household uses and the tenement is outside the river, and hence the operation is not likely to have impact on the river, as the operational site is downstream. However, it has also been learned that people living downstream of the river are also directly using the river for household use. Current status of visual turbidity could have implied that the river is no longer safe for household use and this is also true of the Chari river.

Besides the drinking and household uses of the Chohovio river, the flood patterns of the Chohovio river is also a source of soil fertility supporting substance agriculture. As noted in the field visit, most of the people's gardens are mainly used for subsistent uses. Indeed, these ecosystem service has have helped the village and hamlets distribution along the Chovohio and including Chari river. Been living close to these rivers over generation, makes the people well aware of incoming behaviour of disasters such as flooding-including those adaptation means during disaster.

River has played key roles in unifying of the diverging dichotomy of customary land and its associated right. In fact, rivers are said to be common property for all tribal land that were cognitively demarcated for each clan. Hence they form a strong unifying forces for the four clans that are residing in the tenement. This include Karavu, Manukiki, Kwainahao and Lasi (see annex 3).

River can also use as the medium of transportation, although it is quite rare for people to use rivers as means of transportation nowadays.

As a significant number of people are using river and streams as sources of drinking it could take less than an hour to reach the water sources. It follows that there is no duty segregation for those who involved in fetching water. Men, women and children assist each other in the family duty to collect water. Water shortages are not common problem except for flooding where drinking sources become contaminated with high precipitation.

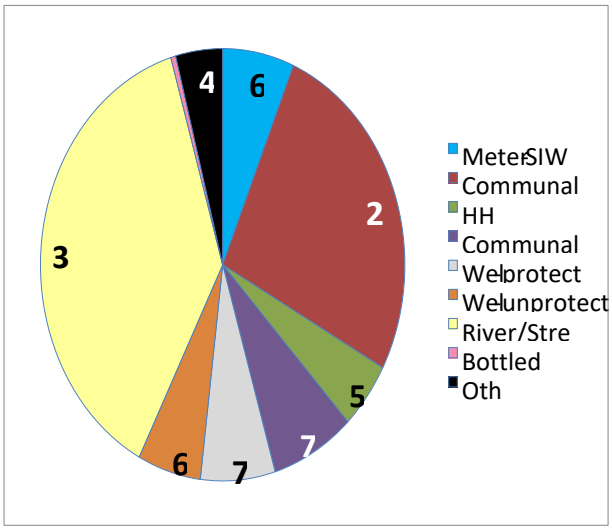


FIGURE 22: HH BY SOURCES OF DRINKING WATER (%), AFTER SI CENSUS FOR GUADALCANAL, 2009.

These alternative sources include water storage tanks, rivers and streams, communal standpipes, unprotected wells, and communal tanks.

Climate change impacts does have an effect on people's access to water, especially when the Tuarana people are sourcing drinking water from river. Because in the event of drought or

extended dry periods, water levels would recede while in longer rain periods water would be more prone to contamination due to increase water run-off.

On **Sanitation**, the 2009 National Census report revealed 31 per cent of households in Guadalcanal has no proper toilet facilities (practicing open defecation) while the other 69 per cent uses either shared flush toilets, such as private/ shared water sealed toilets, and private/ shared pit latrines. Discharge of filled septic and soak pit tanks from households are quite problematic in the rural area, although the small number of households make these as having little issues. According to the interview conducted for this EIS, respondents have noted that most if not all the people of Tuarana are practicing open defecation- particularly using bush. Rubbish disposal is also a problem where empty cans and plastic are found lying all over the place-a typical village problem. Respondents, from the interview also has noted the rivers undergoing pollution from excess nutrients from human and animal waste, sentiment loads from land activities etc. Some also indicated that people also use poisonous chemicals to catch prawn that add to river pollution. There are sporadic community by laws to complement governments' regulation in governing and managing water resources.

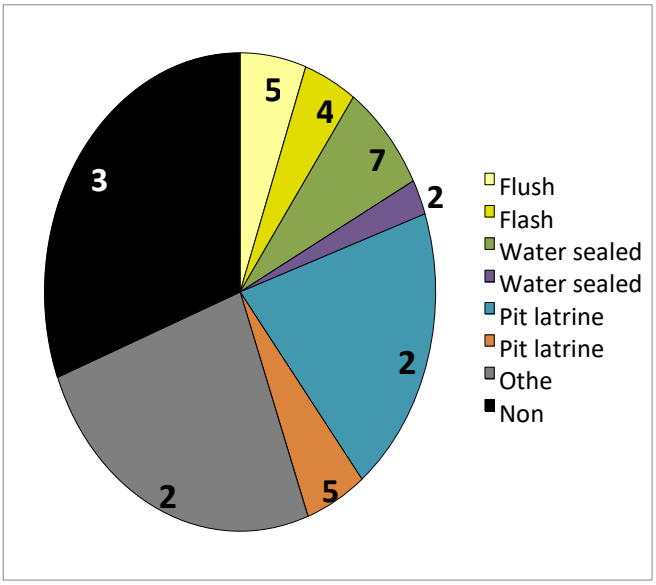


FIGURE 23: PERCENTAGE OF POPULATION BY TOILET FACILITY TYPES, AFTER SI CENSUS FOR GUADALCANAL, 2009.

The Win Win Solomon Islands Ltd camp and accommodation adopts a septic tank system and hence controlled human waste, coming out from employees.

5.4.1 Impacts under water and sanitation

The loose soil within the tenement often allows high riverbank **erosion** and hence puts the village at a high vulnerability. As discussed in chapter 2, under the rehabilitation plan, and as further elaborated in the management plan, the operation is likely to positively impacted on the village structural layout by first laying out boulders – and revegetating the river edges hence reducing the level of village vulnerability to disaster. The digging and removing of ores will deepen the channel for the flowing river hence reducing erosion river edge erosion. Under the social economic support, the company is also likely to introduce water pipe for the villages and hence improving living standard.

On waste management, relevant measures are in place for managing waste as provided in the management plans. For the village in general, there is a possibility to work along stakeholders to improve waste management in the village.

On land governance- the project will reinforces the social structure that based on the unifying nature of river as common property and hence the land board of management (trustees) forms the key mechanism for addressing any disputed arising from the operation and adopted as the mechanism for addressing grievances (see section on land).

5.5 Transportation

The kukum highway is branched through the Gold Ridge feeder road leading via spurs to the Tuarana village where the mining site is located. The existing physical infrastructure (Gold Ridge road) is about 1KM from the project site and links very conveniently with the area. As provided in the road section under the construction component the developer will be upgrading the access road to the village and mine **site.** arrives and they have completed their induction and/or training.

These spurs have already established, hence there upgrading will allow the community to travel to and from Honiara comfortably. These access roads will then also help villagers to access the mine site

FIGURE 24: MAP SHOWING ACCESS ROAD TO BE UPGRADED

to sell their local produce and the main Honiara Market. Currently, villagers use passenger pick-up track to travel to Honiara with a fare of $50.00 one way. The same pick-up-track is also used to carry village produces to the Honiara market and returning of cargos to the village stores. There is a possibility to collaborate with the Guadalcanal province to adopt the feeder road into their systems for future maintenances.

5.5.1 Impacts under transportation

Besides, those operational impacts that have already discussed under the construction and operational components, it has been also anticipated that the operation will improve public transportation. As road improves, the public transportation is also likely to improve hence improving village quality of life. These will also enable villagers to explore other potential economic trades such as transportation, ecotourism and others. Relevant negative impacts are discussed under each subsection.

5. 6 Tourism and trade shops

Tourism development is picking up in the country and often alluded as a potential industry for generating revenue for the country as natural resources such as logging is phasing out. In general, tourism sector development in Solomon Island is slow compared to other key sectors that are driving the country's economy. However, the industry has great potential if properly managed and developed. There have been reports of increasing number of visitors into the country and can be attributed to the combined strong marketing effort by the Solomon Islands Visitors Bureau (SIVB), and other private establishments.

Honiara as the main gateway to other tourist destinations of the country is hosting several hotels in the city centre. This includes the IBS hotel, Coral Seas resort and Greens hotel, Heritage Pack Hotel, Mendana Hotel, Honiara Hotel, Pacific Casino Hotel and many other model houses run by indigenous Solomon Islands business people.

According to the village based interview, none of the villagers of Tuarana is operating homestay as typical of many villages in Guadalcanal. For this mining operation foreign and local employees of the company will enable people to migrate into the area. These will bring with them new skills and cash flow into the area. There is also potential for the villagers to operate home stay as public infrastructure improves by the company. The restoration programme could also potentially allow for improving biodiversity hence the operating of home stay.

In respect to village store most households are operating small canteen, with seven main one. As operation starts cash flow is likely to improve hence improving village store. In this case accumulative household waste is also likely to occur.

5. 6.1 Impacts under Tourism and trade shops

As such, it may not have any effect to potential tourism related activities such as swimming and surfing in the area. It has been told that there are several home stay within the close vicinity of GIPOLL.

5.7 Public health

The nearest health facility to the tenement area is the Tuarana clinic. The clinic is said to be staffed by two registered nurses. majority few people, however, favours travelling to hospital or health clinics in Honiara as the health clinic to be treated. The clinic is serving most people within and close to the tenements as they could only travel

less than an hour to reach the HF. It is assumable that people in the inner ridges are also using the HF and would take them to travel more hours to reach the HF. Malaria Ari and skin diseases are common problem in the village. It follows that the perceived cause of these common health problem (Malaria) are rubbish particularly water holding materials that allowed for breeding of mosquitoes, unhygienic practices and etc.

With respect to health governances, the respondents have confirmed that a health project was commission by the ministry of health but failed to complete. According to the Rural Development Programme, it has commissioned a water supply project for Tuarana with the objective of raising the living standard of Tuarana community through a rehabilitation of a water supply to access a clean and reliable water supply. However, as noted in the field visit the majority of the villagers are still using river as mentioned earlier (see section under water).

5.7.1 Impacts under Health sector

The Win Win Solomon Islands Investment Ltd is supporting the Tuarana Health facility with two patience bed for improving health services. The provision for quality nursing is vital for the company's employees and the surrounding villages. The maintenances of feeder roads that leads to Honiara is also important as those critically ill or undergoing accident can quickly rush to the Number Nine Hospital for emergency attendances. However, as experienced in other large-medium scale industrial operation, issues with sexual transmitted diseases, is also a common occurrences, hence relevant awareness is anticipated to gap some of the possible health risk.

5.8 Education

The student of Tuarana village is served by Tuarana Community High School which is located near the health facility and on the ridge of the targeted alluvial deposit area. Like the Health facility the Tuarana CHS is located within an easy accessibility to children which only take them less than an hour walking distance.

According to the Solomon Islands census 2009, the enrolment rates in Guadalcanal were lower than in most other provinces. It continued to said that school enrolment rates vary significantly by age; a relatively large proportion of the 5, 6 and 7 years olds were not able to attend school, and

enrolment rates drop quickly after the age of 13. This could also characterises the educational behaviour of children living in Tuarana and nearby villages. The reason for poor enrolment has not been deduced, but it could be because of poor class rooms and facilities as it is typical in most remote area. There is also a potential for young people to engage in economic activities as mining generate an increasing level of cash flow in the village.

5.8.1 Impacts under Education sector

The Win Win Solomon Islands Investment Ltd is supporting the Tuarana CHS with 80 chair and desk and could potentially increase once operation start. The provision for quality education is vital for the company's employees' children and the surrounding villages. The maintenances of feeder roads that leads to Honiara is also important as teachers and students can comfortably access resources from Honiara. The company will also work with its employees and the people to ensure students are attending schools. The company also discourage under age employment as this may cause student to leave school and seek early employment instead.

5.9 LAND USE PATTERN

In Guadalcanal there exist six agricultural opportunity areas (AOA) which, covers a total area of 746 km^2. Most of these area is located on the northern side of the island, known as the Guadalcanal plains covering 337 km^2 (45% of the AOA) Land Resources Study (1974). The project is sitting on the upper edge of the Guadalcanal plan, hence are not been disturbed by the Oil Palm plantation.

The Gold Ridge Mining development that are now under progress for its re-opening is lying above the project site.

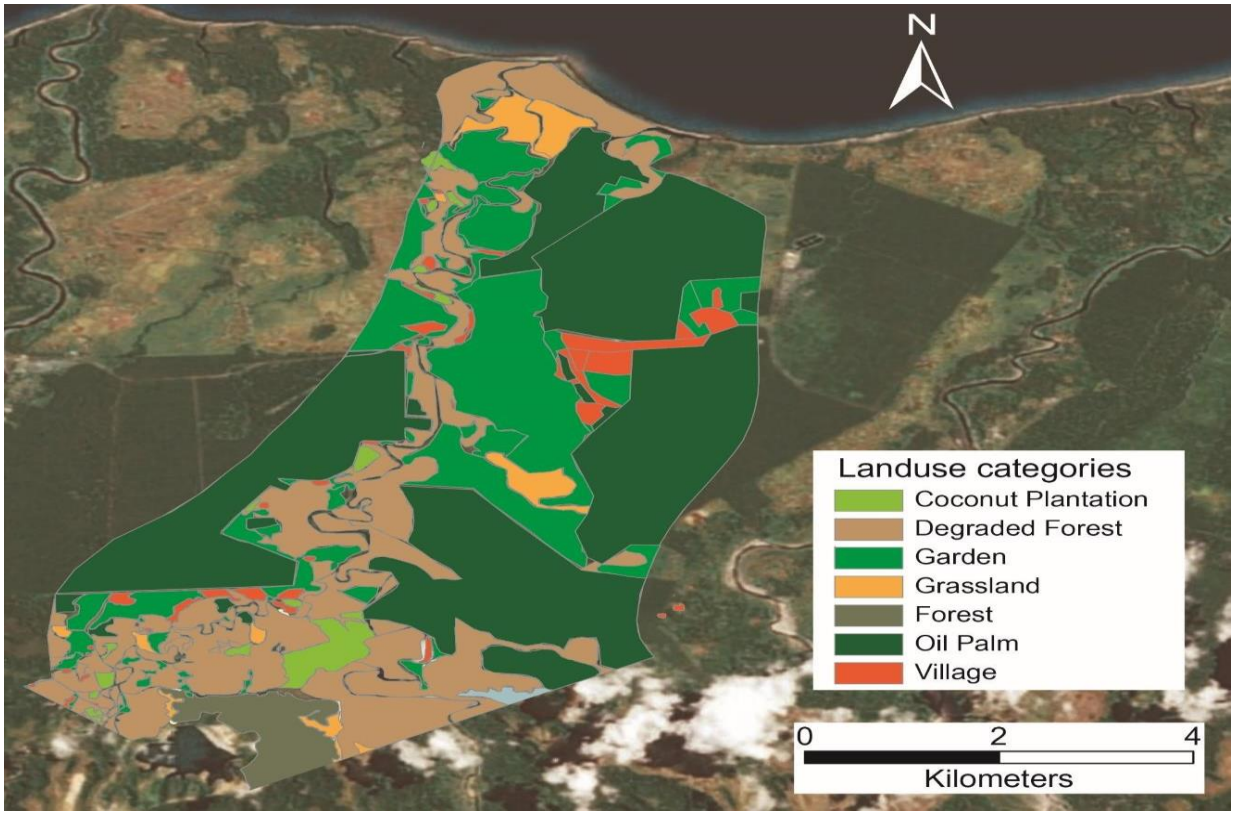


FIGURE 25: LAND USE PATTERN, AFTER SIMON. A, ET AL, 2016: PP 47.

Most of the low land Forests on Guadalcanal were removed by logging (AUSAID 2006) and several valid licence permitted logging operation within the area. As has mentioned earlier under the employment section, there are two logging concession above the tenement that are under operation. However, despite of these industrial operation, the rugged landscapes unsuitable for human habitation and undesirable for logging, has often insulated the interior landscapes untouched and largely remains intact (AUSAID 2006). And this also forms a significant land pattern of Guadalcanal Island. Large part of the southern coast has not experienced the same pressures as the populated northern portion of the island, and some of these forested and rugged landscapes spanning from mountain top to coast remain relatively pristine.

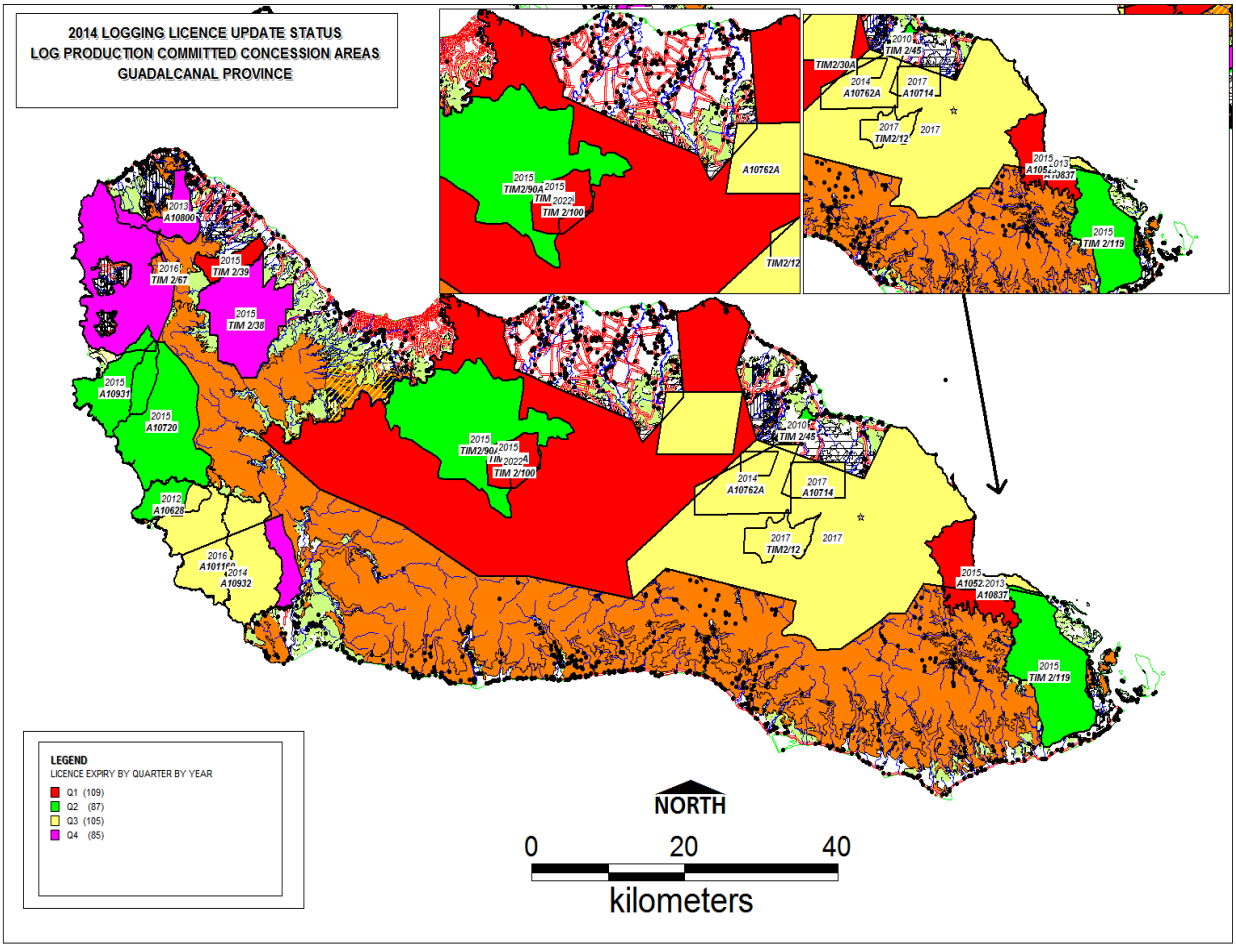


FIGURE 26: CURRENT LOGGING LICENCES, AFTER MINISTRY OF FORESTRY AND RESEARCH.

The land use pattern is also defined by village settlements and its associated subsistence agriculture development. Commercial crops such as cocoa, coconut plantations and the outgrowing palm oil of GIPOL also formed a significant part of the landscape. Village settlement and sweeten subsistence agricultural development also underpins the main land use practices of the ward. Besides soil fertility and land form, village settlements are also constrained by customary land ownership. Most villages and hamlets are in average size of one hectare to five hectares or more. Tuarana village that is located inland are much more uniform and smaller in sizes than coastal settlements. It has been estimated that the garden size for each household is 0.01 hectare and could be rotated two times each year. Given the increasing number of population size the accumulated area for gardening and villages is quite significant to the landscape.

Honiara city is also regarded as one of the major land uses on Guadalcanal. It occupies a large part of the northwest coastal side of the island. Most land on the island is non-registered customary land (83%), 14% is registered alienated land owned by the Government (under Perpetual Estate), some of which is leased to individuals, and the remaining 2% is freehold land. As noted Honiara city forms the

main land use pattern of Central Guadalcanal Constituency which subsequently underpins its social and economic characters.

5.9.1 Impact under land use

The proposed mine will take 11 km,^{2} and considering that it would only excavate along river and pockets makes the disturbed area to be less (at least a quarter of the tenement). This area covers 4 % of the Northern Guadalcanal's plain and the disturbed area should only estimate as 1 % of the plain. This makes the negative impact of the mining insignificant to those areas occupied by oil palm planation, village and hamlet and the associated agricultural uses. Its impact in terms of size is also insignificant in comparison to the Gold ridge mine or the Honiara City development. The significant negative impacts have been evaluated and addressed accordingly under the stage wise management plans and other supporting management plan as provided under the Environment Management and monitoring component.

5.10 SOCIAL AND CULTURAL ENVIRONMENT

5.10.1 Population

Guadalcanal is the second most populated province in Solomon Islands after Malaita (i.e. when Honiara population is included or excluded). Guadalcanal constituted of 22 wards and the 2009 Census recorded a total population of the province at 93613 where female counts were 45330 and male counts were 48283. The population density of Guadalcanal (11 persons/km2) is relatively lower than the country average which stand at a record of 13 persons/km^2. High concentration is on the northern coast, along the Guadalcanal Plains, which is where the three major economic and residential areas are located. With respect to the project site, Vulolo ward has population estimates of 4429 with a population growth rate of 4.9 %. The estimated male and female population and total number of household is provided in table 18.

TABLE 19: VILLAGE POPULATION CHARACTER OF WARD 19 (VULOLO), AFTER SI CENSUS, 2009.

Village Names	Total HH	Males	Females	Total Population
BUVI	7	18	18	36
BUBULAKE	18	44	38	82
NANALA	3	12	8	20
VALENGALI	34	97	93	190
NEW SAVO	48	116	101	217
VALEBEABEA	51	133	97	230
TAUSORO	40	105	93	198
CHUCHUPUNA	20	40	44	84
MAMASA 1	42	91	88	179
MAMASA 2	34	71	77	148
PURAKACHELE	3	5	8	13

VERAKAUKIKI	16	29	30	59
BAEHO	16	39	43	82
PAUPAU	40	99	98	197
VERAVAOLU	1	0	2	2
KATOVA	53	132	144	276
KAO	65	184	153	337
KOLEASI	17	45	42	87
OBOBO	29	83	75	158
TOTUA	22	79	76	155
NEW MADAKACHO	139	365	319	684
CHARIHAIVATI	3	9	5	14
CHARIKOKOILO	175	433	426	859
SALAVE	27	53	46	99

To consolidate the above data, a reliable source from RDP has able to enumerated the population at Tuarana at 425 people. The enumerated population by age and sex is provided in the table 19.

Age Group	Male	Female	Total
0 - 14 years	60	70	130
15 - 24 years	50	70	120
25 - 59 years	70	80	150
60+ years	10	15	25
Total	190	235	425

TABLE 20: POPULATION CHARACTER OF TUARANA, FOLLOWING RDP, 2013

With respect to language, there are eighteen different, but related, dialects spoken on Guadalcanal. The dialects are of the one prototype of Guadalcanal language and it is relatively easy for people from one language group to understand and talk to people from other groups using their own dialect. For the Tuarana people and ward 19, the language use is the Tehe/Teha dialect.

5.10.2 Community and social order

The mobilization and settlements of people in Tuarana and nearby villages were underpinned by several factors. Firstly, current generation are the progenies of successive generation, who have come to settle here from distant villages. The first settlers have also allowed people to move here following earth quakes destroying their villages. Others have also move in because they married to individuals who of the villages. For whatever, reasons for moving to the village, it is customary that the event of Chupu is a prerequisite for incoming settler. As noted earlier, the original clans identified themselves as four-Karavu, Manukiki, Kwainahao and Lasi. The cohesiveness of the village is also shaped by Christianity. As also mentioned earlier water resources played key role in village settlements and is viewed as a common property where all clans claimed ownership.

With respect to community order, the social resiliency of the Tuarana is often disturbed by drunken youths and particularly the use of illegal locally brewed beer (kwaso) and the use of Marujuana. Like

any village in the country, village order is maintained by two important informal phenomena. First, social order is reinforced by cognitive rules (customs) where all are aware of these rules. Any infringer will have provoked shame to the individual or the tribe. Secondly, the role of church and villagers chief ensures order by resolving disputes although the role of chief in resolving dispute has also declining. There are at least four religious sects in the village, and that is SSEC, Catholic, SDA and the indigenous Moro movement. The formal system – policing services is still improving and Tetere police station are within few hours' drive.

With respect to resources sharing, it has also been noted in the survey that, often revenue generated from common resources are not often shared equally and this could remain prevailing in the proposed mining.

5.10.3 Land ownership and archaeological sites

At the provincial level, nearly 90% of Guadalcanal people live on customary clan (sometimes referred to as a line) land. Traditionally, Guadalcanal societies are matrilineal where land and property are inherited from the mother and the mother's family. It is a traditional practice that a male marrying into a line or clan will have rights to use the maternal clan land, and while a male member of a clan marrying a woman from another clan has the right to bring his wife to live on his clan's land, the wife and children will not have land owning rights on the clan land. As already noted above, the original clans identified themselves as four-Karavu, Manukiki, Kwainahao and Lasi. The cohesiveness of the village is also shaped by Christianity. As also mentioned earlier water resources played key role in village settlements and is viewed as a common property where all clans claimed ownership.

Respondents have also noted that community are usually good followers and hence proposals by influential individuals, are not often been challenged. And for this mining operation the intention is to provide conducive environment for its progress and as already noted, the river and the alluvial ores inside are common property that belongs to the four clans. It has been already identified the site of interest does not host archaeological values except for artisanal gold panning and the flowing water. Burial sites have been clearly marked and it also lies outside the tenement (see figure 8).

5.10.5 Impact under SOCIAL AND CULTURAL ENVIRONMENT

The proposed mine will increase the number of population, as new migrant (employees) joints the village population. These can bring in social changes, as people from different cultural background are brought to the village. The possible undermining of current social dynamic can often lead to cultural classes that could escalated into fighting. Likewise, issues with unwanted pregnancy and the spread of sexual transmitted diseases is often attached to development of this scale. Moreover, the increasing level of alcohol consumption is also prevalent in large project in the country that able to bring in village cash flow.

The disparity of royalty distribution or the lack of proper accountant dissemination can also lead to misunderstanding and possible disturbances to the operation. Nevertheless, these possible negative impacts have been taken into account and relevant mechanism are in place to resolve social disturbances-when they arise.

Chapter 6: Environmental Impacts and Mitigation Measures

6.0: Introduction

As noted in subsection 3.2.0 on project description, the report has dissected the operation into six components, encompassing; (1) Administrative component (2) Construction component (3) Operation component (4) Rehabilitation and post mining component and (5) Environment Management and monitoring component and (6) Corporate and social responsibility component.

This will allow for easy monitoring and environment auditing for both the company and the responsible statutory authority. As already implied in the above chapter particularly on those potential impacts, the negative spatial and temporal impacts are quite insignificant except for the positive impacts on the social-economic dimension. This was also a similar conclusion drawn by past EIS for similar project by Moses Biliki.

*"The potential adverse impact of the alluvial mining have been assessed under this assessment and are expected to be mostly insignificant given the current condition of the various facets of the existing environment. Most potential negative impact are considered to be mostly localised, temporary and therefore insignificant. The river is already degraded by the mud and silt that has altered its colourisation completely brown and turbid all the time. The cause of this is the intense panning and prospecting activity in the upper Chovohio in the Gold Ridge area. Tailings water that will be released back into the river system is not expected to elevate the levels of the turbidity compared to what is happening now" (*Moses Biliki, page 36).

Although the above conclusion is relevant to this EIS, this EIS goes on more further than a mere qualitative description. It also provides the relevant quantity data as a baseline for future monitoring and the parameters that could be used to measure potential impacts by magnitude once operation begins. This will leave no space for assumption of potential impacts that are only derived from emotions. This chapter is therefore, focuses mainly on the construction and operation component as descripted in chapter 3. It follows that because of the non-significance of the negative impacts during construction phase due to small uses of space and time (during the construction phase), the construction phase and the operational phase are evaluated together. The significant impacts of the mining as it interacted with the immediate surroundings has then been identified, assessed and scaled their magnitude against - minor or major negative impacts or minor or major positive impacts (see table 20). The identified significant impacts (Negative or Positive) have brought forward for closer attention, with mitigation measures and management plans in place to abate negative impacts. Climate change disaster can exacerbate these impact, hence management plan is also provided.

TABLE 21: MATRIX OF INTERACTIONS BETWEEN PROJECT ACTIVITIES AND ENVIRONMENT

Project Activities	Land clearance for infrastructure setups	Accommodation & Communal area	Materials for Accommodation and Communal area	Access Road/Hauling	Machinery	Electric Supply and utilities	Fresh Water System	Land clearing and removal of overburden	Stock Piling	Backfilling	Mining/excavation of ore	Processing plant	Tailings/waste water	Storm water drainages	Hazardous waste storage	Solid waste	Rehabilitation
Construction phase																	
Environmental Parameters																	
A. General																	
i. General climate	--	--	--	--	--	--	NA	--	--	--	--	--		--	--	--	NA
ii Landform and topography	--	--	--	--	--	--	++	--	--	--	--	---		--	--	--	++
B. Biological environment																	
Flora																	
Terrestrial habitats	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Forest/vegetation	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Rare/threatened plants	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Fauna																	
Mammals	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Amphibians	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Reptiles	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Birds	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Rare/threatened fauna	--	--	--	--	--	--	++	--	--	--	--	--		--	---	--	++
Aquatic																	
Stream habitats	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Swamp habitats	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Coastal wetlands	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Fish	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Aquatic flora	--	--	--	--	--	---	++	---	---	---	---	---		---	---	---	++
Threatened aquatic wildlife	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Physical environment																	
Water																	

Water yield	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Stream flow	--	--	--	--	--	--	++	--	--	--	--	--		---	--	--	++
Sediment load (suspended)	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Water quality	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Ground water	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Land																	
Slope stability	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Sediment runoffs	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Soil nutrients	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Social/economic																	
Employment	++	++	++	++	++	++	++	++	++	++	++	++		++	--	--	++
Income	++	++	++	++	++	++	++	++	++	++	++	++		++	--	--	++
Tourism & recreation	++	++	++	++	++	++	++	NA	NA	++	++	++		++	--	--	++
Rural economy and subsistence life	++	++	++	++	++	++	++	++	++	++	++	++		++	--	--	++
National economy	++	++	++	++	++	++	++	++	++	++	++	++		++	--	--	++
Archaeology/historical sites	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Land ownership	--	--	--	--	--	--	++	--	--	--	--	--		--	--	--	++
Protected areas	NA	NA	NA	NA	NA	NA	++	NA	NA	NA	NA	NA		NA	NA	NA	++
Operational Phase																	
Environmental Parameters																	
A. General																	
i. General climate	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	++
ii Landform and topography	--	--	--	--	--	--	--	---	---	---	---	---		---	---	--	++
B. Biological environment																	
Flora																	
Terrestrial habitats	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Forest/vegetation	--	--	--	--	--	--	--	--	--	--	--	--		--	---	--	+++ _
Rare/threatened plants	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Fauna																	
Mammals	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Amphibians	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Reptiles	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Birds	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Rare/threatened fauna	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++

Aquatic																	
Stream habitats	--	--	--	--	--	---	---	---	---	---	---	---		---	---	---	+++
Swamp habitats	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Coastal wetlands	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	+++
Fish	--	--	--	--	--	---	---	---	---	---	---	--		--	---	---	+++
Aquatic flora	--	--	--	--	--	---	---	---	---	---	---	---		---	---	---	+++
Threatened aquatic wildlife	--	--	--	--	--	---	---	---	---	---	---	---		---	---	---	+++
Physical environment																	
Water																	
Water yield	--	--	--	--	--	---	---	---	---	---	---	--		---	---	---	+++
Stream flow	--	--	--	--	--	---	--	---	---	--	--	---		---	--	---	+++
Sediment load (suspended)	--	--	--	--	--	---	--	---	---	---	---	---		---	--	--	+++
Water quality	--	--	--	--	--	---	--	---	---	---	---	---		---	--	--	+++
Ground water	--	--	--	--	--	---	--	--	---	---	---	--		---	--	--	+++
Land																	
Slope stability	--	--	--	--	--	---	---	---	---	---	---	---		---	--	--	+++
Sediment runoffs	--	--	--	--	--	---	---	---	---	---	---	---		---	--	--	+++
Soil nutrients	--	--	--	--	--	---	---	---	---	---	---	---		---	--	--	+++
Social/economic																	
Employment	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++		+++	+++	+++	+++
Income	++	++	++	++	++	++	++	++	++	++	++	++		++	++	++	+++
Tourism & recreation	++	++	++	++	++	++	++	++	++	++	++	++		++	++	++	+++
Rural economy and subsistence life	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++		+++	++	++	+++
National economy	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++		+++	++	++	+++
Archaeology/historical sites	++	++	++	++	++	++	++	++	++	++	++	++		++	++	++	+++
Land ownership	++	++	++	++	++	++	++	++	++	++	++	++		++	++	++	+++
Protected areas	++	++	++	++	++	++	++	++	++	++	++	++		++	++	++	+++

Legend: ++ Potential minor positive impact; +++ Potential major positive impact

_ _ Potential minor negative impact; _ _ _ Potential major positive impact

6.2.0 Significant Negative Impacts

The evaluation matrix in table 20, continues to clarified the impacts of specific activities on specific parameters and continue to show less significant impacts. This dissection of interaction implies that the negative impacts are likely to be significant, when the operation (both construction and operation) are viewed together and over a temporal scale. Hence for compliance purposes, two of these activities and its interaction with the environment has been put forward. The evaluation of these two specific activities is relevant to the rest-hence the accumulative impacts (whole operation) is also provided towards the end. Nevertheless, the most significant negative impacts of concerned is water pollution.

6.2.1 Land clearing and removal of overburden

The excavation, and removal of overburden and the stripping of vegetation and topsoil to access ore, will increase sedimentation and mineral content of the Chovohio River and subsequently any associated waterways and downstream Metapona River. The overburden along the river (boulder) will be excavated and placed along the river edge as a flood barrier. These changes of land form and including vegetation, will ultimately impact on the flow of the river, and in particular the removal of vegetation will reduce vegetation soil cover, that protect storm water flowing into the stream. Hence, exposing the local area will also increase the level of vulnerability to natural disaster, that might have been avoided if the topsoil and the vegetation remains undisturbed. Loosen top soil exposes for easy erosion and therefore increasing of sediment loads and medal content into the Chovohio waterways, consequently impacting on the fresh water biodiversity and water quality. The increasing level of sediment will subsequently increase nutrient in the river, hence possible encouragements of eutrophication of downstream Metapona.

Slope instability: The removal of gravel and sand from the undulating and rolling hills at mine site will definitely result in some disturbance to slope stability. One contributing factor to this will be the site's lack of thick vegetation since the area is dominated mainly by a few sparse shrubs, found here and there on the flood plain. Hills are sensitive ecosystems and are prone to environmental hazards such as soil erosion or when the landform is disturbed. Changes to the terrain and hydrology through excavation of top soils will cause erosion, which create conditions conducive to slope failure if exposed surfaces are not protected within a short period. Exposed rocks will be weathered at a faster rate and the weathered material is susceptible to movement especially when saturated with water. However, since the site is sitting on flat land and parallel to the Sea Level, the impact due to slope instability is very minimal hence restricted to localized impacts.

Storm water inundation: Soil loosen its compactness and encourages soil erosion into the water. Lack of proper drainage always leads to flooding in the area, whenever there is high intensity rainfall event.

One contributing factor to this is the nature of the local topography, which is characteristically low lying and flat (flood plain).

Without proper drainage system, the proposed mining project has great potential to cause a major impact and concomitant effects on the localized landform, hence disallowed future development. Nonetheless, the impacts are highly localized and can last for short periods and be reversed as surface runoffs are heavily dependent on rainfall intensity. However, the site is sitting on alluvial composition with very high porosity, hence storm water inundation is also not significant in the area.

Sediment runoffs: Sediment runoffs are inevitable and already happening and this can be attributed a couple of factors. First, the sand and gravel materials that were deposited onsite have no big trees to protect them being eroded. Second, the site is an open flood space and very prone to flooding with no large tree protection. However, the turbidity level from natural runoff is not heavy and quickly dissipate, unlike sediment-laden runoffs from surface water systems. The uncertainties and unpredictable nature of changing climatic patterns are a concern since such events can exacerbate the impact, increasing the erosion rate and its intensity. For the impact characteristics, they are highly localized and short term, with major consequences for the benthic communities, if no flooding occurs for a long period.

6.2.3 Mitigation measures

Because of the relatively small-scale of operation the removal of forest cover is also minimal, hence the associated impact on vegetation and biodiversity is insignificant. In fact, the removal of overburden and ores will increase the depth and the width of the river bed hence allows for larger volume of river flowing through, reducing the velocity of the river hence reduces the impact on the flood plains during flooding. Nevertheless, during removal of overburden and vegetation the following mitigation measures has been considered;

- ✓ Digging of the slopes (if any) will be designed to have a batter whereby the slopes retain a reasonable angle of repose.
- ✓ Where necessary, a series of small retaining walls will be constructed, to contain weathered materials. It is anticipated that slope failures will be insignificant since there is no water moving across slope or down the hillside and that erosion is not common on this slope.
- ✓ Mined site to be recovered and replanted with native riverine species.
- ✓ Concrete culverts and manholes of appropriate specifications will be installed to convey excess surface water into the.
- ✓ Well-designed Storm water drainage is provided for the entire facilities.
- ✓ Riverine, to be replanted with native species (see proposed green belt).

- ✓ Concrete culverts and manholes of appropriate specifications will be installed to convey excess surface water into the ocean.

6.3.0 Excavation and removal of ore

The excavation and the removal of ore is the major component for the project and is likely to impacted on the Chohovio River system by increasing of pollution, the alteration of the physical structure of the river channel that will ultimately have effects on biological communities. The degree of impact is influenced by various factors including: morphology (shape / alignment) of the river; sediment type; scale of the extraction operation; extraction methods; and bio-physical characteristics. This is provided in detail below.

6.3.1 Bank Erosion and Alteration of Riverbed Morphology

River bank erosion and accretion are part of the natural dynamic process of any river system. Excessive rates of aggregates extraction can cause the alteration of water flow, which may cause erosion of river banks and the subsequent realignment of the channel. Erosion can also be attributed to poor extraction practices: for instance, where the extraction intensity at a particular location is too high, river bank erosion is accelerated – as witnessed in larger commercial operations.

The most obvious impact of the removal of ore from the riverbed is the creation of pits through the removal of ores from the riverbed. The shape and size of these extraction pits are determined by the frequency of extraction and the methods of extraction. During the process of ore extraction the river beds will be upset only for a short time and time will be allowed for natural process for re-distribution of sand and gravels along the river channel. Depending on specific analysis of the targeted area for excavation of ore, the site might not require backfilling, as these could provide and ideal environment-for reducing flood disaster, as flowing water is drawn deeper having lesser impacts on the flood plain and the villages. It could provide habitat pool for fresh water biodiversity and support fisheries.

The extraction pits may also become temporary sinks for coarser-grained aggregates which have been removed and placed on the river edge. The gravel sink could also useful for village development that could be washed downstream if there is no pool sink. However, materials that would normally be carried further downstream are being continuously removed, depriving the lower part of the river from the supply of coarser aggregates. This change can affect plant and animal communities in the river and as well as human populations that depend on these materials.

6.3.2 Siltation caused by during extraction of ore

Removal of overburdens (boulder) and the extraction of ore, including the movement of excavators during the excavation will subsequently increases the level of sediments generating turbidity of the river. This process will increase the amount of suspended sediments that are flushing down the

flowing water. As noted in subsection 4.1.5, the discharging rate for Chovohio into Metapona is measured at 15.2 m^3/s and the discharging rate of the Metapona into the marine environment is **28.2 m^3/s** hence the suspended particles due to this activity will accumulate the level of pollutant loads that is currently discharging into Metapona river measured at **60 tonnes** per day. Consequently, it will also add to the level of sediment loads that Metapona River is currently exporting to the marine environment measuring **over 95 tonnes per day**. The change of total metal content and its dissolved concentration will increase concurrently.

Indeed, the elevated level of fine material in the river will contribute to poor water quality. Although, the visual nature of the water is already unpleasant. However, in some areas the turbidity generated by the extraction processes may be insignificant compared to siltation as a result of flooding and other resource-use practices.

6.3.3 Pollution

Water pollution of the river is not only restricted to increasing level of sedimentation and the subsequent suspension of natural metals but will also include hazardous waste materials such as oil and fuel at the operation site. Heavy vehicles such as backhoe, excavators and dump trucks that will be used for the various phases of the operation will use diesel fuels. The operation site including the crushing plant is normally situated close to the river. Disposal of unwanted, possibly toxic materials could be another cause of river water pollution around the area of operation. This is particularly relevant as river is still being used for domestic purposes such as drinking and other household used for downstream people. Pollution of the water can severely jeopardize its domestic uses.

6.3.3 Biological Communities

In most Pacific Island countries, common river species are fish, amphibians, mussels, snails, prawns, benthic micro-invertebrates and mosquitoes. Benthic micro-invertebrates live in or on river bottom sediments. They are good indicators of water quality because they are sensitive to the changes in conditions. Different species have different levels of pollution tolerance: generally, a diverse and healthy population of these organisms is indicative of unpolluted waters (see section 4.4).

6.3.4 Mitigation measures

The mitigation measure for this activity is the same mitigation measure provided in 6.2 and 6.4. As emanated from the mining layouts, these activities are designed with proper assessment to ensure minimum impacts on the environment. Hence further modified mitigation impacts are provided in the next activity as described in 6.4 and the subsequent sections.

6.4.0 Stockpile, Transport and Backfilling

A small retreating open pits method is employed for the operation where over layer, stockpile, backfilling and the transportation of materials between the source, the processing plant and return have been integrated together, hence lessen time between these activities and subsequently the reducing of the magnitude of the negative impacts. Sequentially, one side is dug supplying ore to the process plant at a nominal rate of 200t/h. Overburden and tailings are placed into the lee side of the pit for infilling. This approach allows new pits to be opened with minimal disruption to the operations. Rapid deployment of new pits reduces risks associated in having only one pit where pit wall failure and other unexpected problems halts production. The disruption time for opening a new small pit is as long as it takes to tram the excavator to a new site.

Top soil removed by the FEL like excavators and dozers will be stored near the pit. Ongoing rehabilitation of the tailings will be a few months after infill avoiding extensive rehabilitation work at the end of the mine.

This approach also avoids tailing mounds or long term dams as all tailings are deposited into the pit a few months after the ore has been extracted by the excavator. Other advantages over conventional open pit mining includes lower tailings disposal costs, safer and more environmentally friendly.

It has been assumed that wet weather, from and including January to April will hinder the mining. The solution is to only mine the flood areas during the dry season when the water table and river is at its lowest, whereas the elevated areas are only mined in the wet season. This is possible as the mined pits are dug rapidly and are relatively small.

The mining sequence in itself has integrated mitigation measure to ensure the avoidance of negative impacts and as stated bellow;

- ✓ A FEL removes the top soil and overburden ahead and simultaneously of the small open pit being dug.
- ✓ An excavator using a tyne breaks the compacted alluvial sediment in the pit
- ✓ The excavator changes to a bucket and loads 20t trailers hauled by 100HP tractors
- ✓ The ore is hauled to the process plant and dumped into the ore hopper
- ✓ The haulage unit picks up 20 t's of tailings from the tailings hopper at the process plant
- ✓ The tailings are hauled back to the small open pit and dumped into the unused end of the pit, away from the working excavator.
- ✓ The haulage unit trams a short distance to the excavator for reloading and the cycle is repeated

In principle, the mitigation approach here is the reducing of time between the sequence of activities. The level of loads is also considered as the mitigation measures employed for the operation. First the

haulage unit will never be tramming empty as the tailings are returned to the pit. The distance between these activities is also considered as mitigation measures and hence the mining layout was confined within the tenement and as close as possible. Extraction of the ore is predominantly by a 47 t excavator and the haulage to the plant by 3 or 4 haulage units each capable of 20 t. As mining occurs in and near a river and the annual rain fall is greater than for Honiara (3.5m) a selection of large diesel water pumps are required. When the maximum capacity is reached mining transfers to higher land above the water table and this approach reduces the need for larger expensive water pumps.
A 24.8 t front end loader and 17 t bull dozer on tracks is required for various mining activities including removal of topsoil and over burden prior to the excavator removing the ore.

6.5.0 Processing plant

As descripted in 3.4.5, the main concentrator to be used is the Knelson centrifuge. It has been noted in the same section that generally accepted recovery for the Knelson is +95 % but can also rise up to 98% recovery. Nevertheless, the most significant impact of this activity is the efficiency of the machine used and the tailings. For tailing management, it has also noted that the solid tailing is used for the backfilling of pits. For suspended particles (Plant water) will be allowed to flow into settling ponds near the plant where the sediments settle and the water is skimmed for return to the river or reuse by the processing plant (see next section). The machineries used here are procurement management issues, hence only new and efficient machineries will be used for the whole operation.

6.6.0 Tailings, and waste system

The tailing is designed as integral part of the whole mining layout and its day-to-day operation. Hence space required for tailing and the process involves in the whole mining process are ensured to have minimal environmental damages during the construction and operation of the mining. For instance, **tailings and overburden** will be used for filling up of pits before levelling and subsequently releveling and revegetation. According to the facility design, plant water will be allowed to flow into settling ponds near the plant where the sediments settles and the water is skimmed for return to the river or reuse by the processing plant.
This settling ponds will be installed with relevant monitoring equipment to ensure the measurement of the concentration of pollutants (metals). This should also provide the relevant parameters to identify and calculate the amount of water that could be discharged into the flowing water. Since the operation is not using any synthesised chemicals, the accumulation of natural metals is only a faster reaction that resultant from the mechanical disturbance of sentiments during the operation. It could be naturally allowable to skimmed plant water into the flowing water during flooding. Otherwise, this pond is a reminiscence of logging ponds that are widespread throughout the country. With permission

from landowners and the relevant government authority the pond can also use for breading Tilabia or other edible freshwater organism.

Other waste from the plant and accommodation quarters will be small in quantity and can be dumped in suitable sites as agreed with the landowners and recommended in the EIS. As already noted chemicals are not used in the operation, hence toxic waste is not an issue, only vehicle and earthmoving oils and fluids require disposal at regular intervals. As this is a small operation this is expected to be within the capacity of Honiara waste disposal agents. For human waste, the Win Win Solomon Islands Investment Ltd has planted to develop well establish septic tank system for human waste.

6.7.0 Accumulative impacts

As noted in the evaluation matrix in table 20, and further explained 6.2, although the interaction between specific activities and specific character might be insignificant, the accumulation of these activities (whole) project will imposed significant negative impacts. The following provide the overviews of these accumulative impacts over the life of the project.

6.7.1 Hazardous waste

Various hazardous waste is likely to be produced or accumulated during the operation phases particularly as the newly mined area accumulates and put further loads on the current capacity. Hazardous waste will be produced by those remains from machineries and others. These hazardous waste is likely to impact on both terrestrial and human health (to a lesser extent marine life). The following mitigation measures are proposed for the continued operation of the project;

- ✓ If there are any accidental spillages of hazardous substances which may pose risk of contaminating run off, such areas will be immediately remedied
- ✓ All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, ear muffs safety shoes, lifesaving jackets, etc., as required, during the construction phase.
- ✓ Danger areas will be marked in order to restrict unauthorized entry into the Project area. Proper security arrangements will be made during nights to avoid any accidents due to unauthorised entry of workers, or civilians.
- ✓ Movable enclosures or specially designed equipment will be provided to minimize the generation of dust.

6.7.2 Solid wastes

It is anticipated that some quantity of solid wastes will be generated and the likely sources are metals, plastics, papers and domestic household wastes such as discarded food and other biodegradable

materials. These wastes are expected to come from the operation of land preparation, associated with the project's initial stage. It is a common occurrence for PET bottles (mineral water bottle, schweppes bottles, lemonade bottles etc), aluminum cans and, biodegradable wastes to be haphazardly discarded, where commercial and household activities are located.

Solid waste management is a challenge not only for Honiara but, the country at large and this is underpinned by the fact that relevant agencies are inadequately resourced in terms of funding support, ineffective legislations and poor planning, amongst others. Poor waste management practices have detrimental consequences for the environment (reefs, lagoons, beaches and land), which in turn can affect tourism industry. The location of the project along the seafront makes this a realistic possibility.

The project only anticipated solid wastes impacts to be highly localized, temporary, minor and can be reversed. As an immediate measure, proper waste receptacles is placed at convenient locations within the development site where they can be easily accessed by the public and workers, for collection and disposal. This is to ensure household and municipal wastes are not discarded on roadside and in backyards. Within the compound, separate disposal facilities will be made available for the different wastes, for instance, one for cans and one for plastics. In the medium term, employees will be introduced to the concept of the three R, namely Reduce, Reuse or Recycle.

6.7.3 Effluents

Effluents or liquid wastes from the proposed action are likely to be generated from point sources, which include wastewaters originating from kitchens and discharges from septic tanks. During the operational phase, this impact can be expected to increase in volume. With some exception, it is generally the practice in Solomon Islands for liquid wastes to be disposed-off untreated, due to lack of any treatment system. Nutrient pollution and, in particular nitrogen discharge from septic tanks is anticipated to cause pollution of the site's coastal water.

The location of the project within close proximity to the Chovohio River can be tempting, especially to discharge effluents into the River. Typically, solids (dissolved or suspended), biological oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, phosphorus, grease and coliform are known contaminants in untreated domestic wastewater. Whether they are present in their physical or chemical or biological form, these conventional pollutants are not safe for the environment because they lead to environmental stress. Owing to the current project scale, it is anticipated for potential impacts from these liquid wastes to be localized, temporary and minor.

Concrete septic tanks will be built onsite to contain these effluents. As a small scale sewage treatment system, this onsite sewerage facility is considered the most appropriate for the project's current activities. This septic system can be deemed suitable as the area also lacks connection to any sewage

pipes. To ensure the septic system operates efficiently and reduce wastewater discharges, periodic preventative maintenance will be conducted on its efficiency. Regular pumping to remove the solids that gradually fill the tank will be carried out ensuring the facility is maintained in a satisfactory operating condition. This maintenance entails systematic inspection on the system.

6.7.4 Dust/air quality

The processing stages such as extraction, transportation, discharging, crushing and stockpiling will generate more dust materials that may subsequently contribute to elevated silt and mud content of the river. These fine materials are often washed into the river channel, resulting in elevated suspended sediment levels in the water column. During prolonged extraction operations, these suspended materials often settle and accumulate on riverbeds.

In addition, dust can be a health hazard for anyone exposed to it for a reasonable period of time. As already noted people who are working in a quarry, to wear appropriate personal protective equipment. Nearby settlements and other users of the quarry road are usually uncomfortable with dust generated by quarrying activities.

Dusts are likely to be generated at the worksites where soil excavation and land preparation works are taking place, with potential to cause localized air pollution. These are expected in dry periods as finer loose soil particles are easily blown up through wind actions. At the mining site the land is vacant with no few human settlements or habitation. However, this impact will be largely insignificant. Depending on wind direction, the spatial distribution and temporal occurrence should be highly localized and only restricted to site of operation.

Solomon Islands at present does not have an air quality monitoring systems neither are there ambient air quality standards. The burning of municipal wastes or slush and burn practices is also a common problem in the village and the Solomon Islands in large. Hence, the cumulative impacts the project anticipates to contribute little to these impacts within the project area.

6.7.5 Noise

For nearby settlements and communities, noise generated by mining activities can be a nuisance. This needs to be addressed during the licensing stage for a processing plant, which must be situated at some distance from the local communities. It is suggested that the developer lease the area of interest together with a buffer zone extending some distance outside the boundary, to prevent people from settling too close to the area of operation. The use of heavy machinery during mining operation at the main project site may lead to this nuisance during the day, especially for the workers themselves. Selected machinery types are used for operation to address this issue. It is planned for the heavy machinery not be used during the night in efforts to reduce disturbance to the neighborhood and including animals. Depending on weather conditions, noise level will be higher in dry periods with less

wind speed. Conversely, during wet conditions less noise will be expected because of background noise from the rain and the likelihood of work interruption in such conditions. Noise elevation due to the machinery operation and other construction works are anticipated, to some degree, only in dry periods. Nuisance noises is highly likely as more people and activities to the site increase. The Guadalcanal province ordinance on nuisance will be strictly complied with support from security providers-providing night services.

6.8 Employment opportunities

Employment opportunities have already been provided to locals during the prospecting and locals are continuing to be employed as camp security and cleaners. As already noted in 3.2.3 and further evaluated in 5.10, the operation will increase level of employment in the village and the Solomon Islands in large. Once operation is up and running, 43 locals are expected to be employed and this will have boost special skills in the area of mining. A number of expatriates will be also engaged and hence the transfer of knowledge and skills to their local counterparts are anticipated. Security services is also provided by locals including cooks and their assistance.

The project will generate revenue for the province and the National government by way of payment of taxes and licenses. In addition to the above, project development will attract investments into the region and thereby contribute to economic growth of the Solomon Islands (refer to other positive impact under chapter 5).

6.9 Rehabilitation and post mining developments.

As already noted in 3.5, the pre-concept of the rehabilitation component and has reflected under each elements of the proposed mining design, rehabilitation and post mining development is already embodied in all the activities particularly the construction and operation phase. Hence, rehabilitation has been contextualised to takes its feed in the midway of the operation. As also inferred, table 20, rehabilitation is likely to bear positive impacts, having the fact that the site is regarded as a degraded land and the flowing water is already visually dirty. Likewise, the villagers seemed already vulnerable that will be scaling up during time to come especially in today's changing climate. Without mining, rehabilitation is also not possible hence the continuity of ecosystem erosion. Without mining possible opportunity for upgrading of roads and village infrastructure, health services, water services is also a distant goal. Relying on conventional Aid from NGOS or government will remain a distant goal and associated environmental, economic and social benefits denied. Village self-reliant can also be stimulated, despite of emotional environmental cost. Given this context, the project rehabilitation and mining closure plan and the post mining projection is sufficiently articulated within the context of the stage-wise-management plan and its associated management plans (see chapter 7).

Chapter 7: Environmental Management Plan and Monitoring Framework

7.1.0 Introduction

The Environmental Management Plan (EMP), elucidated and depicts relevant actions for the mitigation measures provided in chapter 6. Its implementation and relevant oversight mechanism such as the responsible agencies for the proposed environmental actions is provided here. A monitoring framework is provided toward the end of the chapter. In general, the EMP only covers the following broad themes;

- ✓ Environmental Management Process
- ✓ Stage wise Environmental Management Plan (addressing negative impacts under construction and operation)
- ✓ Green Belt Management Plan (Long term objective)
- ✓ Disaster Management Plan (climate change)
- ✓ Monitoring framework (operational)
    - ➢ Performance indicator
    - ➢ Impact indicators

7.1.1 Outcome objectives

- ✓ To ensure proposed mitigation measures are appropriate and applicable to the identified potential adverse significant impacts, to avoid, minimize or compensate for the impacts;
- ✓ To ensure human health, safety and wellbeing are protected;
- ✓ To ensure areas of high conservation values for biodiversity are protected or managed;
- ✓ To ensure areas of natural scenic values or cultural importance are protected or managed;
- ✓ To ensure impacts associated with climate change or natural disasters are minimized, mitigated or relevant adaptation measures are in place.
- ✓ To ensures activities are undertaken as specified in the public environment report and in accordance with applicable laws;

7.1.2 Environmental Management Process

In the light of the outcome objectives and management principles of ISO 14000, the management plan is premised on the conceptual framework of setting objectives and targets, a framework for review and continual improvement. As such Environmental Management Process consists of:

a. Defining an environmental policy
b. Developing plans for environmental management
c. Implementation of the EMP

d. Monitoring the EMP & incorporating corrective action

e. Review of the policy, EMP and improvement

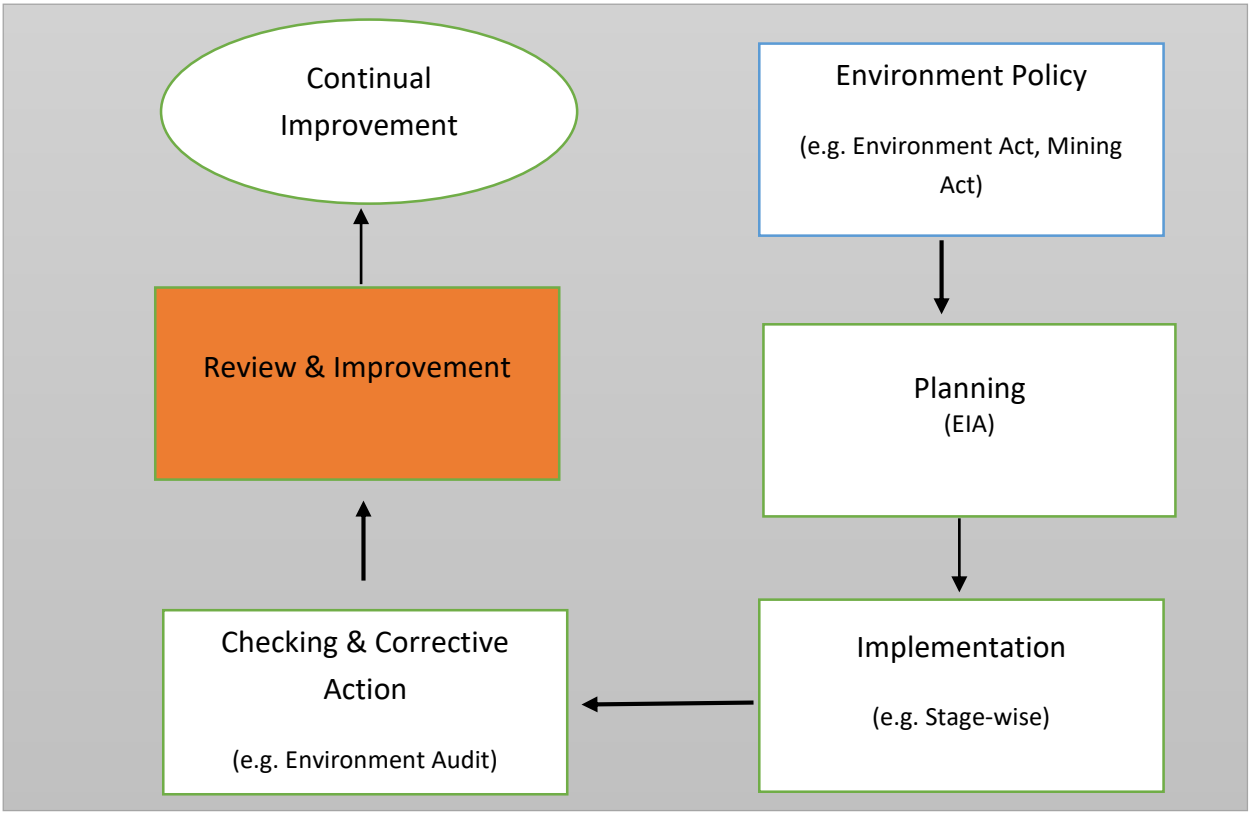


FIGURE 27: CONCEPTUAL FRAMEWORK FOR THE EMP PROCESSES

7.1.3 Stage-Wise Environmental Management Plan

As portrayed in the conceptual design of the Win Win Solomon island Investment Ltd proposed mining layout (construction and operational), environmental concerns are fundamental, hence reduces the cost of mitigation instruments to abate possible negative impacts. It follows that the EMP is designed as a continuum to the mitigation measure hence the adopted concept of stage-wise environmental management plan, as the immediate management strategy for the construction and operation phase of project. The safeguarding of safety of the workers, labor camp management are also considered (see table 21). The stage wise EMP also provide alternative perspective for impacts without mining. Long term impacts and impacts due to external factors such as climate change is provided under the green belt management plan and disaster risk management plan.

TABLE 22: STAGE WISE ENVIRONMENT MANAGEMENT PLAN

Activity	Likely Impacts in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsibilities	
			Planning, Implementation and supervisions	Quality assurance/compliances
Land clearing and preparation (construction and operation).	-Change in land/soil formation -Slope instability -Storm water inundation -Sediment runoffs	✓ No increase of size for the mining operation, unless and until agreements is made with nearby landowners and approval from relevant Ministries and provincial government. ✓ Mined area (flood plain), to be replanted with native riverine species. ✓ Concrete culverts and manholes of appropriate specifications will be installed. ✓ Digging of the hill slopes will be designed to have a batter whereby the slopes retain a reasonable angle of repose and reduce slope lengths	Site supervisor	Project Director/ECD staff
Land clearing, removal of overburden, stock pile and backfilling	-Change in land/soil formation -Slope instability -Storm water inundation -Sediment runoffs -villagers are vulnerable to river flooding	✓ No increase of size for the mining operation, unless and until agreements is made with nearby landowners and approval from relevant Ministries and provincial government. ✓ Mined area (flood plain), to be replanted with native riverine species. ✓ Concrete culverts and manholes of appropriate specifications will be installed. ✓ Digging of the hill slopes will be designed to have a batter whereby the slopes retain a reasonable angle of repose and reduce slope lengths ✓ Excavated soil to be used in filling of and levelling of the mined area-flood plain. ✓ Lessen time between the activities (land clearing, removal of overburden and backfilling. ✓ Overburden or bolder laid along river edge to insulate villagers from incoming food		
Hazardous waste	-Accidents due to hazardous material	✓ Hazardous materials such as (Diesel, engine oil, hydraulic oil, lubricant oil to be deposited in designated areas.	Site supervisor	Project Director/ECD

	handling -Health Issues	✓ Hazardous wastes to be disposed with approval from MECDM as required under the Environment Act 1998). ✓ First aid to be provided and made available for all injured workers and serious cases to refer to Number Nine Hospital or private clinics. ✓ Win Win Solomon Islands Investment Ltd will follow the OSHA standards for safety of health and environment.		
Solid Waste	Land/ Water quality	✓ Provision and installation of waste receptacles at designated areas within the compound for cans, plastics and, papers for recycling due to visual impact; ✓ Timely collection of waste from generation points; ✓ Metal wastes will be kept apart from other wastes for disposal as appropriate; ✓ Food and other biodegradable materials will be sorted in covered waste receptacles to prevent odour; ✓ Ongoing education about waste management be conducted to employees. ✓ Kitchen waste will be supplied organic farming processes (compost) ✓ Prohibition of burning of waste in the operation site (glary sites and stock pile sites).		
Tailing and waste water	-accumulation of solid tailings -accumulation of procession water Water Pollution Sediment pollution	✓ Tailings used for backfilling and reduces period from between processing and backfilling. ✓ Processing water pond regularly monitored and discharge with approval from ECD if required. ✓ The solid waste generated from various processes will be sorted and stored in demarcated area and will be disposed-off with assistance from MECDM. ✓ Excavated soil to be used in filling of and levelling of the mined area-flood plain.	Site supervisor	Project Director/ECD
Excavation, transportation of ores or construction materials	• Generation of dust • Vehicular emission • Noise generation due to;	✓ Springing of water in dust susceptible area during construction activities ✓ Emission control norms to be strictly follow to reduce the impacts from exhausts ✓ Building materials, excess earth excavated and construction waste will be transported in trucks covered with tarpaulins	Site supervisor	Project Director/ECD

	✓ Operation of DG Sets ✓ Vehicles transporting ore and earthwork ✓ Diesel run engines of construction machinery.	✓ Pollution under Control (PUC) certified vehicles to be used for transportation of construction material. ✓ Periodical check up on transporting vehicles to remove accumulated dirt. **Noise** ✓ All noise levels to be maintained below threshold levels Personnel working in noise environments e.g. quarry area and stockpile area to be provided with earplugs, muffs, etc. ✓ Regular shifting of personnel to avoid health impacts. ✓ Acoustic enclosure for DG sets ✓ Maintain equipment, machinery regularly and using enclosures		
Machineries and procession plants	-Generation of noise -Generation of dust -Equipment emissions -Exploitation of water resources -Increased turbid runoff	**Emission & Noise** ✓ Use of ear and eye protection devices, masks & helmets to workers ✓ Regular maintenance of equipment ✓ Appropriate silencers should be used for the equipment **Water Quality** ✓ Water shall be obtained from rain water and Solomon Water. ✓ Stockpile of materials located away from stream and is enclosed ✓ Sediment runoff shall be intercepted by hay bales or detention trenches ✓ Storm water drainage will be provided for entire facility including integration with the existing facility. ✓ Wastewater generated from the toilets, bathrooms and other areas in the operation building will be led directly to the sewerage treatment. ✓ Monitoring shall be carried out at the quarry and stockpile area as per the monitoring schedule and results shall be submitted to Supervisor for action. ✓ Environmental expert shall be required to inspect regularly to ensure compliance.	Site supervisor	Project Director/ECD
Rural fisheries	Impact on rural fisheries due to construction and overharvesting due to increasing of visitors.	✓ Fishermen to be informed about the project activity ✓ Necessary marker buoys will be installed before commencement of mining ✓ Regulate and enforce fisheries rules.	Site supervisor	Project Director/ECD

Safety	Injuries and accidents Risk from Electrical equipment	✓ Protective footwear and protective to be used in all operation. ✓ Safety and compliance training, enforcements and monitoring of relevant workers safety rules, as per the International Labour Organization (ILO) guidelines and applicable national laws. ✓ No under- age staff and work will include gender balance.	Site supervisor	Project Director/ECD
Labour Camp Management	Sanitation, health hazards, other impacts on the surrounding environment due to inflow of construction labours.	**Accommodation:** ✓ The Follow standard housing regulations as provided in the Solomon laws and Guadalcanal province Ordinances. **Potable water:** ✓ Sufficient quantity of potable water in every workplace/labour camp at suitable and easily accessible places and regular maintenance of facilities. **Sanitation and sewage system**: ✓ The sewage system designed not to contaminate ground water and pollute the river and the coastal environment. ✓ Toilets/bathrooms to be cleaned every day, with trainings given to labours on how to use them. ✓ Adequate water supply will be provided in all toilets and urinals ✓ Package treatment plants to be provided should be kept in a strict sanitary condition **Waste disposal:** ✓ Segregated garbage bins (biodegradable and non-biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the corporation plan. ✓ Kitchen waste to be used for compost and used in gardens. ✓ Comprehensive Solid Waste Management Plan approved by project supervisor and endorsed from relevant authority.	Site supervisor	Project Director/ECD

River	Aqueous discharges in river (effluent)	✓ All wastewater to be treated before releasing into water body. ✓ Wastewater generated from the toilets, bathrooms and other areas in the operation building will be led directly to the STP. ✓ Waste water collected from process shops/ areas, workstations will be collected separately through closed conduits and treated through Effluent Treatment Plant (ETP). ✓ The storm water collected from workstations will be diverted to ETP, in case workstations are in operation. ✓ Provision of fuel oil bunkering will not be provided in the ship repair facility ✓ Implement Contingency plan for handling accidental oil spills. ✓ The treated water will be used for gardening/ horticulture. ✓	Site supervisor	Project Director/ECD
Operation of generators and machineries	✓ Air Pollution ✓ Noise Pollution	✓ Acoustic enclosed DG sets will be used as power backup. ✓ Cleaning of vessels may generate dust. Movable enclosures or specially designed equipment will be provided to minimize the generation of dust ✓ Periodic air quality monitoring will be carried out	Site supervisor	Project Director/ECD

7.2.0 Green Belt Management plan

7.2.1 Purpose

Trees and plants are an essential component of healthy environment and during this time of climate change, it has increasing viewed as an important natural infrastructure for mitigating against climate change impacts, such as sea level rise, rising temperature. Trees and plants have long recognized as bioremediation agents for breaking down of hazardous waste hence control pollution. From conservation point of few native plants and trees could help restore or attract native fauna. It follows that trees and plants maintains the oxygen-carbon dioxide balance in the atmosphere through photosynthesis, trees and plants control air and noise pollution, control soil erosion, provide food and shelter to domestic and wild animals including birds and insects, and improve the aesthetic value of the environment. The utility of the green belt predominantly lies in its capacity to attenuate the fugitive emissions and spillage. Thus, the objectives of the green belt are as follows:

- ✓ To control air pollution due to fugitive emissions
- ✓ To attenuate noise generated by various machines
- ✓ To improve the aesthetics of the area
- ✓ To provide food and habitat for avian fauna
- ✓ To control soil erosion

7.2.2 Avenue Plantation/Ecosystem restorations

The development of peripheral green buffer is proposed wherever possible along the river edge and onto the landward side. Line of selected trees and plants will be planted along road and the commercial building and the office premises. Proper care will be taken to select species that preserve the environment and where possible trees protect the river edge and riverine.

The general approach for selection of species for green belt development is their potential for attenuation of fugitive emissions and noise, diversity of vegetation, introduction of endemic species attracting birds, and to create a natural habitat. Fruit bearing trees shall be also planted so as to provide food and shelter to birds and insects dwelling in the area. A green house for nursery is also planned for the revegetating of the pit. For establishment the plantation, the important considerations to be taken in account are as follows:

- ✓ Trees and shrubs will be planted along road and the commercial building, along administrative buildings.
- ✓ Shrubs will be also planted in front row along river edge.
- ✓ Native Orchids and creeper would be trained on the boundary wall
- ✓ Mono-culturing will be avoided and diversity in vegetation encouraged.
- ✓ Security guard will also provide security over the plants

- ✓ All plants supplied must planted within three days of removal from the nursery.
- ✓ The plants must be watered daily in initial stages; watering 2-3 times a week is a must.
- ✓ Continuous monitoring of plant growth, immediate replacement of causalities, supplementation of nutrients, rescheduling watering regime are important aspects for survival of the plantation.
- ✓ Besides the evergreen initiatives the following will also be part of the cooperation obligations;
- ✓ Displayed important native species pictures and diagrams on most accommodation for labors and client public awareness.
- ✓ Moral and economic support towards other conservation initiatives in and around the project site e.g. in Guadalcanal.

7.2.3 Part of implementation plan for rehabilitating of pits

To continue with future rehabilitating of the pits, the following activities is proposed to continue with the implementation of the green belt management plan.

Proposed Target: Less than 10 % of the pits to be reforested with commercial exotic species and native species

Phase 1: Research phase- collecting information

- Asses in detail the site conditions
- Soil
- Forest structure
- Forest composition
- Natural regeneration

Phase 2: Treatment trials

Identify species for planting (coconut, betel nut, eucalyptus and oil palm)

Identify techniques for planting

- Site species trial
- Planting technique trials

Phase three: Actual field planting

Experts required for reforestation programme

- ✓ Nursery experts
- ✓ Sivi-culture specialist
- ✓ Soil specialist
- ✓ Botany specialist

The above plan will consolidate once the mining project phases into its operation phases. Commercial plants such as oil palm has been also anticipated. However, these will also require inputs from stakeholders.

7.3.0 Disaster Management Plan

Solomon Islands is highly vulnerable to natural disasters such as tropical cyclones, earthquakes and climate change including coastal erosion and sea level rise. The country also faces threats posed by tsunamis following tectonic plate movements. As already mentioned, the site is characteristically flat and, as such, can be easily exposed to effects due to natural disasters and anomalous climatic conditions. The risks posed by and associated with unfavorable events in the form of adverse impacts of climate change and earthquakes can be calamitous to the entire mining area. Solomon Islands has experienced 11 earthquakes with a magnitude of above 6 on the Richter scale in 2015 alone. While this shows how vulnerable the country is, it is the coastal areas that are most at risk as experienced in the past, when tsunamis hit certain parts of the country and destroyed properties in their wake. Being a small island developing state (SIDS) and a low lying coastal country, Solomon Islands vulnerability makes it an easy target to suffer the adverse consequences of climate change. This is recognized in the United Nations Framework Convention on Climate Change (UNFCCC). Besides its physical vulnerability, the country is also economically vulnerable as it relies more on very limited commodities export which are subject to unstable global market conditions. According to the NAPA, climate change is the most important environmental and development issue for the country because of its potential to impede economic and social development.

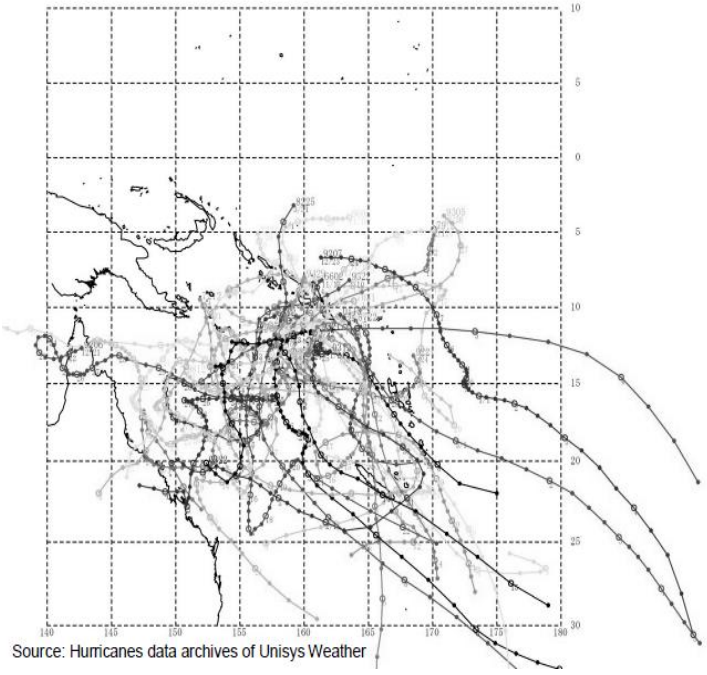


FIGURE 28: CYCLONE ROUTE IN THE SOLOMON ISLAND

It has been estimated for the Melanesian region that the rate of change of sea level rise over ten years was three times (8-10mm/year) higher than the global average. For Solomon Islands, the sea level rise was approximately 7.6 millimeters per year for the period 1994 to 2008. Similarly, the country's temperature shows a warming trend while rainfall records show a declining pattern in its occurrence.

These conditions are proving to be conducive to the increased frequency of severe tropical cyclones affecting the country during the summer from December to February.

As noted Natural disaster, especially cyclone is becoming frequent to date mainly due to the global phenomenon of climate change. These global and regional phenomenon, is likely to be impacted on the local wind and waves imposing risk to the proposed project including the entire Honiara. According to the JICA (2013) report, storm wave could rise up to 3.66 M in height. Along site heavy rain and strong wind, this could bring in major disaster to the project site. The route map of cyclone passing Solomon Islands from 1945 to 2011 is shown in figure 28.

These cyclones have also had direct and indirect impacts on the project site. The case of Cyclone Namu in 1886 is also provided under the climate change scenario below to demonstrate possible impact on the mining operation- if such events occur during the lifespan of the mining operation. The disaster pronged area as mapped in the figure attached as annex 1 has also classified the project site as pronged area. This left as to conclude that the mitigation measure and the management plan for the project is insignificant to the magnitude of any anticipated damage if a cyclone Numu case occurred in the near future. During cyclone Numu it has been recorded that the height of the flood, rivers have rose up to 9 m above their normal level and the whole alluvial plain of the project has disappeared under meters of flood water (Solomon Nius, June 11, 1986).

According to a detail study on Flood and landslide hazard of Northern Guadalcanal in 1989, the following relevant recommendation has been proposed and considered in the EIS;

The operation has factored the possible consequences of flooding and land sliding, and it is assumed that the increasing of depth and with of the river bed, will slow down the velocity of the flowing river, reduces impact on the adjacent flood plain and its composition.

The company stand by to assist relevant Ministries, Guadalcanal Province, and local community representatives to set up to coordinate preparation of a flood management plan for Tuarana village and its hamlets. This may include assistance with the development of simple hand-out or presentation to educate villagers on the consequences of living in hazardous areas and the ways of reducing the hazard.

7.3.1 Case study; Cyclone Namu

The case of cyclone Numu could be useful to explore several scenarios under natural disaster and the impacts that may occur with or without the mining operation. It has to be noted here that prediction of cyclone Numbu is said to occur in every 50 years at its best. During cyclone Numu it has been recorded that the height of the flood, rivers have rose up to 9 m above their normal level and the whole coastal plain disappeared under meters of flood water (Solomon Nius, June 11, 1986). Henderson runway has eventually submerged under 0.5 - 1.0 m of water. The sediment-laden flood

waters receded they deposited a meter or more of mud and sand over much of the Guadalcanal Plains burying village food gardens as well as houses, commercial properties and plantations. In a post-cyclone survey, Jones and Clark (1986) identified flood-related phenomena as causing far more damage on the coastal plain than winds or storm waves. Flood waters wrecked a quarter of the village houses and facilities. As a direct result of Namu, the country underwent a severe shortage of food and building materials that lasted for many months (Kieth-Reid, 1986; Jones and Clark, 1986). Costs of rebuilding bridges, schools and plantations, together with lost production through the breakdown of commercial and public infrastructure, has run into many millions of dollars and severely stressed the country's economy (Keith-Reid, 1986; Solomon Nius, June 11, 1986).

There were huge piles of logs up to 3 m high in their lower channels. Zones up to 250 m wide were largely swept clear of vegetation and contained a chaotic profusion of sand and gravel bars 1-3 m in amplitude. Scour holes were in filled with soft mud and over bank deposits up to 0.5 m thick blanketed the adjacent flood plains and extended into the forests. The over-riding impression was of high velocity and extremely destructive flood discharge carrying massive amounts of sediment as evidenced by large river-mouth sand and gravel bars at the coast.

7.4.0 Public Relations

The Win Win Solomon Islands Investment Ltd staff and its short term consultants in Honiara continue to create effective cooperation with key agencies such as the Ministry of Mines, Energy and Rural Electrification, Ministry of Environment Climate Change Disaster Management and Meteorology, and the communities. As has already noted the Win Win Solomon Islands has already entered agreements with customary Group (see annex) as provided under the strategic plan and action for fostering good relationship with land owners and including those living close to the vicinity of their project site. The implementation of the above community work is a clear indication of the Win Win Solomon Islands Investment Ltd efforts towards the implementation of community and national policies. The section under social and economic environment for community support pledge that the Win Win Investment has promised to support the village community.

It has been noted that the land trust board of the concerned land will form the main grievance and redress mechanism for the mining operation. Besties the conditions laid out in the agreements a specific terms of reference for the land board is expected in the near future.

7.5.0 Environment monitoring and reporting

The monitoring framework is developed to ensure the quality assurance is carried out by the Win Win Solomon Islands Investment Ltd management and at the same time provide external checking and environmental auditing by the statutory agency. In general monitoring is anticipated to be undertaken to ensure the company complies with its environmental management plan and showcase best mining

practices. To be effective, monitoring systems need to identify the different people to be involved and what they should be monitoring. It is particularly important that those to be involved are clearly designated. The developer will be responsible for ensuring the management plan is implemented with clear lines of responsibility between supervisors and other project personnel or employees (see table 13).

The following areas are addressed as part of the EMP design and their implementation largely depends on clear understanding of the roles involved. It is important that project personnel are assigned to undertake environmental inspections, address environmental incidents and emergencies and establish complaints or grievance procedures. As noted previously in chapter three, the size of current activities is very much restricted and this is also clearly reflected in the EMP, with elaborations on roles and responsibilities.

It follows that a performance monitoring framework based on observational check list to provide the imitate quality assurance for the operation. Repeating this checklist by statutory authority will also serve as a compliance checklist and forms the window for monitoring and environmental auditing required. Nevertheless, the stage-wise EMP will ensure the environment within and imitate surrounding of the project is not impacted beyond permissible limits. The operation stage shall essentially focus on monitoring activity within the selected sites using indicators as provided in table (22).

TABLE 23: QUICK QUALITY ASSURANCES OF MONITORING BY OBSERVATION METHOD AND RESPONSIBILITY

Selected project component	Monitoring activity	Responsibility
Land clearing and preparation	Check clearance of existing land; Check equipment types used for specific tasks; Check designated exclusion areas; Check waste management practices; Check noise emissions to sensitive receptors; Check vehicles and equipment for leaks.	Site supervisor
Quarry and gravel extraction	Check for slope failure; Check designated exclusion areas; Check sediment control structures; Check haul trucks are covered when loaded with gravel; Check that engineering measures such as batter slopes are implemented;	Site supervisor
Earthworks	Check sediment control structures; Check for hydrocarbon spills; Check noise emissions to sensitive receptors; Check sediment runoffs and turbidity; Check vehicles and equipment for leaks.	Site supervisor
Pollution	Check noise emissions to sensitive receptors; Check for hydrocarbon spills; Check turbidity due to disturbance of sea floor;	Site supervisor
Storm water drainage	Check the design for correct specifications; Check the stability of the landfill; Check that grievance is addressed;	Site supervisor

For the longevity impacts of the project, specific variables to be monitored and the frequency of monitoring are identified in table 23. This is mainly important for the monitoring of pollutants in water and sediments and others as clearly demonstrated as the most significant negative impacts of the operation. It will also help to safeguard the operation from public opinion based on emotion- other than quantitative and scientific information and judgements.

TABLE 24: MONITORING FRAMEWORK FOR LONG TERM IMPACTS.

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
Air Quality	PM10, PM2.5, SO2, NO2, and CO	Three (03)	Twice/year	Fine Particulate Samplers for PM10, PM2.5, Reparable Dust Sampler for SO2 and NOX, CO analyser/portable CO meter for CO	National/international Ambient Air Quality Standards
Soil	Soil contents of pollutants	Four	Once every year	Collection and analysis of samples as per IS2720	Trend of concentrations.
Noise Levels	Day/night noise level	regular	Once a month	Portable hand-held noise level meter	Trend of noise level
Water Quality	Physical, Chemical and Biological	Four	Once a year (high tide and low tide)	Bottom sampler (Nishkin Sampler) and analysis by using standard methods.	Trend of water quality
Sediment Quality	Physical and Chemical	Four locations	Once a year	Peterson's Grab Sampler	Trend of water quality
Plankton and Benthic Community	Phytoplankton, Zooplankton and Benthic Communities	two	Once a year	analysis by using standard methods of sampling	Trend

TABLE 25: SELECTED SPORTS FOR MONITORING

Description	Latitude	Longitudes
Chovohio (UP Stream)	-9.56453	160.15768
Chovohio Down Stream	-9.48894	160.17644
Matepono River	-9.45564	160.1851
Taurana village	-9.553388	160.18150

7.5.0 Conclusion

The Win Win Solomon Islands Investment Ltd, is foreign and locally registered business entity whose interest of business operation is mining. The Win Win Solomon Islands Investment Ltd has been in the Solomon Islands for at least three years now, and over the past three years is concentrating on undertaking prospecting activity- in areas covered in its prospecting licence (NO.PL.01/17). As a next step the Win Win Solomon Islands Investment Ltd is now in the process of applying for a mining lease over an approximately 11km^2 in Vulolo ward of Central Guadalcanal, near the village of Tuarana along the river of Chovohio, a tributary of the Matepona river.

The Win Win Solomon Islands Investment Ltd has increases its level of confidence and concluded that there is approximately an **ore reserve of 200,000 ounce of gold contained over 16.7 million cubic metres of ore containing alluvial gold that can be mined at Au @0.3g/m3**. The level of confidence is based on the considerable effort made during the prospecting, and the evaluation of its economic gold values, the geotechnical analysis and the style of the deposit modelling.

The fact that Solomon Islands is in a tire need for diversifying of its revenue collection portfolios in the mist of fast disappearing merchantable forest (as the main source of foreign earnings for the past decades), it is argued here that this project is an essential and fundamental aspects of the country's economic diversification endeavours. Mineral and mining has given one of the top priority for investment. Given that that the Win Win Solomon Islands Investment Ltd mining method-based on developing of small retreating open pits and together with the mitigation measure and management plan adopted for abating possible serious negative impacts, it is therefore recommended for the full support from the relevant agency, including the MECDM.

The mine is estimated to last for 17 years of operation. The infancy stage of mining investment in the Solomon Islands provides the business prospect an exciting but risky business undertaken. The confidence for operating the mining lies on the fact that the Win Win Solomon Islands Investment Ltd has well experienced Directors and highly oriented client reputations, bolstered by the demand for gold in the World market.

The project is a prescribed development under the Environment Act and it is a mining development.

And hence, for the purpose of reporting and strategic planning and monitoring, this mining project has dissected the operation into six major components for easy evaluation and monitoring into the future. These includes; (1) Administrative component (2) Construction component (3) Operation component (4) Rehabilitation and post mining component and (5) Environment Management and monitoring component and (6) Corporate and social responsibility component.

This ESI generally describes the project environment particularly with 10 km radius from the centre of the project site. The project components and their characteristics have been described, and assesses

the likely major impacts of the project activities on the environment. It then identifies the necessary mitigation measures to avoid or minimise or compensate for these significant impacts. It has been recognized through the impact assessment that many of the impacts identified are not significant and can only be considered potential minor negative impacts. It follows most of the impacts are localised except the accumulative impacts of pollution. Relevant mitigation measure and management plans has been adopted to minimise longevity impacts, beyond the project lifespan. Apart from the negative consequences, the EIS also predicted positive impacts; (1) Employment opportunities; (2) Increase in the revenue by way of direct/ indirect taxes to the authorities; (3) Climate and disaster risk management.

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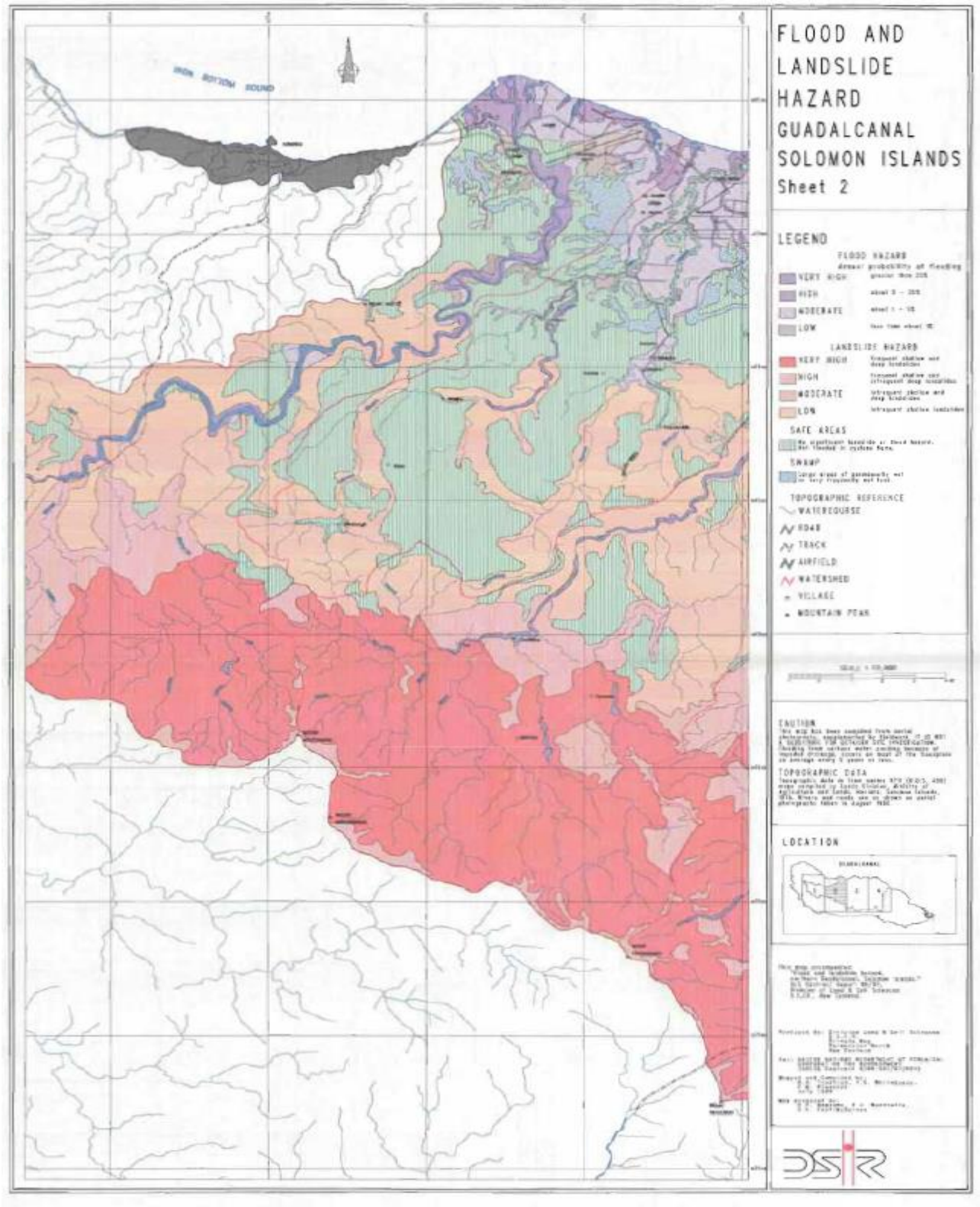
Annex 1: Flood and Landslide hazard of Guadalcanal



Annex 2: Questionnaires

QUESTIONNAIRE 1 (Social and cultural)

Section 1: General	
1. a	Name of interviewee:
1.b	Name of interviewer:

Section 2: COMMUNITY LIFE AND GOVERNANCE	
2.1. a	Describe the brief history of the people (how people came to settle in the village?
2.2	Cultural belief and practices
2.2.a	How does the traditional leader (village chief/headman) chosen?
2.2.b	I. Are village leaders influential in decision making? Yes/No II. Do they help resolve disputes? Yes/No III. Do you think village leaders can help resolve dispute, if land related issues arises during the mining operation?
2.2.c	What language do people speak in the village?
2.3	Religious life

2.3.a	What are the main denominations exist in the village? Denomination 1._____ Denomination 2._____
3.3.c	Do you think that church leaders should also involve in those issues arisen from this mining operation?? Yes/No Reason for your answer:
3.4	Landownership
3.4.c	What is the name of the tribal/clan land?
3.4.e	What traditional markers are used for customary land boundaries?
3.4.f	How is land inherited? (1) Farther (2) Mother (3) Both Description:
3.4.g	i. Do all the villagers have primary right to the customary land? Yes/NO ii. If your answer is **no then** what rules are in place to decide on who should use the customary land/sea or settle on the land?_____
3.4.h	Are there disputes related to land in the past 5 years? Yes/NO i. Are any of the above disputes resolved? Yes/NO
3.4.i	ii. Suggested any means to address land dispute in the village?

<table>
<tr><td></td><td></td></tr>
<tr><td>3.5.b</td><td>What do you perceive as developments? Please list down three development ideas for your village?

i._____

ii. _____

iii. _____</td></tr>
<tr><td>3.5.c</td><td>i. Please name all projects (initiated by outside entities such as government agencies and NGOs) undertaken in your village for the past five years.
<table>
<tr><td>Name of project</td><td>implementing agency</td><td>Total Cost</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>3.5.d</td><td>i. Please name all self-community initiated projects/programmes by villagers and communities for the past five years?</td></tr>
<tr><td>3.5.e</td><td>i. Has life of the people in the village better or worse compared to 10 or 5 years ago? [1] better [2] worse [3] no change

ii. Briefly describe:</td></tr>
<tr><td>3.6</td><td>Peace and Order, and the Judiciary</td></tr>
<tr><td>3.6.a</td><td>What are the common offences or crimes in the village?</td></tr>
<tr><td>3.6.b</td><td>How are these offences or crimes dealt with at the village level?</td></tr>
</table>

QUESTIONNAIRE 2 (Social services and Technology)

Section 1: General	
1. a	Name of interviewee:
1.b	Name of interviewer:

2: **SOCIAL SERVICES SECTOR**	
2.1	Education
2.1.a	i. What is the name of your primary/community High school in the village? ii. How long does it take for you to get from your village to you nearest primary school? [1] Less than 1 hour [2] 2-3 hours and [3] half a day.
2.1.b	What is the main problem with the school?

SECTION 3: TRANSPORT, COMMUNICATION AND MAJOR INFRASTRUCTURES	
3.1	Transport
3.1.b	What is your main transport to Honiara? [1] walk (hours_____) [2] truck (hours_____)
3.1.c	Are there network of roads connecting to other villages? Please describe Bush track/foot path: foot path: Logging track/feeder roads:
4.0	Energy
4.1.a	What is your main source of electricity / lighting? [1] Solar _____

	[2] private generator (fuel) _____ [3] kerosene lamp _____ or [4] others_____
4.1.b	With respect to solar who has funded your solar system? [1]. Buy with own money [2]. Donated by MP or donated by other project. Name of project_____
5.0	Telecommunications
5.3 a	What communication coverage are available in the village [1] telecom [2] Bmobile [3] VHF radio

QUESTIONNAIRE 3 (Employment and Ecology)

Section 1: General	
1. a	Name of interviewee:
1.b	Name of interviewer:

SECTION 2: EMPLOYMENT, TRADING & LOCAL FINANCIAL INSTITUTIONS	
2	**Employment**
2.1	Employment and subsistence life
2.1.a	Where do you mainly sourced your local food? [1] own garden [2] from the wild e.g. fishing and None Forest Timber Products NFTP [2] bought from others
2.1.b	If your answer is 2 then how do you earn your money? [1] salary [2] royalty [2] others _____
2.1.c	How many people in the village are on fulltime paid job e.g. teachers, nurse's carpentry etc?

2.1.d	What type of skills are available in the village e.g. qualified carpenters, plumbers etc?
2.2	Trading
2.2.a	How many trade shops in your village?
2.2.b	Is there any Financial Institution in your village? [1] Bank agency [2] Credit Union [2] Cooperatives [4] saving clubs
2.2.d	Do you have easy access to Bank services?

SECTION 3: PRODUCTIVE SECTOR			
3.1	Large scale cooperative business		
3.1.a	Is there any other large scale development project or commercial activity in or close to the village?		
3.2	Household business character		
3.2.a	**Sub-sector**	**Activities / Commodities**	**Describe**
	Agriculture	Coconut plantation/Copra and coconut oil	
		Oil Palm	
		Rice	
		Fruits / Nuts	

	Betel Nut	
	Kava	
	Coffee	
	Root crops	
	Vegetables	
	Spices	
	Poultry	
	Piggery	
	Cattle	

		Honey	
		Other (specify):	
	Forestry	Natural Timber Extraction (milling)	
		Forest Plantation	
		Non-Timber Forest Products (NTFPs)	
	Tourism	Eco-Tourism	
		Handicrafts / Sewing	
	Energy / Minerals	Mineral Prospecting / Mining Royalty	
3.3	**Questions relating to fisheries and marine resources.**		
3.3.a	**Do people fish or exploit fresh water resources in this village/ward?** **What do people fish**		

	Do people rely on catching: a. freshwater fish = a lot, some, not much, not at all b. shellfish = a lot, some, not much, not at all c. prawn = a lot, some, not much, not at all d. crab = a lot, some, not much, not at all e. ……. = a lot, some, not much, not at all
3.3.b	**What is the state (or health) of the fishery resource?** How do people feel about fishing compared to **five years** ago: a. freshwater fish = a lot, some, not much, not at all b. shellfish = a lot, some, not much, not at all c. prawn = a lot, some, not much, not at all d. crab = a lot, some, not much, not at all e. ……. = a lot, some, not much, not at all
3.3.c	**What is the state (or health/water quality) of river resources that affect fisheries?** Are the state of healthy/water quality ……. compared to **five years** ago: Water quality: = better now, the same, a bit worse, very bad
3.3.e	**How are the resources being managed?** Do people who fish generally know the government rules relating to: a. types of fishing gear allowed. = None, a few, some, most b. minimum size limits. = None, a few, some, most c. closed season/moratorium. = None, a few, some, most
3.3.i	Do the communities have their own rules affecting freshwater resources? a. Fishing gear banned: no communities, some communities, most communities, all communities b. Destructive fishing like dynamite: no communities, some communities, most communities, all communities c. Tabu area: no communities, some communities, most communities, all communities
3.3.j	Do community members obey the community rules?: never, sometimes, usually, always
3.3	Forest and Conservation Questions
3.3.a	Do people exploit None Forest timber product in this village? What do people extract Do people rely on extracting (name NFTP):

	a. Materials for houses = a lot, some, not much, not at all b. bird/_____ = a lot, some, not much, not at all c. frog/_____ = a lot, some, not much, not at all d. flying fox/_____= a lot, some, not much, not at all e. fungus/mushroom_____ = a lot, some, not much, not at all f. ferns_____ = a lot, some, not much, not at all g. medicinal plants_____ = a lot, some, not much, not at all h. edible _herbs_____ = a lot, some, not much, not at all i. Nali nut_____ = a lot, some, not much, not at all j. medicinal plants_____ = a lot, some, not much, not at all k. others/_____ = a lot, some, not much, not at all
3.3.b	What is the state (or health) of the forest resource? How do people feel about collecting of NFTP compared to five years ago: a. Building house materials/_____ = very easy, a bit easier, the same, a bit harder, very hard b. Bird/_____ = very easy, a bit easier, the same, a bit harder, very hard c. Frog/_____= very easy, a bit easier, the same, a bit harder, very hard d. flying fox/_____ = very easy, a bit easier, the same, a bit harder, very hard e. fungus/mushrooms_____ = very easy, a bit easier, the same, a bit harder, very hard f. ferns/_____ = very easy, a bit easier, the same, a bit harder, very hard g. medicinal plants_____ = a lot, some, not much, not at all h. edible herbs_____ = a lot, some, not much, not at all i. Nuts_____ = a lot, some, not much, not at all j. medicinal plants_____ = a lot, some, not much, not at all k. others/_____ = a lot, some, not much, not at all
3.3.c	What is the state (or health) of other forest resources Are these other forest resources healthy compared to five years ago: low land forest: = better now, the same, a bit worse, very bad riverine forest: = better now, the same, a bit worse, very bad

	mountain forest: = better now, the same, a bit worse, very bad
3.3.e	How are the forest resources being managed? a. prohibited or protected animal or plants from harvesting (including freshwater animals). = None, a few, some, most
3.3.i	Do the communities have their own rules affecting forest resources? a. seasonal harvesting: no communities, some communities, most communities, all communities b. land use plan (e.g. no slush and burn and no logging): no communities, some communities, most communities, all communities c. Tabu area: no communities, some communities, most communities, all communities d. Size of tabu area (_____hector)
3.3.j	Do community members obey the community rules? never, sometimes, usually, always Are there any tabu species prohibited from uses in your village/communities? YES/NO Name:_____
3.5.	**Question related to Equity in sharing of common property (e.g. royalty from logging)**
3.5.a	Do monitory benefits from tribal land e.g. royalty from logging shared equally between members? [1] always [2] sometimes [3] never
3.5.b	i. Does your community experience any dissatisfaction toward sharing of royalty? Yes/NO ii. How do you resolve this? [1] Do nothing [2] resolve through village chief/church leader [3] refer to police or court [3] other :_____
3.5.c	Please suggest ways to mitigate conflict arising from sharing of common resources including royalty from this mining operation?

3.6	**Question related to Land use practices**
3.6.a	What are the land use practices in the village or community? a. slush and burn: no communities, some communities, most communities, all communities c. Mining and prospecting: no communities, some communities, most communities, all communities d. Fallow: no communities, some communities, most communities, all communities e: organic and intensive farming practices: no communities, some communities, most communities, all communities f: use of synthesized fertilizer: no communities, some communities, most communities, all communities
3.6.b	What is the level of harvesting of food garden for the past five years? [1] Lesser [2] same [3] more
3.6.c	what are the major threat perceived in affecting your food gardens: [1] low soil fertility_____ [2]no land area _____ [3] logging_____ [3] invasive species: pigs, cats, dogs, rats, African snail [5] pest and diseases [6] waste and pollution [7] others:_____
3.6.d	what are the major threats perceived in affecting your livestock? [1] soil fertility_____ [2]no land area _____ [3] logging_____ [3] invasive species: pigs, cats, dogs, rats, African snail [5] pest and diseases [6] waste and pollution [7] others:_____

QUESTIONNAIRE 4 (Environment and Disaster)

Section 1: General	
1. a	Name of interviewee:
1.b	Name of interviewer:

SECTION 2: ENVIRONMENTAL SECTOR	
2.1	Climate Change
2.1.a	Do you notice or observe any changes in the weather pattern in your village? If 'yes, please name some of the changes you have observed?

2.2.b What is your observation of the following climatic variables in your village? Rate them in terms of their **frequency** of **occurrence** and **intensity** of impact on your land and crop resources.

Climatic Variables	Land resources/River						Crop resources					
	Frequency			Intensity			Frequency			Intensity		
	Rare	Often	Regular	Low	Med	High	Rare	Often	Regular	Low	Med	High
Rainfall												
Temperature												
Wind												
Sunshine												
Humidity												

2.3.c Identify from the list the main climate change threats you have experienced in your village?

Climate Threats	**Coping** and **adaptive** measures you use or apply when you are impacted by these impacts?
Heavy rainfall	

	Strong wind	
	Flooding/Flash flooding	
	Extreme (prolonged) drought	
	Heat wave	

Annex 3 A: Land owners' trustees

KLA LAND TRUSTEES

GARAVU TRIBE

NAME	DATE	SIGNATURE
Baltasare Basi		
Jacob Manengelea	20/04/18 Manengelea	Manengelea.
Dusty Vaena	24/04/18	
Silio Rere		
Eric Doko	23/04/18	Doko
Patrick Kikidi	PATRICK KIKIDI	PK

KOINAHAO TRIBE

Name	Date	Signature
Peter Chris	22/04/18	PETER CHRIS
Saniel Selly	22/04/18	
Augustin Piu	22/04/18	AUGUSTIN PIU
Maxson Kelly		
Bollen Moses		
Willy Tala	22/04/18	

LASI TRIBE

Name	Date	Signature
Aloysio Deni	23/04/18	DENI
John Basi		
Amodo Mae	22/04/18	AMADO MAE

Duddley Varisto		
James Nongi	23/04/18	J. Nongi
Benito Ben	23/04/18	

MANUKIKI TRIBE

Name	Date	Signature
Peter Raemidiha	22/04/18	
Nare Dona	22/04/18	NARE DONA
Primo Keni	22/04/18	PRIMO KENI
Francis Masi		F. Masi
Stanely Doko	22/04/18 STANELY DOKO	Stanely DOKO
Elsy Seri	22/04/18	

Annex 3 B: evidence of landowners' support

KOEHOTO LAND OWNERS ASSOCIATION
P. O. BOX 1316, HONIARA, SOLOMON ISLANDS

To, The Director of Mines &
Rural Electrification,
P. B. Box G37,
Honiara

15th April, 2018

Dear Sir,

Re: Complain - Upper Turarana River

This is to formally submit our Association's complain to your Ministry for allocating the Upper Chovohio river to Gold Ridge.

No proper consultation was done originally to us land owners for the portion of the river.

As such we want your ministry to consider re linquishing the upper part of the river to Koehoto LandOwners' Association so that our area if feasible and viable for Exploration and Mining.

This is important for your Ministry and the Koehoto LandOwners' Association to work cooperatively on, so that mutual understanding is reach for betterment of our Association, Land owners and your Ministry.

We have had contact with a company (Win Win Investment) who operated at lower down river for the area.

Can you consider our request and we will be available to have further dialogue on this issue with your Ministry and Gold Ridge if needs arise.

Thank you for understanding and posittive assessment is very much important and will appreciate your response.

Yours Faithfully

KOEHOTO LAND OWNERS ASSOCIATION
The Common Seal of

Celestine Seri
Chairman

Honourable Jacob Manengelea
Vice Chairman