



Pubic Environment Report

Environment Impact Assessment Study for
Ranadi Dumpsite Rehabilitation

Prepared for Environmental Health Division and Works Division, Honiara City Council

17-Dec-13

Table of Contents

Tables.....	3
Figures.....	4
Acronyms.....	5
Executive Summary.....	6
Section 1: General Information	
1.1 Proposed Prescribed Development.....	7
1.2 Project Proponent Details.....	7
1.3 Outline of Prescribed Development	7
1.4 Institutional Frameworks.....	9
1.5 Location of Proposed Prescribed Development.....	12
1.6 Background to Proposed Development.....	13
1.7 Proposed Prescribed Development to other existing development.....	13
Section 2: Description of Prescribed Development	
2.1. Methodology.....	13
2.2. Steps for Improvement.....	15
Section 3: Baseline Information	
3.1 Geology.....	17
3.2 Hydrology.....	19
3.3 Climate.....	19
3.4 Land Use.....	22
3.5 Soil Type.....	22
3.6 Ecological Environment.....	23
3.7 Biological Environment.....	25
3.8 Status of Present Solid Waste Management Infrastructure	27
3.9 Incoming Waste Collection Vehicle Survey.....	31
4.0 Socio-Economic Status.....	33
4.1 Small-Scale Solid Waste Industry.....	35
Section 4: Relevant Impacts	
i. Screening of Potential Environmental Impacts.....	37
ii. Potential Project Benefits.....	38
iii. Potential Negative Impacts.....	39
Section 5: Proposed Safeguards and Mitigation Measures	
i. Environment Management Plan in Summary.....	49
ii. Mitigation Measures for the Project Design.....	51
ii. Mitigation measures for the Construction Phase.....	53
iii. Mitigation measures for the Operation Phase.....	55
iv. Monitoring Plan.....	57
Section 6 : Conclusion and Recommendation.....	62
Section 7: Information Sources	63
Section 8: List of Annexes.....	65
Annex I: Statement of Compliance	
Annex II: Topographic Survey of Current Ranadi Dumpsite	
Annex III: Letter of Transfer of Land Title to Honiara City Council	
Annex IV: Rehabilitation Plan for Ranadi Dumpsite	

Tables

Table 1	Annual Daily Rainfall Data and average annual temperature (1995-2012)	20
Table 2	Soil Classification for Lungga Land System	22
Table 3	Areas and Types of Pasture 1991-1992 (1993 estimate)	23
Table 4	Baseline Study of Water Quality taken at Creek near Ranadi Dumpsite	25
Table 5	Environment and Social Consideration Study by JICA (2010)	26
Table 6	Scientific data of Flora and Fauna present near surrounding dumpsite	27
Table 7	ECD environment and health observation survey (2011)	28
Table 8	Honiara Refuse Collection Zones	29
Table 9	Positive Impacts	37
Table 10	Community Profile of different level of people at ranadi dumpsite	38
Table 11	Summary of Potential Negative Impacts (Environment Management Plan)	45-48
Table 12	Odor Intensity Scale for Monitoring	57
Table 13	Fire and Smoke Emission Scale for Monitoring	57
Table 14	Water Quality Scale for Monitoring	58
Table 15	Summary of Environment Monitoring Plan	59-61

Figures

Fig 1 Map of Ranadi Proposed Project site, East Honiara	12
Fig 2 Proposed Institutional Framework of Project	14
Fig 3 Annual Daily Rainfall data and average annual temperature in Honiara (1995- 2012)	21
Fig 4 Current Situation of Ranadi Dumpsite, April 2012	28
Fig 5 Honiara Waste Stream	30
Fig 6 Bar graph showing estimated volume of wastes against vehicle (2012)	31
Fig 7 Bar graph showing estimated total volume of wastes within a one week period (2012)	32
Fig 8 Bar graph showing total number of waste collection vehicles daily loads/trips (2012)	32
Fig 9 Domestic Waste Composition in Honiara (2011)	34
Fig 10 Commercial Waste Composition in Honiara (2011)	34
Fig 11 Photograph of waste collection vehicle disposing waste at Ranadi (2012)	35
Fig 12 Photograph of bulky waste at Ranadi dumpsite (2012)	40
Fig 13 Photograph of bulky waste at Ranadi dumpsite (2012)	40

Acronyms

EIA	Environment Impact Assessment
ECD	Environment and Conservation Division
EHD	Environmental Health Division
PER	Public Environment Report
HCC	Honiara City Council
MECDM	Ministry of Environment Climate Change Disaster Management & Meteorology
MHMS	Ministry of Health & Medical Services
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management
NSWMS	National Solid Waste Management Strategy and Action Plan
NAPA	National Adaptation Programmes of Action
NBSAP	National Biodiversity Strategic Action Plan
NCRA	National Coalition for Reform and Advancement
KGA	Kastom Gaden Association
ppm	parts per million
ppk	parts per kilogram
NTU	Nephelometric Turbidity Unit
pH	Potential Hydrogen
JICA	Japan International Cooperation Agency
ROC	Republic of China
WHO	World Health Organization
LRD	Lands Resources Division
IEE	Initial Environment Examination
SAICM	Strategic Approach to International Chemicals Management
CITES	Convention on International Trade in Endangered Species
spp	species
EAC	Environment Advisory Council
PET	Polyethylene Terephthalate
RSWMS	Regional Solid Waste Management Strategy
OHS	Occupational Health & Safety
mg/L	milligrams per Litre
COD	Chemical Oxygen Demand
EMP	Environment Management Plan
SBD	Solomon Island Dollar

Executive Summary

A small-scale environmental impact assessment (EIA) in the form of Public Environment Report (PER) has been undertaken of the activities proposed by Honiara City Council at Ranadi Dumpsite in Honiara, Solomon Islands. Rehabilitation of the Ranadi landfill is part of Honiara City Council's project in collaboration with partner stakeholders.

The purpose of the Public Environment Report (PER) document is to present the information gathered and assessed as part of EIA Process.

The Ranadi dumpsite land parcel no. 192-010-217, 192-010-216 and 192-010-205 are located at the north-eastern end of Ranadi industrial site. The parcel no. for the purpose of this PER is referred to as the project area.

The project proposes to rehabilitate the existing Ranadi dumpsite and the additional project area for the management of solid wastes in Honiara City in order to extend the capacity of the landfill to take in wastes for another 5-20 years.

The construction phase of the project will require both early works and development activities. The operation phase is planned based on operations and maintenance of the dumpsite for an estimated 5-20 years. Following the operations towards the closure of the landfill site, it is anticipated that a small team will remain to manage the site for several years including the monitoring after the rehabilitation.

Section 1: General Information

1.1. Proposed Prescribed Development

The Public Environment Report (PER) identifies the rehabilitation plans proposed by Honiara City Council on Ranadi Dumpsite, Honiara, Solomon Islands.

The PER was prepared in accordance with the requirements of the Environment Act 1998 and the Environment Regulations 2008 of Solomon Islands.

To ensure that the unique characteristics of Solomon Islands are preserved, the Honiara City Council through the Ministry of Environment Climate Change Disaster Management & Meteorology have conducted an environmental impact assessment study of the landfill site and surrounding environment.

1.2. Project Proponent

The Project Proponent for this National Project is Honiara City Council in collaboration with other partner stakeholders such as the Ministry of Environment Climate Change Disaster Management & Meteorology and Ministry of Health & Medical Services. Honiara City Council is located in Honiara, Solomon Islands, and is engaged in waste management within Honiara City apart from other environmental health issues. The proponent's contact details are as below:

Honiara City Council
P.O.Box 324
Honiara
Solomon Islands
Telephone: (677) 28294/28294 or (677) 27545
Email: gitiulu@yahoo.com and labutalu@gmail.com

Environmental Health Division and Works Division was established within the Honiara City Council as departments which deals with waste management and other public works within Honiara City boundary.

1.3. Outline of the objective of the prescribed development

The proposed development is purposely for the rehabilitation of the existing Ranadi dumpsite which is an output under the J_PRISM project. The J-PRISM Project is a regional technical cooperation project that includes 11 Pacific Island Countries including Solomon Islands. Each Pacific Islands country has its own national activities under this project including Solomon Island with three (3) major outputs under this project are as follows;

- (1) 3R (Reduce, Reuse, Recycle) Activities are practiced in Honiara and Gizo.
- (2) Disposal System is improved in Honiara
- (3) Experience disseminated throughout the country.

The proposed rehabilitation of the Ranadi dumpsite is going to improve the landfill disposal site in Honiara as outlined in output two (2) using the Japanese Fukuoka Method or Waste Landfill with a Semi-aerobic Structure which was piloted in several Pacific Countries through the Regional Solid Waste Management Project (J_PRISM) in recent years.

Honiara City as the capital of Solomon Islands is fortunate to be selected as one of the proposed project sites to demonstrate the application of the Fukuoka Method to improve the existing Ranadi waste dumpsite. The location of the project site is some 8 km from the Central Business District to the end of the main industrial site at Ranadi.

This project is a technical cooperation assistance project implemented by JICA in collaboration with SPREP and Solomon Government with the expected time-frame of 5 years. It will be implemented by counterparts from the following agencies;

1. Ministry of Environment, Climate Change, Disaster Management and Meteorology (Environment and Conservation Division)
2. Honiara City Council (Environmental Health Division and Works Division)
3. Ministry of Health and Medical Services (Environmental Health Division)

The main objective of the proposed development is to rehabilitate and improve the existing Ranadi dumpsite to a certain level of sanitary landfill to reduce adverse impacts on the surrounding environment and public health. Since Ranadi dumpsite accepts all types of waste, the existing landfill is limited to a capacity of 5-20 years life or less. Therefore, in consideration to the current situation and to prolong the landfill capacity of life years the proposed rehabilitation of the site will follow the Fukuoka method but with some modifications which will be more applicable to the Ranadi site.

In this project the level of improvement of a semi-anaerobic landfill system in the long term should have follow these various categories below:

Level 1: Controlled Tipping

Level 2: Landfill with side embankment and daily soil cover

Level 3: Landfill with leachate treatment system and gas ventilation system

Level 4: Complete establishment of a modified semi-anaerobic system (Fukuoka Method)

The National Solid Waste Management Strategy and Action Plan (NSWMS 2009-2014) aims to set targets and identify actions on ways to address the existing issues regarding solid waste management. This strategy is aimed at making provision for solid waste management services for all by improving the standard of solid waste collection, as well as transportation, treatment and disposal services and awareness to all communities. This strategy also will set a way forward for all stakeholders including Government Ministries and departments, local authorities, producers of commercial and industrial wastes and the civil society to take action.

The effectiveness of proper waste management within the municipal boundary depends on the integrated management approach of waste generation at source, waste collection systems, immediate or intermediate treatment and the final disposal.

The Solomon Islands is made up of vast scattered communities and Honiara City itself is consisted of different communities from various cultural backgrounds. The recent waste characterisation study conducted in August 2011 and incoming waste collection vehicle survey conducted in May 2012 provide essential data for responsible authorities and Honiara citizens to know concerning the waste profile or waste stream within the city. These data are necessary for future planning and financial activities projected to improve the Ranadi dumpsite which will also assist in drafting a national legislation or policy on waste management in the future.

1.4. Institutional / Legislative Framework

1.4.1. National Legislations

i. Environment Act 1998 and Environment Regulation 2008

The Solomon Islands Environment Act 1998 enacted by the Cabinet stipulates the requirements for the protection and conservation of the environment and administered through the establishment of the Environment and Conservation Division to provide advice and guidance related to matters connected to or incidental thereto under two main parts (i) Development Control and (ii) Pollution Control. The Environment Act 1998 is significant as it ensures that all prescribed developments take responsibility for potential environment impacts outlined in their management plans.

The Environment Regulation 2008 in exercise of the powers vested upon the Director of Environment and Conservation by section 55 of the Environment Act 1998 formulate the regulation to safeguard the protection and conservation of the environment.

ii. Wildlife Protection and Management Act 1998

The Wildlife Protection and Management Act 1998 is an act which was enacted by the National Parliament of Solomon Islands to make provision for the protection, conservation and management of wildlife in the Solomon Islands. The Act regulates the trade of wildlife on export and import of certain plants and animals and to comply with the country's obligation imposed under the Convention of International Trade in Endangered species or wild fauna and flora (CITES) and for other matters connected therewith or incidental thereto.

iii. Protected Areas Act 2010

The Protected Areas Act 2010 enacted by the National Parliament of Solomon Islands makes provision for the declaration and management of Protected Areas or Areas where special measures need to be taken to conserve biological diversity and the regulation of biodiversity and prospecting research and for matters related.

iv. River Waters Act 1996

River Waters Act 1996 is an Act to make provision for the control of river waters and for the equitable and beneficial use thereof and for matters incidental thereto and connected therewith.

v. Fisheries Act (Revised 1996)

The Fisheries Act 1996 is an Act which stipulates for the promotion and regulation of fishing and fishing industries in the Solomon Islands.

vi. Environmental Health Act 1980 (Revised 2006)

An act “to make provision for securing and maintaining environmental health and for matters connected therewith or incidental thereto”.

vii. Honiara Litter Ordinance 1994

The Honiara Litter By-law and Honiara Refuse Disposal was revised in 2009 to formulate the Honiara Litter Ordinance. This legislation was supposed to prevent littering in public areas and offenders to pay a certain amount of fine. However it was not enforced. It was supposedly to promote the use of standard and acceptable receptacles that are approved by the responsible authority which is the Honiara City Council. Due to lack of enforcement it has not been imposed in recent years.

viii. Land and Titles Act 1969

“An Act to amend declare and consolidate the Law relating to the tenure of land, the acquisition of land , the registration of interests in land, to other like purposes and to matters incidental thereto and connected therewith.”

ix. National Solid Waste Management Strategy and Action Plan (2009-2014)

The NSWMS was formulated purposely to “set targets and identify actions on ways to address the existing issues regarding solid waste management in the country. It will also make provision for solid waste management services for all by improving the standard of solid waste collection, as well as transportation, treatment and disposal services and awareness to all communities. Overall, it is a way forward for all relevant stakeholders and civil society to take action.”

x. Solomon Islands National Climate Change Policy (SINCCP) 2012

The Climate Change Policy is very important in Solomon Islands in terms of waste management. This Climate Change Policy makes provision for reduction of emission of greenhouse gases.

xi. National Adaptation Programmes of Action (NAPA) 2008

The National Adaptation Programmes of Action “ states that the relationship between climate change and waste management has not received a lot of attention but with an increasing population, planned and unplanned development and poor infrastructure, waste management problems are an issue of increasing concern with respect to climate change in the Solomon Islands. Honiara and the provincial towns have very old and rundown liquid waste networks

which are poorly managed and it is having negative impacts. NAPA will communicate priority activities addressing the urgent and immediate needs and concerns of Least Developed Countries, relating to adaptation to the adverse effects of climate change. In this context, it is considered that Solomon Islands has a low adaptive capacity and therefore will require urgent and immediate support and actions to adapt to current and projected adverse effects of climate change. Thus, any further delay in implementing activities identified and prioritised through NAPA process would increase its vulnerability and lead to increased costs (economic, social and cultural) at a later stage”(NAPA ,2008: 13, 59-60).

xii. National Biodiversity Strategic Action Plan (2008-2015)

The NBSAP (2009) for Solomon Islands was an outcome from the International Convention on Biological Diversity. The purpose of this important document is to mainstream biodiversity and integration of climate change.

xiii. NCRA Policy Statement

The NCRA Policy statement aims to work towards improvement of the livelihood of Solomon Islanders by implementing a reform program that focuses on greater autonomy for economic development and recognizes the importance of rural contributions to the overall development of the country.

1.4.2. International and Regional Agreements

xiv. Regional Solid Waste Management Strategy (RSWMS) 2010-2015

This regional strategy provides a framework within which to achieve a healthy, socially, economically and environmentally sustainable Pacific for future generations. Its goal is for Pacific Island Countries and Territories to adopt cost-effective and self-sustaining Solid Waste Management systems to protect the environment, in order to promote a healthy population and encourage economic growth. The scope of the RSWMS includes the different wastes types such as:

- Domestic, commercial, institutional and industrial solid waste
- Medical wastes from public institutions such as hospitals and health care clinics
- Special and difficult wastes such as scrap metal, asbestos, mining and disaster waste

xv. Waigani Convention

The scope of Waigani Convention is focused on substances that is categorised as hazardous wastes. For the purposes of the Convention, it takes into account wastes categorized as hazardous classified under the different waste streams as indicated in Annex I and in Annex II of the Convention. This convention purposely is to monitor the transboundary movements of Hazardous and Radioactive wastes and management within its Regional Pacific Member

countries. Solomon Islands is amongst other Pacific countries that have ratified the Waigani Convention.

xvi. Stockholm Convention

The formation of Stockholm Convention was concerning the precautionary approach as set out in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Convention is purposely to protect human health and the environment from Persistent Organic Pollutants. The Solomon Islands is amongst other regional neighbours who signed the Stockholm Convention.

xvii. Strategic Approach to International Chemicals Management (SAICM)

The SAICM is a global framework which aims to support efforts to achieve the Johannesburg Plan of Implementation goal by 2020 that chemicals should be produced and used in ways that lead to the minimization of significant adverse effects on human health and environment. The country has become a member of SAICM secretariat.

1.5. Location of Proposed Prescribed Development

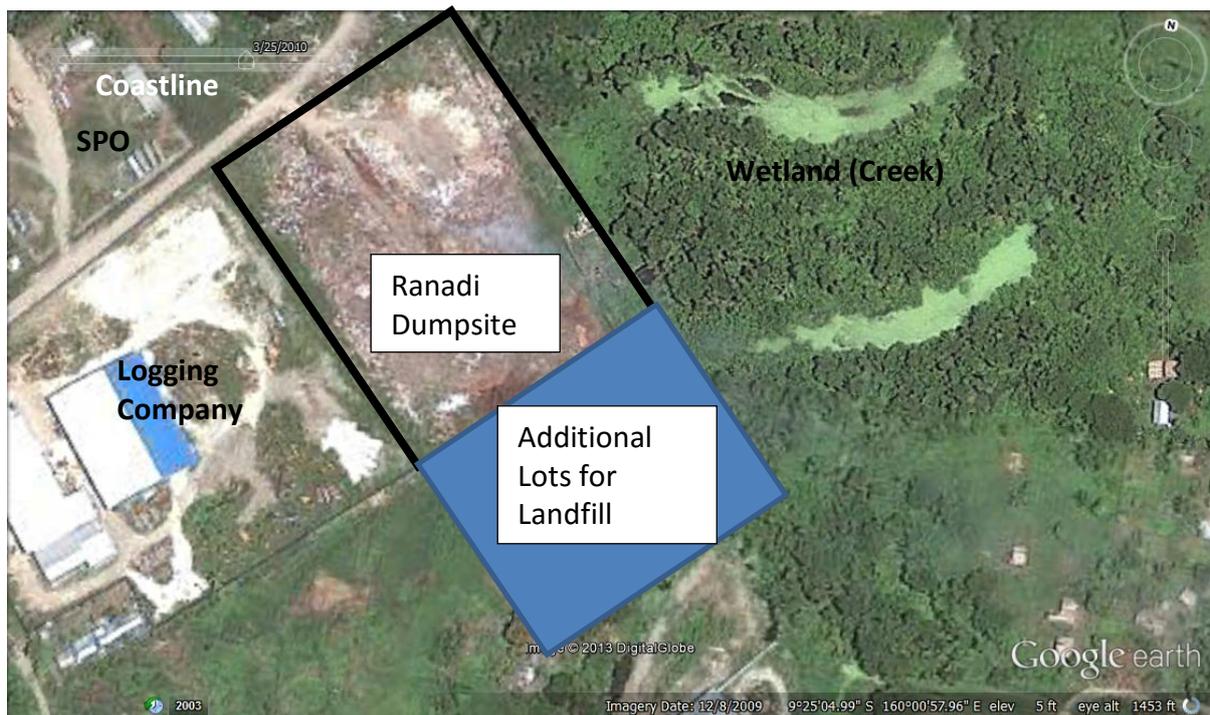


Figure 1: Map of Ranadi Proposed Project site, east Honiara, Source: Google Earth Imaginary 2013

1.6. Background to the proposed development

Honiara City itself has a total population of 64, 609 out of the total Solomon Islands population of 515, 870(Statistical Bulletin 06/2011). As the capital and centre of major developments, the migration of people from rural to the urban centre is usually high. Honiara and all the other urban centres of Solomon Islands have an open dumpsite with no proper management. Current situation of Ranadi dumpsite is the inadequate management and control of waste disposal operations at the dumpsite. There is no specific law to regulate land use for waste and the types of waste to be disposed of. All types of waste are currently accepted at the current dumpsite. The supporting services of waste itself in-terms of administration is a very costly exercise.

Previous waste characterization studies conducted in 1990, 1999, 2009 and 2011 respectively have shown similar results indicating that organics dominate the waste composition that are tipped off at the Ranadi Dumpsite. Amongst other wastes tipped off at the Honiara Ranadi dumpsite, recyclable materials are the next but with no segregation done on site except by waste pickers who are looking for valuables from tipped off garbage.

1.7. Proposed Prescribed development to other Existing developments

With the land use development for a landfill or cemetery, it decreases the environmental, health and aesthetic values for the resource owners. Landowners are usually reluctant to allow their land for landfills or cemeteries due to the negative perspective that the land use is wasted and without worth. This is one of the challenges for local authorities to acquire land outside of the town boundary within their jurisdictions.

In the case of Honiara, the potential sites are located outside of the town boundary and the existing open dumpsite cannot take in more wastes if no actions are taken immediately. Due to this lack of land available for a proper landfill; it contributes to the problems facing waste management in Honiara. The land used for landfills can become worthwhile if it is rehabilitated or constructed using practically proven methods and technology that will enable the reuse of the existing land even after the closure of the landfill.

The consequences of failing to go ahead with this project are an uncontrolled open dump-site with no purpose for proper management of waste by responsible authorities. The life years of the dump-site will be shortened for only a few years.

2. Description of Proposed Project

2.1. Methodology

One of the existing and practical methods to construct a landfill is the Fukuoka method. It is cost effective and practically proven in Japan, Samoa and a few of other developing countries. The same method will be applied in the Solomon Islands context at Ranadi dumpsite but with some modifications of existing dumpsites .

In compliance to section 19 under the *Environment Act 1998*, the categorization of the proposed project proponent in the level of IEE is under category B under the JICA Guidelines and under the Second Schedule; section 16 of the *Environment Act 1998*, it is a prescribed development under public works sector where a landfill is involved. The scale of the proposed project will be small as it will only be focusing on rehabilitating the existing dumpsite at Ranadi with the some additional facilities to be constructed. Additional land parcels given back to the Honiara City Council will also be utilized by the Project proponent at a later date should it be required during the construction and operation phase of the rehabilitation.

The reason for categorizing the scale of the proposed project is because it is not likely to have much significant adverse impacts on the environment under the JICA Guidelines for Environment and Social Considerations in terms of its sectors, characteristics and areas. The Waste Pickers livelihood depends on the existing dumpsite for their living and considerations of this is necessary. The need for the project is to develop the capacity of landfill operators on landfill management as well as Solomon Islands Honiara waste management counterparts to rehabilitate the landfill site to an improved standard through this proposed project.

The Proposed Institutional Framework of the Project will follow as illustrated in figure 2 below.

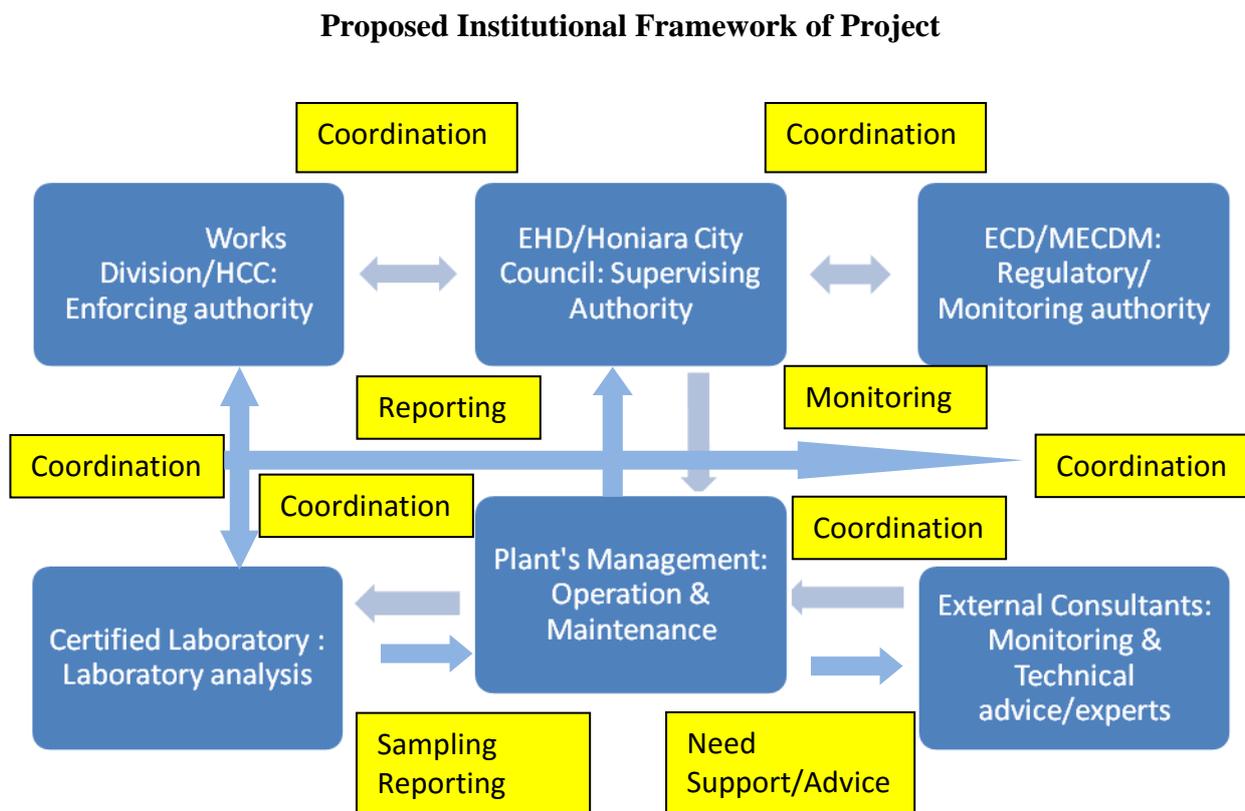


Figure 2: Proposed Institutional Framework of Project

2.2. Steps for Improvement

The Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management (J_PRISM) Project will rehabilitate the existing Ranadi dumpsite and later on the additional plots given to the Honiara City Council , using the Fukuoka Method with some modifications taking into consideration the situation of Ranadi for the improvement phase as follows;

1. Side Embankment Formation

The purpose of establishing side embankment is to contain rubbish within the waste landfill area, minimizing littering and waste from being disposed beyond the site affecting the neighbouring areas. It also demarcates different sections for different types of waste, thus acting as a physical barrier dividing the waste disposal sections. The side embankments height will be more than 3-4 meters and base width of 5-7 meters. It shall form a visible physical barrier to keep waste disposal operation under control.

All the incoming wastes will be directed to marked locations within each designated cells for side embankments. The side embankment will run through the entire boundary of the dumpsite and it will become a natural fence around the landfill. The construction of the side embankment as highlighted above with the use of incoming waste will suck in a lot of waste. The materials which would be used to construct the side embankment formation consists of an incoming wastes disposed at the Ranadi dumpsite including those existing wastes plus soil cover.

In order to construct the side embankment, heavy machines such as Loader (20-30 tonnes), excavator (20-30 tonnes) and bulldozer (20-30 tonnes). During the duration of the side embankment formation the waste cells will be formed with the assistance of the machines to push or move wastes around quickly. Thus, it pulls in waste to form the embankments and clears the waste at base. The technical assistance and guidance of the JICA local expert will be present to advise counterparts on the work progress as well as to pass on knowledge and skills to local counterparts.

2. Installation of Boom Gate and Permanent Fence

The installation of a gate or boom gate is purposely to control incoming traffic into the dumpsite. Currently two boom gates were constructed at the dumpsite and one of the gates was temporarily closed from any incoming vehicles.

A permanent fence will be constructed around the vicinity of the ranadi dumpsite as part of its improvement phase towards the rehabilitation stage. This is to ensure that the site is properly controlled and that revenue collection from fees for disposal at the dumpsite is conducted to ensure the maintenance and operation of the site in the near future.

3. Road Access Improvement and Construction of Site Office

The road access into the dumpsite is one of the important phases for improvement at Ranadi landfill. As part of the improvement process, the site will include a site office with necessary facilities for the site workers and an entrance gate to control access into the site. The Office site will also have access to important facilities such as water, electricity and toilet.

4. Site Levelling and Grading : Leachate Collection and Control

Given the current height of the waste about two meters above the original ground level, it will be much expensive and unworkable to remove all the waste and grade the base of the site. For this reason, the current level of waste will be considered as the base for the vertical extension of the area. The exposed waste will be compacted adequately and then covered with topsoil. The front section has already been covered but the back and inland section has not been covered yet and thus some loads of soil will be brought to cover this remaining section.

This section should also cover the entire landfill surface with topsoil and with good compaction it prevents any seepage of rainwater down to the waste beneath it. Whilst soil cover and compaction is ongoing, some grading will be done to create some inward slope from the side embankments to the center of the dumpsite. The plan is to divert any collected water in the leachate collection pipes to the middle section where it will seep downward along the waste profile to the main leachate collection pipes. Since the height of the waste is more than 2meters, some leaked water or leachate down to the waste beneath will be absorbed by the waste contents or evaporated as the temperature beneath is higher. Some leachate will still be captured at the main leachate collection pipes, which will be channelled down slope and emptied into a main leachate collection pond.

A leachate pond will be constructed at the inland side of the site, and thus the main leachate pipes will be positioned at an angle to ensure the flow of any captured leachate or water is channelled to the pond. The main leachate pipe will run through the centre of the waste landfill from the seaward side to the inland end where the pond will be placed. The leachate collection main pipe will be made from PVC pipes tied together. Holes will be drilled on the top half section of all PVC pipes giving higher probability of leachate capturing when seeping from the waste above. This also helps to prevent problems arising from blocked pipes as leachate will seep to the lower PVC pipes if the top ones are blocked (refer to attachment).

Overall, any water generated within the waste landfill once it is completed will be largely controlled at the waste layer contents through evaporation and absorption. Any remaining waste water collected or leachate waste that is captured by the collection pipes and collected at the pond will be naturally treated using a natural means without the use of any costly technologies.

5. Gas Ventilation and Control

Gas Ventilation Facilities or gas venting pipes will be installed along 20m interval of the main leachate collection pipe. The main leachate pipe will go through the open bases of the gas ventilation facilities and towards the leachate pond end. Oxygen enters from this end and runs through the leachate pipe and the open bases of gas ventilation facilities. During the process, the hot air within the waste landfill rises creating a vacuum which sucks the cool air (oxygen) into the system. Thus the gas ventilation facilities enable the generated methane in the waste contents to be released, while at the same time introducing oxygen to make the system semi-aerobic. Without oxygen input, the system will be anaerobic (refer to attachment).

6. Separate Waste Disposal Cells

The final set up of the waste landfill once it completes should have in designated cells for the disposal of the different waste categories such as the following:

a) Storage Cell for Bulky Waste

This Cell will be for Bulky Waste Items including scrap metals, car bodies and others of the same magnitude. This cell will be located next to the main entrance to divert at the first place these types of non-compactable waste items. The placement at the front section will easily facilitate any plan for the removal of some items by interested recycling companies later.

b) Cell for Non-biodegradable wastes

Cell for the non-biodegradable waste is to be located at certain designated areas on a rotation basis during and after the rehabilitation work stages. All incoming waste will be diverted to their designated locations for storage and disposal. Waste cells for these non-biodegradable general wastes must be compactable for wastes such as papers, plastics, cans, textiles and others of similar nature.

c) Recycling Drop off Points

Some mesh wire cages will be established and located at the main entrance to promote segregation at source by businesses and members of the public who bring in their waste voluntarily.

3. Baseline Information : Physical Environment

3.1. Geology

Guadalcanal is the largest of the six major islands of the Solomon Islands group, approximately 6000km² in area, being 150km long from north-west to south-east and, at its broadest, 45 km wide. It lies south of the gap between Malaita and Santa Isabel in the northern chain. Honiara Ranadi dumpsite is located on the North-eastern tip of Guadalcanal where the natural features is mainly situated on a wetland of pandanus trees and coconut

trees, formerly a swamp area habitat for mangroves . It is located at a centroid coordinate position of 160°00'54''longitude and -09°25'02'' latitude(refer to figure 1).

The geology of the Solomon Islands is divided into five (5) geological provinces as according to Hackman (1980:1). They are;

1. Central Province
2. Pacific Province
3. Volcanic Province
4. Oceanic Volcanic Province
5. Atoll Province

Most of Guadalcanal falls within the Central Province, although the northern-western area represents the eastern end of the Volcanic Province. In addition, the Central Province embraces the whole of Choiseul, San Cristobal and Florida, together with the south-western side of Santa Isabel.

The Islands of the Central Province are characterised by intensely faulted cores of pre-Miocene basic lavas, in part regionally metamorphosed to a low grade (green schist or amphibolites facies). These are overlain by a sedimentary succession ranging in thickness from 5000m in east-central Guadalcanal to perhaps less than 700m on San Cristobal.

The sediments range in age from Lower Miocene through to Holocene, including organic limestones, calcarenite, arenaceous and volcanoclastic material. The sedimentary pile in general shows shallow dips variations being due to block faulting or gentle 'drape' folding reflecting underlying basement structures.

Coleman (1957) sourced in Hackman (1980) gave the name Honiara Beds to 'the calcareous sediments of varied lithology which rise from the sea as a series of three or four terraces and which occupy a belt of country from the Umasani (Segilau) River to the Lungga River, and beyond'.

The Honiara Beds form a grassy escarpment broken by all the major rivers between the Umasani and the Mbokokimbo, behind Honiara itself there is a fine series of terraces.

The Honiara Beds have a rich fauna: molluscan remains are more abundant than in the older sediments. Noteworthy is the giant clam, *Tricadna*. Partly recrystallised coral-algal material is a common constituent of the lime stones. The benthonic foraminifera *Calcarinaspengleri* and *Baculogypsina* are found in the Honiara Beds. The fauna and well-preserved terraces indicate a Recent or Pleistocene date for the Honiara Beds.

The Honiara Beds rest disconformably on the Lungga Beds and Mbonehe Limestones to the west of Honiara, and overlies various members of the Toni Formation to the east. They interfinger with the alluvial of the Guadalcanal Plains and the upper part of the Lungga Beds. The bedding dips at 5° to 20° to the north-north-east. The maximum thickness of the Honiara Beds, between the Lungga and Mberande Rivers is about 800m, but they thin rapidly to about 60m west of Honiara. In the Honiara Beds arenaceous and rudaceous epiclastics bulk large, as

in the underlying Toni Formation but calcareous sediments form a higher proportion of the sequence, especially west of the Lungga River.

Conglomerates predominate towards the eastern end of the Honiara Beds: they comprise the lower two-thirds of the section in the Ghauregha tributary of the Mbalisuna. Orthoconglomerate passes up-section into grey-weathering rusty yellow arenites with occasional pebbly bands. Seventy percent of the phenoclasts in these conglomerates are of hornblende-andesite of Gallego type; fragments of felds-parphyric basaltic andesite and coralgall limestone are also common.

3.2. Hydrology

The average highest tide for 2011 according to Water Resources division is 0.96m and the lowest average tide is 0.15 metres. The location of the dumpsite is on a swamp land prone to flooding and rising sea level. Lungga River is one of the nearest big river system close to Ranadi dumpsite apart from the smaller Burns creek system that flows downstream beside the dumpsite. Hydrological equipment was installed at Lungga River in 2008 but was later destroyed by some people. Up to date, due to lack of installation of adequate reliable hydrological data, no information about the hydrology of the Ranadi dumpsite area can be further explained. Coastal settlements near the dumpsite are also using the underground water source or well. This is often limited and can only be recharged through precipitation. However, due to the location of the site close to two (2) metres above sea level, the intrusion of salinity may affect the water source and also the leachate of heavy metals overtime from the dumpsite.

3.3. Climate

The Climate is tropical, though temperatures are rarely extreme. From April to October is characterized by fine, dry weather. From November to March is the wet season. Annual Rainfall at the Henderson Airport which is the nearest station from the existing dump site is 2,607mm in 2008 as highest and 1,400mm in 2005 as lowest annual rainfall (Refer to table 1 and figure 3 below). In 2011, the total Annual rainfall at the Henderson Airport was 2041.8mm. The maximum mean daily temperature for 2011 was 31.5°C and the minimum mean daily temperature was 22.7°C (Solomon Island Meteorological Service 2000-2012). The quality of air at the Landfill and surrounding sites are exposed to smoke emissions from the factories and from road dust influenced by the dry-wet weather.

Table 1: Annual Daily Rainfall data and average annual temperature (1995-2012)

Year	Total Ave.Temp (°C)	Total Ave.Daily Rainfall (mm)
1995		1326.8
1996	31.3	2168.8
1997	31	15.91.4
1998	31.4	0
1999	31.1	2196.2
2000	28.7	2023.3
2001	31.9	1863
2002	31.5	1747.1
2003	31.9	1312.7
2004	31.5	1802.3
2005	31.7	1400.3
2006	31.5	2097.9
2007	31.6	1549.9
2008	31.5	2607.3
2009	31.3	2515.6
2010	31.6	2113.5
2011	28.8	2041.8
2012	22.6	1392.7

Source: Meteorological Service Data, MECDM, 2012

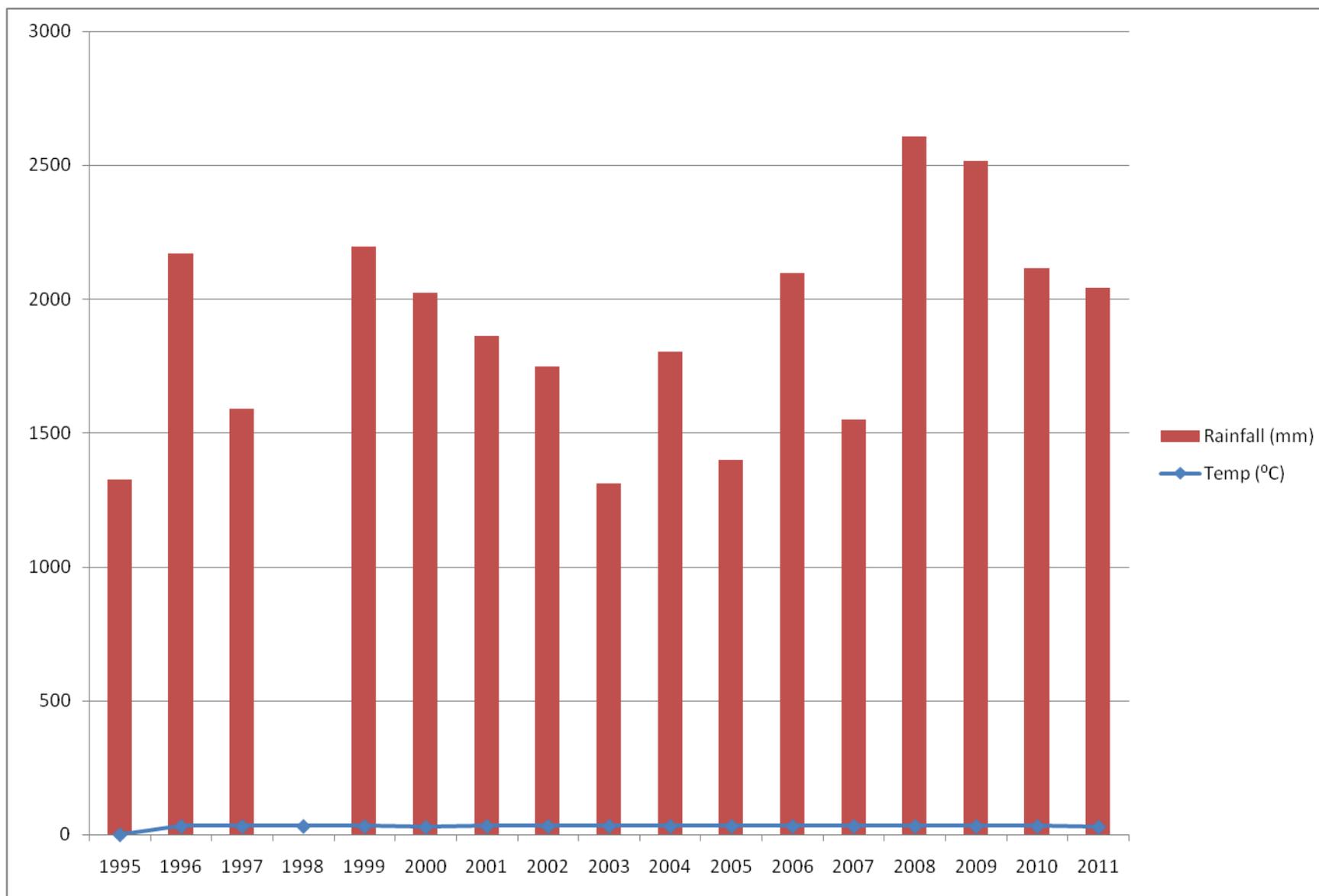


Figure 3: Annual daily rainfall and average annual temperature in Honiara (1995-2012, July).Source: Meteorological Service Data, MECDM 1995-2011.

3.4. Land Use

There are two types of land ownership systems in the Solomon Islands. Government owned land and customary land ownership. The Ranadi landfill is approximately 6 km from the Central Business District. The Ranadi dumpsite is located within the town council boundary of Honiara. The council is currently in the process of registering the open dumpsite. However, there are some matters that need to be sorted out. That is, the actual parameter of the open dumpsite is already been given to the Honiara City the green light by the deputy commissioner of lands for registration. The two additional lots of land which are located within and on the southern end of the dumpsite was also given to the Honiara City for the dumpsite space (refer to attachment).

The total area of the existing dumpsite is approximately two to three hectares. The scale of the site is small that the alternative future option is to relocate to an alternative site since the existing site lifespan is estimated to not have the capacity to go beyond in the next 10-20 years. The site is located on a reclaimed swampy area and is more prone to flooding disturbances and sea level rise due to its location of 2 meters above sea level. The location of the existing Ranadi dumpsite is between land parcel no.192-010-0215 and 192-010-0217.

Surrounding the waste dumpsite, at the sea front is a local piggery business that is currently undergoing as well as a recreational area and a SPO facility. On its western end is a private company compound involved in logging operations and a local owned furniture company and the Solo-Enviro Beautification compound.

3.5. Soil type

The soil data is extracted from a study conducted by The Land Resources Division (LRD) of the Ministry of Overseas Development, United Kingdom. According to this study, the Ranadi area is part of the Lungga land system. The classification of this soil is described as follows in table 2 below;

Table 2: Soil Classification for Lungga land system

Letter	Great Group	Description	Fertility Status
H	Tropofluent	Shallow to deep, mixed textures in flood plains; greyish mottled loams and clays	Weakly weathered weakly acid to alkaline; good phosphorus and moderate potassium status.
B	Tropaquent	Deep poorly drained alluvium; grey to bluish green clay	

Source: L.D.C. Chase, 1981: 50

The five main types of crops that are suitably grown in this Lunnga land system include coconut trees, cocoa, pasture, spices and root crops. At Ranadi, the site is located mainly at the eastern end of major industrial manufacturing and extractive industries including a recreational site and an Oil depot of the South Pacific Oil. The ROC Taiwan Technical Farm is located south-east of the Ranadi landfill and is separated by Burns creek wetland. The soil

type at Ranadi is unsuitable for agricultural crops due to the wetness and particularly prone to flooding from sea and rivers.

3.6. Ecological Environment

3.6.1. Biodiversity

The dominant species of flora found in the wetland area includes Pandanus, coconut trees, mangroves and banana trees. Pastures have overgrown under the coconut trees and in areas where there are no developments or that are abandoned overtime. The *Brachiariamutica* (Paragrass) and other various shrubs and weed species are found common in the inland side of the dumpsite. Invasive plant species such as the *Eichhorinacrassipes*(water hyacinth), *Polygonumperfoliatum* (mile-a-minute) are also found in the wetland or creek. “Pasture species common in the smallholder sector are Koronivia, signal, para, batiki, puero and centro. For clarity, Macfarlane (1996) reported that the overall pasture resources for ruminant livestock production in the Solomon Islands could be categorized into open pastures, pastures under coconuts and pastures under trees”(See table 3).

Table 3. Areas and types of pasture 1991-1992 (1993 estimate)

Property	Area (ha)	Total cattle	Available pasture
Lunga	800	729 (1363)	Koronivia (<i>Brachiariumidicola</i>), para (<i>Brachiariamutica</i>), Nadi blue (<i>Dichanthiumcaricosum</i>), <i>Centrosemapubescens</i> (Centro), <i>Puerariaphaseoloides</i> (Puro), <i>Macroptiliumatropurpureum</i> cv. Sirato (Siratro), <i>Stylosanthesguianensis</i> cv Endeavour (Stylo)
Konga/Tenuvatu	360	705 (1034)	Koronivia (<i>Brachiariumidicola</i>), Para (<i>Brachiariamutica</i>), Signal (<i>Brachariadecumbens</i>), Koronivia (<i>Brachiariumidicola</i>), <i>Stylosanthesguianensis</i> cv Endeavour (Stylo)

Property(cont)	Area (ha) (cont)	Total cattle (cont)	Available pasture (cont)
Koli	240	561	Para (<i>Brachiariamutica</i>), Koronivia (<i>Brachiariahumidicola</i>), <i>Puerariaphaseoloides</i> (Phero), <i>Macroptiliumatropurpureum</i> cv. Sirato (Siratro) Guinea (<i>Panicum maximum</i>), Signal (<i>Brachiariadecumbens</i>), <i>Centrosemapubescens</i> (Centro).
Burns Creek	150	262 (292)	Koronivia (<i>Brachiariahumidicola</i>), <i>Centrosemapubescens</i> (Centro), <i>Puerariaphaseoloides</i> (Phero), Batiki (<i>Ischaemumciliare syn. I. aristatum</i>), <i>Stylosanthesguianensis</i> cv Endeavour(Stylo), <i>Desmodiumheterophyllum</i> (Hetero).
6 Mile/Gizo: Open pasture under trees	35/165	224 (715)	Native grasses, <i>Macroptiliumatropurpureum</i> cv. Sirato (Siratro), <i>Puerariaphaseoloides</i> (Phero), <i>Centrosemapubescens</i> (Centro).
Levers	2000	?	Para (<i>Brachiariamutica</i>), Koronivia (<i>Brachiariahumidicola</i>), Signal (<i>Brachiariadecumbens</i>), Batiki (<i>Ischaemumciliare syn. I. aristatum</i>), <i>Puerariaphaseoloides</i> (Phero), <i>Centrosemapubescens</i> (Centro).

Sourced from Wahananiu et al (1993) in Aregheore (2009), accessed on 13/9/12 from <http://www.fao.org/ag/AGP/AGPC/doc/Counprof/southpacific/Solomon.htm> .

The Ranadi Landfill is located close to the Lunnga River mouth which is one of the common fishing spots by local fishermen from surrounding and nearby communities such as from Fishing Village and Burns creek. Even the creek adjacent to the dumpsite provides a fishing ground for nearby communities at Ranadi and Burns creek to fish for the tilapia or *Oreochromis niloticus*. The Tilapia is an invasive species which is commonly found in aquatic environments and is also the most dominant aquatic fauna found in the wetland creek near the dumpsite. Personnel communication with some waste pickers indicates that saltwater crocodiles *Crocodylus porosus* were also sighted in the creek. However, there were no sightings at the time of the field study to confirm this.

An introduced bird species that is most dominantly found around or within the Ranadi Dumpsite is the common myna bird *Acridotherestrictis*. This species of bird is native to India and South-east Asia but is widespread throughout most of the SPREP countries (Atkinson and Atkinson, 2000:30). *Pteralopexatrata* or Guadalcanal Monkey-faced fruit bats are commonly found on Guadalcanal Island which is assumed to be the same species heard from the tree tops of the pandanus trees and coconut trees at the nearby wetland. Native stray dogs are also seen within the site and scavenging for food. There is also high potential for rodents such as the *Uromysporculus* or the Guadalcanal rat breeding at the dumpsite.

According to reports, Ranadi area is the first known location to be invaded by one of the most dangerous invasive species to Pacific Islands terrestrial flora, *Lissachatinafulica* the Giant African Snail which was introduced into the country through the logging industry. This species is a threat to most of the locally grown agricultural crops, plants or trees. This crop killer pest is a threat to Solomon's food security as it feeds on more than 500 different plant species (Palmer, 2010).

3.7. Biological Environment

3.7.1. Water Quality

Table 4 indicates a comparison between the baseline field data collected at Ranadi and the WHO guideline data.

Table 4: Baseline study of water quality taken at the Creek near the Ranadi dump site;

Baseline Data	Field Data	WHO Data
Dissolved Oxygen	-0.02ppm	No guideline Desirable: less than 75% of saturation concentration
Temperature	36.1 °C	No data provided
pH	7.17	No guideline Desirable: 6.5- 8.5
Conductivity	9.78ms	250microS/cm
TDS	6.04ppk	No guideline
Millivolts	-296mv	No data provided
Turbidity	0.9NTU (low range) 1.1NTU(high range)	Not mentioned Desirable: less than 5 NTU

Source: Environment and Conservation Division Water Quality Survey, 2011

According to WHO guideline, these results above indicates that the water quality of the creek at the Ranadi Landfill is polluted at the surface and is not suitable for consumption or domestic uses. Field study on the quality of water at the wetland as indicated in the table above indicates that the quality of water at the creek is 7.17pH. This means that the amount contained in the aquatic system is neutral and plants and aquatic fauna are still found in the system. People were seen fishing for *Oreocromis niloticus* using nets, using the creek for bathing at the top stream. This proves that the temperature of the water is normal and aquatic organisms can still survive. Turbidity of the water is desirable and is the normal colour of such aquatic ecosystems. With the measurement of 0.9NTU indicates a good product water quality of low turbidity and 1.1 NTU of high turbidity.

Find also below in table 5, the water samples collected from four different sites during the initial stages of J-PRISM project by a JICA survey team. Refer to Table 5 below: Table 5: Environment and Social Consideration study by JICA (2010)

Sites	pH	COD mg/L (ppm)	colour	odour
Spring water (source)	7-8	0-5	clear	No odour
Upper site (Burns creek school)	8-9	5-10	clear	Slight odour
Ranadi Dumpsite	8-9	13-20	Slight brown	Bad odour
Downstream well	7-8	5-10	clear	No odour

Source: JICA Environment and Social Consideration Study, 2010

The type of ecosystem found near the Ranadi Dumpsite is mainly of a wetland ecosystem and marine ecosystem. Surrounding the dumpsite is mainly ruderal vegetation indicating disturbed land areas. At the shore front coastal vegetation commonly found includes the morning glory *Ipomoea purpurea*, the *cocos nucifera* (coconut trees) and secondary vegetation. Due to no protective coastal vegetation, the Ranadi dumpsite is prone to coastal flooding, soil erosion and river flooding. According to Ramohia and da Wheya(2012) it was stated that mangroves are found on most islands in the Solomons. On Guadalcanal Island, even though the mangroves are confined to Marau area east of Guadalcanal, there are few trees in some parts of the island. At the background east of the open dumpsite in the wetland are some less dense mangrove forest predominated by *Bruguierastylosa spp.*

Table 6: Scientific table of flora and fauna present on site (Name and species)

Flora				
Trees	Shrubs	Climbers	Invasive spp	Flowering Plants
<i>Cocos nucifera</i>		<i>Polygonum perforiatum</i>	<i>Paspalum conjugatum</i>	<i>Eichhornia crassipes</i>
<i>Bruguiera spp</i>			<i>Eichhornia</i>	
<i>Pandanus spp</i>			<i>Mikania</i>	
Fauna				
Vertebrates	Invertebrates	Invasives	Reptiles	Fish
<i>Pteropus spp</i>		<i>Acridothera tristis</i>	<i>Crocodylus porosus</i>	<i>Oreochromis niloticus</i>
<i>Pteralopex atrata</i>		<i>Achatina fulica</i>		
<i>Uromys porculus</i>				

Source: Environment and Conservation Division flora and fauna observation survey, 2011

3.8. Status of Present Solid Waste Management Infrastructure

Honiara is the centre of most developments activities and services. As such it is the most populous urban centre in the Solomon Islands hosting most people migrating from the rural to the urban city. As the population continues to increase, there is an increase in the demand for basic goods and services. As more industries are expanding more products are imported for various production processes. Imported goods continue to increase to meet this new trend in this 21st century. At the end when all resources have been used, what were left were garbage, litter, unwanted construction materials and scraps, untreated waste water and sludge.

There is no enforced regulation to control the incoming wastes from imported products or chemicals in products into the country. Existing regulations or policies are either out-dated or lacking enforcement. Wastes management is not only an environmental issue but cross-cut with other sectors as well. Thus, the management of waste in the country is a challenge for local and national authorities to deal with.

People's attitude to waste and landfill is a huge problem to address. Businesses and organizations are not responsible for the after products of the imported goods. The Ranadi open dump site is uncontrolled with supervised landfill attendees. The capacity of the open dumpsite is possible to extend a few more years if segregation or separation, recycling initiatives are introduced to all residents and businesses to minimize waste.



Figure 4: Current situation of Ranadi dumpsite, April 2012. Photo: ECD.

At Ranadi dumpsite, there is no proper office building with water and toilet facilities. The fence which was erected in the past was already damaged and fallen. There are no restricted waste collection vehicles. The different types of vehicles that transported wastes to Ranadi landfill includes open trucks and Garbage collection vehicles from Honiara City Council, individuals and companies. Below are some current problem areas identified at the Ranadi dump-site.

Table 7: ECD Environment and Health observation survey (2011)

Current Problem Areas	Severity of Impact		
	HIGH	MEDIUM	LOW
Fly breeding		✓	
Rodents and Vermin		✓	
Maggots		✓	
Offensive odour			✓
Smoke from open burning	✓		
Contamination of surface water with leachate	✓		
Contamination of groundwater with leachate			✓
Fire hazard caused by open burning		✓	
Dust from landfill operation			✓
Visual impact	✓		
Human and animal scavenging	✓		

Source: ECD Environment and Social Consideration Study, 2011

Table 8: Honiara Refuse Collection Zones

No	From	To
1	White River	West Rove
2	Tasahe	Town Ground
3	Lengakiki road	Honiara City Office
4	Vavaya Ridge	Mataniko River mouth
5	Tuvaruhu	Kolaridge
6	Church of Melanesia Quarters	Green House terrace
7	Fulisango	Naha 4
8	SDA Main Church	Kukum SICHE field
9	Panatina village	Mbaranaba
10	East Panatina	Golf Club laborline

Source: Honiara City Council, 2011

Honiara Waste Stream

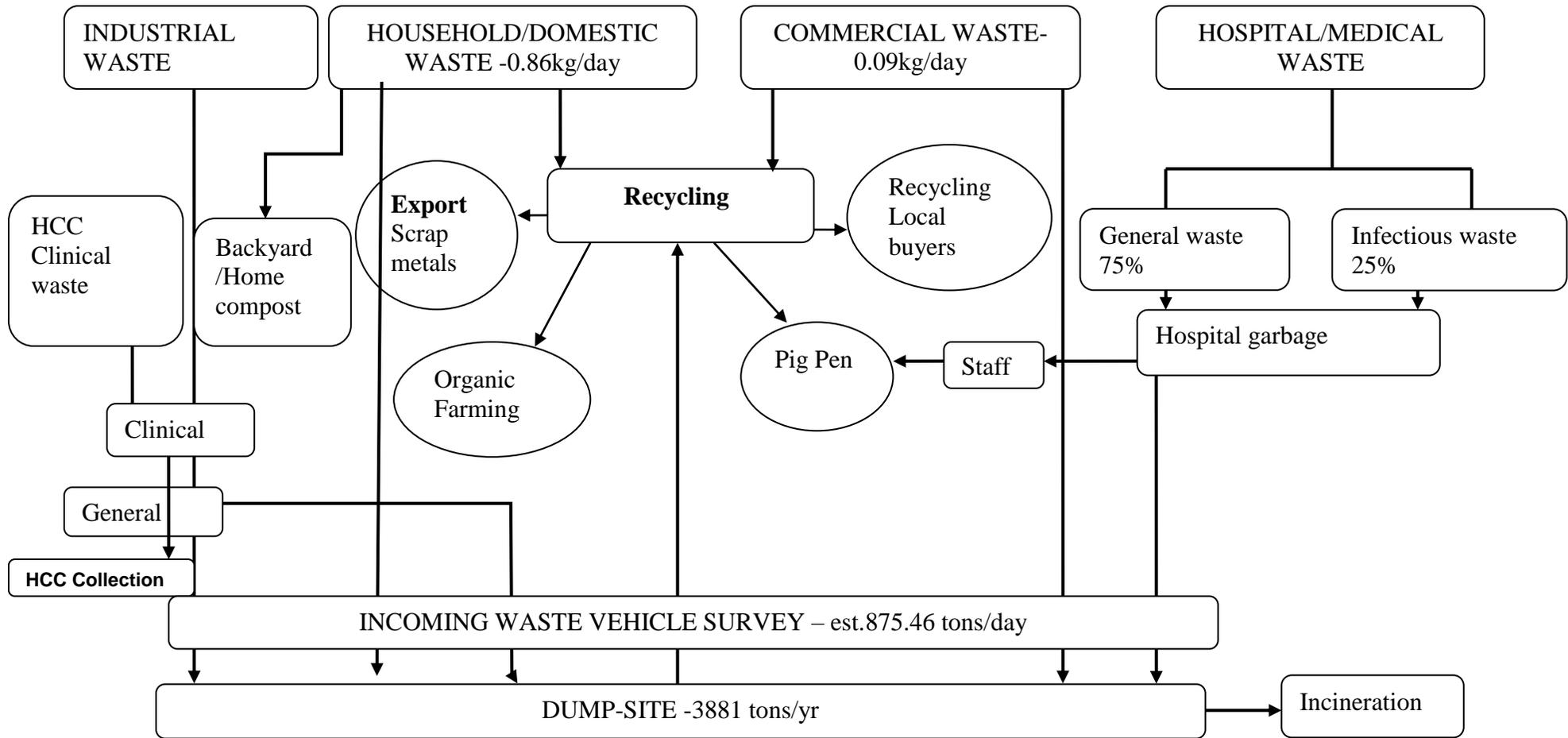


Figure 5: Honiara Waste Stream. Source: MECDM 2012.

3.9. Incoming Waste Collection Vehicle Survey

A week long survey was conducted at Ranadi dumpsite to collect data on the incoming waste collection vehicles disposing waste at the dumpsite. The general observations during the survey were that, there seems to be an increasing cleaning up activities within Honiara towards the recent Oceania Football Confederation Cup and the Festival of Pacific Arts held in 2012. Additionally, during the weekend specifically on Saturday records the highest number of vehicle loads into the Ranadi dumpsite and this may be contributed by the uncollected wastes from the previous day and individuals or companies cleaning up their compound during the weekends. The waste disposed at the dumpsite comes from various sectors such as individual residences, commercial sectors, manufacturing industries and from construction sites. The most dominant waste type observed to be disposed at the dumpsite is organics or green wastes (Incoming Waste Survey Report, 2012) This finding was also supported by a waste characterization study conducted in 2011 whereby an estimate of 0.86kg/person/day is generated at the domestic sector whilst 0.09kg/person/day by commercial sector (Honiara Waste Characterization Audit Report , 2011).

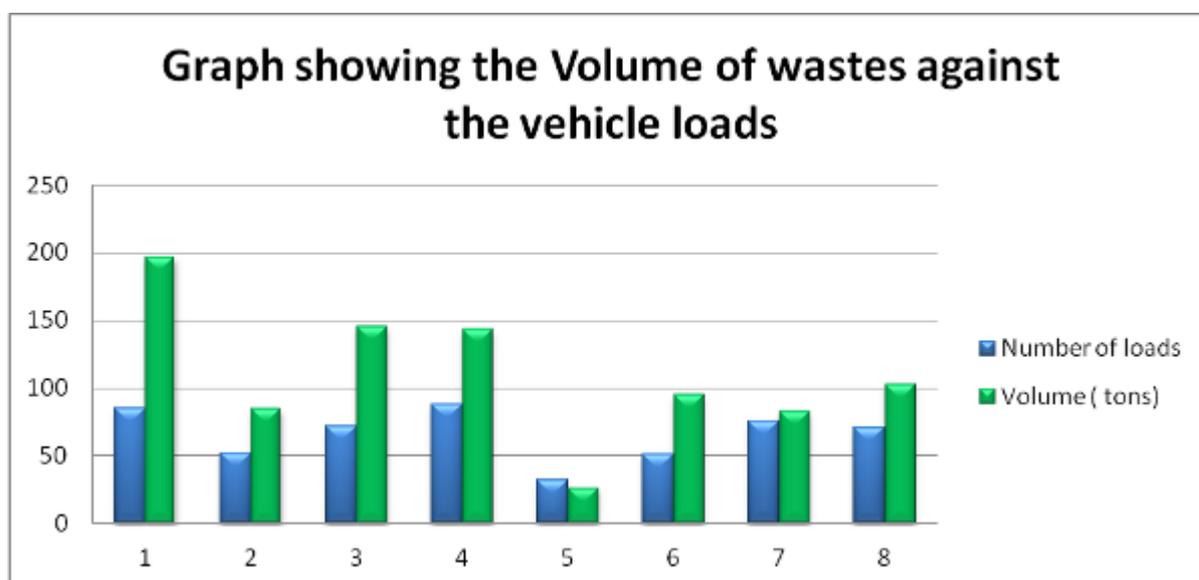


Figure 6: Bar graph showing the estimated volume of wastes against the vehicle, Source: Incoming Waste Collection Vehicle Survey, 2012

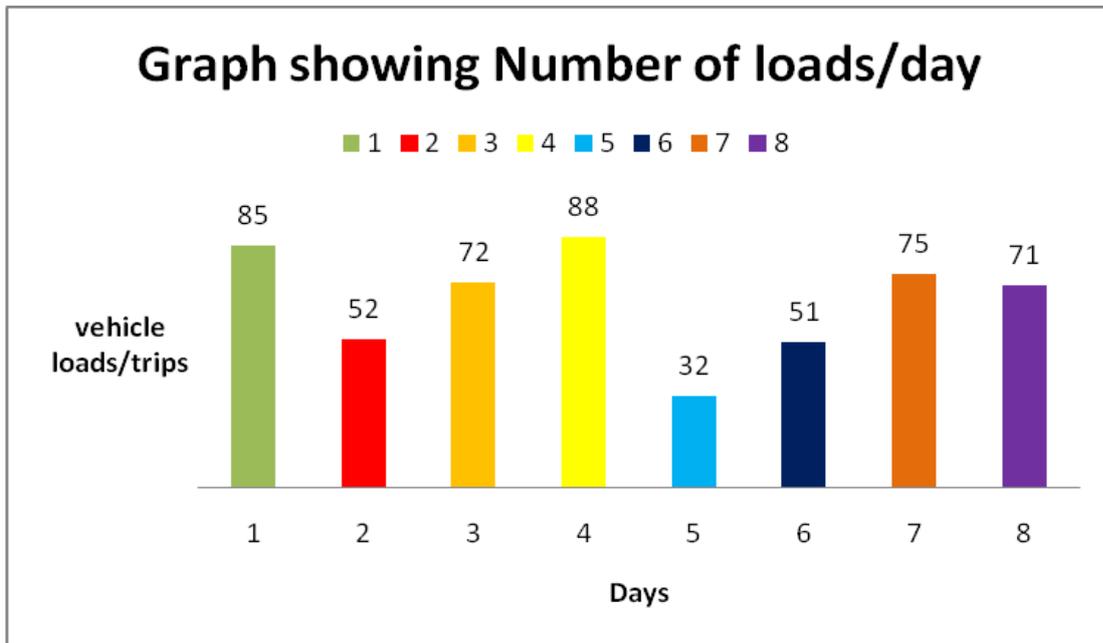


Figure 7: Bar -graph showing the total estimated volume of wastes in tons for one week period, Source: Incoming Waste Collection Vehicle Survey, 2012

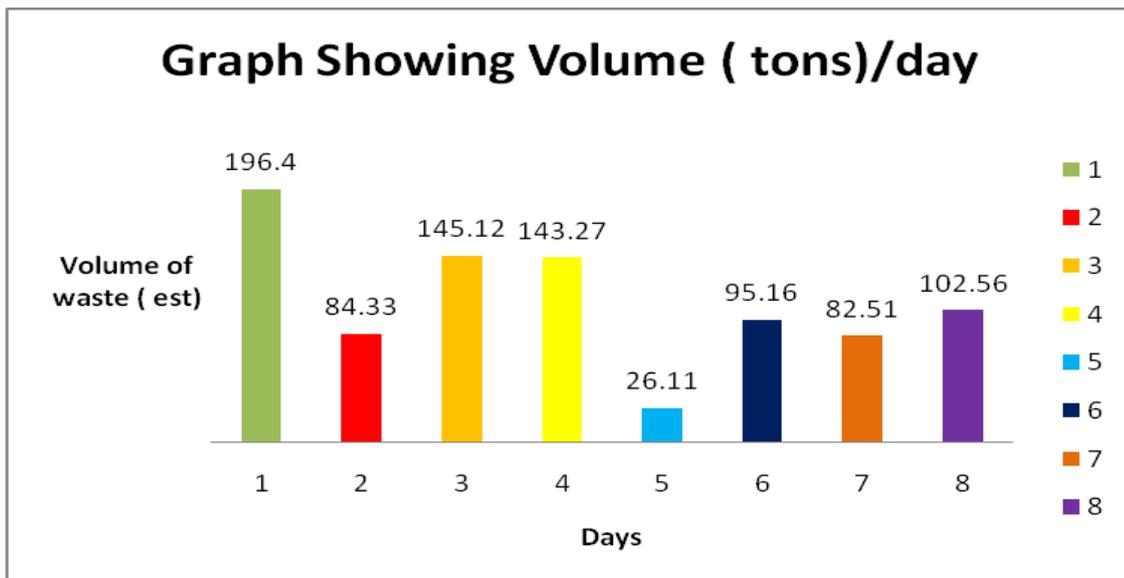


Figure 8: Bar graph showing the total number of waste collection vehicle loads per day, Source: Incoming waste collection vehicle survey, 2012.

4.0. Socio-Economic Status

The total population of Solomon Islands is more than half a million and Honiara comprises of 64,609 people. At Ranadi itself, the estimated population residing in and around the dumpsite is more than 2000 people with most of the waste pickers from the nearby burns creek community and few others from staff residences of private companies at Ranadi industrial area. In the past years, these groups of waste pickers who are living within the dumpsite were relocated back to their province of origin. However they returned back to Honiara for some obvious socio-economic reasons. Some other temporary waste pickers live outside of the dumpsite but occasionally visit the site to collect valuables, scraps and food for feeding pigs. Only a few of them live on site under small shelters made of scrap cardboard boxes, roofing iron and old tyres.

The major export products of Solomon Islands include Timber or Logs, Tuna, Oil Palm, and Gold. The major import products in the country include manufactured goods or products, electronic items to name a few that were not produced in the Country. These imported products are regulated but not to the extent where there is a return system for returning of the products back to the suppliers and manufacturers.

The solid waste industry in the Solomon Islands is still at a small-scale which only contributes a small portion towards the economic growth of the Country. The Solid Waste Industry involves several Scrap metals exporters. Even though these companies' collect scrap metals, bulky waste such as whole car bodies are not collected and exported. These are usually left around residential houses or road side. At the Ranadi dumpsite, these materials are taking up a lot of the limited space at the dumpsite.

Most parts of Honiara City have access to water and have proper sanitation except those erected squatter settlements within or outside of the town boundary. At Ranadi dumpsite, there is no access to proper water supply and sanitation facilities provided and so people went to use the nearby creek, dug up well and water tanks for domestic uses. The local community close to the area who are using the well may have the quality of the ground water polluted by the intrusion of salt water from the sea during high tides or flooding and potential for pollution by leachate of heavy metals contained within the dumpsite.

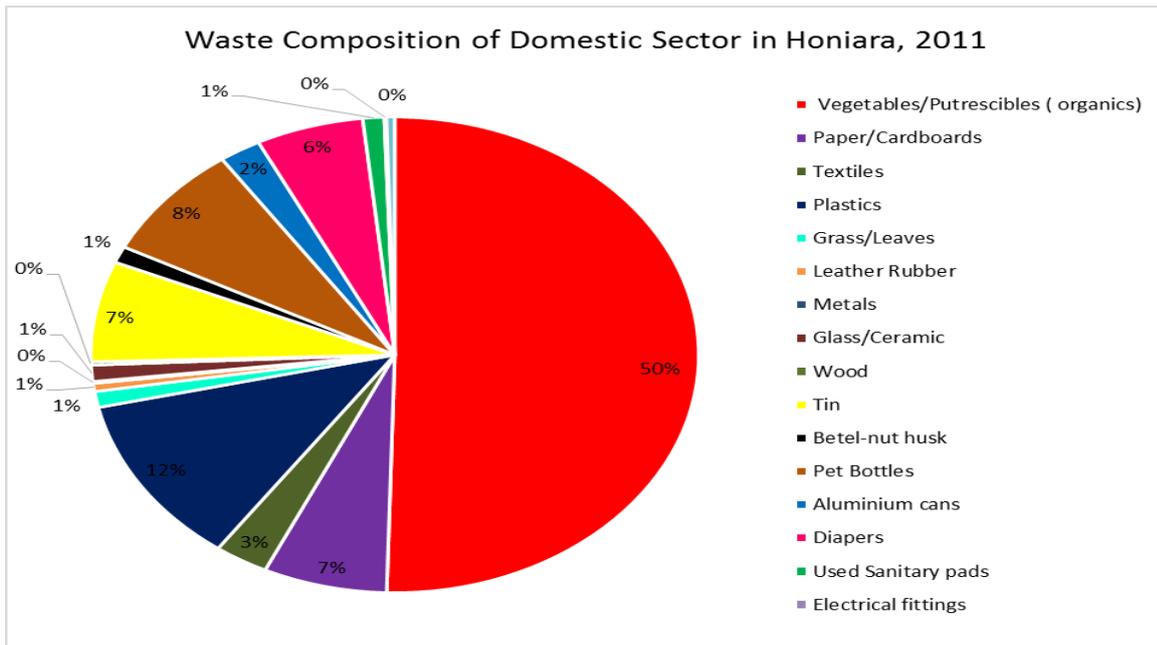


Figure 9: Commercial Sector Waste Composition in Honiara, Honiara Waste Characterization Audit Report 2011

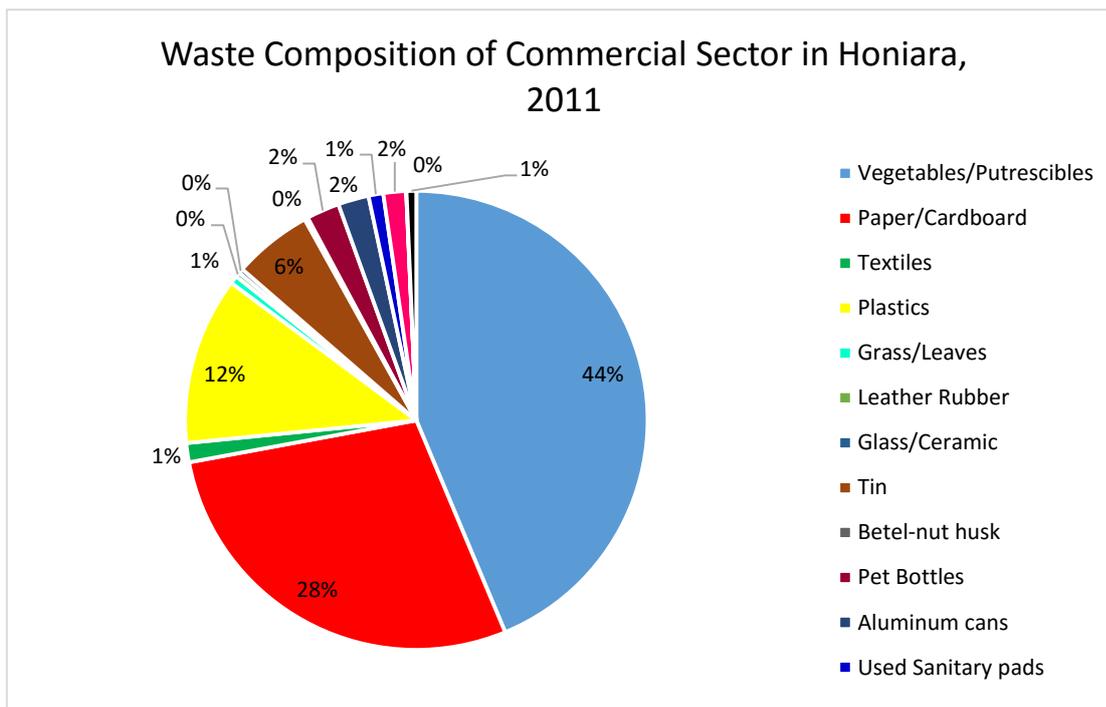


Figure 10: Commercial Sector Waste Composition in Honiara, Honiara Waste Characterization Audit Report 2011

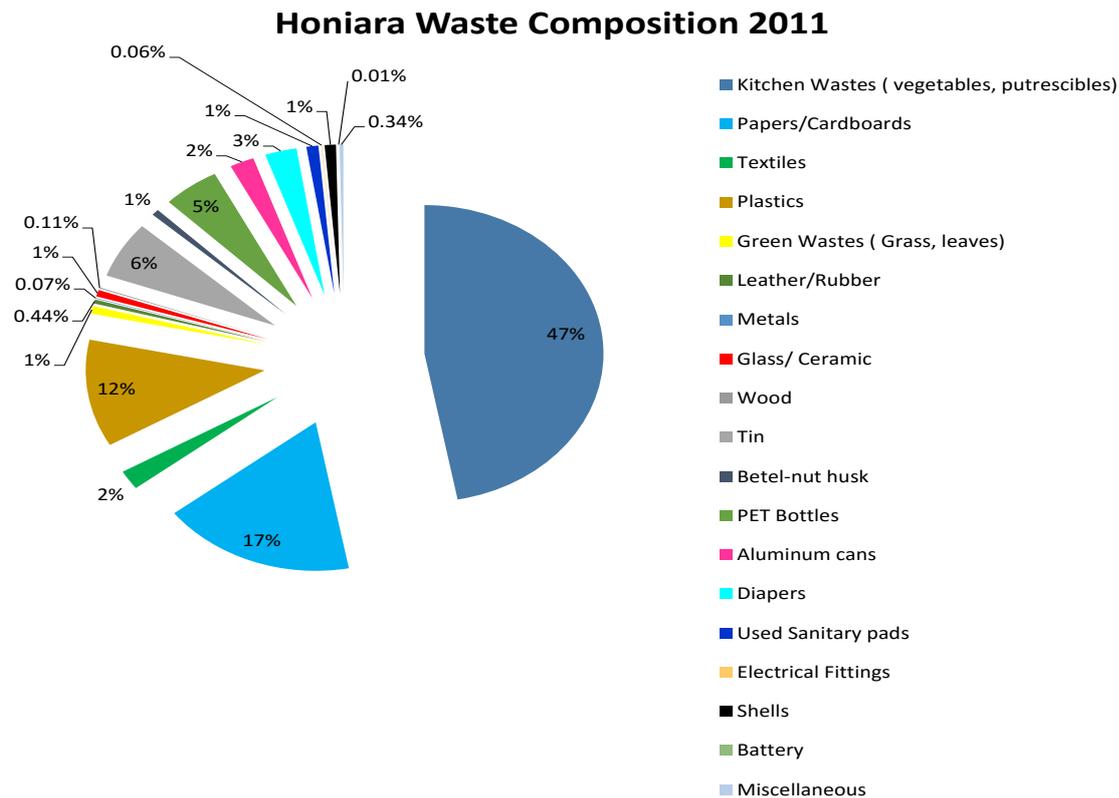


Figure 11: Overall Waste Composition in Honiara in 2011.

4.1.Small-Scale Solid Waste Industry

a. Kastom Garden and Organic Farming (Zaina tina)

The ‘kastom garden’ was founded by the late Joini Tutuo and later on started organic farming. The farm encourages organic composting to be used on the farm. The type of compost being used includes rotten coconut husk which is grated, chicken manure, biomass and soil. The Late Joini Tutua from Choiseul Province was the founder of Organic farming in the Solomon Islands. Late Joini Tutua was also the co-founder of Kastom Garden Association (KGA). In 1991, Zai Na Tina organic demonstration Farm at Burns creek was started.

b. Solomon Breweries Ltd

Solomon Breweries Limited is the only company to have involved in reusing of returnable bottle system specifically beer bottles. Individuals and sales agents are responsible for returning these bottles back to the company. The company recently is encouraging individuals and distributors to return the used bottles through a discount rate system where a discount rate is given to individuals who return crates and beer bottles still in good conditions.

c. BJS group of companies

BJS group of companies has been operating in the Solomon Islands for over 40 years and initially was an exporter of Solomon Islands Handicraft. This is a family-owned business by the Managing Director, Bruce Saunders with a long-term commitment to Solomon Islands and community. The company is involved in purchasing of scrap metals which are non-ferrous metals. These metals includes; aluminium cans, all types of aluminium that are non-ferrous/ free of ferrous material, used batteries (wet cell), radiators, copper, brass. The sellers are people in Honiara whether individuals or business. Some are their contacts in town when they are doing their cleaning up; they sell the materials to BJS. The scrap metals are brought in from sellers in Honiara to BJS group of companies from Monday to Saturday.

The aluminium cans are usually crashed into blocks using a crusher machine and then packed into a container with volumes ranging from 10 tonnes-30 tonnes. Scrap metals are usually exported to Australia usually once a month and sometimes twice month. The importers of the scrap metals are Smorgon Steel is an example of some of the available markets of scrap metals. There are currently two vehicles and there are two drivers with 1 or 2 assistants helping out.

Currently, the company does not go out to the provinces outside of Honiara to buy scrap metals due to the expensive cost of freight and shipping and it is not economically viable. However, sometimes people from the provinces do bring in their scrap metals for sale in Honiara. The prices charged for each of the scrap metals is as listed below:

- Aluminum cans (all types uncrushed- \$ 3/kg) (crashed - \$2.50/kg)
- Stainless steel- \$1.25/kg
- Radiator- \$3.50/kg
- Brass (ferrous free- \$ 10) (with some ferrous material- \$ 4)
- Copper (ferrous free- \$10) (with some iron particles- \$ 4)
- Battery (whole body parts- \$ 0.60/kg) (cleaned battery parts- \$ 1.80/kg)

d. Leksme Metal trading

A company that involves in scrap metals for recycling that have just started its operation in recent years. The company has been exporting scrap metals (ferrous, non-ferrous) to Asia for the past 3 years. There are more than 200 containers .The main market for export is Asia. Main products exported: copper, brass, aluminium, stainless steel, radiators, motors, compressors, batteries.

e. Rax Boy Scrap Metals and Marine Equipments

This company purchases scrap metals, brass, copper, aluminium and old wreckage equipments which are then shipped overseas for recycling.

Section 4.Relevant Impacts

i. Screening of Potential Environmental Impacts

Table 9: Positive Impacts (in table form)

Impact	Cause	Significance
Reducing the negative impacts of an open dumpsite	Green waste cell will provide incentives for composting , pig feeding Composting & recycling initiatives will assist the rehabilitation leading to the closure of the dumpsite system in Honiara Reduce smoke emissions and leachate from polluting the environment	Long Term
Organic waste for compost use	The green waste and organics tipped off at the designated cell at the landfill can be converted into rich organic compost	Short term
Generate Employment	Creating an opportunity for waste pickers to be employed	Short term
Provide an avenue for income generating activity	Revenue collection at gate entrance of all incoming waste collection vehicles to Honiara City Council and selling of recyclable materials by waste pickers	Short term
Solid Waste Industry	Separate recycling materials disposal near gate entrance and increase source segregation , increased recycling due to continuous enforced legislations and awareness to population	Long term
Conservation and Protection of Environment	Leachate treatment and gas venting installation facility well -maintained	Long term
Proportion of recyclables and green wastes decreased increase life of landfill	Solid waste will be segregated into four sections namely recycling, green waste, bulky waste and general waste section. Bulky waste will not be accepted due to limited space of existing wastes at Ranadi. 3R initiatives for waste minimization will be introduced with on-going awareness to local population backed by environment legislations with more enforcement and the implementation of 3Rs pilot project at 10 selected schools.	Long term
Capacity building of local experts	Collaboration of local authority with Government agencies creates partnership with various stakeholders for future planning and operation of a new landfill site in Honiara and provincial centres.	Long term

ii. Potential Project Benefits

a. Socio-Economic Benefits

Full-time waste pickers depend on the collection of recyclable materials at the site for their livelihood. Others who are part-time waste pickers partly depend on the collection of recyclable items for additional benefits for their household. These people collect all types of recyclables of value which the recycling companies directly pay for the materials from them earning approximately SBD \$1000 a day or more based on consultation. The provisions of a proper sanitation facility on site will allow the workers and visitors to Ranadi have access to clean water and proper sanitation facilities which are currently lacking at the moment. As indicated in the table 9 below shows a form of profile of the different level of individuals or people involved at the dumpsite and their status of their socio-economic benefits.

Table 10: Community Profile of different levels of people at Ranadi dumpsite

Community Types		Status	Significance(Impact)		
			High	Medium	Low
Full-time Pickers	Waste	Vulnerable	✓		
Part-time Pickers	Waste	Non- vulnerable		✓	
Settlements		Non- vulnerable			✓
Scrap Metal Buyers		Non-vulnerable			✓
Property Owners		Non-vulnerable			✓
Children		Vulnerable	✓		
			✓		

Source: ECD Environment and social observation survey, 2011

b. Waste Reduction at Landfill

One of the benefits from this proposed project will be the reduction of waste disposed at the dumpsite. The reduction of waste on site is possible if the waste pickers from surrounding communities and settlements at Ranadi are given some sort of permit to allow them in the dumpsite. By doing so, waste pickers are regulated for health and safety regulations as well as to assist the Landfill operators and attendees to segregate the wastes effectively. More specifically, recyclables such as scrap metals and some organics will be allowed to be taken for pig feeding. More so, provision of employment for these waste pickers to segregate recyclables out from the drop off site helps to direct vehicles carrying the different wastes to allocated sections or waste cells and minimize wastage of resources at the dumpsite.

c. Provision for Local employment

During the process of rehabilitation, a section at the entrance will be for segregation of recyclable wastes. There will be temporary employments provided to waste pickers for assisting landfill attendees to segregate waste. In the long-term possible employment opportunities after the rehabilitation and closure of the site where jobs created may be for care taker, gardener or security officer. Other responsible personnel's employed by the Honiara City Council will be assigned to be stationed at the site to control all incoming vehicles to offload the recyclable materials before entering the site as well as another two to control tipping at the different waste cells.

d. Recreational Area

The likelihood of the benefit from the rehabilitation of the Ranadi is that the dumpsite will be restructured. The site will be transformed into a recreational area or park which will be widely used by the people in Honiara. This will allow people of various backgrounds to visit and learn the significance of waste management in Honiara and educate them to practice 3Rs to as the best method to minimise waste.

e. Composting Benefits

Composting is one of the direct benefits that could be derived from the dumpsite. If organic compost is diverted from being wasted and tipped off at a designated site at the landfill, not only does it help reduce waste tipped off at the landfill but also the use and application of compost material for enhancing the soil and plants resulting in environmentally friendly and economic benefits as well.

f. Recycling Benefits

Recycling is another potential benefit if diverted or separated at source from taking up space at the dumpsite. In Solomon Islands, potential candidates for recycling include; papers and cardboards, plastics, PET Bottles, scrap metals, aluminium cans and glass bottles. Although there is currently one brewery that is involved in this, collection of Solbrew beer bottles also helps to protect the environment and generates small income for some locals. The Government needs to be aware of the potential recycling candidates and provide opportunities for existing recycling companies in the form of tax exemption or quota for local recyclers.

g. Conservation of natural resources nearby by reuse and recycling

With the proposed project, the rehabilitation of the Ranadi dumpsite will help to conserve the nearby wetland and marine resources from hazardous leachate from the landfill and poisoning. Through practices of reuse and recycling, it will minimise the amount of waste tipped off at the landfill and prolong the lifespan of the dumpsite.

iii. Potential Negative Impacts

The proposed project could result in predicted and likely negative impacts. Negative impacts are likely to occur as a result of improper construction and operation activities during the rehabilitation. Some negative impacts were identified in the expected landfill waste management facilities.

Factors Leading to Negative Impacts

The following factors were taken into consideration to predict potential negative impacts of the proposed facilities due to operational error and project design unless the facility is properly managed and controlled:



Figure 12: Photograph of a Waste Collection Vehicle disposing at Ranadi dumpsite. Photo: ECD, 2012



Figure 13: Photograph of Bulky waste at Ranadi dumpsite. Photo: ECD, 2012.

- Improper waste separation
- Open trucks for waste collection and transportation
- Uncontrolled tipping
- No erected boundary and gate
- No proper equipments/ heavy machinery
- Manual handling of wastes without proper health and safety gears and equipment

Adverse Significant Environment Impacts

The major impact that may result during the constructions and operation of the Rehabilitation and infrastructure works includes:

- Visual Impact
- Air Quality
- Noise and Dust Nuisance
- Contamination of Groundwater
- Health and Safety Health hazard
- Relocation of Waste Pickers
- Water Quality
- Alteration of landscape
- Waste Management
- Fire and Smoke Emission
- Environment Pollution
- Sewage Pollution

The potential or direct impacts are discussed in detail below;

a. Construction Phase

Visual Impact

The formation of side embankment from all incoming wastes and existing wastes at the dumpsite may cause visual impact to people living around the Ranadi Dumpsite. However, there have been no complaints received of this potential impact on people living nearby. (Refer to table 11 and 12 for summary)

Air Quality

To construct the Fukuoka Method, it will involve site grading and excavation. This may release strong bad odour from the compacted wastes. The potential effect of odour to human health includes stress and complaints from people living close by. In addition to that, too much intake of bad odour causes respiratory infections.

Emission of gas contained in waste at the dumpsite over the years contributes to eruption of fires at Ranadi. Other times, some people start the fires on site and that release black smoke and carbon dioxide into the atmosphere. Methane gas is contained in the wastes at the dumpsite. Although it could be used to generate energy, the amount of methane content is believed to be at a much smaller scale. The potential effect of methane gas emissions to human health includes irritation of eyes and respiratory infections. (Refer to table 11 and 12 for summary)

Noise and Dust Nuisance

The use of heavy equipments and machineries during the construction process will result in noise nuisance being produced. These may cause disturbances to people and to workers which can also result in accidents to happen on site or outside of the work-site. Noise nuisance can be a health hazard to human health and wildlife.

The population that is at risk includes waste pickers, elderly people, pregnant mothers and little children living within the surrounding communities. The probability of occurrence is medium to low. There are no scientific data on likely noise level (Refer to table 11 and 12 for summary)

Contamination of Surface and Ground Water

The intrusion of salinity and leachate into the ground water system may pollute the wells and poison the natural water system that flows out into the sea. This may also affect the marine ecosystem which results in algal bloom in coastal areas and poisoning of marine species. Contaminated water will most likely affect vulnerable people such as children and pregnant mothers. Children are easily sick from bathing, washing and drinking of dirty water. (Refer to table 11 and 12 for summary)

Health and Safety Impact

The health of workers on-site and those dealing with segregation of waste at the dumpsite are always at risk. Due to the mixture of different types of wastes that are not separated and disposed at the dumpsite, there is a high health hazard to people and the environment. Even the conditions of local residents and waste pickers are at a risk because they have no health and safety equipment such as hand gloves, boots or mouth mask while handling waste on the site (Refer to table 11 and 12 for summary).

Identification of Potential site for the relocation of Waste Pickers

The rehabilitation of the Ranadi dumpsite will be one of the major impacts of the proposed project. This will result in the local resident waste pickers who are residing on site to be relocated out from the area. It is understood that these full-time waste pickers have depended a lot on the scraps collected at the dumpsite. There are also some waste pickers who are residing close to the dumpsite and visited the site from time to time. During the construction and operation phase of the Ranadi rehabilitation, the full-time waste pickers will need to be relocated out from the area to allow work to progress on site. The likely impacts of this process of relocation to the full-time waste pickers are that, they have no place to go in Honiara; relatives will not take their families in due to limited space in their Household. They might have issues with going back to the village from Honiara. (Refer to table 11 and 12 for summary).

Water Quality

The location of the dumpsite near the aquatic system poses a threat to the quality of water and flow of the water resource. The pollution of leachate and sewage into the water system contributes to the possible health risk for the local community who are using ground water for domestic purposes such as washing, cooking and bathing (Refer to table 11 and 12 for summary).

Waste Management

Ranadi is the only legal location in the Honiara City that was established for tipping off wastes from domestic, commercial and industrial sectors. At present all the wastes generated in Honiara are tipped off at the Ranadi dumpsite with no waste segregation done on site or at source. This causes the dumpsite to be filled at a short period of time, shortening the expected capacity of the site to accept all incoming wastes (Refer to table 11 and 12 for summary).

Fire and Smoke Emissions

One of the major complaints from local residents and nearby communities at the Ranadi Dumpsite is the smoke from fire and the burning of rubbish on site due to methane contain in the old rubbish. Although there were efforts to eradicate fire, the availability of soil cover is another contributing problem that needs to be also addressed (Refer to table 11 and 12 for summary).

Sewage Disposal

Currently, there is no identified site or facility to treat sewage in Honiara. At Ranadi, the proposed project area does not have enough space for a sewage treatment facility. Previously, the sewage is directly disposed into a stream that flows directly into the sea. Quite recently, sewage trucks release sewage into a designated site within the dumpsite near the creek. Without proper regulation and control of sewage disposal, release of harmful pathogens and bad odour can be a problem. There will be a temporary site designated at the dumpsite for sewage disposal (Refer to table 11 and 12 for summary).

Marine Pollution

The marine environment near the coast and out-shore will be likely to be affected by leakage of leachate, discharge of untreated sewage sludge and from disposal of untreated medical wastes.

b. Operation Phase

Production of Odor

In the event of any operation or management of the Ranadi dumpsite, the project will continue to carry out digging, overturning of green wastes and pushing of wastes at each different waste cell. As part of the future development of the site, an office facility including fire fighting gas venting pipes will be installed at each of the waste cells formed to minimise fires at the dumpsite. To assist with the elimination of this bad odour at the dumpsite from smokes or wastes during the excavation activities, soil cover is the major component which will be used continuously (Refer to table 11 and 12 for summary).

Environment Pollution

During the operation phase of the Ranadi dumpsite, there will be alteration of the land which will lead to environment fragmentation. This alteration of land will pollute the land and marine environment. Pollution comes in all through air, water and sea (Refer to table 11 and 12 for summary).

Occupational Health & Safety Hazards

The occupational health and safety hazards of the workers on site will be affected by the disposal of clinical wastes (Refer to table 11 and 12 for summary).

Noise Nuisance

Noise nuisance which will be generated at the site is from construction works, road maintenance (Refer to table 11 and 12 for summary).

Dust and Visual

Dust and visual impacts will be a major problem from construction works at the dumpsite. (Refer to table 11 and 12 for summary)

Alteration of Landscape

The alteration of landscape will cause an effect to the migration of species such as the tilapia. (Refer to table 11 and 12 for summary)

Table 11: Summary of Environment Management Plan (EMP)

Phase	Potential Impacts	Cause	Significance	Effects	Mitigation Measures
Construction phase	Visual Impact	excavation works and road construction	Short-Medium term		Partition the site for during working phases
	Air Quality (Fire and Smoke Emission)	dust , vehicle exhaust, smoke , fire	Short-medium term	-depletion of air quality -air pollution - production of bad odour contributes to health-related risks	- installation of gas venting pipes installed - OHS and PPE for workers and visitors -Watering of roads
	Water Quality	Leachate Pollution to surface and ground water	Medium-Long term	-contamination of surface and ground water	- construct concrete base slab for leachate pond
	Marine Pollution	Discharge of sewage sludge, medical wastes	short-medium term	-pollution of near shore fisheries and aquatic ecosystems - production of bad odour	- construct a filtration pond for sewage sludge before discharge appropriate for locations with high water table
	Alteration of Landscape	Extraction of wastes Expansion of landfill area	Long-term	-loss of secondary vegetation - exposure of wastes	- laying of leachate collection pipes and laying of stones for aeration

Phases	Potential Impacts	Cause	Significance	Effects	Mitigation Measures
Construction Phase	Occupational Health and Safety	Accidents to workers, local community members or visitors due to lack of safety regulations such as regulations on safety wear and uncontrolled access into the construction site	Long-term	Workers/Visitors at risk from entering the site	-PPE - Restrict entry into site
	Waste Management	Building construction materials and other equipments used for construction	Short term	Contributes to waste at the dumpsite	Store construction waste in bulky waste designated site
	Heavy Machine & Vehicle Usage	Increase emission of carbon	Medium-Long-term	Wastage of company fuel, and air pollution	Reduce usage of vehicles/machine for short distances Minimize fuel usage for usage
	Waste pickers	Relocation of waste pickers	Medium-long term	-Displacement of waste pickers -Children and restricted pickers not allowed to enter site	-Employ some waste pickers to work at the dumpsite as security personnels
	Potential Impacts	Cause	Significance	Effects	Mitigation Measures
Phases					

Operation Phase	Production of odour	Disposal of green waste without immediate treatment and exposure	Short term	Poor air quality	Daily soil cover and compaction Refer to monitoring plan -
	Environment Pollution	Potential leachate seepage into surface & ground water system, uncontrolled dumping of medical wastes other wastes	Long term	Degradation of environment ecosystem or habitat	- Refer to monitoring
	Occupational Health and Safety hazards	Exposure to hazardous wastes and accidents due to non-precaution measures, operation process and during recycling materials disposal	Long term	Workers at risk of accidents during operation works at the site	Compliance to OHS Act and provision of PPE
	Noise nuisance	Results from operation of machines and frequent traffic from all incoming waste collection vehicles	Short term	Noise disturbance to environmental habitat	Compliance to OHS Act and provision of PPE
	Dust	Results from operation of machines and frequent traffic collection vehicles -from burning of wastes	Medium-Long term	Workers experience minor health problems such as irritation to eyes, nasal blockage	Compliance to OHS Act and watering of road
Phases	Potential Impacts	Cause	Significance	Effects	Mitigation Measures
Operation Phase	Visual Impairment	Exposure of wastes from construction of side embankment	Long term	Height of waste from side embankment	Continuous sand/soil cover for exposed side embankments to

					minimize flies
	Heavy Machine & Vehicle Usage	Air pollution & burning of fossil fuel energy	Medium-long term	Contribute to carbon emissions and wastage of fuel	Reduce usage of vehicles/machines for short distances
	Traffic congestion from incoming wastes	Uncontrolled waste dumpings Traffic congestion of incoming wastes vehicles during early hours and late afternoons	Medium-long term	Littering Disturbance of dumpsite rehabilitation work progress	Proper gate control , rotation of working phases, relocation of waste pickers

Section 5. Proposed Safeguards and Mitigation Measures

i.Environment Management Plan in Summary

The development and execution of an effective environmental management plan for Ranadi dumpsite in Honiara will be delayed by weak institutional capacity and lack of proper infrastructure, lack of timely environmental regulatory enforcement, shortage of financial resources and qualified personnel. Although the relatively recent establishment of the Ministry of Environment Climate Change Disaster Management and Meteorology in 2007 strengthened the institutional framework, however, further strengthening and enhancement of cross-sectional coordination, planning, and control mechanisms between relevant stakeholders and project proponent is needed in order to effectively protect and improve environmental conditions (refer to figure 2).

As part of the proposed project, the Honiara City Council as the project proponent will be responsible for implementing an Environmental Management Plan (refer to table 11) through its Environment Health and Works Division. Thus, it aims to continuously collaborate with partner stakeholders to help in any awareness promotion such as implementing the awareness campaign for 3Rs promotion in waste reduction and pollution control; and educating different age groups and gender on measures to minimize waste at different sectors of the society within Honiara.

The implementation of an Environmental Management Plan (EMP) on the level of the proposed project using the Fukuoka Method (Semi-Aerobic system) with some modifications could enhance current environmental conditions. The objectives of this plan are to improve the landfill site, reduce the waste volume, recover recyclable materials and promote the recycling markets that will lead to a market for composting of green wastes on site in the future.

Three main tasks are suggested to achieve the specified objectives: training, conducting local awareness campaigns, and look at feasible options for promoting markets for compost and recyclables in the near future. The training workshops with some common objectives for awareness campaign will be also opened for the local stakeholders and interest individuals or private sectors people involved in the waste management business in the Honiara City.

a. Training requirements

There will be three types of trainings required for this proposed project. The first training is a workshop for all counterparts and relevant stakeholders on the lessons learnt at a later stage. The second is to train landfill machine operators, landfill attendees, waste collectors (private and HCC) and supervisors from Honiara City Council including those going to be recruited to manage the dumpsite on how to manage and operate the facility in the long term. The third training will focus on training of trainers on landfill operation which will lead to a operational manual guidebook to be developed at the later stage.

1. Environmental Awareness inception workshop

This inception workshop is for all stakeholders in all levels, from relevant Government Line ministries, NGOs and private sectors to raise environmental awareness on the different levels of the proposed project.

2. Landfill operation and facility workshop

This training is purposely to train landfill operators, landfill attendees, waste collectors and supervisors from Honiara City Council and any relevant individuals on how to manage and operate the facility in the long term. Through this training, landfill workers will build capacity of the significance of their work to manage waste at the landfill daily as well as of the guidelines to occupational health & safety (OHS) skills.

3. Train the trainers workshop and Landfill manual guidebook

This training is focused on training of trainers on landfill operation which will lead to a manual guidebook to be developed and produced for the long term operation of the Ranadi landfill before and after its closure. This guidebook will be used in any new landfill opened in the future.

b. Environment awareness campaigns

The campaign will focus on these issues:

- Promotion of Initiatives on waste minimization at all levels of the economy
- Promotion of composting at the household level and community level
- Prevention of pollution from hazardous wastes in imported products
- Minimization of wastes disposed into the Ranadi dumpsite
- Change in the attitude of people towards Solid waste management

c. Market Stability

For compost products, the issue of a stable and sustainable market in the long run needs to be identified and maintained. Although there are potential market opportunities within the country and Honiara City, the issue of how to maintain this market can be influenced by whether there are high demands of customers who are willing to buy for the finished compost product.

Likewise, with the market for recycling, there are no recycling facilities in the Country. Therefore, the recycled item needs to be exported overseas. And this involves a lot of energy and resources. Current situation is that there are some companies involved in exporting recycled materials specifically for ferrous and non-ferrous metals including car batteries. However, these operations are centred within Honiara City due to cost factors. There is an upcoming proposed project to be focused on PET Bottles recycling into other domestic products that is yet to be established and in operation in the country.

To ensure that the negative environmental impacts are reduced as much as possible, the mitigation measures and plans are the basis for monitoring to ensure the project complies with measurements that they state in this PER. These prescribed mitigation measures are

highly dependent on the significance of the predicted impact, nature of impact and phase of the project.

ii.Mitigation Measures for the Project Design

Improvement of Air Quality

The construction phase will involve a lot of digging, clearing and overturning of the waste and soil compaction to construct the waste cells, during the installation of leachate collection pipes and installation of gas venting pipes within the open dumpsite. In order to minimise and eliminate the production of bad odour resulting from this construction work, the project proponent will continuously apply soil cover and compaction daily under the supervision of HCC landfill supervisor whenever any construction work in each stages of the rehabilitation improvement is done at the site.

Waste Management

The issue of waste littering will be at the landfill site during and after the rehabilitation of the dumpsite will be minimized by constructing sign boards or notices at the entrance and within the site to direct incoming wastes vehicles to properly dispose wastes at the proper waste cell. The project proponent will install waste bins or receptacles within certain locations at the dumpsite to avoid littering by visitors or workers.

Safeguard Water Quality (Surface and Ground)

The risk of ground and surface water contamination will be reduced by lining tarpaulin or any alternative material at the base of the floor structure of the dumpsite after excavating the inner section of the dump-site and waste cells. Proper drainage system will be constructed to divert any rainwater infiltration during wet seasons. All discharges from the landfill will be controlled and monitored.

This rainwater or leachate will be collected in the leachate collection pipes throughout the dumpsite and channelled towards the leachate pond. Medical and hazardous wastes will be temporarily stored at a designated and secure location within the existing dumpsite whilst measures to manage these types of wastes are actioned. Any incidents of ground and water contamination must be recorded and reported to the responsible authorities. A monitoring system will be implemented around the landfill to monitor the ground and water surface quality.

Dust Reduction

Dust from road construction and construction works at the landfill will be mitigated by compacting the roads with sand or soil and watered during dry seasons to minimize dust. Road access into the dumpsite near the entrance will be constructed with a hump to slow down traffic which causes a lot of dust from fast moving or travelling vehicles.

Environmental Protection

The only alteration to the existing landscape will be construction and formation of the waste cells, side embankment for boundary, and installation of gas venting pipes, leachate pond and the construction of the office site for landfill workers on site. Temporary incinerator and

sewage storage pond will also be considered until further means for proper management and disposal.

Any construction work will safeguard the existing surrounding environment in the short-term and long term. Towards the closure of the site in the future, the site will be beautified with trees and plants. Alteration of the landscape in terms of the height of the side embankments must not be more than 2 meters. Installation of leachate collection pipes will be only visible during construction except for the gas venting pipes which will be visible during and after the construction phase.

Public Hazards

The creation of the side embankment overtime provides a natural fence to prevent any unauthorised personnel from entering the premises without the prior consent and awareness of the landfill attendees or operators. Prior arrangements and notifications of any visits other than for disposal of wastes at the dumpsite will be made before entering the site during or after working hours with the landfill manager or supervisor. However, to ensure that the site is restricted and well-secured, a permanent fence will be constructed to ensure the control of traffic and reducing risk to people's life.

Occupational Health and Safety

Occupational Health and safety standard or compliance will always be maintained during and after construction phase. These regulations will be applied to all workers and visitors to the site to wear safety footwear, reflective vests and helmet upon entering into the dumpsite. Any workers who do not comply with these occupation health and work safety rules will be given a warning letter at the first offence. At the second offence, they will be suspended and if they continue to disobey the same rules, they will be immediately dismissed from work. This rule will also be applied to all visitors to the site to wear protective clothing before and when entering the Ranadi dumpsite. Notices and directions will be constructed on site to direct all incoming vehicles and visitors within the site.

Noise Reduction

To minimize the production of noise within the vicinity of the Ranadi dumpsite, any heavy construction works will be strictly carried out during normal working hours, between 8am to 4.30 pm. If there are complaints raised by nearby residents of noise disturbances after working hours, such complaints or incident will be reported to site supervisor for further actions to be taken.

Traffic Control and Usage

Local landfill attendees will be responsible for directing vehicles into the dumpsite and to ensure that there is no traffic congestion on site especially during the rehabilitation works.

iii. Mitigation measures for the Construction Phase

Noise and Dust Emissions

The emissions of noise and dust will be the major impacts resulting from the construction phase of the project. To minimise the dust emission to an acceptable level, the roads will be paved or sprayed with water daily especially during hot weather and when there is a lot of road traffic. The Honiara City Council will maintain any construction works that will cause noise disturbance to be limited during morning late morning to afternoon within the normal working hours (8 am to 4.30 pm). Communities and residents close to the dumpsite will have to be informed whenever; loud construction work will be taking place. On site workers will also be provided with proper health and safety working gears to avoid any potential health hazard and maintain workers safety working condition.

Wastes Management

Construction wastes resulting from construction materials and work of any magnitude will need to be properly managed and stored for proper disposal or recycling. Any excavation of rocks and soil during the construction works will be utilized for the rehabilitation process specifically during the installation of the gas venting pipes or leachate collection pipes and pond at the site. Uncontrolled littering of construction wastes within the site or around the site will be avoided at all times with the provision of wastes bins on site and a well secured site for storage of recyclables.

Bulky waste will also be temporarily stored at the site before any alternative option is organized for export of car bodies in the near future.

Disposal of medical wastes and sewage sludge are currently done on site. In order to properly managed these two additional types of wastes so as not to disturb the actual rehabilitation process at the landfill, a temporary incinerator which is simple to manage and a small pond for storage of sewage sludge will be allocated at two designated locations for time being.

Occupational Health and Safety

Occupational Health and Safety standard or requirements will be always maintained on site. These requirements will include health and safety tool kits, safety wear and equipments and health hazards. Some of the requirement will also be applied to the any visitors to the site. To prevent any fatal accidents, permanent fencing surrounding the site needs to be constructed with 24 hour night guard security. Unauthorised personnels will not be permitted to enter the premises without any prior arrangement and notification to site workers.

Environment Protection

To avoid any harmful substances polluting ground water, soil and the natural resources, the bottom floor structure will be lined with lining membrane sheets to prevent any seepage or leakage. The leachate pond is constructed to serve for this purpose of purifying the leachate collected from the dumpsite before it is releases out to the water system and natural environment. The quality of the water system and soil will be continuously monitored and the gas ventilation pipe facility will allow methane gas to be released at a much lower and less harmful level.

Visual Impact/Impairment

Visual Impairment or impact will be improved by maintaining the height of the side embankments not more than 2 meters.

Prevention of Marine Pollution

To mitigate the leakage of leachate into the aquatic and marine environment, the base of the dumpsite will be lay with a protected cover as a layer before installing the leachate collection pipes to be connected to the leachate pond. Sewage sludge will be disposed at a contained allocated space temporary before any further measures.

Vehicles and Machines usage

The Ranadi dumpsite has experienced a lot of traffic especially during peak hours (9- 11am and (4-6pm) and less traffic during off-peak hours (12 pm- 3pm). During the construction and operation phase, there will be a lot of traffic movement in and out of the dumpsite. In order to reduce the usage of fossil fuels on site, the project will ensure that it will reduce the usage of vehicles or heavy machines for short distances. Non- renewable resources such as fossil fuel are easily depleted and the project will put an effort to avoid any wastage of fossil fuel for company vehicle usage for short distances. Heavy machines or equipment is unavoidable to conduct work in short distances.

iv. Mitigation Plan for Operation Phase

Waste Management

Uncontrolled littering around the premises, along the road or within the site will not be tolerated. Waste collection vehicles will be notified to cover open trucks to avoid plastics or papers blown off by wind in a travelling vehicle. The wastes disposed at the dumpsite will be covered daily with soil or sand, compacted and enclosed to prevent wastes being blown off by the wind. During any rainy weather seasons, the landfill attendees or operators stationed at the site will control the incoming traffic entering the dumpsite. This is to ensure waste collection vehicles dispose their waste at the proper waste cell and not along the access road.

Odour Production

To prevent any bad odour production during the operation phase of the rehabilitated site leading to its rehabilitated stage the green waste or organic waste will not be disposed at the site. Composting at source through the 3Rs pilot project will be implemented through close collaboration with the Ministry of Environment and Ministry of Health to encourage and motivate residents to do home composting or sup sup garden and to divert market waste and other green waste to a potential site identified by the Honiara City Council.

Environment Pollution To avoid any harmful substances polluting ground water, soil and the natural resources, the bottom floor structure will be lined with tarpaulin sheets or any alternative material to prevent any seepage or leakage. The leachate pond is constructed to serve for this purpose of purifying the leachate collected from the dumpsite before it is released out to the marine and natural environment. The quality of the water and soil will be continuously monitored using simple methods and the gas ventilation pipe facility will allow methane gas to be released at a much lower and less harmful level.

Occupation Health and Safety

The health and hazard safety of workers and visitors to the dumpsite from any hazardous chemical exposure or to any risk at the dumpsite will be avoided at all times. Whenever, the project sees that any worker or visitor is at risk of any threats, the site will be restricted to undergo quarantine and clearance procedures before any work can be continued. Monitoring systems will be in place for monitoring the water quality, soil and air quality which will be done on a quarterly basis to report of any likely changes or extremes caused to occupational health and safety of workers or visitors. First-aid kit and fire extinguishers will be provided on site office for any immediate emergency situation.

Noise Disturbance

To prevent the impacts of noise disturbance, landfill attendees or landfill operators will direct and control all incoming traffic during the day. During work progress, the number of traffic entering the site will be limited and controlled as well as during the night so as not to disturb nearby residences. Any large construction activities will be limited to certain times of the day and all work will stop at night-time. Workers on site will be provided with ear plugs for their protection to avoid too much exposure to noise which may cause any future health problems.

Vehicles and Machines usage

The Ranadi dumpsite has experienced a lot of traffic especially during peak hours from 9-11am and during late peak hours from 12pm- 3pm. During the construction and operation phase, there will be a lot of traffic movement in and out of the dumpsite. In order to reduce the usage of fossil fuels on site, the project will ensure that it will reduce the usage of vehicles or machines for short distances. Non- renewable resources such as fossil fuel are easily depleted and the project will put an effort to avoid any wastage of fossil fuel for company vehicle usage for short distances. Heavy machines or equipment is unavoidable to conduct work in short distances.

Maintenance of Site

In the long-run, after the site is in full operation and for maintenance part of the site, fees will be collected from all incoming waste collection vehicles to the site excluding the HCC waste vehicles. This action is to ensure the sustainability of the site and for revenue generation in terms of Solid Waste Management.

v. Monitoring Plan:

Odor monitoring (air quality)

The ideal goal for using the Fukuoka method is to extend the life span of the Ranadi as well as to reduce the odour and smoke emissions from the dumpsite.

Table 12: Odor Intensity Scale for monitoring

Scale Description	Odor Intensity description
0- No odour	Odor cannot be detected
1- Very light	Odor present in the air which activates the sense of smell but the characteristics may not be distinguishable
2- Light	Odor is present in the air and is distinguishable and definite but not necessarily objectionable in short durations
3- Moderate	Odor present in the air which easily activates the sense of smell is very distinct and clearly distinguishable /irritating
4- Strong	Odor present in the air which would be objectionable and cause a person to attempt to avoid it completely, could indicate a tendency to produce physiological effects during prolonged exposure
5- Very strong	Odor present that is so strong it is overpowering and intolerable for any length of time and could tend

Table 13: Fire/Smoke Emission Scale for monitoring

Scale Description	Fire/ Smoke Emission Intensity description
0- No smoke	Smoke/Fire is not visible
1- Moderate	Smoke/Fire present in the air which easily activates the senses which is irritating
2- Strong	Smoke/Fire is present in the air and cause a person to avoid it completely, indicates that it can produce physical effects during prolonged exposure
3- Very strong	

Water Quality Monitoring

The Fukuoka method to rehabilitate the dumpsite, it is also aimed to extend the life span of the Ranadi which will look at monitoring the quality of water in the surrounding environment to ensure that rehabilitation process safeguards the existing environment.

Table 14: Water Quality Scale for monitoring

Scale Description	WHO standards	Sample sites			
		1	2	3	4
TDS	No guideline				
Salinity level/conductivity	250microS/cm				
Turbidity level	➤ 5 NTU				
Hydrological level					
Dissolved oxygen level	➤ 75% saturation				
pH level	6.5-8.5				
Colour	Clear colour				
Odour	No odour				
Temperature	No data provided				

Other Monitoring Activities- litter, health and safety, noise, visual

This other monitoring activities will be recorded continuously and weekly through visual inspections, from complaints and accident incidences using a site incidences record which will be developed accordingly to the OHS safety standards.

Monitoring responsibilities

The contractor is the Honiara City Council in close collaboration with other stakeholder partners like Ministry of Environment, Climate Change, Disaster Management & Meteorology should be responsible for monitoring of the various impacts as part of the J-PRISM Project team in Honiara. Monthly inspections will be carried out to monitor the water quality and air quality. Unlike other monitoring activities for litter, health & safety, noise and visual should be performed on a weekly basis to ensure that the mitigation measures are implemented and that the project facilities are not affecting the environment through the Environmental Management Plan.

Table 15: Environment Monitoring Plan (Summary in table form)

Phase	Mitigation Measure	Parameters to be monitored	Location	Frequency	Responsibilities
Preparation Phase	Issue of permits to waste pickers	Number of approved waste pickers with permits recorded	Ranadi	Quarterly	HCC, MHMS, MECDM
	24 hour security presence	Ability of security personnel to do task	Ranadi	Weekly	HCC
	Issue of Development Consent	Letter of Development Consent received by HCC	Ranadi	Once	Director of ECD/MECDM
Construction Phase	Improvement of road access	Road access is improved with reduction of dust emissions	Ranadi	Weekly	HCC
	Construction of site office	Toilet, electricity and water facilities installed in office	Ranadi	Quarterly	HCC
	Control of Incoming traffic	Data record of all types of incoming waste vehicles kept	Ranadi	Daily	HCC landfill supervisors/dumpsite manager
	Environmental Protection	<ul style="list-style-type: none"> Update baseline data of important flora & fauna near site Minimize environmental damage as much as possible 	Ranadi	Quarterly	ECD/MECDM
	Visual Quality	<ul style="list-style-type: none"> Beautification of site with trees and plants Minimize height of wastes not exceeding 2m 	Ranadi	Quarterly	HCC, MECDM
	Air Quality	<ul style="list-style-type: none"> Smoke and fires minimize to none No production of bad odour on site & Soil cover Less dust emissions 	Ranadi	Quarterly	HCC, MECDM

Phase	Mitigation Measure	Parameters to be monitored	Location	Frequency	Responsibilities
Construction Phase	Proper storage of sewage disposal	Sewage sludge is properly stored before discharged	Ranadi	Weekly	HCC
	Ensure OHS requirements & standards	<ul style="list-style-type: none"> • Workers provided with OHS wear • Accidents is reported & recorded • Complaints is recorded & reported 	Ranadi	Weekly	HCC, MECDM
	Noise Pollution	<ul style="list-style-type: none"> • Working hours limited to normal working hours (8am-4.30pm) • Construction noise level is minimized 	Ranadi	Weekly	HCC
	Traffic control	Traffic congestion is minimized	Ranadi	Weekly	HCC
	Waste Management	<ul style="list-style-type: none"> • Wastes separation is practiced on site • Littering is minimized on site 	Ranadi	Weekly	HCC
	Water Quality	Surface and Ground water quality is safe and up to standard	Ranadi, surrounding	Quarterly	MECDM, HCC

Phase	Mitigation Measure	Parameters to be monitored	Location	Frequency	Responsibilities
Operation Phase	Different sections for general , green and bulky waste	Segregation of waste in assigned section	Ranadi	Weekly	HCC
	Charge of reasonable fee for households, commercial and industrial waste disposals	Daily record of number of Incoming Waste Vehicles to the site is kept	Ranadi	Weekly	
	Site Monitoring	<ul style="list-style-type: none"> • Operations ongoing according to plan • Road infrastructure maintained • Office site in full operations 	Ranadi	Quarterly	HCC, MHMS, MECDM

Section 6. Conclusions and Recommendation

In Conclusion, with the rehabilitation of the current Honiara-Ranadi Dumpsite will not only help to manage and reduce the amount of waste tipped off at the landfill but this will assist the implementing agencies to prepare for a new landfill site that will be located far from the town boundary where future wastes is managed properly based on the lessons learnt. The major environmental and health impacts associated with the rehabilitation of the dumpsite are the control of leachate pollution to nearby aquatic system and marine ecosystem. Additionally, the reduction of health risks associated with food poisoning or exposure to medical or hazardous wastes at the dumpsite. The major socio-economic impacts regarding the rehabilitation of the dumpsite is the proper management of waste segregation which provides incentives for waste pickers to easily segregate recyclable materials at the gate entrance. This will also boost local income earners who depend much on the solid waste industry for their livelihood.

Therefore, it is recommended that development consent is approved for the rehabilitation of the Ranadi dumpsite as it will not have any major impacts on the environment and people. It is a national project which will benefit the people of Solomon Islands in the near future as well as to control waste management within the Honiara city. The project proponent will take mitigation measures as outlined in the EMP to safeguard activities are in compliance to the institutional frameworks that will provide guidance during its working phase.

Section 7. Information Sources

Ahikau, F.2012 .*Solomon Island Meteorological Service, from 2000-2011*. Ministry of Environment Climate Change Disaster Management and Meteorology. Meteorological Division, Honiara.

Aregheore, E.M.2009.*Solomon Islands* .Alafua Campus, University of the South Pacific, accessed on 13/9/12 from
<<http://www.fao.org/ag/AGP/AGPC/doc/Counprof/southpacific/Solomon.htm>>

Atkinson, I.A.E and Atkinson, T.J.2000. *Land Vertebrates as invasive species on the islands of the South Pacific Regional Programme*, SPREP, Samoa.

Chase, L.D.C.1981. *A Preliminary guide to the suitability of land in the Solomon Islands for Smallholder crops*. Research Bulletin no.1. Agriculture Research section. Dodo Creek Research Station. Ministry of Lands and Agriculture, Solomon Islands.

Directorate of Overseas Surveys.1974.*Soil Associations: Guadalcanal and the Florida Islands Map 2d*. Land Resources Division (LRD) of the Ministry of Overseas Development, UK.

Dr. Mataki.2011. *A critical assessment of the paradigms for Solid Waste Management in Pacific Island Countries*.Murdoch University.

Earth Link and Advanced Resources Development (ELARD). 2004. *EIA: Solid Waste Treatment Center*, “JBEIL-HBALINE”, Union of Municipalities of Jbeil, Caza of Jbeil.

Hackman, B.D. 1980. *The geology of Guadalcanal, Solomon Islands*. Institute of Geological Sciences Natural Environmental Research Council, London.

Japan International Cooperation Agency. 2010. Questionnaire for PICs on Japanese Technical Cooperation Project for Promotion of Regional Initiative on SWM in PICs (J-PRISM).

Japan Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management (J-PRISM). 2011. *Honiara Waste Characterization Audit Report*. Honiara, Solomon Islands.

Pio, G. Ranadi Dumpsite Topographical Survey Report. Surveying and Spatial Solutions, Honiara. 2012.

Palmer, E.2010. Solomon Star News.<http://www.solomonstarnews.com.sb> .Tuesday 02 February 2010.

Ramohia, P.C and da Wheya, N. Accessed 17th Sept 2012. From www.sprep.org/att/IRC/eCOPIES/Countries/Solomon_Islands/

Sinclair, K.M. 1999. *Solid Waste Characterisation and Management Plan, Final Solomon Islands, prepared for the South Pacific Environment Programme.*

Solomon Islands Government. 1969. *Land and Titles Act 1969.* Ministry of Lands and Housing, Honiara.

Solomon Islands Government. 1994. *Honiara Litter Ordinance.* Honiara City Council, Ministry of Health and Medical Services, Honiara.

Solomon Islands Government. 1996. *Fisheries Act 1996.* Ministry of Fisheries and Marine Resources, Honiara.

Solomon Islands Government. 1996. *River Waters Act 1996.* Ministry of Lands and Housing, Honiara.

Solomon Islands Government. 1998. *Wildlife Management and Protection Act 1998.* Ministry of Environment Climate Change Disaster Management and Meteorology, Honiara.

Solomon Islands Government. 1998. *Environment Act 1998.* Ministry of Environment Climate Change Disaster Management and Meteorology, Honiara.

Solomon Islands Government. 2012. *Cadastral Topography of Ranadi Industrial Area, 2003 Orthophoto Scale 1:30,000,* Ministry of Lands and Housing Survey, Mapping Section, Honiara.

Solomon Islands Government. 2006. *Environmental Health Act (Revised 2006).* Ministry of Health and Medical Services, Honiara.

Solomon Islands Government. 2010. *Protected Areas Act 2010.* Ministry of Environment Climate Change Disaster Management and Meteorology, Honiara.

Solomon Islands Government. 2011. *Report on 2009 Population and Housing Census.* Statistical Bulletin 06/2011. National Statistics Office, Ministry of Finance and Treasury, Honiara.

www.googleearth.com

www.saicm.org

Section 8. List of Annexes

Annex I. Statement of Compliance

The Honiara City Council under the Environment and Conservation Division and Works Division, their stakeholder partners confirm they will adhere to the provisions of the Public Environmental Report and will comply with the national regulations as well as will adopt the proposed mitigation measures and monitoring plans, and will send to the Environment and Conservation Division under the Ministry of Environment Climate Change Disaster Management and Meteorology all monitoring results generated at specified monitoring intervals not exceeding 4 months period , or as mutually agreed.

The proponent will make adjustments whenever necessary to mitigate any unpredicted potential impacts that may occur during construction or after the construction phase or during the course of operation phase of the project. It will also make provisions to meet any costs pertaining to any workers health and safety during or after rehabilitation resulting from construction works other accidents. The project proponent will also meet the costs for monitoring's of the rehabilitation works at Ranadi dumpsite specifically for odor production, emissions, water quality and keep record of the authorised waste pickers from time to time.

Annex II: Letter of Transfer of Land Title to Honiara City Council

Annex III: Topographic Survey Report of Ranadi Dumpsite

Annex IV: Ranadi Rehabilitation Plan (Draft)