Feasibility Report Solomon Islands

Scoping Study for Landfill Rehabilitation and/or Climate Proofing in Solomon Islands

Sustainable, transformative, and resilient for a Blue Pacific

SPREP PROE

Feasibility Report Solomon Islands

Scoping Study for Landfill Rehabilitation and/or Climate Proofing in Solomon Islands

Secretariat of the Pacific Regional Environment Programme

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→ **The Power of Commitment**

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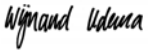
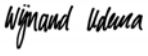
S3	A	F Mills and W Udema	S Chirgwin		W Udema		27/03/23
S4	0	F Mills	S Chirgwin		W Udema		21/04/23
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Acronyms

ADB	Asian Development Bank
AFD	Agence française de développement
CAUSE	Community Access and Urban Services Enhancement
DFAT	Australia's Department of Foreign Affairs and Trade
ECD	Environment and Conservation Division
EIS	Environmental Impact Statement
ESIA	Environmental and Social Impact Assessment
EU	European Union
GTC	Gizo Town Council
HCC	Honiara City Council
J-PRISM I	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase I
J-PRISM II	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase II
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
NGO	Non-government Organisation
PacWastePlus	Pacific Waste Management Programme
PET	Polyethylene terephthalate
PER	Public Environment Report
PPE	personal protective equipment
SPREP	Secretariat Pacific Regional Environment Programme
SWAP	Committing to Sustainable Waste Actions in the Pacific
TLTC	Tulagi Local Town Council
UNDP	United Nations Development Programme
WPA	Western Provincial Authority

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1. Introduction

1.1 Background

“Committing to Sustainable Waste Actions in the Pacific” (SWAP), aims to improve environmental, social, and economic conditions in Pacific Island countries and territories through proper waste management. Funded by the *Agence française de développement* (AFD), this work stemmed from an awareness of the increased pressure from development and population growth, and the impact of increasing and changing waste streams for Pacific Island Countries and Territories (PICTs).

SWAP has a focus on four key areas:

- used oil
- marine debris
- disaster waste
- sustainable financing mechanisms.

This targeted approach for three key problematic waste streams, and the over-arching enabling mechanism of sustainable financing, provides the beneficiary countries with support to improve local waste management systems and infrastructure.

Six countries and territories will benefit from this project: Fiji, Samoa, Solomon Islands, Tonga, Vanuatu, and Wallis and Futuna. The SWAP implementation pathways include:

- regional vocational training
- pilot projects
- tools for sharing successes and challenges through a Community of Practice.

In collaborating with partner governments, support is targeted to meet the needs on the ground. In both Vanuatu and the Solomon Islands, there is an identified need to improve waste disposal sites, with a focus on rehabilitation and/or climate proofing to reduce environmental and social impacts.

SWAP has funded this Project to scope the most appropriate interventions in both Vanuatu and the Solomon Islands. Working with in-country focal points, GHD has selected priority sites, and then assessed the needs on the ground. The funding available for works is USD110,000 per country, including USD100,000 to implement the selected activity/activities plus USD10,000 to hire a consultant to oversee the implementation. The budget allocation can be revised if there is less need to recruit a consultant to oversee the field works or if the need for supervision is greater due to work complexity.

After options for the works were selected in collaboration with local focal points, broad technical specifications, costs and work planning were undertaken to enable the works component to be undertaken in 2023 / 2024. This report relates to the proposed works in the Solomon Islands.

1.2 Purpose of this report

The purpose of this report is to support SWAP and the Solomon Islands government agencies with decision making on the allocation of funds available for waste disposal site rehabilitation and climate resilience in Tulagi and Gizo. The report provides the recommendations on the selected waste disposal sites and a definition of the specific activities to be implemented within the budget allocation. The report provides a summary of current and planned activities at the sites, technical assessment of current operations and the site infrastructure, analysis of options for interventions, and selection or recommended works, including high level costs, equipment and work requirements, specifications, a workplan and recommended timeline.

1.3 Limitations

This report: has been prepared by GHD for Secretariat of the Pacific Regional Environment Programme and may only be used and relied on by Secretariat of the Pacific Regional Environment Programme for the purpose agreed between GHD and Secretariat of the Pacific Regional Environment Programme as set out in section 1.2 of this report.

This document has been produced with the financial assistance of the Agence française de développement (AFD). The views expressed herein can in no way be taken to reflect the official opinion of the AFD.

GHD otherwise disclaims responsibility to any person other than Secretariat of the Pacific Regional Environment Programme arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by Secretariat of the Pacific Regional Environment Programme and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimates set out in sections 6.7.4 and 7.7.4 of this report and Appendix A, using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of evaluating interventions and providing high level budgeting, and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the works can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

The opinions, conclusions and any recommendations in this report are based on information obtained from site visits and interviews conducted with stakeholders. No testing has been undertaken at or in connection with, specific sample points.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.4 Assumptions

This report has been prepared upon the following assumptions:

- USD$110,000 is available in capital works for the project, inclusive of an estimate of USD$10,000 for supervision costs. The focus of this Feasibility Report is to explore potential infrastructure improvement projects, and where necessary identify capacity development initiatives that could be included in the capital cost of the project.
- Information provided by third parties, and during stakeholder interviews was, true, correct and information complete.
- As advised by SWAP, the donor funds cannot be utilised for day-to-day operations.
- For costings, this was based on discussions with contractors and suppliers with sound understanding of Solomon Islands context. Whilst best efforts have been made for realistic pricing, final pricing from the quotation process may differ from these estimates.

2. Methodology

2.1 Scope and Methodology

The methodology for this assessment included:

- Desktop review of published literature and available reports
- Legislative and policy framework review to contextualise potential interventions
- Engagement with key Solomon Island Government agencies relevant for the waste disposal sites governance and management
- Through engagements, evaluation of capacity development needs at the central government, and provincial government level.
- Field site inspection of shortlisted waste disposal locations (Tulagi and Gizo)
- Review of existing national, provincial and local initiatives by government agencies or other donors related to waste management, or climate change that are relevant for consideration
- Develop a multicriteria ranked priority list of interventions for each location for potential rehabilitation or climate resilience initiatives.
- Workshop discussion of long listed potential interventions and draft recommendations with SWAP, Solomon Islands MECDM and Council representatives, and other donor partners working to improve waste management in the region.
- Written feedback from stakeholders after considering long-listed potential interventions.
- Compilation of summary report and recommendations
- High level costings, technical requirements, and proposed timeframe for implementation.

2.2 Stakeholder Engagement

Stakeholder engagement was largely focused on government agencies that would likely be involved in the project, should it proceed. Engagement was also undertaken with NGOs working in the resource recovery sector, and with relevant donors funding waste management programmes in the Pacific Region. The key stakeholders for the Solomon Island Feasibility Study are included in Table 1

Table 1 Stakeholders interviewed to date

Name	Organisation	Role / Function
Julie Pillet	SWAP	Technical Waste Project Coordinator
Tooa Brown	SWAP	Project Technical Assistant
Debra Kereseka	Ministry for the Environment, Climate Change, Disaster Management and Meteorology	Deputy Director
Wendy Beti	Ministry for the Environment, Climate Change, Disaster Management and Meteorology	Chief Pollution Control Officer (Waste Management)
Thaddeaus Soita	Ministry for the Environment, Climate Change, Disaster Management and Meteorology	Deputy Director Climate Change Division
Charles Konai	Tulagi Town Council	Planning Specialist
Galaigu Polycarp	Central Province Government	Premier
Alan Chris	Central Province Government	Permanent Secretary
Adrian Toni	Tulagi Hospital	Director of Health
John Gildea	ADB Honiara Solid Waste Management Project Readiness Finance	Team Leader / Waste Specialist
Patrick Toiraena	Western Province Government	Deputy Permanent Secretary

Name	Organisation	Role / Function
Charles Kelly	Town Clarke	Gizo Town Council
Renee Rario	Waste Management Officer	Gizo Town Council
Kedrian Vilibasia	Manager	Plastic Waste Gizo
Sumana Dani	Waste Management Officer	Positive Change for Marine Life

2.3 Intervention Prioritisation

2.3.1 Site Prioritisation

The site prioritisation process was largely undertaken by Ministry for the Environment, Climate Change, Disaster Management and Meteorology (MECDM) staff, where sites they identify as high priority were shared with the project team. It is understood that this prioritisation was primarily based upon perceived need, and whether other donor resources had been allocated to these waste disposal sites, seeking to avoid duplication of efforts in sites that had received recent donor attention. Four short-listed locations were discussed, including Honiara, Lata, Gizo and Tulagi. The site prioritisation is described in further detail in Section 4 of this report.

2.3.2 Review of Existing or Planned Interventions

The purpose of this assessment was to identify existing or planned interventions for waste management, and where relevant, climate change (only considered where it relates or may impact waste management). This assessment of intersecting projects was undertaken to avoid duplication of efforts, and also to potentially identify where there may be opportunities to augment existing projects or programmes of work being executed by government, donor agencies or third parties such as Non-governmental Organisations (NGOs).

This review was largely a desk top exercise, reviewing publicly available sources of information. This was supplemented with information gathered during stakeholder engagement sessions. This information was collated into a database presented in the Inception Report and considered in the analysis of intervention options.

2.3.3 Multi-Criteria Analysis of Potential Interventions

By applying a multi-criteria analysis to interventions, it provides a standardised method to assess criteria that are considered important when prioritizing interventions. The criteria provide a weighting, based upon importance, and also based upon feedback from stakeholders.

Three main categories, and sub-categories of criteria are included:

– Social criteria:
  - Adverse human health (contact, drinking water)
  - Local nuisance (odours, vectors, traffic, noise, dust)
  - Capacity building potential
  - Improvement in waste transport cost/effort
  - Local ownership constraint
  - Adverse tourism effects
– Environmental:
  - Surface water / marine effects
  - Level of climate resilience improvement (coastal vulnerability / inundation / flooding / storm surge)
  - Complexity of permitting and approvals
– Operational / Implementation complexity:

- Available waste disposal site operational resources
- Ability of provincial government to support (in kind contribution of plant and/or people)
- Available third party contractor on island
- Maintenance requirement
- Delivery timeframe for intervention
- Ability to augment with other donor funding
- Local technical capacity for maintenance
- Capital cost

MCA Evaluation

Each criterion is assigned a low, medium or high rating (high being positive and low being negative), with descriptors for each of the criterion. These include both semi-quantitative, and subjective criteria that are evaluated on the findings of this feasibility study, stakeholder engagements, field inspections and professional judgement.

The tallies for each category are added up to provide a cumulative ranking from high (most desirable), to low (least desirable). This helps bring focus to the shortlist of interventions that should be considered for funding. Further consultation with key stakeholders was then undertaken on the shortlist, to ensure that there is alignment on priorities for funding.

3. Legislative and Policy Context

A summary of legislation and policy relevant to Solomon Islands is provided in Table 2.

Table 2 Relevant legislation

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
Stockholm Convention on Persistent Organic Pollutants (Stockholm POPs Convention) (2004)/ **Solomon Islands National Implementation Plan for Stockholm Convention on Persistent Organic Pollutants (2018)**	3.2.1 3.3.5 3.3.7 4.1 4.2 4.3.1 4.3.2 4.3.6 4.3.8 4.8.9 4.8.10	The Pacific POPs Release Reduction aims to reduce emissions of POPs. The current decline in effectiveness of malaria vector control may warrant the limited reintroduction and use of DDT for targeted malaria control activities. Future releases of uPOPs are expected to decline due to ongoing regional and national efforts. Chemical management is an increasingly important sustainable development issue. Implementation of measures to reduce POPs and manage other chemicals of toxic nature is the responsibility of the Government. Action plan to establish a dedicated long-term storage area at landfill sites for potentially PFOS contaminated consumer goods. Action plan to develop and enforce a national code of practice and training schedule on safe work procedures for waste incinerator and landfill workers; reduce uPOPs emissions from open burning (including burning on landfills); restrict public access to landfill tipping face where possible; reduce uPOPs emissions from disposal and landfilling; prepare and enforce landfill operation manuals and environmental management plans for waste disposal sites; undertake routine monitoring of landfill sites and contaminated sites;	**Solomon Islands Environment Data Portal | Environmental Information for Decision Making (sprep.org)** In effect in country since 26 October 2004. No specific implementing legislation.	Relevant to potential air emissions from proposed Tulagi incinerator, and the requirement for training and safe operating procedures
Convention to ban the Importation of Hazardous and Radioactive Wastes into Forum Island Countries and to Control the Transboundary Movement and Management of Hazardous Waste within the South	15	The Waigani Convention is modelled on the Basel Convention and constitutes the regional implementation of the international hazardous waste control regime (Basel, Rotterdam, and Stockholm Conventions). The objective is to reduce and eliminate transboundary movements of hazardous and radioactive waste, to minimize the production of hazardous and toxic wastes in the Pacific region and to ensure that disposal of wastes in the Convention area is completed in an environmentally sound manner. The Conference of the Parties shall consider the establishment of a revolving fund to assist on an interim basis in case of emergency situations to minimise damage from disasters or accidents arising from transboundary movement or disposal of hazardous wastes within the Convention Area.	**Waigani Convention | Pacific Environment (sprep.org)** In effect in country since 21 October 2001. No specific implementing legislation.	Limited relevance

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
Pacific Region (Waigani Convention) (2001)				
National Development Strategy (NDS) (2011-2020)	Objective 7	Effective response to climate change and management of the environment and risks of natural disasters. Articulates the important of wastes and pollution noting that solid, hazardous, and toxic wastes are a major threat to sustainable development. Alludes to limited capacity for and awareness of waste management and inadequate sanitation systems to treat liquid wastes to avoid contaminating rivers, coastal waters and groundwater near urban areas and communities.	**Solomon Islands Environment Data Portal | Environmental Information for Decision Making (sprep.org)**	Relevant to building capacity for improved waste management through proposed interventions
Democratic Coalition for Change Government (DCCG) Policy Statement		Improve waste management and disposal with the strategic action to promote waste minimization in all aspects of development. Two expected outcomes: improved solid waste management regulations and practices; and alternative waste treatment systems tested and implemented in the country.	**Solomon Islands Environment Data Portal | Environmental Information for Decision Making (sprep.org)**	Limited relevance in relation to waste minimisation, except having an onsite backhoe will assist with management of stockpiles and site house-keeping
National Adaptation Programme of Action (NAPA) (2008)	2.3.13 5.3	The NAPA is formulated to address the growing adverse impacts of climate change in the Solomon Islands. One of the key profile targets in NAPA is to address waste management issues through an integrated and sustainable approach. The relationship between climate change and waste management are of increasing concern. The main actions needed for waste management in Solomon Islands are, among others, to encourage the incorporation of waste management into the educational curriculum along with climate change and to undertake research into waste and climate change issues. Main goal of the waste management project is to better manage impacts of climate change on waste management. To develop a national integrated sustainable Waste Management Plan and Strategy for incorporating impacts of climate change Encourage incorporation of impacts of climate on waste management into educational curricula The absence of an institutional framework for managing waste means that waste is managed on a piece-meal basis.	**FinalDraftNAPA Revised 2 (unfccc.int)** Identifies that climate change impacts will be felt critically on the systems on which humans depend, especially on agriculture and food security, water supply and sanitation, human settlements, and human health.	Moving the medical waste management site at Tulagi is important in relation to climate change, as the current area is vulnerable to inundation through storms and King tides, and not suitable siting. Having the backhoe on site at Gizo will also provide better operational capacity for managing disaster waste, and improving overall waste management.
National Climate Change Policy (NCCP) (2012)	5.2 7.1.1-9 8.1	Mission to enhance adaptation, disaster risk reduction and mitigation capacity throughout Solomon Islands that contributes to increased resilience and achievement of sustainable development goals.	**SI CC Policy - Final draft 11-6-12 (gcca.eu)**	Moving the medical waste site at Tulagi to a more climate resilient

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
	8.2 8.3 8.4 8.5 8.7 8.8	Guided by the following principles: alignment with and guidance from the Solomon Islands national constitution; Stakeholder participation and collaboration; Holistic and multi-disciplinary approach; Precautionary principle and no regrets approach; Respect for culture and rights of indigenous people; Gender equity and involvement of youth, children and people with special needs; Mainstreaming and integration; Integration of climate change adaptation and disaster risk reduction; and Science and evidence based adaptation, disaster risk reduction and mitigation. Solomon Islands shall have in place an effective enabling environment and institutional arrangement to plan, implement and coordinate an integrated and multi-stakeholder participatory approach to addressing climate change. Climate change shall be mainstreamed into all development sectors and integrated into the work of government agencies, national institutions, civil society, and private sector. The IPCC Fourth Assessment Report (2007) predicts that Least Developed Countries such as Solomon Islands will be amongst the most vulnerable to the predicted impacts of climate change. The Government of Solomon Islands considers it vital and urgent to develop the capacity of the country to assess risks and vulnerabilities associated with climate variability and change and to reduce climate change risks and adapt to the predicted impacts of climate change. This includes short term disaster risk reduction measures for climate variability and episodic extreme events, and long-term adaptation to climate change including, inter-alia, enhancing ecosystem and social resilience, climate proofing infrastructure and relocating communities as a last resort. Solomon Islands government will continue to exhort Annex-1 countries to reduce their GHG emissions. On its part the government is committed to carrying out its own inventory of emissions and pursue nationally appropriate mitigation actions (NAMAs) to reduce its own GHG emissions through use of renewable energy and other mitigation technologies that brings benefits to the country's economy, environment and improves the livelihoods of its people. The government shall work together with national stakeholders and development partners to ensure that there is a better understanding of climate change at all levels and sections of society for the effective planning and implementation of appropriate climate change adaptation and mitigation actions. The government shall work together with stakeholders and development partners to strengthen the capacity of national, provincial and community organizations and human resources for the effective planning and implementation of appropriate climate change adaptation, disaster risk reduction and mitigation actions.	Focus on strengthening the adaptive capacity of the country through adaptation measures and taking appropriate mitigation actions to reduce global greenhouse gas emissions. Alludes to the absence of a management strategy and system in place for GHG emissions in the country and encourages waste disposal site management to include the opportunities to generate electricity from methane.	location is aligned with the NCCP.

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
		The government will ensure that technical assistance and financial resources to support climate change programs and projects in the country is mobilized, managed, and accounted for in an efficient, participatory, and transparent manner.		
Environment Act (1998)	3 5 34	Administered by the Environment and Conservation Division of the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECCDM). The Act regulates the discharge of pollutants to air, land, and water. The Act also provides oversight to the transport, collection, treatment, storage and disposal of waste, and the promotion of resource recovery. Objects of the Act include to regulate the transport, collection, treatment, storage, and disposal of wastes and to comply with and give effect to regional and international conventions and obligations relating to the environment. Environment and Conservation Division consisting of a Director and Environmental Inspectors who enforce provisions of the Act established. No person shall cause or allow waste to be placed in any position from which the waste could reasonably be expected to gain access to any part of the environment and is likely to result in pollution. Application of environmental impact assessments (EIA) in order to include environmental considerations as a component of any project. This is the most comprehensive legislation for the Solomon Islands, seeking to address waste and pollution at the national level.	**environment_act_1998.pdf (spc.int)** Emphasizes environmental management and protection. Public waste sector includes major waste disposal plants and waste management, drainage, and disposal systems.	EIA process will need to be followed prior to the development of the incinerator site at Tulagi
National Development Strategy (2016-2035)	Objective 4 Strategy 11	Resilient and environmentally sustainable development. Promote a holistic, sustainable approach to waste management. Development of increased percentage of urban households with regular solid waste collection.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	Aligned with holistic and sustainable approach to waste management
National Solid Waste Management Strategy 2009-2014	3.1.5	Proper disposal facilities are needed – Honiara and all the urban centres of Solomon Islands do not have proper landfills. There is no control in waste disposal, supporting services are ineffective. There are existing methods of constructing a landfill that will enable reuse of the land at the end of the landfills' lifetime (see Fukuoka method).	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	Having an on-site backhoe in place at Gizo will allow staff to implement proper controls at the site.
Environment Regulations Act (2008)		Covers pollution control relating to waste discharge, and any waste management aspects of environmental impact assessments.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation:	Moving medical waste site will reduce waste discharge in marine environment

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
			Solomon Islands.	
Provincial Government Act (1997)		Establishes nine provincial governments, which have responsibility for services such as waste collection and disposal. The Act also enables provincial governments to issue policies and ordinances.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	Limited relevance to this Project
Honiara City Act (1999)		Establishes the tenth province (and only Council) in the Solomons. The Act gives HCC responsibility for waste collection and disposal, street cleaning, and environmental health control.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	No relevance to this Project given that no interventions are planned for Honiara
Honiara Refuse Disposal By-Law (1994)		Enables the HCC to plan and implement solid waste management systems and infrastructure. The associated Honiara Litter By-Law 1994 prohibits littering in public places.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	No relevance to this Project given that no interventions are planned for Honiara
Environmental Health Act (1980)		Prohibits the creation of impacts from solid waste practices, banning practices such as dumping waste in watercourses or beaches, and minimizing health impacts such as disease spread by mosquito breeding in refuse. The Environmental Health Division under the Ministry of Health and Medical Services has responsibility to oversee waste service providers, ensuring they do not create nuisances and operate in a hygienic manner.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	Moving the medical waste site will reduce health risks. Improving operations at Gizo will also reduce health risks from uncontrolled waste and associated vectors
National Waste Management and Pollution Control Strategy (2017-2026)		Provides the over-arching strategic framework to improve waste management. The Strategy includes an action plan with nine policies encompassing environmental, social, economic, and institutional aspects. The Strategy includes an objective for an integrated approach to waste management and pollution control, with a stated outcome of each province having a designated landfill, a waste collection and disposal system, and application of the 4Rs principles (reduce, reuse, recycle, return). A national guide on landfill disposal site use and management will be developed for use in all provinces to improve standards.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	Planned interventions in Gizo and Tulagi will improve waste disposal site use and operations.

Legislation/ Policy/ International Convention	Relevant Clauses	Relevance to rehabilitation/climate resilience improvements of waste disposal sites	Consideration/ comments	Project Relevance
Solid Waste Management Plan (2018-2027) – Honiara City		Includes nine action plans and a prioritization of actions. In 2020, a waste management service division was established to oversee waste services and infrastructure.	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	No relevance to this Project given that no interventions are planned for Honiara
Pipeline		Climate Change Mitigation and Adaptation Bill Proposals for development of a healthcare waste policy Honiara City Council litter by-law Section on nuisance in the Environmental Health Act Development of National Waste Policy for 2021-2025 Reviews of the Solomon Islands Water Authority Act and River Waters Act	SPREP (2020). Stocktake of Existing and Pipeline Waste Legislation: Solomon Islands.	

4. Site Prioritisation

4.1 Site Shortlisting

Engagement and discussions with key Solomon Islands Government Stakeholders[1] identified a number of waste disposal sites that are in need of rehabilitation and/ or climate related resilience works. The locations that were identified included:

- Lata, Temotu Province
- Auki, Malaita Province
- Gizo, Western Province
- Honiara, Guadalcanal Province
- Tulagi, Central Province

Lata Waste Disposal Site

The Lata waste disposal site is located on Nendo Island in the Temotu Province. Lata is the capital of the Temotu Province, with a population of approximately 550 people. The Temotu Province is one of the most remote in the Solomon Islands, located 657 km southeast of Guadalcanal. The province is dominated by low-lying atolls. Due to its remoteness Lata was discounted, due to the likely high project implementation cost, low population, and the infrequent flight schedule (once per week).

Auki Waste Disposal Site

Auki is the capital of the Malaita Province. Auki is located on the north-west coast of Malaita Island, which is the most populous Island in the Solomon Islands with approximately 160,000 people. Malaita is also one of the least developed, with varied infrastructure and social needs. Auki has a population of approximately 8,000 people, with Auki Town Council responsible for managing waste in the town. Auki urban and economic development (and more broadly Malaita) is the focus for many donor agencies. Bina Harbour development is a significant project that aims to support development of the tuna industry in Malaita, and would include green field development of a port, fish processing facilities and a cannery. This broader development is also seeking to improve waste management for the town of Auki, and to support the construction and operation actives of the is project. The donor agencies that have an interest in this project include ADB, World Bank / IFC, New Zealand Ministry of Foreign Affairs, Australian Department of Foreign Affairs, Japanese's International Cooperation Agency, and the Australian Infrastructure Financing Facility for the Pacific. Given the level of interest in this project and broader development outcomes for Malaita and Auki (including waste management) – Auki was considered no further.

Gizo Waste Disposal Site

The Gizo site, managed by the Gizo Town Council (GTC), serves approximately 7,000 people. Designs were completed in 2011, but improper waste disposal remains a challenges for Gizo. The disposal site has a number of impacts, including leachate pollution into the terrestrial and marine environment, the spread of litter and debris, and vermin such as rodents. The site was upgraded in 2015 under JPRISM Phase 1, establishing waste cells and leachate systems under a Fukuoka landfill method[2]. The site has had some improvements over the years and support from some donor agencies but currently needs investment to improve operations and long-term management of the site. There are some complementary donor activities in Gizo, but mostly focussed on recycling and organic waste management of the Gizo market waste.

Honiara Waste Disposal Site

[1] Debra Kereseka – Deputy Director –Ministry of Environment, Climate Change, Disaster Management and Meteorology / SWAP Focal Point
Wendy Beti – Chief Waste Officer - Ministry of Environment, Climate Change, Disaster Management and Meteorology / SAWP Focal Point
Thaddeus Soita – Principal Climate Change Officer - Ministry of Environment, Climate Change, Disaster Management and Meteorology

[2] This has fallen into disrepair to some extent and was not evident at the time of the site visit.

The Honiara Landfill or Ranadi Landfill is located approximately 6 km southeast of the Honoria town centre. The landfill services the population of Honiara (approximately 92,000 people) and accept all waste, including municipal and industrial. There is no structured disposal of hazardous materials, and these are included in the main waste streams. Waste collection services are provided by Honiara city council, using their own collection trucks.

The ADB are currently in the preparatory phase for the proposed Honiara Sustainable Solid Waste Management Project[3] that includes improvement of the existing land fill and waste management operations, closure planning, and site selection and engineering of the new land fill. Given ADB's substantive project in Honiara, this was also discounted for the purposes of the feasibility study.

Tulagi Waste Disposal Site

Tulagi town is located on Tulagi Island in the Central Province, a small island approximately 40 km north east of Honiara. The town has a population of approximately 1,200 people. The waste collections and disposal are managed by Tulagi Town Council. The disposal site comprises an informal dump in a swampy area north of the Tulagi town.

4.2 Location Selection

Tulagi was selected as a priority site for this project as it needs improvement and has received limited support from other donor agencies. The Tulagi site is described in further detail in Section 60 of this report.

The Gizo disposal site was selected as an additional priority site by MECDM for further consideration as part of this Feasibility Study and is described in detail in Section 76.6. It is recognised that there are some pressing challenges at the site, with other donor activities focussed more on waste minimisation and resource recovery than improving operations and infrastructure at the waste disposal site.

[3] ADB (2022): Solomon Islands: Preparing the Honiara Sustainable Solid Waste management Project.

5. Capacity Review

An in-depth review of institutional capacity was not undertaken as part of this feasibility study, as such the commentary herein is based upon observations noted during engagement with government agencies and contractors.

5.1 Ministry for the Environment, Climate Change, Disaster Management and Meteorology

From GHD's interactions with staff from the Ministry for the Environment, Climate Change, Disaster Management and Meteorology (MECDM) including management and technical staff (Waste Management and Climate Change), overall, it was a positive experience, with staff demonstrating a high level of competence and professionalism. Staff members have been supported technically through two phases of the Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries (JPRISM), and capacity development initiatives under this programme. This has included multiple short training programmes in Japan, to allow firsthand understanding of waste management, landfill operation and engineering in a different context. The Phase Three of the JPRISM programme of will commence in March 2023 and run through to March 2028 and will continue to focus on capacity development within MECDM and relevant provincial and council staff, utilizing a similar modality of delivery.

As with many central government agencies across the Pacific, the capacity limitation does not relate to the technical ability of the staff, rather the financial, human resources and equipment available for staff to effectively undertake their duties within the organization. With MECDM, it appears that the capacity is constrained through lack of financial resources, inadequate staffing numbers, and lack of equipment and financial support for waste management and climate change activities to be undertaken in an effective manner.

There may be some opportunity to strengthen financial sustainability through financial instruments such as waste levies, advanced disposal fees, or user pays bag systems (such as the red and yellow bag system in Vanuatu or green bag system in Kiribati). Strengthening financial mechanisms is being supported by both PacWaste Plus and SWAP, with the intention to strengthen revenue streams for the Ministry, potentially building broader resources to adequate levels.

5.2 Provincial Government & Town Council – Tulagi

The engagements in Tulagi included meetings with the Central Province Premier and Permanent Secretary, along with Tulagi Town Council Staff and the Director of Health (Tulagi Hospital).

The staff members directly responsible for the disposal site and the medical waste disposal site were the Tulagi Town Council and the Director of Health. All staff members were well motivated and proactive in their commitment to improving waste management in Tulagi.

Most activities to date have been focused on planning and there appears to be limited technical understanding of the following areas:

- Environmental risks and compounding impact of contaminant and litter release into the environment
- The value of "wetlands" and swampy areas and the functions they perform in the ecosystem
- Risk posed by waste disposal on water courses and groundwater
- Minimum environmental standards for waste disposal
- Human health and environmental hazards posed by medical waste burning and inappropriate disposal

Whilst these technical aspects need strengthening at the Tulagi Council / Tulagi Hospital level – there is an in-depth understanding of these matters and solutions with MECDM staff. As such, it considered that some concerted training workshops run by MECD with town council, with some support from international specialists (such as PacWaste Plus or J-PRISM staff) would be an effective way to close these knowledge gaps. This is discussed further in the recommendations section of this report. It is understood that the Phase 3 of the JPRISM project will continue to focus on technical development of staff at the MECDM, Provincial Government, and town

council levels, which will continue to strengthen capacity. One of the key challenges is that without adequate operational resources, this knowledge cannot be applied on the ground. Sound site management practices can only be achieved with the appropriate level of machinery, staff, and operational resources.

5.3 Provincial Government & Town Council – Gizo

Engagement with the Provincial Government demonstrated that there was an excellent understanding of the key issues around waste management, and that there was a clear pathway to improving social and environmental outcomes relating to waste management in Gizo. In its function, the Western Provincial Government is focused on improving the regulatory framework (ordinances) which will enable issues such as disposal fees to be progressed. Some legislation has been drafted and presented to the Attorney General, however none had yet been passed or gazetted. Despite its alignment with national policy, the proposed legislation may be low priority for the Attorney General and as such had not been given due consideration.

Overall, our perception is that the Western Provincial Government performs well at this executive governance level, supporting the Gizo Town Council in their functions to deliver waste collection services and operate the disposal facility. As such, for the purposes at this project there are no further recommendations for capacity development recommended for Provincial Government Officers.

This observation was also true for the Gizo Town Council where the officers demonstrated a high level of competency, with a clear understanding of technical issues and how these should be resolved. The Gizo Town Council Waste Officer had participated in an extensive waste management training programme in Japan as part of the JPRISM Phase 2 programme. The training was broad and has provided an excellent understanding of good practice when it comes to waste management, and waste disposal site operations and maintenance. Overall, there appears to be a limited need for capacity development – as the capacity constraint appears to be more about resource and financial constraints.

5.4 Implementation capacity

An in-depth capacity assessment was not undertaken for Tulagi or Gizo government agencies in terms of ability to support project implementation, and as such the following commentary is based upon engagement and discussions.

Overall, the ability for town council officers to resource and support the project is limited as they all have their day-to-day duties to fulfill in their current roles, meaning that there is limited spare capacity to support additional work load with project implementation. It is recommended that council officers' involvement is limited to liaison, and engagement with stakeholders and community. This is part of their normal functions, however the intensity of this would be heightened through the project implementation cycle.

6. Tulagi Waste Disposal Site

6.1 Site overview

6.1.1 Location

The Tulagi waste disposal site is located approximately 3km northwest of the Tulagi township on the western end of Tulagi Island in Central Province as shown in Figure 1. The site is accessed via a 4WD track that follows the coastline. The track is deteriorated in places with deep standing water visible at the time of the site inspection.

The site is located directly next to the 4WD track, with dumping activities occurring less than 3m from the sea. The coastal margin is dominated by mangroves, that extend out to reef flats, beyond which is 20-30 m water depth.

6.1.2 Waste disposal site description

The Tulagi Waste Disposal site is relatively small in scale, servicing a population of approximately 1,750, or 255 households from the Tulagi township.

The underlying geology appears to be metamorphic in origin, with granite bed rock dominating across the islands. The island is hilly, with a short section of former reef flat, rising quickly in elevation. The flats below this are dominated with residential housing and gardens.

The waste disposal site is located in a low lying swampy area, approximately 0.5 m above sea level. Due to its low elevation, it is anticipated that during storm surge and king tides, the site is likely to be subject to inundation.

The site is approximately 200-300 m^2 and extends from the road to approximately 60 m back into the forest. The historic dump areas are now overgrown with vegetation. The site is on land that is owned by the Commissioner of Lands, with the site occupying a proportion of a larger parcel.

In addition to the main waste disposal site, there was a secondary waste disposal site used for rudimentary disposal of medical waste from the Tulagi hospital. This secondary site is located on the foreshore approximately 250 m northeast, along the 4wd track from the main site.

6.1.3 Climate

Tulagi has a mean annual temperature of 27 °C with annual precipitation of ~2,600 mm (2.6 m). There is very little temperature variation throughout the year, however rainfall is highest during November – April.

Legend

Tulagi site

Paper Size ISO A4

0 25 50 75 100

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Figure 1: Tulagi waste disposal site

Project No. 12587989
Revision No. -
Date 24/03/2023

Data source: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. Created by: fmills2

C:\Users\Fmills2\Desktop\2023\SI\Gizo_GHD.mxd
Print date: 24 Mar 2023 - 18:10

6.2 Site management and oversight

The waste disposal site is managed by the Tulagi Local Town Council (TLTC). The Council also operates a waste collection service with no charge to the community. The disposal site is unstaffed, and not fenced providing open access to site users and no supervision of waste disposal.

It is noted that the Tulagi Central Province has identified the development of a new waste disposal site as a key component of their Action Plan within their Solid Waste Management Plan (2022-2026).

6.3 Waste disposal site operations

6.3.1 Onsite infrastructure

There are no facilities for staff at the waste disposal site. There is no toilet, no water and no electricity on site.

A tractor is used for moving waste to the waste disposal site. When not in use the tractor is parked outside the Provincial Government office in the open. At the time of the site inspection, the tractor was parked close to the gate house where it is open to the elements. The tractor used is four years old and is important for the operation of the disposal site. The tractor is in reasonable condition however undergoes little maintenance.

6.3.2 Staff resources

The municipal and medical waste disposal sites are unattended and not secure. TLTC employ 7-8 full time staff to provide a waste collection service for provincial government staff and offices. In addition, there are four open air, covered 'garbage houses' with concrete floors where households can place their waste for regular collection using a tractor and trailer. Approximately 28% of households do not receive a waste collection service[4].

In the Tulagi Solid Waste Management Plan (2022-2026), it is recommended that a Solid Waste Management Division be established within the Tulagi Central Province. This Division would be responsible for the recruitment of solid waste management officers to be stationed at the disposal site. Our understanding is that this proposed Division has not been formally established.

6.3.3 Site access

Access to the Tulagi disposal site is via a four wheel drive road as shown in Figure 2. With no staff stationed within the site, and most waste arriving through the collection service, the site is not established as a waste receival facility. However, given the lack of fencing or controls at the site, it can be accessed at any time. With no directions or receival procedures, waste can easily be placed in the wrong area, exacerbating operational conditions.

[4] MECDM (2019): Tulagi Waste Characterisation Audit Report.

Figure 2 Tulagi disposal site access road

6.3.4 Waste acceptance

The municipal waste collection is provided by the TLTC, free of charge. This includes household collections, industrial waste from Silent World slip way and shipyard, and collection of waste from the community waste drop-off locations (there are a total of 6 waste collection huts for this purpose). The collections are undertaken using a tractor and trailer, and 2 tonne collection vehicles, accepting all wastes produced from both households and commercial businesses. Not all households receive waste collection services, with 47.6% reporting illegal dumping (Tulagi Central Province 2022).

An example of the waste at the waste acceptance site is shown in Figure 4 and Figure 5. Medical waste is brought to the site by Tulagi Hospital staff, taken to a separate area and burnt (Figure 3). This issue was raised in the Tulagi waste characterization study funded by JPRISM in 2019, stating that the dumping and burning of medical wastes in this location will pose long term risk to the population. However, the practices have not changed.

Figure 3 *Burnt medical waste encroaching into mangroves and coastal environment*

Figure 4 *Butane gas canisters and chemical drums in waste at disposal site*

Figure 5 *Butane gas canisters at dump site*

6.3.5 Landfilling methods

The waste disposal is open dumping, with no pit or liner present. The waste is dumped at the disposal location and occasionally burnt to reduce volume. Waste is transported to the disposal site by the tractor to the site (Figure 6). Waste placement takes place without a clear landfilling plan and method (Figure 8) . General waste was present in the coastal margin and within the mangroves (Figure 10). There is no waste segregation or sorting at the site. There is an excavator on Tulagi (Figure 9) that can be used on the site. However, there are no operational funds to undertake waste shaping, compaction and covering on a regular basis.

With practices at the Tulagi site including open burning and incursion of the waste into the sea (Figure 10, Figure 11), this increases the risk of vector borne diseases and health related issues.

Figure 6 Waste collection tractor

Figure 7 Roller available for use at disposal site

Figure 8 Waste placement

Figure 9 Excavator available for use at adjacent ship yard

Figure 10 General waste in the coastal margin

Figure 11 Medical Waste is burnt to reduce volume

6.3.6 Site water management

There is no structured drainage, with the exception of a cut off channel between the 4WD track and the waste disposal site. This appears to drain directly to the sea, via a culvert. The drain was filled with waste materials, limiting its effectiveness. The ground beneath the waste disposal site was saturated, indicating a high groundwater table, and is described locally as a swamp.

Some staining and debris were observed in the coastal zone, which likely indicates leachate discharge into the marine environment (Figure 12).

The sensitivity of the receiving water environment is assumed to be moderate as the marine environment is relatively pristine, but impacted by human activity. There is no monitoring of water quality by the Provincial Government or the TLTC, and no environmental reporting.

Figure 12 Staining and debris observed in the coastal zone in Tulagi

6.3.7 Waste disposal site gas management

There is no landfill gas management installed and given the low waste volumes, this is not a priority at the site.

6.4 Site impacts

6.4.1 Environmental impacts

The following discussion is based upon site visual inspection. No intrusive investigations, testing or analysis has been undertaken to verify impacts to the environment.

A summary of key environmental risks with current site infrastructure and operating constraints, and any environmental impacts that were observed include:

- Likely leachate discharge into the coastal marine area
- Waste in intertidal zone and on reef flats in the sea
- Waste within mangroves
- Uncontained waste disposal area with waste extending into secondary growth forest
- Human health and environmental hazards associated with improper medical waste disposal (sharps, bandages and medical vials apparent)
- Likely inundation of municipal and medical waste sites during king tide and storm surge events due to less than 0.5 m elevation above sea level
- Air discharges during rubbish burning events
- Unconstrained disposal site operations
- Surface water seepage from saturated soils through waste materials
- Recyclable materials with dumped materials (aluminium and tin cans)
- Medical waste and ash after burning appeared to be pushed into the sea
- Waste stockpiles and uncovered waste creates potential for windblown litter, odour emissions, breeding areas for insects and vermin (both potential disease vectors), ponding water within stockpiles, and a loss of amenity.
- Human health and environmental hazards associated with contact with hazardous waste
- Human health and environmental hazards associated with improper medical waste disposal (sharps, bandages and medical vials apparent)
- Fire risk from uncompacted and uncovered waste cells and stockpiles

6.4.2 Social impacts

The Tulagi site is located well away from any residential housing, gardens or any other community facilities, as such, the disposal site is not considered to have any appreciable social impact. This is similar for the medical waste disposal site. However, site workers, particularly those handling the medical waste, are exposed to risk of injury and disease. The medical waste would likely pose a health hazard to community members if they encountered residual waste materials, which is possible given the non-containment on the site.

6.5 Summary of ongoing and planned work

6.5.1 Planned investment in the site

The Tulagi Council is reasonably active with ongoing waste management activities, including recent drafting of the Tulagi Solid Waste Management Plan that has been endorsed by MECDM.

Some of the key features of this plan are to improve waste management, including improving waste collection rates, development of an alternative waste disposal site, and implementing waste segregation. The planned segregation includes separating municipal waste, medical waste and organic wastes, with designated areas for each type of waste. The plan includes expansion of the disposal site footprint to approximately 1,800m2. The expansion would include segregation areas for recyclable materials such as metals (aluminium and tin cans). In principle, the proposal has merit, however the current location is not likely to be suitable, due to water saturation / high groundwater, and low elevation / inundation risk. Further to this, the expansion would also require destruction of mature secondary growth forest.

The Tulagi Council has been engaging with the Japanese High Commission to seek sponsorship for fencing the site, and building a site office. A draft proposal has been prepared and is awaiting Provincial Government executive approval prior to submission to the Japanese High Commission. It is understood that there is in principle support from the Japanese to sponsor this project. The J-PRISM regional project will commence its third phase in 2023, with an emphasis on ongoing capacity building and technical support.

It is understood that the Tulagi Hospital (with support of the Town Council) has been in discussions with the World Health Organisation (WHO) to sponsor a medical waste incinerator. It is understood that the discussions have been continuing for 2 years. A site has been chosen adjacent to the existing 4WD track that approximately 400 m south of current disposal site. This area is currently secondary growth forest.

6.5.2 Other relevant donor activities in Tulagi

Solomons Water has a water treatment plant planned for Tulagi, however there is a current lack of donor funding to implement the project. There are no other known activities planned for Tulagi. Whilst the Solid Waste Management Plan (2022-2026) identifies a number of priorities, there is no indication of committed funds to these initiatives, or donor support.

6.6 Analysis of Options for the Tulagi Site

6.6.1 Description of potential interventions

The existing municipal and medical waste disposal sites have fundamental flaws, and as such careful consideration should be given to any investment in the existing sites, as any improvement is not likely to have long term sustainability due to climate change risks, and environmental unsuitably of the current location.

The Provincial Government have identified an alternative waste disposal location located on the southern side of the island, near to the Silent World staff housing compound. Whilst the site is elevated (low sea level rise risk), the site may not be suitable for waste disposal – as it is directly adjacent to a water course used by the local community for water collection, bathing and clothes washing. Further, the nearest residential units are less than 100 m from the proposed site.

During the site visits, GHD did identify a potential alternative waste disposal site in an ad-hoc quarry site. This site is elevated approximately 3 m above sea level, yields daily cover material, and is located less than 1 km from the current disposal site, back towards the Tulagi township. A preliminary assessment indicates that this is suitable as a candidate site for consideration. However, relocating the waste disposal site will require the necessary environmental and social due diligence and approval processes. This work is viewed as a high priority for Tulagi, but not within the budget of the current SWAP funding.

The current medical waste disposal site is considered not acceptable from an environmental or health perspective. Broader consideration needs to be given to improving the incineration process to a higher temperature, and disposal of ash and residual material after burning. An improved incinerator is recommended to reduce risks, and an alternative location that provides a good option is the concrete hard stand area that was formally a Sol Tuna facility. It is recommended, that the medical burning site be relocated to this site which is adjacent to a derelict wharf. This would also be a suitable location (subject to community consultation and permitting and approval) for a medical incinerator. One occupied house is located within 50 m from this site and would need to be considered. Moving the hospital waste to a dedicated incineration facility would provide a controlled burning environment and stop the environmental release of waste and contaminants into the sea. In terms of addressing the risks, this is viewed as the most effective use of funds to provide immediate improvements on the ground.

Figure 13 Location of Tulagi medical waste disposal site (inset photo - poor disposal practices)

Figure 14 Concrete hard stand area previously tuna processing site. Potential location for medical waste incinerator

In summary, the waste disposal site rehabilitation / climate resilience options for Tulagi include:

- Do Nothing
- Waste segregation
- Improvement of existing site
- Relocation of the site to a climate resilient area
- Incineration options to improve medical waste management.

Table 3 Summary of intervention options for Tulagi

Area	Key Issue	Potential Interventions
Waste disposal site	Environmental impact Health risk Resilience	Relocate existing disposal site to alternative location (e.g. quarry site)
Waste disposal site	Resilience	Earth bund to reduce inundation risk (use Government excavator, compactor, tractor and MOH 5t truck). Maintain existing drainage system.
Medical waste	Environmental impact Health risk Resilience	Move medical burning site to former Sol. Tuna wharf hard stand. Develop De Monforte Mark 9 style incinerator
Segregation	Environmental impact	Establish waste separation for organic waste and aluminum cans at waste collection hubs
Segregation	Environmental impact	Basic Composting facility

6.6.2 Basis for prioritisation

The process of analysis and criteria are described in further detail in section 2.3 of this report. The multi-criteria analysis prioritises the projects from most favourable, to least favourable as ranked against the performance criteria (Appendix A).

This shows that the highest-ranking options include:

- Move the disposal site to a more environmentally and climate resilient location and
- Move the medical waste burning location to the former Sol Tuna concrete hard stand area and install an appropriate incinerator.

Following this narrowing of options, broad costings were explored to understand what was possible within the funding allocation for the works.

6.6.3 Discussion of options at stakeholder workshop

Once the interventions were assessed, this information was provided to a stakeholder workshop for discussion on 15 February 2023. See Appendix B for a copy of the presentation.

A number of issues were discussed at the forum, summarised below in Table 4.

Table 4 Intervention options workshop - discussion summary

Issue	Discussion points	Actions
Incineration technology	Concern about whether the proposed technology (De Monforte Mark 9) reaches adequate temperature to minimise pollution from dioxins and furans MECDM noted that there are no relevant air emission standards at present, but it is important to consider emissions Acknowledgement that current practice is very poor and stepped improvement worth considering Pacwaste Plus have provided guidance and advice on applicable technologies. Particularly for waste to energy technologies applicable to PICs context (GHD di technical work on this project) Discussed other pilot project being run through rural training centres using pyrolysis to produce energy from plastic waste	GHD team to research technical performance of De Monfort Mark 9 Review outcomes from PacWaste Plus report on waste to energy applicable technologies GHD team to review plastic waste pilot and if there is any linkages, or other suitable technologies from NuFuels.
Waste disposal site relocation	General agreement on poor siting of waste disposal site Agreement that finalisation of an alternative site would then need an EIA process and relevant approvals, as well as detailed design. Discussion that this would be challenging to make inroads given limitations on funding in this package.	No further action
Donor and Government coordination	Waste Plan for Tulagi has been developed and approved by MECDM No donor programs identified for Tulagi J-PRISM III – no funds allocated to physical investment, with focus on capacity building and training. National projects to be finalised in September 2023.	MECDM to provide copy of Tulagi Waste Plan

At the conclusion of the workshop, it was agreed that the presentation would be shared, and stakeholders were to provide feedback on recommended interventions. It was on the basis of the feedback provided via email that the recommendations were finalised. Feedback was received from the Government participants, and from SWAP in Samoa.

6.6.4 Selected works for SWAP investment in Tulagi

Following the MCA exercise, Table 5 provides the ten short-listed intervention options for Tulagi.

Table 5 Short-listed intervention options for Tulagi

Investment Option	Current State / Benefit	Proposed action	Cost (USD$)	MCA Ranking	Comments
ESIA and approvals for new incinerator at former Sol Tuna site.	Current medical waste disposal procedure is hazardous for workers, with no emission control and limited safety. Waste is not destroyed and spreads in coastal environment The benefit of completing an Environmental and Social Impact Assessment (ESIA) and approvals process is to provide safeguards, but also to seek support from neighbours and broader community	Commission local consultant to assess SolTuna site (or any viable alternatives) and undertake consultation. Complete required approval process. Local consultant. Note no biodiversity impacts, and air emissions documented in tech standards	4,100	1	This is inter-linked with construction, although separated out for purpose of splitting the steps. This is ranked as 1 to reflect order of implementation. Risk that if this is done without construction no material difference.
Construction of new incinerator at Sol Tuna Site	Current medical waste disposal procedure is hazardous for workers, with no emission control and limited safety. Waste is not destroyed and spreads in coastal environment The new incinerator will provide improved medical waste handling and disposal, improving safety and environmental outcomes.	Import of materials such as refractory bricks, with the rest sourced locally. Construction of incinerator and roofing structure. Includes shed, tools, PPE, and contingency of 20%/ Does not include fencing	26,800	2	Viewed as the best solution as the hardstand is already there and the technology presents a marked improvement
Construction of new waste disposal site	Existing disposal site unsuitable location, with investment recommended for new site (to be located and approved). Construction of the site will allow the existing site to be closed and improve Tulagi waste management.	Local construction contract	205,500	3	Note that the ESIA, approvals and design work are a pre-cursor to moving the site. MCA ranking very high due to impacts but cannot happen without approvals and design.
Detailed design of new waste disposal site	There is no approved alternative site, and as such no design work has commenced. Note that J-PRISM have provided technical support for this type of work and have a strong understanding of appropriate design for small landfills. The site can be designed to minimise contamination risk from leachate and reduce the risk of spread of waste. Site design can	Liaise with J-PRISM and SPREP to access technical expertise in the region. Design to be prepared by local consultant with input from regional expertise.	25,000	4	This needs to take place after approvals

Investment Option	Current State / Benefit	Proposed action	Cost (USD$)	MCA Ranking	Comments
	improve resource recovery, and reduce impacts				
Undertake detailed feasibility, (including social and environmental assessment) and gain approvals for new waste disposal site.	Disposal site is located on unsuitable land. Waste mass is regularly inundated with water due to low lying swampy site. Waste is washed into coastal environment in storm events and king tides. Climate change will exacerbate these issues. The Provincial Government has identified one site but this has some environmental constraints being close to residents and a river. Quarry site may be a better alternative. Select a sustainable site that can be operated into the long term and that will not be impacted by climate change. Alternative siting will stop the pollution into mangroves and coastal environment.	Commission local consultant to assess at least two alternative sites and undertake consultation. Complete required approval processes.	37,900	5	Important that this is undertaken as a priority. We believe identified quarry site is a better option than identified option which will have impacts on neighbouring houses. Ideal for donor funding / support
Waste separation (organics and aluminium) at collection hubs	Current collection hubs have no waste segregation facilities Less waste to landfill. Potential for income from resources such as aluminium	Local construction contract. Also need to consider end destination for materials, and separated collection	5,900	6	This would include installation of bins and awareness. The challenge is finding viable markets for recyclables without a CDS (likely only aluminium)
Basic composting facility	Currently there is no segregation of organic waste. Less waste to landfill. Potential for creating a resource for agriculture or gardens	Utilise Sol Tuna hardstand. Tractor driven PTO Hansa C13shredder/chipper CIF. Chainlink fence. Composting SOP. Contingency 20%	24,000	7	It is noted that the Tulagi SWM Plan does not promote a composting facility but emphasises home composting. This is supported
Construct open burn pits at Sol Tuna site	Current medical waste disposal procedure is hazardous for workers, with no emission control and limited safety. Waste is not destroyed and spreads in coastal environment. Moving to Sol Tuna is viewed as an improvement with waste emission into marine environment reduced, but relocating the impacts elsewhere	Set up a burning area at Sol Tuna site, with some type of structure to facilitate improved burning. Fenced off area.	18,900	8	Some improvement, but potential for ongoing health and social impacts

Investment Option	Current State / Benefit	Proposed action	Cost (USD$)	MCA Ranking	Comments
Relocate current medical waste treatment practice to new disposal site	Current medical waste disposal procedure is hazardous for workers, with no emission control and limited safety. Waste is not destroyed and spreads in coastal environment. Moving to new disposal site is a better co-location. However, current practices not viewed as	Set up fenced open burning area for medical waste as a part of new site development	4,000	9	Improved outcome in terms of moving from coastal zone. However, not viewed as a significant improvement to health risks for workers. Unlikely to be socially acceptable
Improvements to existing waste disposal site.	The current siting is poor, particularly from a climate change perspective. Waste mass is likely inundated with water during wet weather / King tides. Leakage of waste into marine environment. In the interim, could mitigate some of the impacts such as spread of waste into marine environment	Earth bund to reduce inundation risk (using Government excavator, compactor, tractor and MOH 5t truck). Maintain existing drainage system.	5,000	10	Team view is that this is not effective use of funds. Difficult to make a sustained difference at this site. Also note that funds to operational costs ineligible for SWAP

During the stakeholder workshop discussion, and the feedback received via email, it is clear that there are a number of priorities to be addressed in Tulagi. However, the funding allocation of $110,000 for both the Gizo and Tulagi sites precludes a number of these options, particularly the construction of a new waste disposal site.

The following options for intervention have been selected:

1. Environmental and social impact assessment and approvals for new incinerator at Sol Tuna site
2. Construction of new incinerator (De Montfort Mark 9) at Sol Tuna site, including shed, personal protective equipment (PPE) and tools.

6.6.5 Works suitable for additional funding or other donor projects

The following works are recommended for additional donor support. An indicative budget in USD has been provided for the purpose of early planning, with further refinement needed through project feasibility work:

1. Detailed feasibility study into at least two potential sites for the new waste disposal site. Includes Environmental and Social Impact Assessment and approvals. USD 40,000
2. Detailed design of new waste disposal facility. USD 25,000
3. Construction of new waste disposal facility. USD 210,000
4. Closure of existing waste disposal facility, including compaction, cover, and removal of any waste at risk of moving into the marine environment. USD 80,000
5. Improve waste separation at collection hubs and encourage home composting. USD 6,000

6.7 Proposed Site Works at Tulagi

6.7.1 Description of Works

For the Tulagi site, it is recommended that there are two packages that implemented through a limited request for quotation (RFQ) process.

The first is to select a suitably qualified locally based ESIA consultant to undertake the ESIA for the proposed new incinerator to be located at Sol Tuna site. Importantly this will include consultation with stakeholders to provide details about the benefits of this change, and any potential impacts and mitigation measures.

The second package is a works contract for the supply and installation of the in De Montfort Mark 9 incinerator at the Sol Tuna site. The package will include the supply and construction of a shed to house the incinerator, personal protective equipment (PPE) and tools.

6.7.2 Technical specifications

Package 1 – Local ESIA Consultancy

A suitably qualified ESIA consultant will undertake a study into potential impacts and mitigation measures for the installation of a De Montfort Mark 9 incinerator at the Sol Tuna site. The proponent needs to be determined, whether it is the Tulagi Town Council, the Central Province, The Ministry of Health and Medical Services, or the Central Provincial Health Service. The SWAP in-country focal points will provide advice on this (in consultation with stakeholders).

The consultant will assist the Proponent to undertake the approvals process, under the Environment Act 1998. This includes the initial application with the fee of SBD $200, to enable the Environment and Conservation Division (ECD) to undertake the initial Project screening and scoping stage. The ECD will advise whether a Public Environment Report (PER) or Environmental Impact Statement (EIS) is required.

It is noted that there will be no land clearance given the development will occur on the existing concrete hard stand area at the Sol Tuna site. It is also noted that air emission data can be sourced from the technical information readily available on the De Montfort Mark 9 incinerator[5]. A key part of the consultancy will be community engagement, providing information on the current and proposed practices, and seeking engagement to ensure people understand the benefits and the potential impacts.

The PER or EIS be reviewed and will need to be modified by the consultant if there are any information gaps identified by ECD. Both documents also need to consider any public submissions made during the review process.

The package may be divided into quotations for the initial application and then the EIA phase, as the decision on the EIA process and the type of information required will inform the next steps.

The consultant must be suitably qualified and experienced, and able to demonstrate similar EIA work they have undertaken for developments in the Solomon Islands.

Given that the proposal is for public infrastructure owned by the Government, it is also suggested that there is discussion of the potential to waive application, processing and development consent fees.

Package 2 – Construction of De Montfort Mark 9 incinerator

The construction of the incinerator has clearly defined technical specifications that can be used from open sources such as Engineering for Change. The Technical Specifications for the incinerator are included as Appendix C. It is noted that the 300 fire bricks may not be available locally – this needs to be a part of the quotation (source and pricing). It is also recommended that the construction specifications include a temperature gauge to improve operational guidance.

In addition to the specifications for the incinerator itself, the additional requirements are for:

– A shed to enclose the incinerator and store PPE and tools
– PPE for operational staff
– Weighing sales for recording amounts received / processed
– Tools for operational staff.

Shed

The shed will be bolted onto the existing concrete hardstand and be similar in dimensions to a minimum of 5m x 4m x 3.6m. A kit shed that meets the relevant building standards in the Solomon Islands is acceptable. Ideally the shed can be fully opened to allow use of natural light for operations. There is no requirement for electricity or lighting, but secure storage of firewood is recommended.

PPE

Recommended PPE includes a supply of the following:

– Face mask or safety visor (to protect eyes and mouth)
– Safety glasses (alternative option to protect eyes if visor unavailable)
– Heavy duty gloves (to protect hands)
– Safety aprons (to prevent damage to clothing)
– Heavy duty rubber boots (to protect feet)

Safety Equipment

Recommended safety equipment to have on site at all times include:

– Sand bucket
– First aid kit

[5] See **De Montfort Medical Waste Incinerator | Engineering For Change** or **Welcome to the new de Montfort Medical Waste Incinerator website (mw-incinerator.info)**

Tools

Recommended tools for loading and operating incinerator include:

– Steel rake for ash removal
– Hard bristle broom for cleaning vicinity
– Shovel for ash removal and clean-up
– Hand brush and dust pan
– Chimney cleaning brush

6.7.3 Personnel and equipment requirements

The successful bidder for Package 1 must meet experience and qualification requirements to demonstrate their capacity in EIA work.

The successful bidder for Package 2 must demonstrate construction experience, including welding and blockwork.

7. Gizo Waste Disposal Site

7.1 Site overview

7.1.1 Location

The waste disposal site in Gizo is located on the coast (Figure 15), approximately 3 kilometres west of the town and serves a population of approximately 7,100 people (2019 census).

7.1.2 Waste disposal site description

Gizo is the third largest town in the Solomon Islands after Honiara and Auki. With a population of 7,177 (2019 Census), Gizo is part of the Western Province, with provincial administration, planning and urban management undertaken by the Western Provincial Authority (WPA).

The Gizo disposal site is operated by the Gizo Town Council and covers approximately 3000 m^2. The disposal site is part of a larger parcel that extends from the road through to the coast, that is understood to be owed by the commissioner of lands (this covers an area of approximately 23,000$m^{2)}$. The Gizo Town Clerk mentioned that they have commenced the process of assigning land ownership to the Gizo Town Council, in order to simplify approvals process for future improvement projects.

The site is approximately 10 m above sea level. The site slopes in a northerly direction from the waste disposal area to the coast that is dominated by mangroves and salt marsh.

7.1.3 Climate

Gizo has a mean annual temperature of 29 °C with annual precipitation of ~3,600 mm (3.6 m). There is very little temperature variation throughout the year, however rainfall is highest during January – July.

Legend

Gizo Site

Paper Size ISO A4

0 25 50 75 100

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Figure 15 **Location of** Gizo waste disposal site

Project No. 12587989
Revision No. -
Date 24/03/2023

Data source: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. Created by: fmills2

C:\Users\Fmills2\Desktop\2023\SI\Gizo_GHD.mxd
Print date: 24 Mar 2023 - 18:19

7.2 Site management and oversight

Gizo town has a designated waste disposal site that is located to the west of the town. The existing waste collection service is provided by the Gizo Town Council (GTC) with no charge to the community. It is estimated that approximately 45 tonnes of waste are disposed at the site per week (SPREP, 2011). Waste disposal site operations

7.2.1 Onsite infrastructure

There are no facilities for staff at the waste disposal site. There is no toilet, no water and no electricity on site.

The waste disposal site itself has no liner present, and no infrastructure for waste segregation. There are some waste pits utilised for residual medical waste disposal after the material has been burnt on the foreshore in Gizo.

There are a number of informal settlers (Figure 16) on the larger land parcel, and 8 permanent houses have been constructed within the legal boundaries of the disposal site. These residents were also growing crops within the site boundary of the waste disposal site. Crops grown include bananas, pineapples, cassava, papaya, and beetle nut. Crops are often growing within the refuse (Figure 17).

Figure 16 Convenience store which is part of an informal settlement neighbouring the waste disposal site (fenced)

Figure 17 Banana trees and casava growing in older waste disposal areas of the site

7.2.2 Staff resources

The Gizo town council employees one full time staff member to oversee and monitor disposal site operations. This appears to be relatively informal, and the staff member lives in one of the neighbouring houses.

7.2.3 Site access

The road frontage has a chain link fence, however this is in poor condition and in need of repair. There are two entrances to the site, with concrete ramps providing all weather access. The site is not secure, as gates have been removed. Fly tipping is prevalent outside the site along the fence line. It is understood that the World Bank funded Community Access and Urban Services Enhancement (CAUSE) project is supporting Gizo Town Council with improving fencing and site access.

The site is located approximately 1.5 km from the Town Centre, accessed via an unsealed road. An image of both the sealed and unsealed roads and the chain link fence is shown in Figure 18.

There is no site control or site office, however a site minder is employed by the Town Council to monitor waste disposal at the site.

Figure 18 The waste disposal site is fenced (as seen in left of image) and has a mixture of paved (centre) and aggregate road

7.2.4 Waste acceptance

There is no discrimination of waste types and all wastes are accepted including hazardous materials.

The Gizo Hospital has a medical waste incinerator, however, since commissioning, this has not been used due to odour and smoke complaints from residents adjacent to the hospital. It is understood that the residents petitioned the Provincial Government to shut down the operation of the incinerator. The hospital now burns medical waste on the coast, next to the Gizo Hospital medical stores. The medical waste is stored in wheelie bins, and then burned in an open burning enclosure. The ash and residual waste is understood to be disposed at the Gizo waste disposal site. Residual waste and ash are apparent in the vicinity of the burning area.

Waste types are not sorted and recyclable, compostable, general waste, residual medical waste and hazardous waste materials are dumped together (Figure 19Figure 19).

Figure 19 Waste at Gizo disposal site. All waste types are accepted and no sorting of waste occurs.

7.2.5 Waste disposal methods

The waste disposal is open dumping, with no pit or liner present. The waste is dumped at the disposal location and occasionally burnt to reduce volume (Figure 20). The refuse disposal area is largely across a level platform at the same elevation as the road. This platform drops off approximately 4m to a salt marsh, and intertidal flats and mangroves. There were a number of pits visible across the site, and these were reportedly used for disposal of medical waste.

The site utility is poor, with waste piled up towards the road. There is no burial of waste or application of cover material, with open dumping being practiced. There is no source of cover material available on site. The conditions are unsanitary, with strong odours and leaching apparent. There is no segregation of waste, and all waste is dumped in an uncontrolled manner, and includes hazardous materials. The north and southern extents of the site are bounded by a stream (north) and a drain in the south. The drain on the southern side of the site was full of refuse, reportedly due to fly tipping by Gizo residents.

There is no active management of the disposal site, with waste management staffing limited to collections. Waste is collected by Gizo Town Council who operate a waste compactor truck, and by a private contractor operating 3t trucks to collect waste from smaller streets within the town.

At the time of writing one of the compactor trucks had not been operational for 3 months, due to needing new tyres. Quotes had been obtained for replacement tyres and these had been submitted to the Provincial Government for expenditure approval – however the approvals process can be lengthy.

Within some communities in Gizo, practices such as open burning and dumping of the waste into the sea and bush occur. This increases the risk of vector borne diseases and health related issues.

Figure 20 Waste disposal is by open dumping

7.2.6 Site water management

There were no water management systems observed on site, nor did Town Council staff have any knowledge of drainage systems on site. As mentioned above, a drain is located along the southern boundary, and a stream along the northern boundary that flows to the coast at the rear of the site. With waste blocking the drain, it is clear that operational practices for site water management need improvement.

7.2.7 Waste disposal site gas management

There is no waste disposal site gas management installed and given the low waste volumes, this is not a priority at the site.

7.3 Site impacts

7.3.1 Environmental impacts

The following discussion is based upon site visual inspection of both the Gizo disposal site and the medical waste burning area. No intrusive investigations, testing or analysis has been undertaken to verify impacts to the environment.

The main environmental impacts that were observed include:

- Leachate discharge into surface water bodies and groundwater
- Fly tipping and wind dispersal of refuse
- Cropping within disposal site and potential for contaminant uptake in plants
- Unsanitary and unsafe burning of medical waste, with waste residues and ash release into the surrounding environment
- Feral dogs foraging within refuse may pose safety or vector risk
- Unsanitary disposal of wastes may pose insect or vermin vector risks to surrounding community
- Disposal of hazardous materials may increase environmental contamination risks, that may pose a risk to environmental or human receptors in the future
- Limited resource recovery

The environmental impacts are recognised as a critical issue by the Western Provincial Government, who have recently formed a task force to urgently address operational improvements.

7.3.2 Social impacts

The main social constraint and risk at the site, is the presence of established informal settlement on the disposal site, within the legal boundary of the site. This issue is recognised by the Gizo Town Council who have begun the process of moving these settlers off the land. It is understood that there have been two engagements with this community over the last 6 months, and if required will be escalated with the Police Department and formal eviction notices.

The social impacts associated with the disposal site (including informal settlers as per Figure 21), include:

- Health risks to informal settlers from hazardous material, leachate, exposure to contaminated water and contact with medical waste residuals
- Health risks associated with consumption of potentially contaminated produce grown on the disposal site land
- Odour nuisance for occupiers of neighbouring properties
- Potential disease borne vectors (insects, vermin, dogs) due to unsanitary practices at the disposal site
- Visual impact due to fly tipping and unsightly refuse disposal practices

The Western Provincial Government understands the imperative to not allow settlement on the waste disposal site due to health risks and operational constraints. There are currently moves to formalise the title ownership to the Gizo Town Council, with informal settlers provided notice that they need to vacate the site.

Figure 21 Aerial image of Gizo waste disposal site, including informal settlers within boundary (approximate)

7.4 Planned activities at Gizo Site

7.4.1 Planned investment in the site

There is a significant ADB project underway – *Preparing the Honiara Sustainable Waste Management Project*, but this is confined to the solid waste management system for Honiara. Other donor funded waste activities include the World Bank funded Community Access and Urban Service Enhancement (CAUSE) project, implemented from 2018 to 2024. This aims to improve basic infrastructure and services for vulnerable urban populations in the Solomon Islands, including road maintenance and repairs and waste management. Potentially this may include improvement works to the Gizo waste disposal site, such as repairing and improving fencing, and general site maintenance, but it is expected that these works will be relatively minor.

JPRISM Phase 3 (commencing in March 2023) will continue to support technical development of waste staff at the council and province level. A technical volunteer funded by the Japanese Government will arrive in February to support council officers. It is expected that this will assist with improving operational systems at the site.

7.4.2 Other relevant donor activities in Gizo

There are some broader initiatives relevant to improving waste management in the Solomon Islands, and in Gizo. There was a pilot project completed with NuFuels from New Zealand, working with the community to recover energy from plastics using a small-scale pyrolysis technology. The New Zealand Government partially funded the initial pilot testing of the technology, with UNDP funding the implementation of three systems through St Martin's Rural Training Centre in Honiara, Kaotave Rural Training Centre in Guadalcanal and St Peter's Rural Training Centre in Gizo. The system is typically fired by wood or bio-fuel (generated from the process), taking approximately 7kg of PET plastic and mixed polyethylene plastics (such as plastic bags) and converting this into useable energy. The end product is approximately 5 kgs of a viscous plastics crude and 2kgs of gas, equivalent to approximately 8 hours of energy from one process batch. Nufuels is partnering with Solomon Airlines to investigate production of a bio-fuel, initially for use in the ground fleet. Each unit has the potential to utilise approximately 7 tonnes of waste plastic per annum. In Gizo, the NGO Plasticwise are an additional partner in the pilot with their efforts in source segregation and collection systems.

Strongim Bisnis[6] supports two Non-Governmental Organisations (NGOs) that operate in the waste recovery and recycling space. This includes Plastic Waste Gizo and Positive Change for Marine Life (Positive Change). Both NGOs are collocated in Gizo Township, in a former fish processing factory.

Plastic Waste Gizo is focused on the collection and processing of PET bottles, and aluminium cans. It is understood that they pay casual collectors to go around Gizo and collect these two waste products. The intent is to process these materials for export from Noro Port, to receiving markets – such as China. Currently, they have approximately 10 t of aluminium cans ready for processing. Strongim Bisnis is currently exploring markets for export of these recyclable materials. Plastic Waste Gizo is funded until June 2023. It is unclear whether there will be an extension of funding. The goal is for the organisation to be self-sustaining through the sale of recyclable materials on the international market. One of the biggest operating costs is the building rental (shared with Positive Change for Marine Life). Processing equipment includes an aluminium can bailing machine, PET granulator, and a 41kv generator. Discussions with the operations manager revealed that if the sorting facility was located at the Gizo disposal site, there would be the opportunity for processing larger volumes as the waste could be sorted upon arrival at the site. This may improve long term sustainability of the operations.

The business model for Positive Change is slightly different, in that they have established household separation of waste (with mixed success). This includes PET bottles, soft plastics, glass, tins and aluminium cans. Again, these are currently being stored, and processing has not commenced as Strongim Bisnis is exploring export markets to sell these materials. Positive Change shares equipment with Plastic Waste Gizo, and have a soft plastic bailing machine that recently arrived in Honiara. They are also funded by Strongim Bisnis and have funding through to June 2027. Their largest operational cost is also rent, and they would also process significantly more volume if located on the waste disposal site.

PacWaste Plus are assisting the GTC with an initiative to compost organic waste from the market. The project includes design and implementation, focussing on requirements for segregation, collection, and processing. A company has been engaged to design the facility and determine optimum processing equipment., along with a market assessment for end products.

PacWaste Plus is also supporting the construction of a recycling centre for the packaging and storage of recyclable material. In addition, they are supporting the Government with implementing sustainable financing mechanisms, including a container deposit system but also covering other financing mechanisms to improve waste management.

7.5 Analysis of options for Gizo Site

7.5.1 Description of potential interventions

The three core focus areas examined for improving waste management in Gizo were:

1. Waste disposal site improvements

[6] DFAT funded community enterprise programme in the Solomon Islands

2. Improvements to resource recovery efforts
3. Improvements to medical waste treatment.

Waste disposal site improvements

For the Gizo waste disposal site, one of the core issues is the lack of equipment to undertake basic Waste disposal site operations. Without the ability to move and compact waste, the site becomes very difficult to manage, with waste disposed in an ad hoc manner, encroaching into drains and roads, and into the surrounding environment.

Looking at the range of machinery options, it was determined that the best fit would be a backhoe. This would provide staff with the means to move waste around, cover, compact (albeit to a lesser degree than heavier equipment), and to dig pits for disposal of special waste such as asbestos or medical waste.

Given that the backhoe would be used for waste management, preventing punctures is a worthwhile investment given the cost of repairs, and the time delays in sourcing replacement tyres. Arranging for solid fill of the tyres would address this issue and provide a more robust machine for the operating conditions.

Storing the equipment securely and out of the weather would require the construction of a storage shed.

A different option explored for the Gizo waste disposal site was categorised as improved house-keeping. This includes the provision of a basic office, ablution facilities, a concrete pad, septic tank and a simple PV/BESS for the supply of power to the site for staff amenities. The package could also include the development of a site operations manual, training, PPE, hand tools, and some funds to assist with the relocation of informal settlers. However, these facilities would have less impact on the site's environmental performance if there was still no means to move the waste.

Resource recovery improvements

Gizo is fortunate to have two operating NGOs addressing resource recovery. However, longer term sustainability is a challenge. One of the needs identified was to have a shed facility to house operations for both NGOs in order to strengthen their operations and reduce outgoings through rental payments.

Strengthening composting operations was also explored as an intervention, focussing on the purchase of a chipper (along with spare parts and service items), construction of a concrete pad for composting windrows, construction of a basic compost area cover, and development of a standard operating procedure for compost operations and quality controls.

Medical waste treatment

There is an existing medical waste incinerator that is unable to be operated due to its proximity to neighbouring residents. However, the current treatment and residual disposal practices are at a poor standard. Relocating the incinerator to the waste disposal site would provide an alternative. This intervention includes construction of a 100 m2 concrete pad and a chain link fence, installation of a roof, and power connection.

Table 6 Summary of intervention options for Gizo

Area	Key Issue	Potential Interventions
Waste disposal site	Environmental impact Health risk Resilience	Existing site operations extremely compromised by lack of equipment to move waste, dig pits for special waste, or maintain the site in a useable condition. Purchase of a suitable backhoe would make the most difference operationally.

Waste disposal site	Resilience	Building a simple storage shed for the backhoe will provide protection from weather and security.
Medical waste	Environmental impact Health risk Resilience	Relocation of the existing medical waste incinerator to Gizo waste disposal site.
Segregation	Environmental impact	Establish waste separation for organic waste and aluminum cans at waste collection hubs
Segregation	Environmental impact	Basic Composting facility

The rehabilitation climate resilient options for Gizo include:

- Do Nothing
- Purchase second-hand backhoe to utilise for site operations, including moving waste, clearing drainage trenches, and digging pits or trenches for special waste disposal
- Purpose build waste segregation facility to accommodate Plastic Waste Gizo and Positive Change
- Build compost facility
- Move existing waste incinerator from hospital to the Gizo waste disposal site

7.5.2 Basis for prioritisation

The process of analysis and criteria are described in further detail in section 2.3 of this report. The multi-criteria analysis prioritises the projects from most favourable, to least favourable as ranked against the performance criteria (Appendix A).

This shows that the highest-ranking options include:

- Purchase of a backhoe to provide on-site equipment for day-to-day waste operations, including movement of waste and provision of pits to dispose of special waste such as medical waste ash or asbestos.
- Construction of shed to securely house the backhoe at the waste disposal site
- Review of site management and provision of disposal site management plan
- Resource recovery sorting and processing facility
- Composting facility
- Construction of pits for disposal of medical waste
- Relocation of hospital waste incinerator to the waste disposal site

Following this narrowing of options, broad costings were explored to understand what was possible within the funding allocation for the works.

7.5.3 Stakeholder discussion workshop

Once the interventions were assessed, this information was provided to a stakeholder workshop for discussion. See Appendix B for a copy of the presentation.

A number of issues for Gizo were discussed at the forum, summarised below in Table 7.

Table 7 Intervention options workshop 15 February 2023 – discussion summary

Issue	Discussion points	Actions
Supply of suitable machinery for Gizo site	General agreement that having on-site equipment is fundamental to the ongoing operations and maintenance of the site. Also provides opportunity to undertake disposal of special wastes such as asbestos or medical waste. The Task Force that has been established to address the challenges at the Gizo site have stated that their priority is to clear the site. To that end they have published a tender notice to undertake this work. The machinery will need to come from elsewhere, which will be costly, and will not resolve issues over the longer term	GHD team to further investigate options. Concern noted from SWAP in regard to no warranty for second hand machinery on arrival – need to look at ways to de-risk this.
Site operations	Discussion that the site is in a poor situation, with garbage right up to the road, and poor containment. A Task Force has been created to address these issues. Agreement that relocation of squatters is a priority, and the Government is working on this aspect. With the site in a poor condition, this in turn impacts resilience, as there is limited area to place disaster waste, or to manage significant waste volumes that are produced through natural disasters. Task Force will also be working on regulatory front, drafting an ordinance to provide clarity on responsibilities.	GHD to understand works proposed by Task Force, and the priorities identified by the Task Force.
Donor and Government coordination	Discussion on the works being undertaken through PacWaste Plus, particularly on the assistance to GTC for market waste composting. There is investment funds allocated to this, including design and implementation. Tonkin and Taylor are currently undertaking this work, with segregation, collection, equipment, construction and market assessment aspects being considered. PacWaste Plus are also providing assistance to construct a recycling centre for Gizo to improve packaging and storage. The broader work includes looking at sustainable financing mechanisms to underpin the sustainability of resource recovery J-PRISM III – no funds allocated to physical investment, with focus on capacity building and training. National projects to be finalised in September 2023.	Improvements to composting facilities will not be considered further due to cross-over with PacWaste Plus work. Improvements to recycling facilities will not be considered further due to cross-over with PacWaste Plus work.

At the conclusion of the workshop, it was agreed that the presentation would be shared, and stakeholders were to provide feedback on recommended interventions. It was on the basis of the feedback provided via email that the recommendations were finalised. Feedback was received from the Government participants, and from SWAP in Samoa.

7.5.4 Selected interventions for SWAP investment

Following the workshop, it was clear that investment priorities do not lie with the composting and resource recovery interventions, given the work being completed with the support of PacWaste Plus in Gizo.

A clear priority for improvement in waste disposal operations is having on-site machinery for day to day operations, and to assist with managing waste flows in the event of natural disasters, or for special waste requirements such as asbestos or medical waste disposal. With such limited availability for machinery hire on Gizo itself, this has led to the current situation with waste flows uncontrolled and creating impacts from the site.

The shed for the backhoe was considered, but this is viewed as less of a priority than the machine itself. Further site improvements such as installation of an office and toilet facilities were viewed as a lower priority. Although these aspects are important, the ability to manage the waste on an ongoing basis is viewed as critical. After considering a number of options, a backhoe was viewed as the most suitable due to its multi-purpose nature. With a backhoe, the Council will have the ability to clean out drains, dig pits, move waste, build bund walls to contain waste, and generally adhere to a waste disposal site plan.

One of the risks in purchasing second-hand equipment is that it will not have a warranty in place. To de-risk this, purchasing needs to be undertaken with the following safeguards:

- Use of a reputable machinery agent, who already supplies equipment into the Pacific Region (e.g. Intracor from New Zealand)
- As a part of machinery selection, the agent must understand the machinery use hours, and its maintenance history. Records must demonstrate that the appropriate level of maintenance / refurbishment have been undertaken.
- Pre-departure inspection

7.5.5 Works suitable for additional funding or other donor projects

It is recommended that a waste disposal site management plan be developed with the assistance of the JPRISM III project. This is viewed as a good fit, as J-PRISM to date have provided this type of technical support in other PICs (and in Honiara). J-PRISM have significant experience in developing locally appropriate landfill plans, which are an important means to implement improvements and provide site based training resources.

As discussed earlier, Pac-Waste Plus are already working in Gizo to improve resource recovery.

It is recommended that a shed be built at the Gizo site to securely house the backhoe, and to provide an area to undertake regular servicing and maintenance. There is inadequate budget under this Project to undertake this component, with a preliminary budget estimate of USD 50,000.

The relocation of the existing medical waste incinerator to the landfill site is estimated to cost approximately USD 50,000 to construct the housing and fund the installation process.

The funding of improved house-keeping and site facilities (basic office, ablution facilities, a concrete pad, septic tank and a simple PV/BESS for the supply of power to the site for staff amenities) along with the development of a site operations manual, training, PPE, hand tools, and some funds to assist with the relocation of informal settlers is a further opportunity for a funded package of works. It is estimated that this would cost in the vicinity of USD 58,000.

7.6 Proposed Site Works at Gizo

7.6.1 Description of Works

Procurement of second-hand backhoe loader to be imported into Gizo. Package to include pre-purchase inspection, spare parts and shipping. Any import duties or taxes would be the responsibility of the Government.

The options investigation included the pricing of new equipment, but this was well beyond the budget ceiling for the intervention. In discussion with the team, it was agreed that if proper due diligence was undertaken prior to the selection of the machine, it was possible to procure one in sound operating condition with a projected life expectancy appropriate for its use.

7.6.2 Technical specifications

Supply of a second-hand 4WD Backhoe loader, CIF to Gizo.

Preferably the hours of use would be below 7,000 hours, but additional hours may be considered if the machine has documented evidence of a high standard of service and repairs. This history must be documented.

The backhoe will be used at a small regional waste disposal site at Gizo in the Solomon Islands. It must be capable of moving waste, digging trenches, cleaning out trench drains, and keeping the site in order.

The backhoe must be of a make and model where parts are readily available in the region (e.g., Fiji, New Zealand and Australia). Access to spare parts and advice is critical for sustainability, and therefore well known makes with strong service back-up in the region, such as Case, Cat, John Deere, Komatsu and JCB.

General Scope

The package components consists of but is not limited to the following:

- Supply one (1) 4x2 Wheeled Backhoe Loader
- Loader to be fitted with quick hitch for loader front bucket and with quick coupler for backhoe digging bucket.
- Supply loader with a general purpose 4 in 1, front bucket shovel configuration with fitted steel cutting edge.
- Supply loader with a retractable/extendable reach backhoe boom allowing minimum to maximum dimensions at ground level to slew centre of approximately – minimum 5.3 metres and maximum 6.5 metres.
- Supply two backhoe buckets – one (1) x 600mm nominal width, 4 tooth, standard profile trenching bucket with side cutters, and one (1) x 800mm nominal width, standard profile bucket (mud bucket) steel cutting edge attached.
- Supply Parts and Accessories as detailed by Purchaser and recommended by Bidder
- Workshop and Service/Operation Manuals

The Supplier shall provide all plant, equipment, labour, materials, and related training services necessary to supply one (1) Wheeled Backhoe Loader, in good second-hand condition, of high quality and fully operational for the following tasks;

- Safe and efficient handling of domestic refuse on a developed landfill waste mass with overall operating weight of at least 7.5 tonnes.
- Fitted with front loader bucket, general purpose, of nominal 1.0 m3 capacity and backhoe standard bucket nominal 610mm width. Backhoe digging depth capacity of at least 4.2 metres.
- Fitted with stabilisers and powered side shift for backhoe boom operation.

Spare Parts Package

The supplier shall provide the following spare parts items for the backhoe loader (noting that modifications may be recommended by the supplier, with justification):

- Three (3) full sets of primary and secondary filter elements (air and hydraulic oil) for hydraulic system
- Two (2) full sets of replacement drive belts, including but not limited to cooling fan, air conditioner, power steering and alternator. All belts to be marketed and numbered.
- One (1) full set of hydraulic hoses including fittings, marked and numbered.

- Three (3) full engine service kits to supply all service parts for the first three (3) scheduled services, including all filters (fuel and oil), sump plugs and seals.
- One (1) set of all brake and clutch wear items, e.g. brake shoes / discs wear pads and seals
- One (1) full set of piston seals for all hydraulic cylinders including fittings, marked and numbered.

The total supply package has a budget ceiling of $74,000 USD. The supplier must be satisfied that all reasonable steps have been taken to ascertain that the machine is in sound working condition. Inspection of the machine will include service and repairs history, hours, condition report for engine, tyres, hydraulic hoses and components, attachments, and any other relevant factors.

7.6.3 Personnel and equipment requirements

This procurement package is for the supply of goods and as such does not require personnel.

It is recommended that the tender be undertaken on a Request for Quotation basis. The following are a short list of three companies that can provide this service within the region, who have strong capacity in reputable second hand machinery supply and import/export, dealing in both new and second hand equipment.

Intracor Commodity Exports Ltd
Grant Sorenson
Marketing Manager
grant@intracor.co.nz
11A Piermak Drive
Rosedale
Albany
Auckland
NEW ZEALAND
649 3580428
6421 875969

RDW Machinery
Grant Rennick
guyr@rdw.com.au
1917 Ipswich Road
Rocklea. QLD.
AUSTRALIA
+61 7 38751358

Smith Equipment
sales@smithequipment.com.au
405 Hammond Road,
Dandenong, Victoria.
AUSTRALIA
+61 3 9793 1588

8. Solomon Islands SWAP Interventions

8.1 Projected costs

The costs provided in this section are high level costings based on discussions with suppliers, contractors, and estimates of components such as shipping. Whilst conservative costs have been used, it remains a possibility that quotation outcomes may differ to these projected costs given the high level of uncertainty in procurement outcomes to remote areas.

The costs to implement projects in the Solomon Islands, due to remoteness, shipping, and skilled labour shortages must be considered. Typically, costs are expected to be 40-150% more than executing a comparable project in an adjacent developed market such as Australia.

The costs presented herein represent rough order costs, and likely to vary from actual spend. In order to price more accurately, detailed designs, volume estimates and the services of a qualified quantity surveyor should be engaged to provide oversight.

The following cost projections presented in Table 8 provide guidance for the implementation phase.

Table 8 Cost Estimates

Item for Procurement	NZD	USD
	0.6323 NZD:USD	
Tulagi		
EIA Consultancy for Incinerator		
Initial Application		800
PER or EIS – Draft		2400
PER or EIS – Final		800
TOTAL ESTIMATE		**$ 4,000**
Brick incinerator (De Montfort Mark 9 style) and associated works		
Supply and installation of kit shed (5mx4mx3.6m) (NZD $600m2) 20m2 with CIF Note that the option to import a kit shed from supplier such as Bunnings may provide better pricing.	$ 18,000	$ 11,381
Firebricks and mortar	$ 8,000	$ 5,058
PPE for incinerator Operators	$ 500	$ 316
Hand tools and weighing scales	$ 500	$ 316
Labour to construct	$ 10,000	$ 6,323
Contingency (20%)	$ 7,400	$ 4,679
TOTAL ESTIMATE	$ 44,400.00	**$ 28,074**
Gizo		
Second-hand backhoe wheeled loader	$ 77,000	$ 48,700

Item for Procurement	NZD	USD
Freight to Gizo	$ 25,000	$ 15,808
Spare parts package	$ 6,000	$ 3,794
TOTAL ESTIMATE	**$ 108,000**	**$ 68,200**
TOTAL INTERVENTION ESTIMATE		**$100,274**

8.2 Implementation mode

The total funding package for the Solomon Islands is 110,000 USD. Of this budget, 10,000 USD has been allocated to implementation and oversight. The additional budget estimate of $10,000 is allocated to hire an independent consultant to supervise the works in Tulagi and the procurement process for the machinery for Gizo. The consultant will be responsible for the activities stated in this report. Using an independent consultant will reduce the impact on MECDM's limited human resources.

The interventions would include the procurement of three packages:

- EIA / approvals consultancy for the incinerator
- Supply of materials and construction of De Montfort Mark 9 incinerator, with shed housing and supply of PPE and tools
- Supply of second-hand backhoe loader CIF to Gizo, including full service, pre-departure inspection and spare parts package.

The independent consultant will finalise the RFQ documents, conduct the bid evaluation process, manage the budget, and provide quality oversight. This person will also supply SWAP in Samoa with a report detailing all expenditure, and documenting the arrival and acceptance of equipment, and the completed works packages.

It is advised that the RFQ documents contain separate line item costs to improve flexibility. For example, the supply of the shed housing for the proposed incinerator at Tulagi could be removed from the package in order to meet budget constraints. Similarly, if there is additional budget surplus, the supplier of the backhoe could be asked to include additional budget for a staff training budget. Providing flexibility during the procurement process is an important means to gain full utilisation of the funding.

8.3 Workplan and timeline

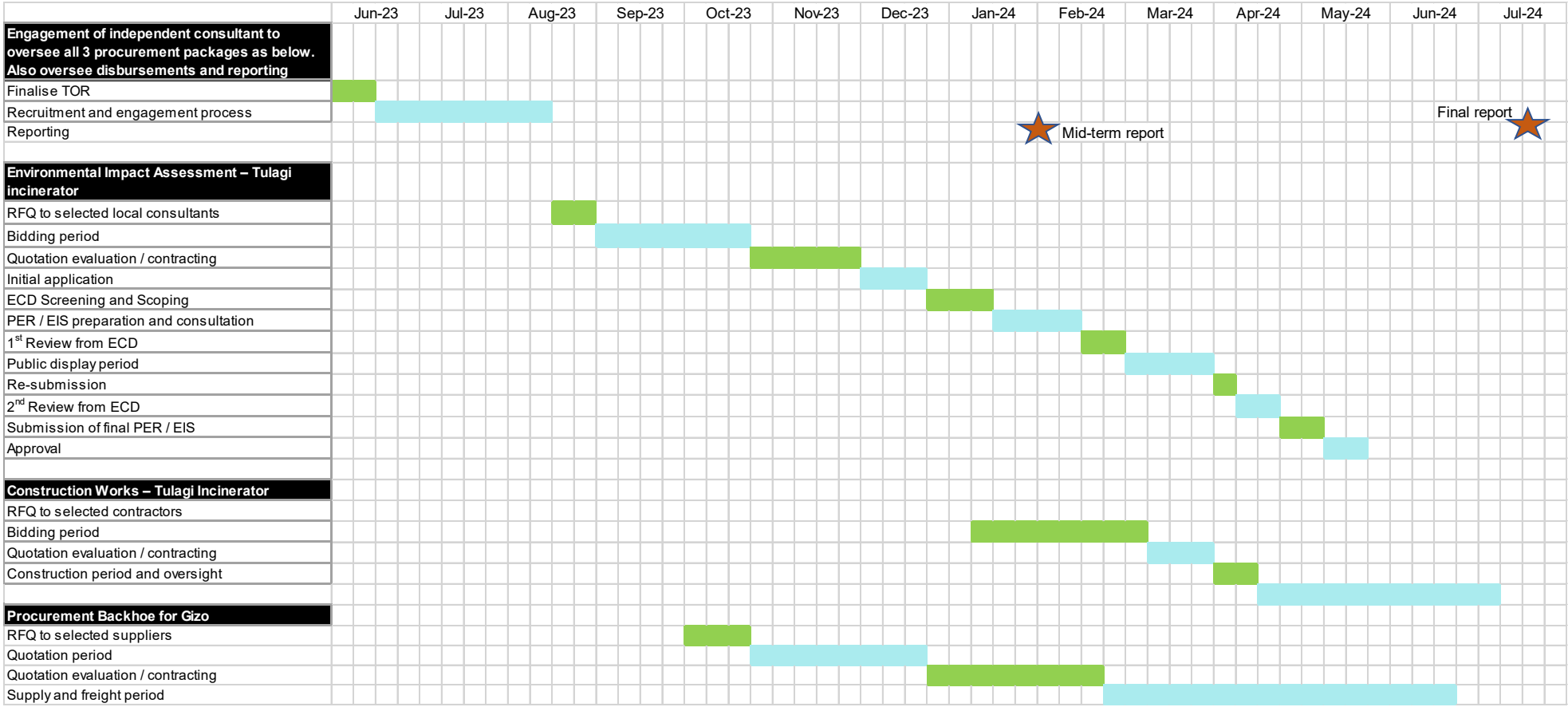


Figure 22 Proposed work steps and timeline for implementation

8.4 Risks and mitigation measures

There are a number of risks and associated mitigation measures outlined below in Table 9, covering both the implementation of the proposed packages, and the longer-term risks in terms of sustainability of the interventions. This provides an indicative analysis of risks, with unforeseen events possible.

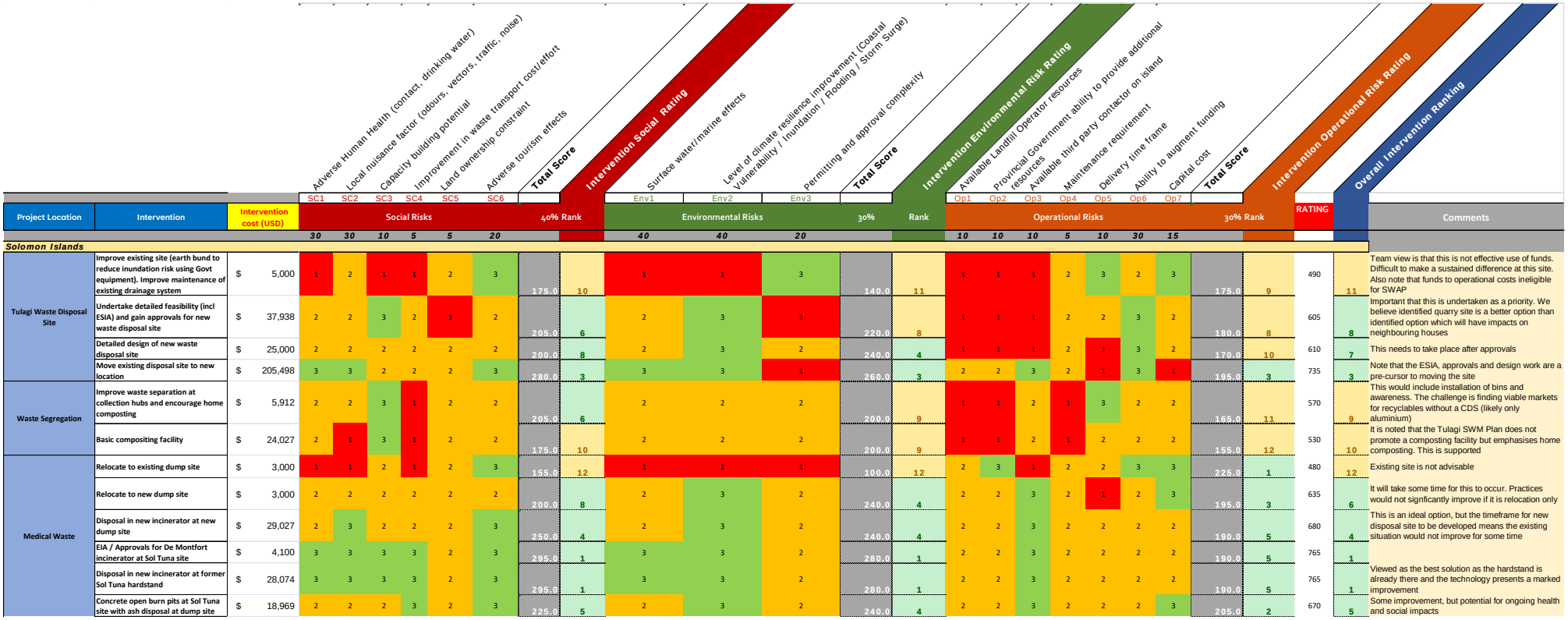
Table 9 Risk matrix for implementation and sustainability

Risk Description	Potential Impact	Likelihood	Consequence	Risk Profile	Proposed Mitigation
Sourcing person to provide oversight / management of project	Project delays. Poor oversight compromising outcomes	Possible	Significant	High	SWAP focal point to seek candidates early and discuss with SWAP in Samoa who will provide support for selection process. Mid term report to provide SWAP with update, but regular informal communication prior to this to identify and resolve issues.
Delays in EIA approval process	Delays in approval leading to construction not able to complete in time	Possible	Significant	High	Early meeting with EIA team in MECDM to describe objectives and timeframes, and seek support. Project manager to work with EIA consultant to ensure timelines are achieved.
Unforeseen issues leading to Sol Tuna site not being possible option for incinerator	Inability to complete this package	Unlikely	Moderate	Low	If this becomes apparent, the fund allocation for this activity will need to be reallocated. Therefore this needs to be determined early in the process. If funds require reallocation, SWAP focal points to immediately inform SWAP in Samoa, and commence dialogue to select an alternative site or to reallocate the funds
Pollution emissions from incinerator due to poor operating procedures and oversight	Impacts to workers health, and air pollution impacting neighbours	Unlikely	Significant	Medium	Project Manager to provide training to operators, and copies of operations manual (available at Welcome to the new de Montfort Medical Waste Incinerator website (mw-incinerator.info)

Lack of suitable backhoe equipment on the market within the budget allocation	Cost overruns, or significant delays	Possible	Moderate	Medium	It will be important to start the quotation process early and provide adequate time for the suppliers to locate suitable options. In the event that no suitable bids are received, speak to the suppliers about ways to resolve through measures such as extending the bid period.
Backhoe has shortened lifespan as it is stored in the open. Also risk of damage / theft of parts.	Less project impact, as machine does not last	Possible	Moderate	Medium	Discuss with Provincial Government and Council about short term storage options. Discuss options for Provincial Government or Council to construct storage shed, either with internal budget resources or through donor assistance.
Backhoe has shortened lifespan due to lack of servicing and maintenance capacity and/or funds	Less project impact, as machine does not last	Possible	Moderate	Medium	Project Manager to identify options in Gizo for service and repairs. If there are unspent funds, it is recommended that initial repairs and maintenance are scheduled and pre-paid, with the expectation that the Town Council would allocate adequate resources on an ongoing basis.

Appendix A

Multi-criteria assessment for investment options



Project Location	Intervention	Intervention cost (USD)	SC1 Adverse Human Health (contact, drinking water)	SC2 Local nuisance factor (odours, vectors, traffic, noise)	SC3 Capacity building potential	SC4 Improvement in waste transport cost/effort	SC5 Land ownership constraint	SC6 Adverse tourism effects	Social Risks 40% Rank	Intervention Social Rating	Env1 Surface water/marine effects	Env2 Level of climate resilience improvement (Coastal Vulnerability / Inundation / Flooding / Storm Surge)	Env3 Permitting and approval complexity	Environmental Risks 30%	Rank	Intervention Environmental Risk Rating	Op1 Available Landfill Operator resources	Op2 Provincial Government ability to provide additional resources	Op3 Available third party contactor on island	Op4 Maintenance requirement	Op5 Delivery time frame	Op6 Ability to augment funding	Op7 Capital cost	Operational Risks 30% Rank	Intervention Operational Risk Rating	RATING	Overall Intervention Ranking	Comments
			30	30	10	5	5	20			40	40	20				10	10	10	5	10	30	15					
Solomon Islands																												
Tulagi Waste Disposal Site	Improve existing site (earth bund to reduce inundation risk using Govt equipment). Improve maintenance of existing drainage system	$ 5,000	1	2	1	1	2	3	175.0	10	1	1	3	140.0	11		1	1	1	2	3	2	3	175.0	9	490	11	Team view is that this is not effective use of funds. Difficult to make a sustained difference at this site. Also note that funds to operational costs ineligible for SWAP
	Undertake detailed feasibility (incl ESIA) and gain approvals for new waste disposal site	$ 37,938	2	2	3	2	1	2	205.0	6	2	3	1	220.0	8		1	1	1	2	2	3	2	180.0	8	605	8	Important that this is undertaken as a priority. We believe identified quarry site is a better option than identified option which will have impacts on neighbouring houses
	Detailed design of new waste disposal site	$ 25,000	2	2	2	2	2	2	200.0	8	2	3	2	240.0	4		1	1	1	2	1	3	2	170.0	10	610	7	This needs to take place after approvals
	Move existing disposal site to new location	$ 205,498	3	3	2	2	2	3	280.0	3	3	3	1	260.0	3		2	2	3	2	1	3	1	195.0	3	735	3	Note that the ESIA, approvals and design work are a pre-cursor to moving the site
Waste Segregation	Improve waste separation at collection hubs and encourage home composting	$ 5,912	2	2	3	1	2	2	205.0	6	2	2	2	200.0	9		1	1	2	1	3	2	2	165.0	11	570	9	This would include installation of bins and awareness. The challenge is finding viable markets for recyclables without a CDS (likely only aluminium)
	Basic compositing facility	$ 24,027	2	1	3	1	2	2	175.0	10	2	2	2	200.0	9		1	1	2	1	2	2	2	155.0	12	530	10	It is noted that the Tulagi SWM Plan does not promote a composting facility but emphasises home composting. This is supported
Medical Waste	Relocate to existing dump site	$ 3,000	1	1	2	1	2	3	155.0	12	1	1	1	100.0	12		2	3	1	2	2	3	3	225.0	1	480	12	Existing site is not advisable
	Relocate to new dump site	$ 3,000	2	2	2	2	2	2	200.0	8	2	3	2	240.0	4		2	2	3	2	1	2	3	195.0	3	635	6	It will take some time for this to occur. Practices would not signficantly improve if it is relocation only
	Disposal in new incinerator at new dump site	$ 29,027	2	3	2	2	2	3	250.0	4	2	3	2	240.0	4		2	2	3	2	2	2	2	190.0	5	680	4	This is an ideal option, but the timeframe for new disposal site to be developed means the existing situation would not improve for some time
	EIA / Approvals for De Montfort incinerator at Sol Tuna site	$ 4,100	3	3	3	3	2	3	295.0	1	3	3	2	280.0	1		2	2	3	2	2	2	2	190.0	5	765	1	
	Disposal in new incinerator at former Sol Tuna hardstand	$ 28,074	3	3	3	3	2	3	295.0	1	3	3	2	280.0	1		2	2	3	2	2	2	2	190.0	5	765	1	Viewed as the best solution as the hardstand is already there and the technology presents a marked improvement
	Concrete open burn pits at Sol Tuna site with ash disposal at dump site	$ 18,969	2	2	2	3	2	3	225.0	5	2	3	2	240.0	4		2	2	3	2	2	2	3	205.0	2	670	5	Some improvement, but potential for ongoing health and social impacts

Figure 23 Outcome of MCA for Tulagi intervention option

Project location	Intervention	Intervention cost (USD)		Adverse Human Health (contact, drinking water) SC1	Local nuisance factor (odours, vectors, traffic, noise) SC2	Capacity building potential SC3	Improvement in waste transport cost/effort SC4	Land ownership constraint SC5	Adverse tourism effects SC6	Social Risks	40% Rank	Intervention Social Rating	Surface water/marine effects Env1	Level of climate resilience improvement (Coastal Vulnerability / Inundation / Flooding / Storm Surge) Env2	Permitting and approval complexity Env3	Environmental Risks	30%	Rank	Intervention Environmental Risk Rating	Available Landfill Operator resources Op1	Provincial Government ability to provide additional resources Op2	Available third party contactor on island Op3	Maintenance requirement Op4	Delivery time frame Op5	Ability to augment funding Op6	Capital cost Op7	Operational Risks	30% Rank	RATING	Overall Intervention Ranking	Comments
				30	30	10	5	5	20				40	40	20				10	10	10	5	10	30	15					
Gizo Waste Disposal Site	Secondhand Backhoe CIF to Gizo (Case, Deere, or TerreCat) - (1000-7000hrs), Full service, shipped. No warrantie or customs clearance	$	68,288	3	3	3	2	3	3	295.0	1		3	2	3	260.0	1		2	1	2	1	2	2	2	165.0	4	720	1	Team agrees that having a machine on site would make a material difference for day-to-day operations. Would improve disaster waste management, and management of special waste
	Solid cushion tyres CIF, supply and install at Gizo	$	10,000	3	3	3	2	3	3	295.0	1		3	2	3	260.0	1		2	1	2	1	2	2	1	150.0	8	705	2	Solid fill tryes would decrease repair costs, but they are very expensive, and the budget is inadequate to cover additional cost
	Shed for storage of back hoe (6mx10mx3.6m) Totalspan Kitset CIF with 100m2 concrete pad, power connection	$	50,078	3	3	2	2	3	3	285.0	3		3	2	2	240.0	3		2	2	2	2	2	2	1	165.0	4	690	3	This is a priority to protect the machine from the elements and provide secure storage. However, the funds are not adequate. It is hoped that this is a measure that can be funded by Solomon Islands Government
	Improved house keeping and facilities	$	58,077	2	3	2	2	2	2	230.0	5		2	2	3	220.0	5		1	2	2	1	2	2	2	165.0	4	615	7	This includes a site office, bathroom facilities, tools, PPE, and some funds to assist with resettlement of squatters.
	Review landfill management plan and provide design for special waste (Dependant on backhoe)	-		3	2	3	2	2	2	240.0	4		2	2	3	220.0	5		2	2	2	1	2	3	3	220.0	1	680	4	This is viewed as important technical support, and it is hoped that this could be available through the J-PRISM III program
Resource Recovery	Waste sorting facility simple Totalspan shed (accommodate Plastic Wise Gizo & Positive Change for Marine Life) (160m2), concrete pad 200m2, and power connection	$	177,550	2	2	2	2	2	2	200.0	7		2	3	2	240.0	3		2	1	3	2	2	3	1	195.0	3	635	5	Noted that whilst this was identified as a need in the field and stakeholder engagemement, PacWaste Plus are funding improvements for these facilities
	Basic Composting facility (dependant on back hoe)	$	68,288	2	2	3	2	2	2	210.0	6		2	2	2	200.0	8		2	2	3	1	2	3	2	215.0	2	625	6	Noted that whilst this was identified as a need in the field and stakeholder engagemement, PacWaste Plus are funding organic waste segregation, composting facilities and market development
Medical Waste	Install special waste pits for medical waste / ash	-		2	2	2	2	2	2	200.0	7		2	2	3	220.0	5		1	2	2	2	2	1	2	140.0	9	560	8	If the backhoe was purchased, this type of work could be undertaken as part of operations
	Relocation of Medical Waste Incinerator to Gizo dumpsite	$	50,078	2	2	2	2	2	2	200.0	7		2	2	1	180.0	9		1	2	2	1	2	2	2	165.0	4	545	9	Current incinerator not operating due to neighbour complaints about emissions. However, moving would be expensive due to need for housing and power.

Figure 24 Outcome of MCA for Gizo options

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Appendix B

Presentation to stakeholder workshop on intervention options

Landfill Rehabilitation / Climate Proofing Scoping Study

Feasibility Workshop

Welcome

Purpose

- Observations
- Priorities
- Options for investments and high level pricing
- → Spending prioritisation between sites
- Recommendations for current funds
- Recommendations for future funds

Tulagi Disposal Site Overview

- Main dumping area about 200m2 (approximately 100m3)
- Approx 600m2 historic dumping area

Tulagi Disposal Site Overview

Site observations

- Open dumping, with no pit or liner present

- No waste separation.

- Waste present in the coastal margin

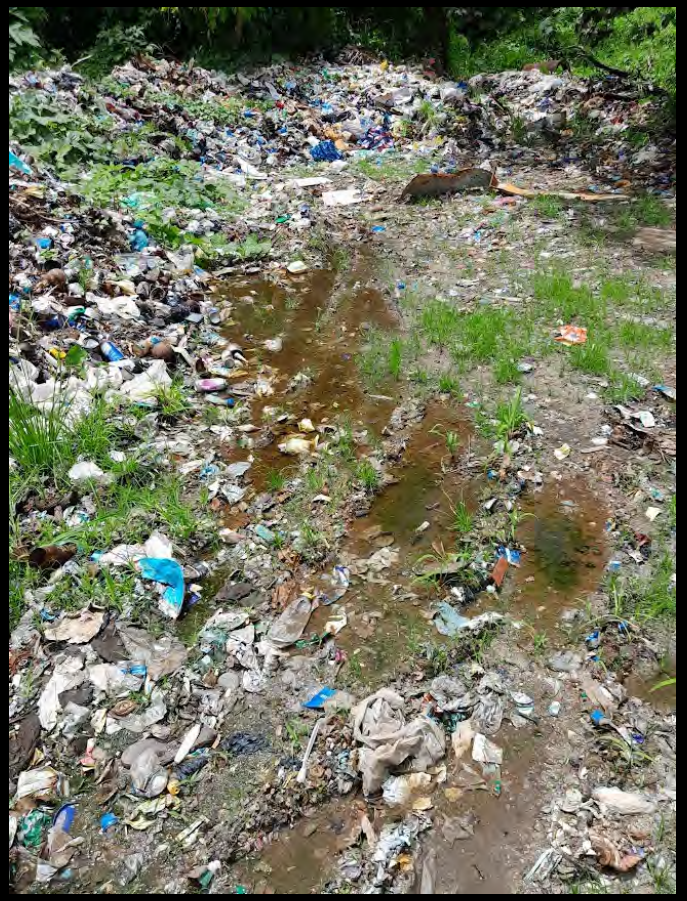
- Site located in low lying swampy area, approximately 0.5 m above sea level.

- Secondary waste disposal site used for burning / discarding medical waste from Tulagi hospital

Tulagi Disposal Site Impacts / Risks

Impacts / Risks

- Potential climate change risks
  - Flooding from valley
  - Inundation risk from sea level rise / storm surge
- Environmental risks
  - Uncontrolled disposal
  - Waste in the sea
  - Leachate observed with staining in the marine environment
- Health and safety risk to staff and public



Tulagi Medical Waste Disposal Site

Tulagi Medical Waste Disposal Site

Observations

- Open burning
- Sharps / vials present
- Some waste residuals moved to dump site
- Waste present in the sea / mangroves / reef

Key Priorities at Tulagi

Key priorities

- Improvements on the existing site is not recommended – poorly located
- Need to identify new site that will provide improved resilience

Key Priorities at Tulagi

Key priorities

- Move medical burning site to former Sol Tuna concrete wharf hard stand (image).
- De Monfort Mark 9 style incinerator

Preparing the concrete base

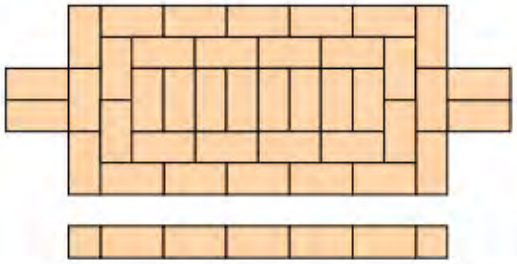
A concrete platform of at least 3 m x 2 m x 150 mm thick should be prepared on the chosen site, preferably with a roof about 3 m high to protect the incinerator and the operator from the effects of weather.

Once ready, the building of the brick body can start.

Building the brick body

The base layer of bricks should be laid on a bed of refractory mortar on the foundation. The bricks should be laid in the pattern shown below, with a minimum thickness (about 6mm) of refractory mortar between them.

When this is completed, the overall dimensions of the incinerator can be measured so that the steelwork can be started.



plan view of base layer

side view of base layer

Subsequent layers of bricks are then laid on top of the base layer as shown in the following diagrams. Care should be taken to keep all walls vertical and straight.

Build up the refractory brick body in layers as shown below, taking care to keep all walls vertical. Insert the two mild steel tunnels (3 bricks high x 2 bricks wide) and the air ducts (2 on the primary side, 1 on the secondary side) and fill the gaps with refractory cement and firebrick chips.

Photo 1: building the brick body

Diagram 2: layers 1&3

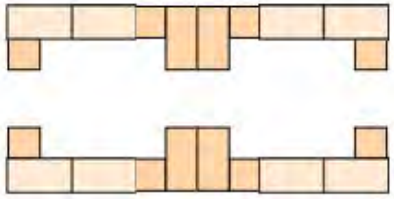
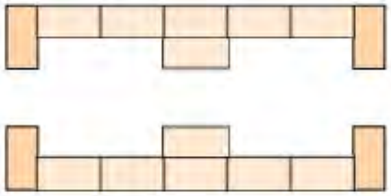


Diagram 3: layers 2&4



Tulagi Site - list of potential interventions

Key Issue	Potential Interventions
Environmental impact Health risk Resilience	Relocate dump site to alternative location (e.g. quarry site)
Environmental impact Health risk Resilience	Move medical burning site to former Sol. Tuna wharf hard stand. Develop De Monfort Mark 9 style incinerator
Environmental impact	Establish waste separation for organic waste and aluminum cans at waste collection hubs
Environmental impact	Basic Composting facility
Resilience	Earth bund to reduce inundation risk (use govt excavator, compactor, tractor and MOH 5t truck). Maintain existing drainage system.

Recommendations to discuss

Recommended interventions for Tulagi site (list in order of priority and budget estimates)

Priorities	Budget Estimate (USD)
Waste disposal site relocation (not engineered landfill) to quarry site	$245,000
Rudimentary brick incinerator (De Montfort Mark 9 style) – wood fired	$48,000
Waste separation (organics and aluminium) at collection hubs	$6,000
Basic composting facility	$26,000
Waste disposal site. Earth bund to reduce inundation risk (use govt excavator, compactor, tractor and MOH 5t truck). Maintain existing drainage system.	$0

Gizo Disposal Site Overview

Gizo Disposal Site Overview

Site observations

- Open dump, with no pit or liner present, occasional burning of waste
- Good access with concrete driveway
- No waste separation
- Medical waste pits
- Informal settlers growing crops within the site boundary
- Number of informal
- Waste collection service is completed by the Gizo town council with no community charge.

Gizo Medical Waste Challenge

Site observations

- Incinerator shut down upon commissioning due to community petition
- Open burning on foreshore in Gizo
- Residuals disposed of at waste disposal site
- Poses environmental and human health risks

Key Priorities at Gizo

Challenges

- All waste types accepted
- Open access all hours
- Unsanitary disposal – no cover
- No plant available to move or compact waste
- No separation
- Waste in drainage channel

Key Priorities at Gizo Waste Disposal

Impacts

- Down stream environmental impacts
- Climate change risks
  - Adjacent to inlet / sea level rise
- Environmental risks
  - Leaching to marine environment
- Health and safety risk to staff and public
- Medical waste treatment and disposal

Key Priorities at Gizo

Key priorities

- Waste segregation
  - Separation of hazardous and non-hazardous – controlled burial
  - Consider accommodating Plastic Waste Gizo and Positive Change for Marine life
  - Basic composting facility
- Backhoe with solid tyres

Recommendations to discuss

Priorities (in order)	Budget Estimate (USD)
Second-hand Backhoe CIF to Gizo (Case, Deere, or TerreCat) - (1000-7000hrs), Full service, spare parts, shipped. No warrantee or customs clearance.	$100,000
Solid Tyres	$6000-10,000
Shed to store backhoe (60m2 with 100m2 concrete pad)	$50,000
Relocation of Medical Waste Incinerator to Gizo dumpsite	$50,000
Site office, utilities, tools, PPE, strengthening operations	$38,000
Basic composting facility and plant (dependant on back hoe)	$58,000
Purpose build waste segregation facility to accommodate Plastic Waste Gizo and Positive Change	$180,000
Review landfill management plan and provide design for special waste (dependant on backhoe)	$5,000
Install special waste pits for medical waste / ash / hazardous waste (dependant on backhoe)	$6,000

Discussion

Split of expenditure between the 2 sites.

Pros and Cons of interventions at Gizo vs Tulagi

Recommended interventions to make a difference now

Priority interventions needing additional funds

* Thank You

ghd.com

Appendix C

Technical specifications – De Montfort Mark 9 incinerator

De Montfort Mark 9 Incinerator

Introduction

This incinerator is the recommended model for larger hospitals (generally more than 300 beds). It is a development of the Mark 3 and is to be built where high rates of combustion are required. It simplifies the construction, particularly of the steelwork, and thereby reduces the likelihood of failure due to distortion of the steel top plate.

It should be built on a concrete platform of at least two metres square, and should preferably have a roof to protect it from rain. The roof may also incorporate the support for the chimney stack.

The instructions which follow are meant to be used in all countries. The building instructions give the number and position of the bricks, but not the overall dimensions of the incinerator. This is because bricks differ slightly in size between one country and another, and it is simpler to adjust the overall size of the incinerator to the available bricks than to have to cut bricks to an exact dimension.

Similarly, only approximate dimensions of the steelwork are given. The correct procedure is to lay out the first two layers of bricks, and then measure the length and breadth of the steel which fits on top. The steel top can then be made to fit the finished brickwork.

The steel tunnel and ash door can also be dimensioned to fit the brickwork by taking measurements from the brickwork once the tunnel is formed in the first five layers of bricks.

Summary of characteristics

Use: designed especially for larger hospitals. (generally more than 300 beds)

Capacity: 50 kg/h

Lifespan (average): 3-5 years

Approximate unit cost in USD (materials only): 500 - 1'500 depending on the availability of refractory bricks

Time necessary to build: 5 – 6 days

Remarks: Only approximate dimensions of the steelwork are given. The correct procedure is to lay out the first two layers of bricks, and then measure the length and breadth of the steel which fits on top. The steel top can then be made to fit the finished brickwork.

The steel tunnel and ash door can also be dimensioned to fit the brickwork by taking measurements from the brickwork once the tunnel is formed in the first five layers of bricks.

List of materials

item	dimensions	quantity
Fire bricks	230x116x76mm	300
Cement (Portland)		250 kg
Ballast (for concrete base)		500 kg
Sand		1000 kg
Fire cement (high alumina)		100 kg
Rolled steel angle (mild steel)	40x40x3mm thick	42 metres
Rectangular section mild steel	75x75x3mm wall thickness	2 metres
Flat sheet (mild steel)	2400 x 1200 x 3mm	1 sheets
Mild steel pipe	150mm diameter x 3mm thick (approx)	3 metres
Welding rods (mild steel)		60
Steel cable	5 mm 7 strand	40 metres
Turnbuckles	M8 x 150 mm long	4 (not essential)
Rolled steel angle (mild steel)	50 x 50 x 3 mm thick	6 metres
Fuel tank with tap.	2 litres capacity approx	1
Fuel pipe, steel	350 mm long x 6mm diam.	1
Fuel pipe flexible	2 metres x 6 mm ID	
Bolts with nuts and washers	10 mm x 75 mm long	24
Wire Mesh	Any fine gauge	loose fill

Please note that the materials should be obtained before starting the construction !

Complete layout

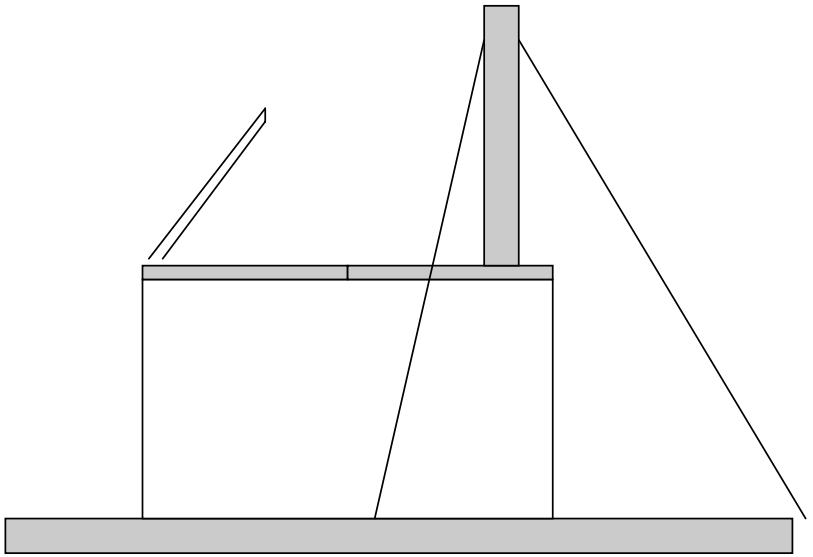


Figure 1: De Montfort incinerator Mark 9

Preparing the concrete base

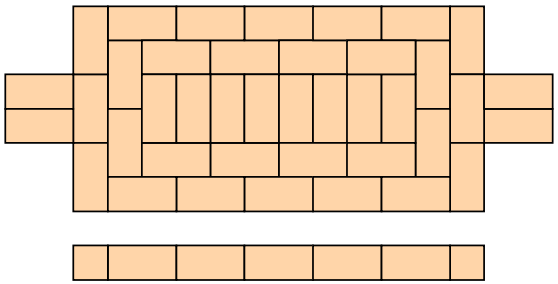
A concrete platform of at least 3 m x 2 m x 150 mm thick should be prepared on the chosen site, preferably with a roof about 3 m high to protect the incinerator and the operator from the effects of weather.

Once ready, the building of the brick body can start.

Building the brick body

The base layer of bricks should be laid on a bed of refractory mortar on the foundation. The bricks should be laid in the pattern shown below, with a minimum thickness (about 6mm) of refractory mortar between them.

When this is completed, the overall dimensions of the incinerator can be measured so that the steelwork can be started.



plan view of base layer

side view of base layer

Subsequent layers of bricks are then laid on top of the base layer as shown in the following diagrams. Care should be taken to keep all walls vertical and straight.

Build up the refractory brick body in layers as shown below, taking care to keep all walls vertical. Insert the two mild steel tunnels (3 bricks high x 2 bricks wide) and the air ducts (2 on the primary side, 1 on the secondary side) and fill the gaps with refractory cement and firebrick chips.

Photo 1: building the brick body

Diagram 2: layers 1&3

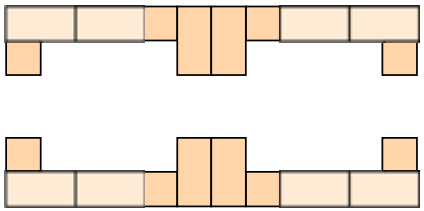


Diagram 3: layers 2&4

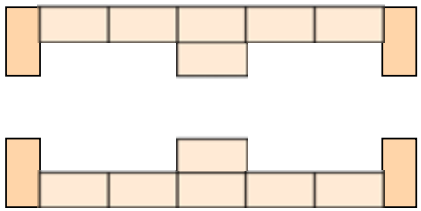


Diagram 4: layers 5, 7, 9, 11, 13

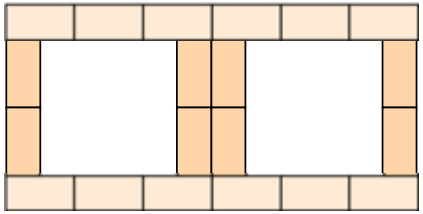


Diagram 5: layers 6, 8, 10, 12,14

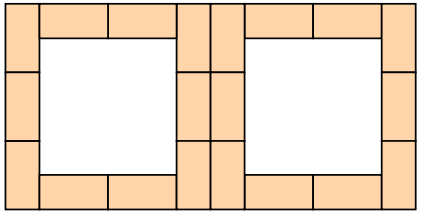
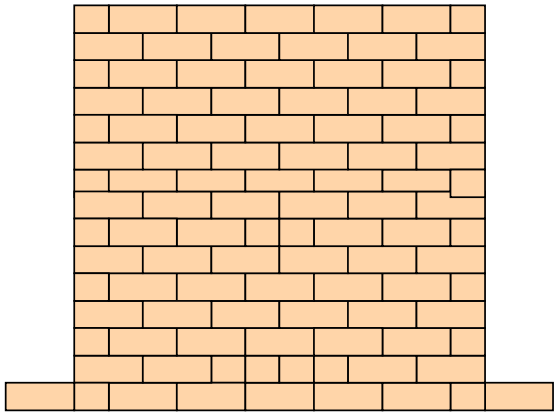


Diagram 6: Side elevation of completed brickwork



Preparing the steel top-frame

Once the base layer has been laid, the overall length and breadth of the incinerator can be measured. This gives the overall dimensions of the steel top frame. More importantly, after layer 5 has been completed, the dimensions of the two rectangular sand traps that make up the top frame can be fixed so that the frame can be made.

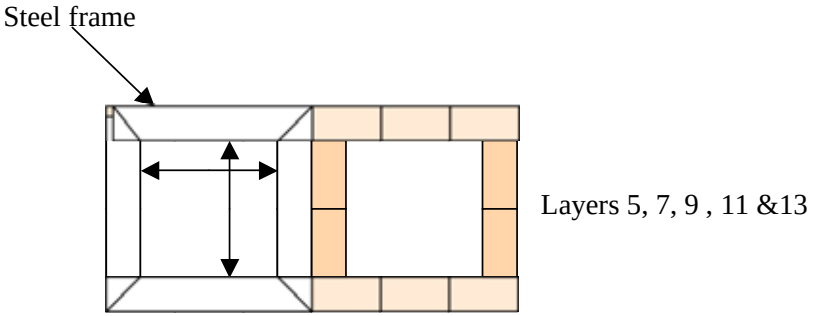


Diagram 7

The steel top frame consists mainly of two rectangular frames made from “U” section steel, one to fit over each of the combustion chambers. In many countries it is not possible to obtain “U” section steel, but these can easily be substituted by welding together two lengths of angle steel to make a “U” of roughly the correct dimension.

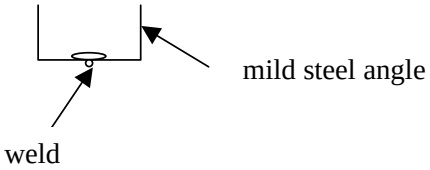


Diagram 8

The two rectangular frames are welded together, with the “U” facing upwards, and Hinge Support Brackets and locating brackets welded as in the diagram below.

Diagram 9: steel top frame

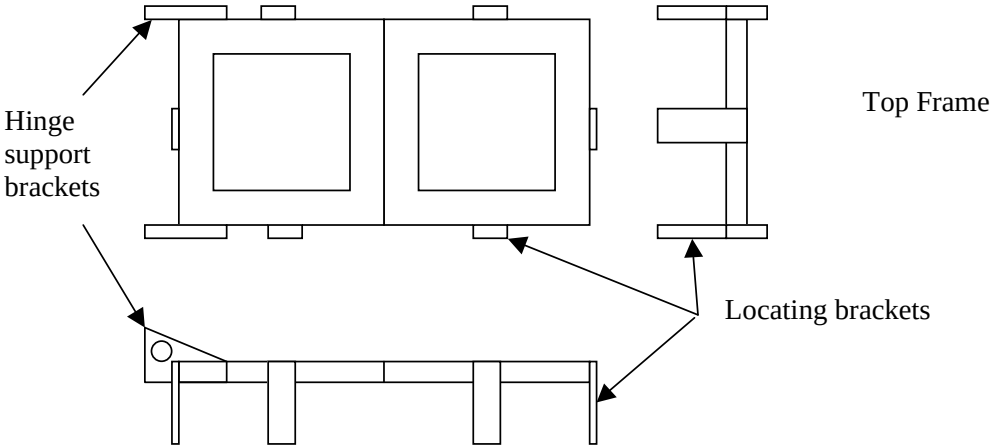


Photo 2: welding of steel top with door and chimney spigot

The Loading Door can now be made with a rolled steel angle frame of size to fit within the square channel top frame

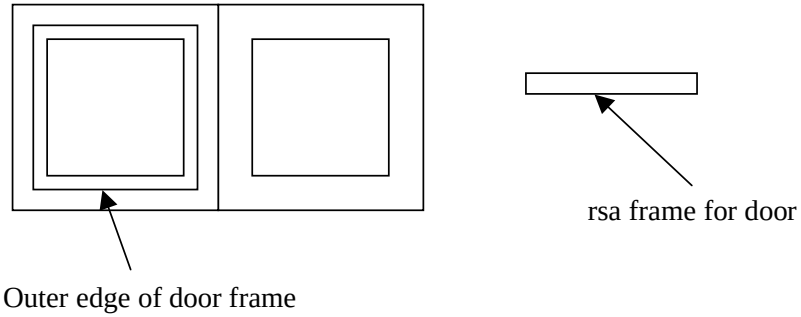


Diagram 10: loading door top view

The door may now be completed by adding a mild steel plate to the frame, a pair of hinge brackets and the handle, as shown below.

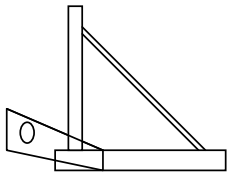


Diagram 11: Loading Door with handle and hinge bracket (side view)

Photo 3: welded steel top with door and chimney spigot ready to be installed

The chimney support panel can be made in a similar manner to the door, but with extra rolled steel angle to support the chimney.

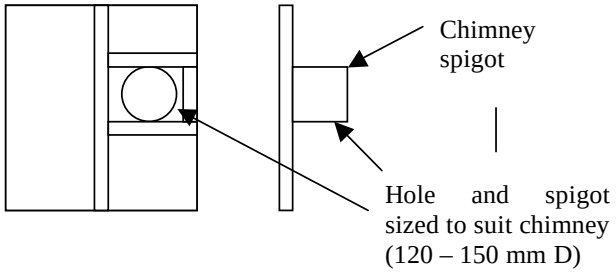


Diagram 12: chimney support plate and spigot

The sand frames of the steel top should be filled with dry sand so that the loading door and the chimney spigot plate can be sealed when closed.

The steel top may now be fitted over the firebrick core and sealed carefully with more refractory cement. This is best achieved by covering the top of the firebricks with a 5 mm layer of cement and lowering the steel top on to it, locating the top by means of the brackets already fitted.

Steel tunnels an ash doors

Two steel tunnels should be constructed, each to be a loose fit in the gaps in the brickwork at either end of the incinerator. An ash door should be fitted to the front of each tunnel, with a 30 mm gap above the primary chamber door, and a 10 mm gap above the secondary chamber door. A flange should be attached to each tunnel so that it can be fitted to the brickwork to a depth of one brick thickness.

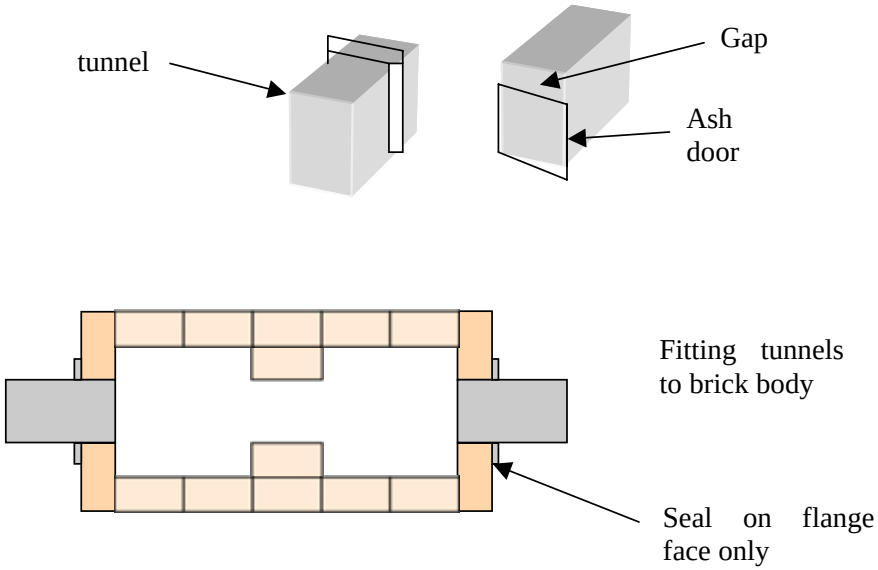


Diagram 13: steel tunnels and ash door

The tunnels are sealed to the brickwork only between the flanges and the brick face so that expansion of the tunnel will not crack the brickwork.

Photo 5: ash door, ash tunnel and air ducts

The chimney is best made from a length of steel tube with a minimum wall thickness of 3mm and internal diameter of between 100mm and 150mm. It should be 4 metres long (more if it necessary to clear buildings. If steel tube is not available, the chimney can be fabricated by rolling lengths of mild steel plates and joining them together. It should be remembered that the thinner the plate, the shorter will be the life of the chimney, because it can get very hot at the base.

The chimney can be raised to fit over the chimney spigot and supported by the roof trusses or by steel cables anchored into the ground around the incinerator.

Photo 4: raising the chimney

The outer case (if desired**)** can then be built up using common bricks with Portland cement mortar, as shown to a height just less than the inner core. Any space between the two types of bricks may be filled with Portland (white) cement. The top is then sealed with cement.

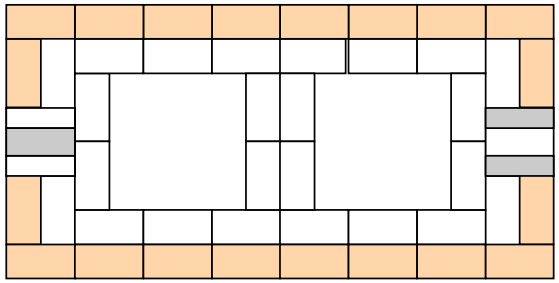


Diagram 14: incinerator outer case

A simple fuel tank, with tap should be fitted 500 mm above the incinerator top with a fuel pipe leading through both layers of brick into the primary combustion chamber,100 mm below the top.

Operation

The incinerator should be started by putting **waste paper, cardboard** or similar easily ignited material over the grate. Burning paper can then be dropped on top, and when a good flame is established, more combustible material added till the combustion chamber is half full. If available, about 100 cc of kerosene, diesel oil or used lubricating oil can be poured on top to speed the heating process. Only dry, non-infected waste should be added for the first 10 minutes or until a fierce flame is established.

The combustion chamber should be **kept at least half full**, and infectious and/or wet waste should be added above dry materials to ensure that it dries before reaching the combustion zone, Additional liquid fuel can be added if it is suspected that the combustion rate is decreasing. Any plastic waste available will also help to raise the temperature of combustion, but both this and the oil will give rise to black smoke if used to excess.

The incinerator will be most efficient if it is operated for fairly long periods once it is ignited. **The last load before closing down should be as dry and safe as possible**, so that no unburned material is left.

Maintenance

As with any type of equipment, there is a need to perform some regular maintenance to ensure both that the system will continue to work properly and to prolong the life span of the incinerator.

Before each operation.

- Check that ashes have been completely cleared from the grate and floor of incinerator.
- Check that loading door closes properly onto the sand seal in an air-tight manner. Loosen sand if necessary.

Annual inspection and rectifications

Component	Check	Rectify if necessary
Chimney	Vertical fixings	Reset or renew
	Corrosion	Repair any holes or weak points. Replace chimney or section thereof if necessary
Chimney support plate	Corrosion	Replace if necessary
Top sand seals	Cement seal to brickwork. Adequate sand level	Re-seal with refractory cement. Top up sand
Ash door	Corrosion, hinges, catch, blockage in door-frame	Repair and clean as necessary
Brickwork	Missing cement	Replace with refractory cement
	Evidence of thermal damage to bricks	Line inner surface of bricks with 10 mm refractory cement

Disclaimer

Since the safe and successful use of the incinerator, which operates at very high temperatures, is entirely dependent on the building, operation and maintenance thereof, the University and the organizations supplying the drawings and instructions can bear no responsibility for any mishaps to personnel or inadequate technical performance of the incinerator.

Information & questions

Any questions relating to these instructions should be referred to: Professor D.J. Picken (De Montfort University, Leicester, UK)

Contact formular available at:
http://www.mw-incinerator.info/en/601_contact_us.html

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