



GOVERNMENT OF BELIZE CONSULTANCY TO PREPARE A NATIONAL SOLID WASTE MANAGEMENT POLICY AND STRATEGY AND UPDATE THE NATIONAL SOLID WASTE MANAGEMENT PLAN

DRAFT FINAL REPORT

NATIONAL SOLID WASTE MANAGEMENT STRATEGY & IMPLEMENTATION PLAN

presented by



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Client	Government of Belize, Ministry of Natural Resources & Agriculture Belize Solid Waste Management Authority (BSWaMA) Market Square, Belmopan Tel/Fax: (501) 802 - 1527	
Client Representatives	Mr Gilroy Lewis, Director, BSWaMA Ms Lumen Cayetano, Senior Solid Waste Technician, BSWaMA	
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	Prepared by	Reviewed by	Reviewed by
ORIGINAL	NAME	NAME	NAME
	M P Betts	N Crick	
DATE	SIGNATURE	SIGNATURE	
25 th June 2015	HTM.H.	Pin	

Glossary of Acronyms

AD	Anaerobic Digestion
AIC	Average Incremental Cost
BAHA	Belize Agricultural Health Authority
BATNEEC	Best Available Techniques Not Entailing Excessive Costs
BSWaMA	Belize Solid Waste Management Authority
BPEO	Best Practicable Environmental Option
BWS	Belize Water Services
BZD	Belize Dollars
CA	Civic Amenity
CAPEX	Capital Expenditure
DBO	Design-Build-Operate
DOE	Department of Environment
EfW	Energy-from-Waste
ELV	End-of-Life Vehicle
EPR	Extended Producer Responsibility
EU	European Union
GoB	Government of Belize
HWRC	Household Waste and Recycling Centre
IDB	Inter-American Development Bank
IFI	International Financing Institution
ISL	Integrated Skills Limited (the Consultant)
ISSWM	Integrated Sustainable Solid Waste Management
IVC	In-Vessel Composting
Kg	Kilogram
kWh	Kilowatt Hours
lb	Pound
LFG	Landfill Gas
Ltd.	Limited
MBT	Mechanical-Biological Treatment
МоН	Ministry of Health
MNRA	Ministry of Natural Resources and Agriculture
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NSWMP	National Solid Waste Management Policy
OECD	Organisation for Economic Co-operation and Development
OPEX	Operating Expenditure
PCB	Pesticides Control Board
PSP	Private Service Provider
SMEs	Small and Medium-sized Enterprises
SWM	Solid Waste Management
ToR	Terms of Reference
TS	Transfer Station
UNDP	United Nations Development Programme
USD	United States Dollars
WEEE	Waste Electrical and Electronic Equipment (E-Waste)
WM	Waste Management
WMP	Waste Management Policy

Explanation of Some Expressions Used in this Strategy & Plan

Affordability Ratio: The share of household income (%) spent on MSW management services.

Capture Rate: The amount of recyclable material(s) collected divided by the total amount of recyclable material(s) generated. Statistically, it is the percentage of the total amount of recyclable material(s) generated that has been segregated and recovered from the waste stream. People are never 100% efficient in segregating their waste for recycling.

Civic Amenity Site: A facility where the public can dispose of household waste (often including drop-off points for recyclable materials, WEEE and other bulky waste, and hazardous household wastes).

Collection: The gathering of waste, including the preliminary sorting and preliminary storage of waste, for the purposes of transport to a waste treatment or disposal facility.

Cost-effective: Effective or productive in relation to its actual or anticipated cost (usually in comparison with alternative ways of achieving a desired outcome or delivering a service such as waste collection).

Environmentally Sound: In the context of Waste Management (see below), means managing waste in a manner that prevents any significant adverse effects on human health and the environment.

Governance: The exercise of economic, political, and administrative authority to manage a country's affairs at all levels.

International Waste: Solid waste generated outside the land borders and territorial waters of Belize.

Re-use: Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

Recovery: Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.

Recycling: Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Reject Rate: The amount of residual material (expressed as the % by weight of waste input), including contaminants, produced by MRFs which is sent for landfill disposal instead of recycling.

Separate Collection: Collection where a waste stream is segregated and kept separately by type and nature so as to facilitate a specific treatment process.

Treatment: A controlled physical, thermal, chemical or biological process that changes the characteristics of the waste in a beneficial way prior to recovery or disposal.

Waste: Any substance or object which the holder discards or intends or is required to discard.

Waste Management: The collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.

Waste Management Policy: A concise "vision" and set of overarching principles, strategic goal / objectives and policy guidelines for the future management of wastes in a country, region or locality.

Waste Management Option: One discrete process or measure for managing waste, such as waste segregation and separate collection, incineration or the use of a Build-Own-Operate-Transfer (BOOT) contract for procurement of a facility / service.

Waste Management Scenario: A set of waste management options which, taken together, would enable the cost-effective management of specified wastes in accordance with stated policies, strategic objectives and legislation. For example, a scenario might consist *inter alia* of various waste reduction measures, processing of recyclable materials at a centralised sorting plant, a composting plant and a landfill facility, financed and delivered through a Public-Private Partnership (PPP).

Waste Management Strategy: An overall framework or 'blueprint' which stipulates what actions and measures will be taken to achieve the Waste Management Policy, and by when. The final strategy is typically formulated and prepared based upon a *preferred waste management scenario* identified following an analysis of the existing situation, and an assessment of different options and alternative scenarios for managing various waste streams in a more sustainable manner.

Waste Management Plan: A document containing the details of how the various actions and measures foreseen in the Waste Management Strategy will be undertaken and by whom. This is normally prepared / finalised after the Waste Management Policy and Strategy have been approved and adopted.

Waste Prevention: Actions taken before something becomes waste that reduce:

- The quantity of waste produced, including the extension of product life through design, repair or reuse;
- The adverse impacts of waste produced on the environment and human health; or
- The content of harmful substances in materials and products.

Waste Producer: Any person (legal or natural) whose activities produce waste or who carries out preprocessing, mixing or other operations resulting in a change in the nature or composition of waste.

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FOREWORD BY THE MINISTER

It is my pleasure to present herein the Government's National Solid Waste Management Strategy and Implementation Plan.

The Government is committed to promoting sustainable development, and preventing and managing waste in an environmentally-sound manner is a key facet of sustainable development¹. Unless valued as a potential resource and managed properly, wastes can often result in unnecessary depletion of natural resources, unnecessary costs, and environmental damage that could have been avoided.

Sustainable waste management is ultimately about *using resources more efficiently*. As a society, we currently produce at least 200,000 tons of municipal and other solid wastes annually (approximately 3.6 lbs or 1.6 kg per capita per day), and the quantities are continuing to grow². At the moment, most of this waste is either landfilled without pre-treatment or simply dumped or burned. This situation is clearly unsustainable, especially for a small country like ours.

Our economic system still encourages the inefficient use of resources by pricing some below their true costs. Also, few people understand or appreciate the true cost of managing waste in an environmentally sound way. At the moment, those who generate wastes are seldom required to pay the full costs for their proper management, nor do the prices for products paid by consumers reflect the full cost of collecting, processing and disposing of those discarded products at the end of their useful lives. But these costs are nevertheless substantial and growing. Preventing waste and making better use of waste as a resource will eventually bring significant economic as well as health and environmental benefits for Belize.

Moving towards sustainable waste management will require major changes in our existing practices and attitudes towards waste. These will aim *inter alia* to encourage the production of less waste, and promote a fundamental shift in the way in which we regard and deal with waste once we have produced it.

This *National Solid Waste Management Strategy* sets out the Government's strategic objectives for the prevention and management of wastes for the next 20 years, and the measures and actions we intend to implement for achieving them. Its purpose is to provide a framework within which individuals and organisations can make a contribution through more efficient use of resources and by making better informed choices and decisions about how to manage and dispose of waste once products have reached the end of their useful life.

For the objectives of this Strategy to become reality, we must work in partnership – with businesses, local government, civil society and the public at large. Beyond that, we must all recognise the impact that waste has on our economy, health and environment, how our waste can be put to better use and how we, as individuals, can play a vital role in managing waste more sustainably. Let us all work together to achieve that reality!

The Honourable Hugo Patt

Minister of State, Ministry of Natural Resources & Agriculture

¹ For an explanation of what is meant by 'sustainable development', see section 3.1 of the *National Solid Waste Management Policy* downloadable from <u>http://belizeswama.com</u>

² Source – The Department of Environment









PART I NATIONAL SWM STRATEGY

1. INTRODUCTION

1.1 Scope of the Strategy

This **National Solid Waste Management Strategy** ("the Strategy") has been developed by the Government of Belize (GoB) in order to provide a framework for *achieving the goal and objectives set forth in the National Solid Waste Management Policy* (see section 1.6 below) and for *managing solid wastes more sustainably in future*. It has been developed in close consultation with stakeholders from all sectors of Belizean society and applies to:

- > All people living or residing in Belize;
- All community, governmental, institutional, industrial and commercial activities undertaken on or in all land or waters falling under the jurisdiction of Belize.

The Strategy presented herein is concerned primarily with the management of the following waste types:

- Municipal Solid Waste (including household, institutional and commercial wastes)
- Industrial waste (including waste from agro-industrial processing and manufacturing)
- Hazardous wastes (including healthcare risk wastes)
- Construction and Demolition (C&D) waste
- Waste from Electrical and Electronic Equipment (WEEE)
- Used batteries and accumulators (both dry cell and lead-acid)
- Packaging waste (including plastic shopping bags)
- End-of-Life Vehicles (ELVs) and tyres
- Pesticides and herbicides
- Sludge from waste water treatment

It does <u>not</u> apply to wastes generated by activities related to agriculture, mining, quarrying and mineral extraction³ which are covered by other sectoral policies / strategies (although some of the planned actions presented in Chapters 3 and 0 below are also relevant to these waste streams).

1.2 Strategy Context

The Strategy context is the environment or setting in which a Strategy is formulated and subsequently implemented, and includes many external influences (political, economic, sociological / demographic, technological, legislative, environmental, etc.). In relation to this Strategy, some of the more important *adverse* contextual influences are:

- A relatively *small domestic population* of ca. 340,000 residing within a land area of ca. 8,900 square miles, of which roughly 45% live on or near the coast, and along an East-West belt running across the middle of the country (known as the Western Corridor).
- Consequently, there is *limited scope for exploiting economies of scale*⁴ in the provision of infrastructure and services for managing waste;
- In areas where tourism plays a significant role, *large seasonal fluctuations in population levels* and therefore the *quantities of waste generated*;
- For islands located some distance from the mainland, the *constraints on extra-island movement of wastes and recyclable materials* imposed by the weather and tides;

³ As defined by the Standard International Trade Classification 2008. Downloadable from: <u>http://unstats.un.org/unsd/publication/seriesM/seriesm_4rev4e.pdf</u>

⁴ The cost advantage that arises with increased output of a product or, in the case of SWM, input of waste.

- A complex and somewhat *inefficient legal / institutional framework* for managing wastes and for protecting the environment generally;
- High *dependence on imported technology* and the equipment required to manage wastes in a cost-effective and environmentally-sound manner;
- Lack of local markets for recyclable materials, and high transport costs to reach export markets;
- Long and porous land borders making it difficult to prevent or control the import / export of illegal and / or dangerous goods and substances (including wastes);
- Limited market size and constraints to creating effective competition in the provision of infrastructure and services for managing wastes by the private sector;
- Limited national pool of human resources trained and experienced in the development and operation of modern waste management facilities and systems;
- An historical resistance by waste generators to paying for essential services such as solid waste management;
- A spectacular but *fragile natural environment*, with sensitive terrestrial, aquatic and marine ecosystems located in many areas of the country.

On the other hand, some significant *positive* influences are:

- With an economy based primarily on agriculture, tourism and services, the *quantities* of hazardous and difficult wastes generated are relatively small;
- In most cases, the conditions prevailing in urban areas are amenable to the introduction of standardised and more efficient methods of MSW containment and collection, and the segregation at source and separate collection of recyclable materials;
- A paved / all-weather highway network which is, for the most part, of good quality and lightly trafficked, thereby enabling wastes to be transported economically in large-capacity waste collection vehicles over longer distances than would be the case in countries with generally poor road conditions and high traffic densities;
- A high proportion of the population lives in close proximity to a highway which will help to facilitate future expansion of waste management service coverage;
- A generally *well-educated and literate populace* which, on the available evidence, would appear to be broadly receptive to the notions of managing waste in a more sustainable manner and paying a reasonable fee for better quality waste management services.

1.3 Government's Strategic Ambitions

The Government's strategic ambitions with respect to solid waste management (SWM) are primarily threefold:

- 1. Placing SWM in Belize on a more environmentally sustainable footing by:
 - a. Taking steps to limit the amount of solid waste generated;
 - b. Adopting environmentally sound methods and systems for managing solid wastes; and
 - c. Recovering value from the wastes generated where technically feasible and economically viable.
- 2. *Improving the quality* and *extending the coverage* of SWM services throughout the country;
- 3. Improving the *financial sustainability* of SWM infrastructure and services by:
 - a. Using available resources more cost-effectively; and
 - b. Gradually applying and reflecting the "Polluter Pays Principle" in the fees / charges for SWM services.



1.4 Strategy Development Process

This National SWM Strategy has been developed as one of a series of interrelated tasks – these are illustrated in **Figure 1** below.



Figure 1: Strategy Development Process

In essence, the process applied to develop the Strategy involved a sequence of steps which aimed to provide comprehensive responses to the following key questions:

- Where are we now (current situation / baseline)?
- What do we need to change (situation / problem analysis)?
- Where do we need or want to be, and by when (objectives and targets)?
- How will we get there (planned actions for achieving the objectives / targets)?
- How will we know when we have arrived (arrangements and criteria for monitoring progress towards, and achievement of, objectives / targets)?
- How will we respond to future changes (strategy and plan review / revision)?



As indicated in **Figure 1** above, the Strategy has been formulated and prepared based upon a *preferred waste management scenario* identified following an in-depth analysis of the existing situation, and a detailed assessment of different options and alternative scenarios for managing municipal and similar solid waste streams in a more sustainable manner (see section 4.3 below).

1.5 The Need for Change

In one way or another, waste management affects everyone and there can hardly be a person living or residing in Belize who does not recognise the urgent need to change attitudes and behaviour regarding wastes and the way in they are managed. We currently generate upwards of 200,000 tons per annum of solid waste, including around 100,000 tons of Municipal Solid Waste (MSW), 350-450 tonnes tons of hazardous waste and a substantial but unknown quantity of construction and demolition (C&D) waste. If, for example, the quantity of MSW and similar wastes generated continues to grow at a rate of 5% per annum, the total amount of waste requiring management would more than double by the year 2035 (see also section 2.2 below).

The experience of other countries at whatever stage of economic and social development confirms that, to achieve and maintain an environmentally-sound and financially sustainable system for managing wastes, <u>all</u> of the following elements must be in place:

- 1. *A Policy* which addresses all aspects of the 'enabling environment' required to manage wastes sustainably (see section 1.6 below).
- 2. *Primary legislation supported by comprehensive secondary legislation* which gives legal effect to / underpins as necessary all of the principles, objectives, targets and guidelines set forth in the Policy.
- 3. An effective system and sufficient resources for *monitoring and enforcement of legislation*.
- 4. A system and sufficient resources for *physically managing the various types and quantities of waste generated*, cost-effectively and in accordance with all applicable standards and legal requirements.
- 5. A reliable and predictable means of *financing / paying for the costs* of providing elements 3 and 4 above on a continuing basis.

If any of these elements is missing or deficient in a significant way, then this is likely to have severe adverse effects on a country's ability to achieve and maintain an environmentally and financially sustainable system for managing solid wastes. It should be noted that 4 out of the 5 elements listed above relate to *waste governance*, and it is in this area where Belize faces the greatest challenges and needs for reform.

National and international policies and legislation provide a foundation and starting point for shaping many of the standards and requirements for the future management of wastes in Belize, and also represent a driving force for implementing changes aimed at improving the existing situation.

While considerable progress has been made in recent years in developing state-of-the-art infrastructure for managing solid wastes in some areas of the country (notably along the Western Corridor and the islands of Ambergris Caye and Caye Caulker), continuing growth in population and the amount of waste generated will require further investments in SWM equipment, facilities and systems to be made over the next 20 years.

Environmentally sound and sustainable systems for managing solid wastes are undoubtedly more difficult and expensive to develop and maintain in countries like ours, which has a relatively large land mass and small scattered population, few local markets for recyclable materials and limited opportunities for exploiting economies of scale. Developing an integrated network of modern, environmentally sound waste treatment, recovery and disposal facilities, and reducing the amounts of waste going to landfill, as envisaged by the National SWM Policy, therefore represents a further challenge. Nevertheless, we must face



this challenge and address the need for new systems and additional facilities for managing wastes within the constraints imposed by scale, markets and affordability.

While modern sanitary landfill facilities will play an essential role in meeting this challenge, it should be a *diminishing role over the long term*. This in turn will require much greater efforts both to prevent waste and to substantially increase re-use, recycling and recovery of materials and / or products from waste. The National SWM Policy is intended to provide the foundations for such a fundamental change in the way in which we manage our waste, and emphasises the importance of waste prevention, recovery and recycling.

In considering the changes and actions needed to improve existing arrangements for managing wastes in Belize, attention has so far been focused primarily on developing new systems and *infrastructure for the physical handling, recovery and environmentally-safe disposal of wastes*, and on closing and rehabilitating existing / former uncontrolled dump sites. While this is understandable, it would be a mistake to underestimate the importance of also implementing a series of legal, institutional, financial and other policy measures that, together, will *improve waste governance*, provide incentives to *reduce the amounts of waste produced* and establish the essential *foundations for an integrated and sustainable national solid waste management system*.

Indeed, without such non-technical measures, there is a significant risk that investments in new waste management systems, equipment and infrastructure will fail to achieve our desired objectives (see section 3.1 below).

Actions designed to meet the need for change will therefore be required across a broad front, and will involve or affect everybody. The priorities and options for action / change are presented and discussed in Chapters 3 and 0 below. But, in order to appreciate the background and rationale for these priorities and proposed measures, we have first summarised in Chapter 2 the existing situation regarding the key stakeholders involved with SWM, waste streams and flows, waste governance and management, and related problems and constraints.

1.6 National Solid Waste Management Policy

The design of a National SWM Policy ("the Policy") necessarily preceded, and established the foundation for, the development of this Strategy. The Policy was approved and published by the Government in [month] 2015, and should be *read and considered in conjunction with this Strategy (Part I) and related Implementation Plan (Part II)*.

The *vision* which the Policy seeks to pursue is:

A healthy, prosperous and resource-efficient society in which wastes are prevented, re-used, recycled or recovered wherever feasible and beneficial, and disposed of safely only as a last resort.

The *overall goal* of the Policy and this Strategy is to ensure that:

The system for managing solid wastes in Belize is financially and environmentally sustainable, and contributes to improved quality of life.

The *primary objectives* of the Policy are to achieve and maintain a situation where:

The National Policy and Strategy for managing solid wastes are sufficiently developed to facilitate preparation, implementation and operation of an integrated and costeffective national solid waste management system.



- National legislation relating to solid waste management is comprehensive, coherent, accessible and effective.
- > Enforcement of legislation relating to solid waste management is effective.
- Institutional and organisational arrangements are optimal for the development and operation of an integrated and cost-effective national solid waste management system.
- Numbers and capacities of human resources engaged in solid waste management (in both the public and private sectors) are adequate.
- Available data and information on the sources, nature, quantities and fate of wastes, and SWM facilities, is sufficiently comprehensive and reliable to be able to regulate and manage wastes effectively.
- Stakeholders have a sufficient awareness and understanding of their roles, duties and responsibilities in achieving an integrated and cost-effective national SWM system.
- Revenue flows from existing SWM fees and other sources are sufficient to be able to meet the full costs of providing an integrated and environmentally-sustainable national SWM system.
- > The potential for waste prevention at source is realised.
- > The potential for greater waste recovery and recycling is realised.
- Methods / systems for the temporary storage, collection and transport of wastes are efficient, cost-effective and hygienic / safe.
- Wastes generated are treated / processed efficiently and in accordance with best practices.
- > Wastes requiring final disposal are disposed of in accordance with best practices.
- Existing and old (non-operational) waste dump-sites and "hotspots" are closed, progressively remediated and restored.

The purpose of the Strategy is therefore to provide an overall framework or 'blueprint' which stipulates *what actions and measures will be taken* to realise the vision and strategic objectives / policies presented in the National SWM Management Policy, and *by when*.



2. WASTES AND WASTE MANAGEMENT - OVERVIEW

This Chapter provides an overview of *key stakeholders* involved with SWM, and the existing situation regarding *waste streams and flows*, *waste governance* and *waste management*, and related *problems and deficiencies*.

The framework and resources for *waste governance* create the pre-conditions which influence the types and quantities of wastes generated, and *determine / regulate the way in which these are subsequently managed*. *Waste management* is concerned with the *physical handling of solid wastes* from the point of generation to the point of recovery or final disposal. The arrangements for *waste governance* and *waste management* together provide the "enabling environment" for *integrated sustainable solid waste management (ISSWM)*⁵.

The overview of the current situation and analysis of related problems presented below is therefore broadly divided into issues relating to *waste governance* and issues concerned with the *management of solid wastes* after they have been generated.

2.1 Key Stakeholders

An overview of the institutions and stakeholders involved (directly or indirectly) in solid waste management related activities, and their respective roles / mission, is presented in **Table 1**. There are various other organisations with an actual or potential interest in solid waste management but those listed in Table 1 are the principal ones.

Table 1: Overview of Institutions and Stakeholders Involved in SWM					
Stakeholder Type / Name	Roles / Mission				
Central Government (Ministries):	 Formulation of policies & enactment / enforcement of legislation. 				
Ministry of Natural Resources and Agriculture	➔ Management of natural resources; Responsible for BSWaMA and BAHA.				
Ministry of Forestry, Fisheries and Sustainable Development	 Enforcement of the Environmental Protection Act, Returnable Containers Act & Hazardous Waste Regulations (through the DOE); Protected areas management; responsible for DOE. 				
Ministry of Health	 Enforcement of the Public Health Act; Control of infectious diseases and contamination arising from SWM activities; Management of healthcare & other hazardous wastes. 				
Ministry of Energy, Science & Technology and Public Utilities	 National Policy on Energy; Enforcement of the Public Utilities Commission Act (through the Public Utilities Commission); Promotion of energy recovery from waste (biomass). 				
Ministry of Finance and Economic Development	 Generation and allocation of financial resources for public SWM infrastructure and services; Enforcement of the Environmental Tax Act (through the Comptroller of Customs); Servicing of the IDB loan for the Belize SWM Project. 				
Ministry of Labour, Local Government, Rural Development, NEMO and Immigration	 National Policy on Local Governance; Enforcement & oversight of the system of local government; Responsible for NEMO. 				
Ministry of Education, Youth & Sports	 Inclusion of SWM & environmental protection in educational curricula. 				

⁵ For an explanation of integrated sustainable solid waste management, see section 3.2 of the National SWM Policy.



Table 1: Overview of Institutions and Stakeholders Involved in SWM						
Stakeholder Type / Name		Roles / Mission				
Central Government (Subordinated Agencies):	→	Implementation of policies / legislation enacted by Central Government.				
Belize Solid Waste Management Authority (BSWaMA)	→	Overall responsibility for SWM in Belize; Planning, provision & operation of infrastructure for MSW transport & disposal.				
Belize Agricultural Health Authority (BAHA)	→	Enforcement of legislation related to food safety, quarantine, plant and animal health; Control of disposal of condemned food, infected animals, international garbage, quarantine waste & similar wastes.				
Department of the Environment (DOE)	→	Control of environmental pollution; Enforcement of legislation related to SWM; Preservation, protection and improvement of the environment.				
Comptroller of Customs	→	Administration of the Environmental Tax Act.				
Public Utilities Commission	→	Economic regulation of the electricity, water, and telecommunications sectors.				
National Emergency Management Organization (NEMO)	→	Management and coordination of preparation for, and responses to, national emergencies such as floods and hurricanes. Organising clearance and removal of debris in the event of natural disasters.				
Statistical Institute of Belize	→	Statistics on population, trade & economy; Statistics on solid waste.				
Local Government:	→	Local governance in cities, towns & villages				
City Councils (2) & Town Councils (7)	→	Coordination, control, management & regulation of the collection and removal of all garbage material from all residential or commercial areas.				
Community Councils (12) & Village Councils (180)	→	Enactment & enforcement of By-Laws for the cleanliness of streets and other public places; Maintenance of streets, drains and sanitation in general.				
National Association of Village Councils	→	Representation of Village Councils at national level.				
Private Sector – WM Companies:	→	Provision of SWM infrastructure, know-how & services.				
PASA Belize Ltd.	→	Design, construction & operation of waste management infrastructure on behalf of, and under contract to, BSWaMA.				
Belize Waste Control Ltd.	→	Collection of MSW in Belize City; Recovery & recycling of materials from waste.				
Belize Maintenance Limited	→	Street & drain cleaning in Belize City.				
Belize Recycling Company Inc.	→	Recovery & recycling of materials from waste.				
Placencia Sanitation Co. Ltd.	→	Collection & disposal of MSW in Placencia.				
Resource Recovery Recycling Belize Ltd.	→	Recovery & recycling of materials from waste.				
Private Sector – Industrial & Commercial Waste Producers:	→	Minimisation and recycling of waste; Duty to ensure proper handling, recovery and disposal of waste; Monitoring and reporting on waste production, recovery and disposal.				



Table 1: Overview of Institutions and Stakeholders Involved in SWM							
Stakeholder Type / Name		Roles / Mission					
The Public:	→	Placement of MSW for collection; Minimisation & segregation of MSW at source; Payment of fees / taxes for SWM services; An interested and affected party within the proximity of existing / proposed SWM facilities.					
Non-Governmental Organisations (NGOs):	→	Representing & promoting specific public & sectorial interests. Lobbying on development, planning and environmental issues.					
Association of Protected Areas Management Organizations (APAMO)	→	Umbrella organisation for protected areas management organisations; protection of the integrity and diversity of Belize's protected areas system.					
Belize Tourism Industry Association (BTIA)	⇒	Umbrella organisation for the tourism sector promoting sustainable development of the tourism industry.					
The Recycling Network of Belize	→	A project run by the BTIA and Resource Recovery Recycling Belize Ltd., which is developing a network of collection centres for paper & cardboard, plastics (except for Styrofoam), dry cell batteries and E-Waste.					
Programme for Belize (PFB)	→	Promotion of the conservation of the natural heritage and wise use of the natural resources of Belize.					
Protected Areas Conservation Trust (PACT)	→	Promotion of the protection, conservation and enhancement of the natural and cultural resources of Belize.					
Belize Alliance of Conservation NGOs (BACONGO)	→	Umbrella organisation of nine separate environmental & similar bodies based in Belize.					
Belize Audubon Society (BAS)	→	Promotion of sustainable management of Belize's natural resources through leadership and strategic partnerships with stakeholders in order to achieve and maintain a balance between the needs of both people and the environment.					
Belize Institute of Environmental Law and Policy (BELIPO)	→	Promotion of the development, improvement and enforcement of Belize's environmental laws & policies in a manner that is consistent with international conventions for the conservation and sustainable use of natural resources.					
Toledo Institute for Development & Environment (TIDE)	→	Promotion of sustainable use and management of ecosystems within the Maya Mountain Marine Corridor of Southern Belize.					

2.2 Waste Streams and Flows

For practical management purposes, wastes may be broadly divided into:

- Non-hazardous waste: for example, Municipal Solid Waste (MSW), which comprises waste from households, as well as other wastes which, because of their nature or composition, are similar to waste from households, and which can be handled in the same way;
- Hazardous waste: i.e. waste which is explosive, oxidizing, flammable, irritating, toxic, carcinogenic, corrosive, infectious, teratogenic, mutagenic, eco-toxic or otherwise potentially harmful;



- Difficult waste: waste which, although not classified as hazardous, is very unpleasant, can cause a nuisance or has properties which cause it to require extra care in handling and disposal (e.g. condemned foodstuff, slaughterhouse wastes, quarantine wastes, dead domestic animals, end-of-life tyres, international solid waste);
- Inert waste: i.e. waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health.

For the reasons explained in section 2.3.4 below, there is still very considerable uncertainty about the quantities and fate of the wastes currently generated, but the estimates presented in this Chapter represent the best data / estimates currently available.

2.2.1 Municipal Solid Waste

Municipal Solid Waste (MSW) generally consists of household waste and wastes of a similar nature produced by commercial and light industrial premises, institutional wastes (schools, government offices, etc.), market wastes and street / drain cleaning wastes. While typically regarded as non-hazardous in nature, MSW usually contains a relatively small proportion (< 3% by weight) of potentially hazardous materials such as cleaning agents, paints, spent batteries and pharmaceuticals.

It is estimated that a total of around 100,000 metric tonnes (~110,000 short tons) per annum of MSW is currently generated, of which approximately 70% is collected through an organised collection service. This includes approximately 25,000 metric tonnes (~28,000 short tons) originating from smaller commercial and light industrial premises. This is equivalent to around 270 kg (597 lbs) / inhabitant / year. The majority of collected MSW (>60%) is disposed of in uncontrolled dumpsites, of which there are estimated to be around XX. Small amounts of waste paper and board, glass and plastic (PET) containers, metals and post-consumer products are collected separately for recycling. Empirical evidence suggests that this waste stream is growing rapidly.

The average physical composition of MSW is illustrated in **Figure 2** and **Figure 3**.



Figure 2: MSW Composition, % by weight - Belize City

Source: Derived from Waste Generation and Composition Study for the Western Corridor, Final Report, Hydroplan, May 2011





Figure 3: MSW Composition, % by weight – Remainder of Belize

Source: Derived from Waste Generation and Composition Study for the Western Corridor, Final Report, Hydroplan, May 2011

2.2.2 Hazardous Wastes

The storage, transport, treatment and disposal of hazardous wastes are generally more strictly regulated than non-hazardous wastes, and Belize is no exception in this regard (see **Table 6** below). The principal international legal instrument relating to hazardous wastes and their management is the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, which Belize ratified in 1997. In this regard, Parties to the Convention are expected to minimize the quantities that are transshipped across borders, to treat and dispose of wastes as close as possible to their place of generation and to prevent or minimize the generation of wastes at source.

Examples of wastes regulated by the Basel Convention are:

- Biomedical and certain healthcare "risk" wastes;
- Used oils;
- Used lead acid batteries;
- Persistent Organic Pollutant wastes (POPs wastes), chemicals and pesticides / herbicides that persist for many years in the environment;
- Polychlorinated Biphenyls (PCBs), compounds used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, sealants and plastics;
- A very wide range of chemical wastes generated by industries and other consumers.

Reliable data on the sources, types, quantities and fates of hazardous wastes generated do not yet exist. However, as Belize is a small country with an economy based primarily on agriculture, tourism and services, the quantities of hazardous and difficult wastes generated are believed to be relatively small.

No chemicals or chemical products are manufactured in Belize and, until the discovery and subsequent exportation of petroleum in 2006, Belize was a net importer of chemicals and chemical products.



In 2012, around 62,000 metric tonnes (\sim 68,000 short tons) of chemicals and chemical products were imported, of which approximately 33,000 metric tonnes (\sim 36,000 short tons) consisted of fertilizers⁶.

Of particular significance for their hazardous waste generating potential are the following imported chemicals and chemical products:

- Pesticides (insecticides, herbicides and fungicides) for agricultural, public health and consumer use – 4,393 metric tonnes (4,842 short tons)
- Lubricants and brake fluids 2,530 metric tonnes (2,789 short tons)
- Pharmaceutical products 1,628 metric tonnes (1,795 short tons)
- Organic chemicals (hydrocarbons and derivatives including refrigerants) 198 metric tonnes (218 short tonnes)
- Tanning or dyeing extracts (including pigments, paints and varnishes) 1,700 metric tonnes (1,874 short tons)
- Explosives, pyrotechnic and certain other combustible preparations 24 metric tonnes (26 short tons)
- Other chemical products and residuals 1,686 metric tonnes (1,858 short tons)

Most of the above-listed materials and products are consumed in use, but small amounts are discarded as waste in the form of spoiled, obsolete or redundant product, contaminated packaging and / or consumption residues. There is also 21 tons of expired DDT stored at the Western Regional Hospital compound in Cayo District.

The recycling of hazardous waste is limited to the collection of lead acid batteries and some used mineral oils which are exported. A small amount of used oil is used under permit as a fuel for local smelting cottage industries.

A special category of potentially hazardous waste is the wastes generated by hospitals and other healthcare facilities that are infectious, contaminated or otherwise potentially hazardous – so-called *healthcare* "*risk"* wastes. There are 8 public hospitals, 3 private hospitals, 37 public health centres and 55 private clinics in Belize.

Provided that they are properly segregated at source, the other ("non-risk") wastes generated at such institutions generally can be handled in the same manner as Municipal Solid Waste. If risk and non-risk wastes are not effectively segregated at source, the entire waste stream should be regarded and handled as hazardous waste. There is some evidence to suggest that effective segregation of risk waste at source does not always occur.

It is estimated that around 190 tons of healthcare risk wastes are generated in Belize each year⁷. There are 8 healthcare waste incinerators installed at hospitals, but only one of these is still in use (at the Southern Regional Hospital). Consequently, most healthcare risk wastes are mixed and disposed of together with MSW.

2.2.3 Difficult Wastes

Difficult wastes do not usually pose any major risks to public health or the environment but, nevertheless, should be handled and disposed of separately from MSW. Data on the sources, types, quantities and fates of difficult wastes generated do not exist.

Slaughterhouse wastes arise from 9 livestock and poultry slaughtering and processing facilities, much of which is rendered or otherwise converted into by-products such as animal feedstuff or fertiliser.

⁶ Source: *ECLAC Logistics Profile Belize*, September 2014. Relates to products covered by Standard International Trade Classification, Section 5, including: Organic and inorganic chemicals; Dyeing, tanning and colouring materials; Medicinal and pharmaceutical products; Essential oils and resinoids and perfume materials; toilet, polishing and cleansing preparations; fertilizers.

⁷ Source: Water and Sanitation in Belize, Inter-American Development Bank, December 2013

Infected animals, condemned food, confiscated products and similar wastes are incinerated in a facility owned and operated by the Belize Agricultural Health Authority (BAHA).

International solid waste entering Belize consists mainly of garbage off-loaded by visiting small pleasure craft. This is similar in nature to household waste and is typically collected and disposed of together with domestic MSW. Otherwise, such waste cannot be imported into Belize without a permit issued by the DoE.

One type of difficult waste which can create environmental and public health risks, as well as being problematic to manage, is *end-of-life tyres*. This is the case especially in countries or regions with a tropical or sub-tropical climate. The design of tyres makes them *ideal breeding sites for several species of mosquitoes*, as well as harbourage for vermin, many of which are important vectors of disease. Since they are easily filled by rain and collect leaf litter, they provide an ideal "incubator" for mosquito larvae. Mosquitoes are in turn responsible for transmitting some deadly diseases such as dengue, encephalitis and malaria. There were almost 200 reported cases of dengue and malaria in 2012.

End-of-life tyres, which have been dumped or stockpiled in significant numbers, also pose a *major fire risk*. Tyre fires, which can give rise to serious environmental pollution⁸ and potential health hazards, require substantial skills and resources to combat / extinguish and subsequently clean up. Accordingly, it is important that end-of-life tyres are captured, stored and disposed of in a way which avoids these risks to public health and the environment. For these and other reasons, in many countries, end-of-life tyres are not permitted to be disposed of in landfills.

The quantities and values of tyres and inner tubes imported during the period 2009-13 are indicated in **Table 2**. As can be seen, imports of tyres and inner tubes are currently in excess of 2,000 metric tonnes (~2,200 short tons) per annum. By contrast, exports currently amount to only around 4 metric tonnes (~4.4 short tons) per annum, and comprise new tyres only. From this, it may be deduced that end-of-life tyres are all processed / disposed of incountry. No data are available on the fate of end-of-life tyres, but it is known that some are re-treaded for subsequent re-use, some are used for protective, constructional or agricultural purposes (e.g. as boat fenders, silage clamps, security barriers), while the remainder are burned or dumped (for the most part illegally).

Table 2: Importation of Tyres and Inner Tubes, 2009-13								
Year	2009	2010	2011	2012	2013			
Quantities, metric tonnes:								
New pneumatic tyres, of rubber	1,440	1,684	3,056	1,517	1,740			
Re-treaded or used pneumatic tyres of rubber	302	320	615	450	364			
Inner tubes, of rubber	57	38	157	77	72			
TOTAL	1,799	2,042	3,828	2,044	2,176			
Values, BZD `000:								
New pneumatic tyres, of rubber	11,204	13,538	13,356	15,598	15,764			
Re-treaded or used pneumatic tyres of rubber	550	604	512	878	658			
Inner tubes, of rubber	342	302	528	640	604			
TOTAL	12,096	14,444	14,396	17,116	17,026			

Source: United Nations Commodity Trade Statistics Database

⁸ Open tyre fire emissions include a wide range of pollutants, such as particulates, carbon monoxide (CO), sulphur oxides (SO₂), oxides of nitrogen (NOx), volatile organic compounds (VOCs), poly-nuclear aromatic hydrocarbons (PAHs), dioxins, furans, hydrogen chloride, benzene, polychlorinated biphenyls (PCBs); and metals such as arsenic, cadmium, nickel, zinc, mercury, chromium, and vanadium.



2.2.4 Construction and Demolition Wastes

Construction and demolition (C&D) wastes form the second largest waste stream after municipal and similar solid wastes. This waste stream can cover a very wide range of materials. The main categories are:

- Waste arising from the total or partial demolition of buildings and/or civil infrastructure;
- Waste arising from the construction of buildings and / or civil infrastructure;
- Soil, rocks and vegetation arising from land excavation or levelling, civil works and / or general foundations;
- > Road planings and associated materials arising from *road maintenance activities*.

Most of this waste stream is essentially inert. However, cross-contamination and general mixing of materials is frequently observed on construction and demolition sites. This is of greatest concern if the mixing involves hazardous materials. Hazardous materials typically constitute a small but significant proportion of C&D wastes. The following materials may be present: asbestos, lead pipes and roofing material, other heavy metals, hydrocarbons, paint, adhesives, wood treated with preservatives, contaminated soil and various materials containing PCBs.

Although in principle there is significant potential for recovering materials from this waste stream, most of it is currently used either as fill material for land raising / reclamation purposes or illegally dumped. No data on the quantities of C&D waste generated or recovered are available but it is known that generation of this waste stream tends to be volatile and fluctuates markedly in response to changes in the general level of economic activity and the commencement / completion of major construction projects.

2.2.5 Other Significant Solid Waste Streams

End-of-Life Vehicles

An 'end-of-life vehicle' (ELV) is generally understood to mean a motorised vehicle which is regarded by its final owner / holder as waste (for a definition of waste, see the explanation of expressions provided at the beginning of this Strategy).

Basic statistics on the numbers of registered motor vehicles are shown in **Table 3**, while the composition of a "generic car" is illustrated in **Figure 4** and further broken down in **Table 4**.

Table 3: Numbers of Licensed Motor Vehicles								
Year	Total	Cars / Taxis	Pick-ups	Vans	Goods Vehicles	Cycles	Other	
Registe	red Motor V	ehicles:						
2006	54,225	16,149	14,350	4,596	4,744	1,546	12,840	
2007	56,094	16,999	15,181	4,478	4,757	2,389	12,290	
2008	51,357	14,546	14,028	3,887	5,361	2,208	11,327	
Newly I	Registered M	lotor Vehicle	es:					
2006	7,101	2,115	1,403	514	680	832	1,557	
2007	7,714	1,833	1,663	511	859	1,252	1,596	
2008	7,118	1,411	1,506	475	952	1,161	1,613	

Source: Abstract of Statistics Belize, Statistical Institute of Belize, 2012.







Table 4: Composition and Mass of a Generic Car					
Category	Material	Mass (kg / lbs)			
		kg	lbs		
Ferrous	Plain / sheet steel and cast iron	727.4	1,603.6		
	Aluminium	56.1	123.7		
	Copper	11.7	25.8		
Non forrous	Lead	10.3	22.7		
Non-remous	Zinc	1.3	2.9		
	Other metals	1.1	2.4		
	Sub-total	80.5	177.5		
	Acrylonitrile Butadiene Styrene	8.6	19.0		
	Polypropylene	36.1	79.6		
	Polyethylene	6.0	13.2		
Plactics	Polyamide 66	6.7	14.8		
riastics	Polyvinyl Chloride	10.0	22.0		
	Polyurethane	11.7	25.8		
	Other Plastics	14.0	30.9		
	Sub-total	93.1	205.3		
	Rubber	41.8	92.2		
Other colid materials	Glass	34.6	76.3		
other solid materials	Other Materials	48.9	107.8		
	Sub-total	125.3	276.3		
	Coolant	6.0	13.2		
Fluide	Lubricant	6.9	15.2		
T TUTUS	Other fluids (exc. Fuel)	3.9	8.6		
	Sub-total	16.8	37.0		
	TOTAL	1.043.1	2,299.6		

Source: Application of Life Cycle Assessment to Investigate Options for Disposal and Processing of End-of-Life Vehicles in 2015, UK Environment Agency, 2002.



The available data are insufficient to allow ELV scrappage rates⁹ to be calculated for different types and age classes of vehicle in a particular year. But applying a conservative assumption of an average annual scrappage rate across the entire national vehicle park of 7% to the figures presented in **Table 3**, suggest that at least 3,800 vehicles are scrapped each year. Applying the further broad assumption that the material composition illustrated in **Figure 4** and the weights presented in **Table 4** are typical of the average ELV in Belize, then the quantities of materials contained in 3,800 ELVs generated would be as follows:

- Steel and other ferrous metals 2,800 metric tonnes (~3,100 short tons)
- Non-ferrous metals 300 metric tonnes (~330 short tons)
- Plastics 350 metric tonnes (~385 short tons)
- Other solid materials 480 metric tonnes (~530 short tons)
- Fluids 55 metric tonnes (~60 short tons)

The above rough estimates probably understate the true situation because of the substantial number of US-manufactured vehicles and pick-ups within the national vehicle park, which tend to be both larger and heavier than vehicles manufactured in Europe or Japan. UN trade statistics indicate that Belize exported a total of around 6,500 metric tonnes (~7,200 short tons) of ferrous waste and scrap in 2013, principally to Guatemala, Taipei China (PRC) and Mexico. It is likely that a large proportion of this material originated from ELVs.

Currently, there is no organised national system or integrated network of facilities for collecting, transporting and processing / recovering ELVs. However, there are several large and numerous small private operators engaged in vehicle salvage and breakage activities.

ELVs are usually stripped of reusable parts and high value materials, which are then sold. Vehicle hulks are either dumped or in most cases processed for recycling. Other types of materials remaining after the dismantling of ELVs (rubber, plastic, glass) are mostly burned and / or dumped. Oils, cooling fluids and batteries are usually removed – batteries are generally recovered for recycling, but oils and other fluids are probably burned or dumped.

Information on methods of processing ELVs is provided in **Annex B**.

Waste Electrical and Electronic Equipment (WEEE)

Waste electrical and electronic equipment (WEEE, also sometimes referred to as E-Waste) includes the following categories of WEEE:

- Large household appliances
- Small household appliances
- IT and telecommunications equipment
- Consumer equipment
- Lighting equipment
- Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
- Toys, leisure and sports equipment
- Medical devices (with the exception of all implanted and infected products)
- Monitoring and control instruments
- Automatic dispensers

UN trade statistics indicate that Belize imported electrical and electronic equipment (industrial and consumer) with an approximate value of BZD 80 million in 2014.

⁹ The percentage of vehicles of a certain type in a given age class that are retired from use (lacking registration) in a given year.



According to a study published recently¹⁰, Belize produces an average of 6.5 kg (14.3 lbs) of WEEE per capita per annum, equivalent to around 2,300 metric tonnes (~2,500 short tons) per annum. Data from other countries suggest that, measured by weight, the majority of WEEE (>50% by weight) is generated in the form of large household appliances, followed by IT and consumer electronic equipment (>30% by weight).

Table 5 shows the material composition of selected electrical and electronic products. As can be seen, ferrous metals and plastics are the main materials arising in WEEE.

Table 5: Material Composition of Selected Categories of Appliances (% by weight)							
Product Category	Ferrous Metals	Non- Ferrous Metals	Glass	Plastics	Electronic Components	Other	
Refrigerators & freezers	64.4	6.0	1.4	13.0		15.1	
Washing machines	59.8	4.6	2.6	1.5		31.5	
Computer equipment	53.3	8.4	15.0	23.3	17.3	0.7	
Television sets	5.3	5.4	62.0	22.9	0.9	3.5	
Cellular telephones	8.0	20.0	10.6	59.6		1.8	

Source: *E-Waste Volume I – Inventory Assessment Manual*, United Nations Environment Programme (UNEP), 2007.

Currently, there is no organised system or national network of facilities for processing / recovering WEEE. Most WEEE is dumped or collected as bulky municipal waste, and then subsequently landfilled. Only small amounts are currently recovered for reuse or recycling.

Information on recycling options / routes for managing WEEE is provided in **Annex B**.

Sewage Sludge

Sewage sludge refers to the residual, semi-solid material that is produced as a by-product during treatment of industrial or municipal wastewater. The term septage is also sometimes used to refer to sludge from simple on-site sanitation systems such as septic tanks.

Currently, only ~11% of the population (in Belize City, Belmopan and San Pedro) has access to sewerage services, which include both wastewater collection and treatment. The treatment facilities in Belize City and San Pedro provide secondary level treatment, while the facility in Belmopan provides only primary treatment. Belize Water Services Limited does not provide any sewerage services in any of its other service areas nor does it provide collection or treatment of septage from septic tanks.

In *Belize City*, treatment is provided by a two-cell facultative lagoon system and the treated effluent is discharged into the Caribbean Sea via canals cut through a mangrove wetland. The lagoon cells operate in series and are designed to provide 10 days hydraulic retention time in each. The system presently serves some 37,500 consumers and treats about 1,500,000 gallons (~5.7 million litres) of sewage per day.

In *San Pedro Town*, two facultative lagoons operating in series followed by one maturation pond with impermeable layers at their bottoms are used to treat the collected sewage. The treated effluent from the maturation pond is discharged to the surrounding mangrove wetland via a dispersion pipe, for polishing before final disposal into the natural lagoon environment (the Caribbean Sea). The cells are each designed to provide a hydraulic retention time of 10 days. The sewerage system currently serves approximately 3,400 consumers and treats about 160,000 gallons (~0.6 million litres) of sewage per day.

¹⁰ *The Global E-Waste Monitor 2014 – Quantities, Flows and Resources*, United Nations University, Institute for the Advanced Study of Sustainability.



In *Belmopan*, a primary treatment plant made up of a settling tank and four sludge drying beds together with $1\frac{1}{2}$ miles of 18-inch diameter disposal pipe makes up the facility for treatment of sewage in Belmopan. The treated effluent (clarified waste water) empties into the Belize River via the disposal pipe and the sludge is deposited onto the drying beds and later made available for agricultural use. Approximately 7,900 consumers are served by the sewerage system. It is estimated that the flow to sewage treatment plant is 200,000 gallons (~0.8 million litres) per day.

BWS plans to start construction of a wastewater treatment plant on the Placencia Peninsula, which is funded by the IDB and the Global Environment Facility. This project will provide wastewater services to the second largest area of tourism growth, which includes 3,000 inhabitants and 7,000 tourists. BWSL also plans to upgrade the wastewater treatment plant and expand the wastewater collection network in Belmopan. All of the aforementioned planned treatment facilities will generate sewage sludge.

No data are available on the quantities or composition of sewage sludge currently generated. However, by way of illustration, if the total volume of sewage currently collected were treated to at least secondary level, this would result in the production of approximately 43,000 metric tonnes (~47,000 short tons) of liquid sludge per annum (@ 3% dry solids content), or 4,300 metric tonnes (~4,700 short tons) of stabilised and dewatered sludge (@ 30% dry solids content). Given that the sewage generated in Belize is predominantly domestic in nature, it is likely that stabilised sludge produced following treatment could be beneficially applied *in a controlled manner* to certain types of agricultural land in suitable locations without creating any significant risks to public health or the environment. But this would need to be confirmed through testing and monitoring.

Agro-Industrial Wastes

Primary agricultural and forest-based activities account for around 10% of total GDP, while the manufacture of food products and beverages accounts for around 5% of total GDP. There are relatively few agro-based industries in Belize. These consist primarily of the production of sugar and molasses, citrus concentrates and fertilisers, dairy processing, flour milling, production of various beverages and dehydrated fruits, wood processing, food and fish processing operations. The dominant activities are *sugarcane and citrus processing*. In 2011, exports of traditional agricultural products such as sugar, citrus and bananas exceeded BZD 250 million and represented 38% of merchandise exports.

Agro-industrial wastes generated in Belize include: bagasse (waste from sugar cane processing), shrimp heads, chicken offal, pig and cattle offal, blood and bone meal, reject bananas, brewery waste, citrus pulp and peel, and beans trash. Wastes from production of lumber and other forestry products mainly consist of residues from logging and commercial sawmilling.

For every 10 tonnes of sugarcane crushed, a sugar factory produces around 3 tonnes of wet bagasse. The sugarcane crop fluctuates significantly from year-to-year. In 2014, 1.2 million metric tonnes (\sim 1.3 million short tonnes) of cane were processed to produce 123,000 metric tonnes (\sim 135,000 short tonnes) of sugar. This resulted in the production of approximately 360,000 metric tonnes (\sim 395,000 short tonnes) of bagasse. Most of the bagasse generated is used for energy production in the form of electricity which is then used to power sugar industry machinery and provide electricity to the grid (approximately 49,000 MWh or 8.9% of total power supply in 2013¹¹).

As with sugarcane, citrus production fluctuates considerably. Solid waste from citrus processing comprises orange and grapefruit peels, pulp and seeds, and amounts to approximately 130,000 metric tonnes (\sim 143,000 short tonnes) per annum. Most of this is converted into compost which is then given to farmers free-of-charge for use as fertiliser.

¹¹ Source: Belize Electricity Limited, Annual Report 2014.



Shrimp farming and related industrial processing produces a significant amount of biological waste, mostly in the form of shrimp heads, accounting for almost 35 % of the total production¹². Total shrimp production in 2014 amounted to approximately 8,000 metric tonnes (~8,800 short tonnes), giving rise to around 2,800 metric tonnes (~3,000 short tonnes) of solid waste. What currently happens to this stuff?

Most other agro-industrial wastes are generated in comparatively small quantities and are typically converted into useful by-products (e.g. feed, fertiliser, livestock bedding material), used as a fuel or returned to the land in order to enhance or protect the soil.

Waste Oils

Waste oils are residual products typically originating from motor vehicles, ships, industrial machines, etc. They arise when lubricating oils in mechanical processes have to be changed after some period of use.

As noted in section 2.2.2 above, around 2,500 metric tonnes (~2,700 short tons) of lubricants and brake fluids are imported each year, of which only around 35 metric tonnes (~38 short tons) comprises brake fluids. Exports of lubricating oils are negligible. On average, around 50% by weight of the total lubricating oils consumed arise as waste oils (the rest is lost during use, or through leakages, etc.), implying that around 1,200 metric tonnes (~1,300 short tons) of used oils are generated each year. No data on lubricating oil consumption patterns or waste oil generation rates for different product categories are available. However, a breakdown of the global market for lubricants is shown in **Figure 5**.





Source: Sustainability... and the Global Lubricants Industry, Fuchs Petrolub AG, February 2012

Industrial manufacturing plays only a very small role in the Belizean economy and so it is likely that the pattern of lubricating oil consumption is somewhat different to the global picture, with automotive and process oils accounting for a higher proportion of total consumption.

As noted earlier, some used lubricating oils are exported, while a small amount of used oil is used under permit as a fuel for local smelting cottage industries. The fate of the remainder is unknown but it is likely that some is used illegally as a fuel and in diverse other applications (e.g. as a corrosion inhibitor, wood preservative, dust suppressant, etc).

¹² Source: *Belize CDM Guidebook 2011*, published by Roskilde University.

Used Batteries and Accumulators

Batteries and accumulators are an essential energy source in our society, and are used in a wide variety of products and appliances. There are three main types of portable batteries and accumulators:

- General purpose batteries and accumulators which are non-rechargeable (mainly zinccarbon and alkaline manganese batteries).
- Button cells (mainly zinc air, silver oxide, manganese oxide and lithium batteries), which are non-rechargeable.
- Rechargeable batteries and accumulators (mainly nickel-cadmium, nickel-metal hydride, lithium ion and sealed lead-acid batteries).

Non-rechargeable portable batteries represent the largest proportion of the portable battery market. Most used batteries and accumulators are classified as hazardous waste.

In 2013, Belize imported 126 metric tonnes (~138 short tons) of primary cells and batteries, and 498 tonnes (~550 short tons) of electric accumulators (85% lead-acid). In addition, unknown quantities of batteries and accumulators were imported as components in new vehicles and electronic equipment. In the same year, 44 metric tonnes (~49 short tons) of waste and scrap derived from primary cells, primary batteries and electric accumulators were exported¹³. These figures suggest that, currently, less than ~10% by weight of batteries and accumulators entering the country are recovered for recycling. However, it is known that a substantial quantity of used lead-acid batteries is being sent illegally (and therefore unrecorded) to neighbouring countries, for subsequent recovery.

2.3 Waste Governance – Current Status

2.3.1 Policy and Legislative Framework

The Belize Constitution provides the primary policy direction for protecting the environment. Its preamble states that "... the people of Belize require policies of state which ... protect the environment". Since independence, various sectoral and thematic polices and strategies of relevance to environmental management and protection have been developed and applied by successive governments, most notably a series of National Environmental Action Plans.

However, until recently, a policy specifically focused on the governance and integrated management of wastes did not exist. But, with the adoption and publication of the National SWM Policy in [month] 2015, this crucial need has now been comprehensively addressed.

Belize's first environmental law, the Environmental Protection Act, was enacted in 1992. Since then, the legislative framework has evolved piecemeal in response to a variety of pressures and events. As a result, the existing legislative framework for SWM comprises several primary Acts, secondary Regulations and local by-laws, the most significant / relevant of which are summarised in **Table 6**.

The existence of an appropriate national policy and legislative framework is not in itself sufficient to ensure that wastes are managed in an environmentally-sound and financially sustainable manner. To be effective, such measures must be *administered and enforced* which in turn requires that adequate systems, procedures and resources be deployed to fulfil these tasks. The relevant provisions of the Environmental Protection Act and the Hazardous Waste Regulations have not been enforced very effectively in part because, until recently, there were no facilities located within Belize capable of receiving and disposing of hazardous wastes in a legal and environmentally-secure manner. A lack of monitoring and enforcement is also evident from the continuing widespread occurrence of illegal waste dumping.

¹³ Source: UN Trade Statistics.



Table 6: Principle Existing Laws / Legal Instruments of Relevance to Solid Waste Management				
Law / Regulation	Mandated Institution(s)	Mandate		
Solid Waste Management Authority Act. Chapter 224, Revised Edition 2000	Ministry of Natural Resources and Agriculture; Solid Waste Management Authority	Provides for the formation of an independent Solid Waste Management Authority (SWaMA) with power to provide for the collection and disposal of solid waste in declared areas and in accordance with regulations issued under the Act.		
Solid Waste Management Authority (Amendment) Act, 2010 (draft)	Ministry of Natural Resources and Agriculture; Solid Waste Management Authority	Provides for the vesting of solid waste management facilities in the Solid Waste Management Authority (SWAMA).		
Environmental Tax Act, CAP. 64:01, (Revised edition 2003)	Ministry of Finance and Economic Development, Comptroller of Customs	The Act levies an ad valorem tax of 2% on every good imported into Belize.		
Returnable Containers Act, 2009 (No. 12 of 2009)	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	Provides for the payment of a deposit on certain beverage containers.		
Environmental Protection Act, CAP. 328 (Revised edition 2000); Environmental Protection (Amendment) Act (No. 5, 2009)	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	The Act imposes a wide range of functions on the Department of Environment. These include (section 4(j) maintain a register of all waste, discharge, emissions, deposits or other sources of emission or substances which are of danger or potential danger to the environment."		
Public Health Act, CAP 40. (Revised edition 2003) Refuse Removal By-Law	Ministry of Health	Under the Act, the Ministry of Health (through its Public Health Bureau) is given statutory powers for a number of matters including investigation of public health and related complaints; monitoring of sewage and solid waste; prosecution of public health offenders.		
Town Councils Act, CAP. 87 (Revised edition 2000)	Ministry of Labour, Local Government, Rural Development, NEMO and Immigration	Under section 30 of the Town Councils Act the Council has an obligation to "coordinate, control, manage or regulate the timely and efficient collection and removal of all garbage material from all residential or commercial areas in its town."		
Village Councils Act, CAP. 88 (Revised edition 2000)	Ministry of Labour, Local Government, Rural Development, NEMO and Immigration	Section 23 of the Village Council Act provides that the Council may make By Laws for the cleanliness of streets and other public places.		
Nuisance Act (CAP. 95)	Ministry of Labour, Local Government, Rural Development, NEMO and Immigration	Under the Nuisance Act, the court may empower the Belize City Council or any town board to enter the place where the nuisance is located to take remedial action to abate the nuisance.		



Table 6: Principle Existing Laws / Legal Instruments of Relevance to Solid Waste Management				
Law / Regulation	Mandated Institution(s)	Mandate		
Belize Port Authority Act (Chapter 233) (Revised edition 2003)	Ministry of Works and Transport; Belize Port Authority	Under section 74 (1) of the Act, the Port Authority may with approval of the Minister make regulations with regard to the proper control and maintenance of the foreshore of any port and, the deposit of any substance, solid matter or article that causes pollution in any port. In addition, the Belize Port Authority Regulations (S.I. 32 of 1980) prohibit any person from depositing, placing or discharging pollution into the territorial waters of Belize.		
Pollution Regulations, 1996 (S.I. 56 of 1996 Pollution (Amendment Regulations, 2009 (S.I. 101 of 2009)	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	Regulation 12 of the Pollution prohibits the burning of refuse or other combustible matter in any area so as to cause a nuisance to any or person or to burn refuse in a commercial area.		
Environmental Impact Assessment Regulations, 1995 (S.I. 107 of 1995), and (S.I. 24 of 2007).	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	Sets out the procedures for carrying out Environmental Impact Assessments (EIAs) and also specifies the types or categories of projects that require EIAs. Regulation 7 provides that all undertakings, projects or activities specified in Schedule I require an EIA, this is a mandatory requirement.		
Hazardous Waste Regulations 2009(S.I. 100 of 2009)	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	The Hazardous Waste Regulations establishes the requirements for the construction and operations of hazardous waste facilities and sets standards for the storage, transportation and treatment of hazardous waste.		
Environmental Protection (Effluent Limitation Regulations) 1995 (S.I. 94 of 1995 & (Amendment) Regulations, 2009 (S.I. 102 of 2009	Ministry of Forestry, Fisheries and Sustainable Development; Department of the Environment	It establishes effluent limitations. The Effluent Limitations Regulations were amended in 2009 by the Environmental Protection (Effluent Limitations) (Amendment) Regulations (S.I.102 of 2009).		
Summary Jurisdiction (Offences) Act – Littering Offences (Violation Tickets) Regulations	Ministry of Works and Transport	The Act makes provision for the removal of derelict vehicles. Secondly, the Littering Offences (Violation Tickets) Regulations made under the Act, authorize police, environmental officers, health officers and other designated persons to issue violation tickets for littering offences.		

Source: Adapted from *Strategic Plan for the Solid Waste Management Authority*, GENIVAR Trinidad & Tobago Ltd, August 2011

2.3.2 Institutional and Organisational Arrangements

As with the policy and legislative framework, the institutional framework for environmental management and protection has also evolved piecemeal in response to a variety of pressures and events, with the result that responsibilities for different aspects of solid waste management are spread across numerous government institutions at central and local level.

An overview of the existing institutional structure and organisational arrangements related specifically to solid waste management is presented in **Figure 6**. As can be seen, the existing arrangements *at the central level* are rather confused and fragmented, with responsibilities not always clearly defined and in some cases overlapping. Existing institutions are also, for the most part, under-resourced (see also section 2.3.3 below).

At *the local level*, the existing institutional arrangements for municipal SWM collection and street cleaning services are also fragmented, under-resourced and unreliable, and this is clearly having a negative impact on service coverage and quality, resulting in significant environmental problems and public dissatisfaction throughout much of Belize. In particular, it is evident that, with the exception of Belize City, all local authorities are *too small to be able to exploit economies of scale in service provision or deliver these services reliably and cost-effectively*.

2.3.3 Human Resources

As may be seen from **Table 1** and **Figure 6**, the public institutions primarily responsible for the day-to-day management, control and supervision of SWM facilities and services are:

- The Belize Solid Waste Management Authority (BSWaMA) currently employing 7 fulltime staff;
- The Department of the Environment (DoE) currently employing XX full-time staff, of which XX are directly concerned with SWM;
- The Local Councils the number of full-time staff currently employed in delivering SWM services is unknown.

BSWaMA and some Local Councils also employ private contractors to operate municipal SWM facilities and services on their behalf. Organograms for BSWaMA and the DoE are presented in **Figure 7** and **Figure 8** respectively.

An in-depth assessment of the numbers and capacities / skills of human resources required to perform various public SWM functions satisfactorily has yet to be carried out (see section 3.2 below). But the number of staff currently engaged in SWM activities is self-evidently insufficient, even for a relatively small country like Belize. There is also no formal national system for the education, training and on-going professional / vocational development of people engaged in SWM-related activities.

The task of attracting, retaining and motivating appropriately qualified and experienced staff and workers has become increasingly difficult in recent years, due partly to the significantly lower salary and wage levels in the local government sector compared with those offered in the private sector, and partly to poor working conditions and a lack of job satisfaction amongst front-line service staff and operatives. Likewise, the health risks and hazards confronted by people engaged in SWM activities, especially manual workers and plant operatives, are much greater than those typically found in other fields of activity. The proposed Occupational Safety and Health Act has yet to be passed by the National Assembly, nor is there any regulation, guidance or code of practice related specifically to occupational health and safety in the solid waste management sector.





Figure 6: Existing Institutional Structure & Organisational Arrangements for Solid Waste Management



Acting Environmental

Officer Anthony Mai

Environmental

Technician

Marlenie De La Fuente

Environmental

Technician

Marco Escalante

Environmental

Technician

Marco Leal

Environmental

Technician

Henry Sanchez



Figure 7: BSWaMA Organogram

Technician

lemellda Landaberde

Victor Alegria

Technical Assistant Gisel Correa

Library

Data Management

Technician

Francis Martinez Assistant Data Management Technician Erwin Jimenez

Administrative

Assistant

Elvira Magana



2.3.4 Data Availability, Monitoring and Reporting

Currently, there is a lack of reliable data and information on waste types and flows, and their fate and impact on public health and the environment. Although various consulting assignments carried out under the auspices of the Belize Solid Waste Management Project have from time-to-time generated valuable data and information on different aspects of SWM (most recently, in relation to waste generation and cost recovery in the Western Corridor), there is no national system for classifying and regularly collecting, processing, analysing and disseminating data and information on wastes and their fate. This is quite a serious shortcoming and constraint on long-term planning and the development of a more sustainable SWM system.

To some extent, the dearth of reliable data has also been exacerbated by the fact that:

- Commercial and industrial waste producers, processors and SWM service providers are not obliged by law to collect, record and report data and information about the wastes they generate / manage; and
- Until recently, equipment for weighing and recording the types and quantities of solid wastes delivered to SWM facilities (weighbridges) has not been available.

A weighbridge is now available at the recently-opened regional landfill facility at Mile 24.

2.3.5 Stakeholder Awareness and Communication

Implementing a SWM strategy and plan obviously involves numerous changes in existing attitudes and practices, and the achievement of the Government's policy objectives as articulated in the National SWM Policy. In any society or community, the interests and aims of different organisations and individuals do not always coincide. As a consequence, it is usually necessary to overcome a variety of institutional and social barriers if the policy objectives are to be reached. The main purpose of stakeholder communications is to inform stakeholders and respond to their concerns, try and reconcile any conflicting or competing interests, and build consensus for implementing the actions foreseen in the Strategy and Implementation Plan.

BSWaMA has recognised the importance of this issue and has already taken action by appointing a consultant to assist in developing a stakeholder communications strategy and programme. BSWaMA also undertakes *ad hoc* public relations activities aimed at providing information and raising awareness on specific issues, and has recently established a website dedicated to providing information about its mandate, activities and achievements¹⁴.

Compliance with environmental regulations and standards has been rather lax in the past, and the importance of effective enforcement has not yet been fully recognised or accepted by all sections of our society. While there is evidence to suggest that we have become generally more concerned about environmental issues in recent years, the fundamental shifts in social attitudes and behaviour required to bring about a major and sustainable improvement in waste management standards and practices have yet to occur.

Further actions aimed at enhancing stakeholder communications and bringing about fundamental long-term changes in social attitudes and behaviour are therefore foreseen in the National SWM Policy and included in this Strategy (see section 3.2 below).

2.3.6 Financing and Cost Recovery

Currently, the *costs of developing and operating SWM infrastructure* are met almost entirely by Government through the MNRA budget. The actual expenditures over the period 2009-14 are summarised in **Table 7** below.

¹⁴ http://belizeswama.com



Table 7: GoB Expenditures on SWM Infrastructure & Services			
Capital Funding & Expenditure, 2009 to 2014	USD		
Sources of funding:			
Inter-American Development Bank (IDB)	11,150,000		
OPEC Fund for International Development (OFID)	3,260,000		
Government of Belize (GoB)	379,000		
TOTAL	14,789,000		
Investments:			
Landfill Phase I & Phase II	5,104,279		
Access Road - 2 miles paved	980,343		
Belize City Mile 3 Transfer Station	2,276,451		
San Pedro/Caye Caulker/San Ignacio-Santa Elena Transfer Stations	2,500,471		
Belmopan Transfer Station	845,654		
Sub-Total	11,707,198		
Works Supervision	913,196		
Institutional Strengthening	2,011,835		
Auditing	116,821		
Contingency	39,950		
Sub-Total	3,081,802		
TOTAL PROJECT COST	14,789,000		
Operating Costs & Solid Waste Received at Mile 24 Landfill			
Operating Costs, August 2013 – March 2014, in BZD	1,068,435		
Waste received at Mile 24 landfill in tonnes, August 2013 – March 2014	15,947		

Source: BSWaMA

As can be seen, *capital expenditure* is heavily reliant on donor financing, in particular from the IDB, and has been focused hitherto on the development of SWM infrastructure in the Western Corridor.

In terms of *revenue*, the Environmental Tax Act 2001 (as subsequently amended) was originally enacted to generate revenues for the specific purposes of:

- > Developing a national solid waste management program;
- Defraying the cost of the disposal of refuse generated by the use of goods referred to in section 3 of the Act (basically all imported goods with the exceptions of certain medical supplies and basic foodstuffs);
- Assisting in the collection and disposal of garbage throughout Belize;
- Cleaning up rivers and canals and other internal waterways;
- Preserving and enhancing the environment; and
- > Strengthening the institutional capacity of the Department of the Environment.

Under the Act, an *ad valorem* tax (currently 2%) is applied to the CIF value of all imported goods, with certain exemptions.


In 2013/14, the revenue raised by this tax amounted to approximately BZD 25.1 million and is projected to increase to around BZD 27.1 million in 2015/16. Clearly, revenues generated by the tax exceed GoB budgeted expenditures on SWM infrastructure and services by a substantial margin. Section 7 of the Act states that the proceeds of the tax shall be placed into a special fund. However, revenues from this tax are currently absorbed into the GoB general revenue budget and are not earmarked or allocated for the purposes stated in the Act.

The costs of providing *waste collection and similar environmental services* represent a significant expense for local authorities, and most local authorities are struggling to find and allocate sufficient funds just to cover the day-to-day costs of operating these services. The main funding sources for local SWM services are municipal revenues generated primarily from *local fees and property taxes*, and *subventions from central government*.

In towns and cities, residential waste collection and disposal services are provided mainly free of charge to household users. Commercial waste collection services are normally paid for directly by waste producers based on the quantities of waste produced. Apart from Belize City, none of the authorities visited has invested in vehicles and equipment in recent years and, in most cases, the existing vehicles / equipment are old and in very poor condition, as illustrated in section 2.4.2 below.

2.3.7 Waste Prevention

Waste prevention encompasses a range of policy options and measures, and has a broad range of benefits. Targeting waste production at source reduces the amount and / or toxicity of waste before recycling, composting, energy recovery and landfilling become options. Waste prevention also includes measures to reduce the adverse characteristics and impacts of the generated waste on the environment and human health.

Waste prevention can be achieved by reducing the quantity of material used in the creation of products and increasing the efficiency with which products, once created, are used. Preventing waste by limiting unnecessary consumption and by designing and consuming products that generate less waste are strict forms of waste avoidance. Waste prevention also encompasses actions that can be undertaken once a product reaches its end-of-life: rather than discarding the product, the final user should consider re-use, repair or refurbishment as options. Extending a product's lifetime or considering options like re-use are also forms of prevention through diversion of waste flows.

Waste prevention is positioned at the top of the Waste Management Hierarchy¹⁵, and is therefore considered as preferable to all other methods of managing waste. Currently, because most waste producers in Belize neither perceive nor bear the true costs of managing their wastes in an environmentally-sound manner, they have little reason or incentive to try and avoid or reduce the amount of waste they generate. Moreover, product importers and suppliers, consumers and other waste generators are often not aware of the potential opportunities for, and benefits of, avoiding and / or reducing wastes. As the majority of products consumed in Belize are imported, the Government has very limited ability to influence the way such products are designed, manufactured and packaged.

However, one area where GoB intervention has resulted in a worthwhile reduction in the amount of waste generated is in relation to beverage packaging. The Returnable Containers Act 2009 states that a deposit on beverage containers (a separate, sealed glass, metal or steel bottle or can used for containing one US gallon or 3.8 litres or less at the time of sale of a beverage intended for use or consumption in Belize) shall be collected by all distributors and dealers at the time of sale or distribution. "Beverage" is defined in the Act as carbonated soft drinks, beer and other malt products.

¹⁵ For an explanation of this term, see section 3.6 of the National SWM Policy.



Importantly, the scope of the Returnable Containers Act does <u>not</u> include non-beverage or other types of container. There therefore appears *prima facie* to be considerable scope for further reducing the amount of packaging material arising as waste, as well as increasing the amount captured for subsequent recycling.

2.4 Waste Management – Current Status

2.4.1 Waste Recovery and Recycling

As in the case of waste prevention, because most waste generators in Belize neither perceive nor directly bear the true costs of managing their wastes in an environmentallysound manner, they and other economic actors have little incentive to recover / recycle materials from waste themselves, or to facilitate recovery and recycling of their wastes by others.

Recovery and recycling of MSW currently occurs only on a limited scale, and is focused on materials which are easy to sort manually and for which there is a ready market – mainly paper and board from commercial sources, plastics and metals, and glass bottles for re-use. These activities are undertaken by informal recyclers, a small number of private scrap dealers, and by operatives using manual picking and sorting methods undertaken in designated areas at the two new transfer-loading stations serving Belize City and San Ignacio / Santa Elena. Collectively, these activities account for no more than a few per cent of the total quantity of MSW generated in Belize.

Other solid waste categories / streams which are currently recovered / recycled on a notable scale include:

- Waste remaining from sugar cane processing (bagasse) of which approximately 360,000 metric tonnes (~395,000 short tonnes) were used in 2014 to generate electricity for powering sugar industry machinery and to provide electricity to the grid;
- Part of the waste remaining from citrus fruit processing which is used to produce compost and animal feed;
- End-of-life vehicles (ELVs);
- E-Waste;
- Dry cell batteries;
- Lead acid batteries.

Based on feedback received from stakeholders during the preparation of the National SWM Policy, the expansion of recovery and recycling activities appears to be constrained by a number of factors including:

- Market outlets for most types / grades of recyclable material either do not exist or are very weak;
- A lack of long-term export markets for some types / grades of recyclable materials;
- A lack of economies of scale;
- High costs for collection, segregation and shipment of some recyclable materials to export markets;
- Apart from the Returnable Containers Act (which is primarily a waste prevention measure), legislative support and economic incentives to encourage greater recovery and recycling do not currently exist;
- Manufacturers, importers and distributors of products giving rise to specific productrelated waste streams are not obliged to take-back the wastes resulting from their products for subsequent re-use / recycling;



 Apart from one or two areas such as San Pedro, Ambergris Caye, convenient and easily-accessible facilities for dropping off recyclable materials separated from household and similar types of waste do not exist.

2.4.2 Waste Segregation, Containment, Collection and Transport

Waste collection and street cleaning services are the aspects of SWM which are of greatest visibility and importance to the general public and, at the moment, these create a rather poor impression in many areas of Belize, especially in suburban and rural areas.

Common problems and deficiencies with the existing *MSW collection services* include:

- Inadequate service coverage and quality;
- A lack of standardised waste storage containers of an appropriate size, type and quality which are capable of being mechanically emptied;
- Inappropriate and insufficient vehicles and equipment;
- Poor organisation and inefficient working methods;
- Inadequate maintenance of vehicles, equipment and containers;
- Poor condition of vehicles, equipment and containers (see Figure 9 to Figure 12);
- Except in Belize City, a lack of economies of scale;
- Except in a few areas, no systems for source-segregation, separate storage and collection of recyclable materials and hazardous wastes (including healthcare risk wastes).



Figure 9: Large Capacity 3-axle Collection Vehicle Used in Punta Gorda





Figure 10: Large Capacity 3-axle Collection Vehicle Used in Placencia

Figure 11: Tractor-Trailer Unit Used for Collecting Waste in Placencia





Figure 12: Waste Awaiting Collection in Dangriga

In those areas which receive regular MSW collection and street cleansing services, these are mainly managed and operated directly by local councils. A major exception is Belize City where the provision of waste collection services has been out-sourced by the City Council to a private contractor (Belize Waste Control Ltd).

With regard to the *transport of MSW*, until recently, the universal practice has been to transport all MSW collected to the final disposal point directly in the collection vehicle. However, since the opening of two new transfer stations in August 2013 (see **Figure 13** and **Figure 14** below), all of the MSW collected in Belize City, San Ignacio / Santa Elena and Benque Viejo has been transported to the new regional sanitary landfill at Mile 24 in bulk transfer vehicles. These facilities are owned by BSWaMA, and were developed and are being operated by a private contractor, PASA Belize Limited, on behalf of the Authority under a 10-year Design-Build-Operate (DBO) contract.

Additional waste transfer stations are currently being developed to serve San Pedro, Caye Caulker and Belmopan.

2.4.3 Waste Treatment / Processing

Currently, most solid wastes are disposed of without any form of processing or pretreatment. Notable exceptions are:

- Small-scale / home composting of organic household wastes in some rural communities;
- Aerobic treatment (composting) of solid residues resulting from the processing of citrus fruit (peels, pulp and seeds) to produce soil conditioner;
- Processing (sorting, cleaning, baling, etc.) of recyclable materials (paper and board, plastics, metals) recovered from household and commercial wastes prior to shipment;
- Processing of ELVs prior to shipment;





Figure 13: New Transfer Station Serving San Ignacio / Santa Elena

Figure 14: New Transfer Station Serving Belize City





 Incineration (as necessary) of infected animals, condemned food, confiscated products and similar wastes in a facility owned by the Belize Agricultural Health Authority (BAHA).

There are also waste incinerators installed at a number of hospitals but, at the moment, only one of them is currently functioning.

2.4.4 Final Disposal

Despite the existence of legislation prohibiting the dumping of wastes, most of the solid wastes generated in Belize have hitherto been disposed of in an uncontrolled manner, resulting in serious adverse impacts on the environment – see **Table 8** and **Figure 15** below. Open dumping and burning of waste has been the standard approach to solid waste disposal throughout the country. The burning of waste is typically done in open low-temperature fires thereby polluting ground water, soil and air, and is also sometimes responsible for uncontrolled fires.

However, since BSWaMA took over the responsibility for waste transport and disposal, various measures have been taken to improve the situation and this process is still ongoing. The regional sanitary landfill opened in 2013 at Mile 24 (see **Figure 16** and **Figure 17** below) constitutes a major step forward in the development of a more sustainable system for managing solid wastes. Once the remaining transfer facilities foreseen for the Western Corridor have been completed, more than 50% of the solid waste generated in Belize will be disposed of safely at the Mile 24 sanitary landfill, enabling numerous uncontrolled dumpsites to be closed and remediated.

The challenge for the future is to develop similar facilities to serve the remaining areas of the country.

2.5 Existing Problems and Deficiencies

A summary of the main problems and deficiencies associated with the existing arrangements for managing solid wastes in Belize is presented in **Table 9**. This is based on a baseline review and analysis of the existing situation undertaken by consultants on behalf of the Government in late 2013 / early 2014. A more detailed analysis of the problems and deficiencies associated with the existing arrangements for managing solid wastes is provided in **Annex A**.

The analysis presented in **Annex A** has been used extensively to inform the development of the National SWM Policy and this Strategy.



Table 8: Method of Garbage Disposal by District								
	Corozal	Orange Walk	Belize	Сауо	Stann Creek	Toledo	Tot	als
							2010	2000
Total %	100	100	100	100	100	100	100	100
Dump on land	1.9	2.7	3.3	1.4	2.8	4.4	2.7	4.5
Take to dump site	23.5	21.4	4.0	6.3	10.0	11.8	10.5	8.5
Compost	0.2	0.2	0.1	0.3	0.2	1.0	0.3	n.a
Burn	36.5	39.4	13.9	27.2	22.4	52.0	27.1	32.9
Throw into river, sea or pond	0.0	0.1	0.4	0.0	0.1	0.1	0.2	0.5
Bury	0.5	0.4	0.7	0.9	2.9	2.8	1.1	1.7
Municipal collection	27.3	32.2	66.0	51.4	45.4	21.4	47.5	50.9
Garbage truck - private	8.6	2.4	11.1	10.0	14.4	5.8	9.3	n.a
Other	0.0	0.1	0.2	0.3	1.2	0.4	0.3	0.8
DK / NS	1.5	1.1	0.4	2.2	0.5	0.3	1.0	0.2

Source: 2010 Population & Housing Census



Figure 15: Uncontrolled Dumpsite Serving Dangriga and Surrounding Area¹⁶



¹⁶ Located near the Junction of the Hummingbird and Southern Highways



Figure 16: New Regional Landfill Facility for Non-Hazardous Wastes at Mile 24



Figure 17: New Landfill Cell for Stabilised Hazardous Wastes at Mile 24





Table 9: Exis	sting SWM System – Summary of the Main Problems & Deficiencies
Policy & Legislative Framework	 The existing legislative framework is fragmented, inefficient and in need of substantial reform. A comprehensive strategy, addressing all key areas of performance for SWM does not yet exist.
	 Enforcement of legislation relating to SWM is not effective.
Institutional / Organisational Arrangements	 Existing institutional and organisational arrangements for SWM at the national level are rather fragmented, with responsibilities not always clearly defined and in some cases overlapping. Existing national institutions are also, for the most part, severely underresourced. Existing institutional arrangements for municipal SWM collection and street cleaning services at local level are also fragmented, under-resourced and unreliable. With the exception of Bolize City, all local authorities are too small to be
	able to exploit economies of scale in service provision or deliver these services reliably and cost-effectively.
Human Resources / Capacity	 The numbers and capacities of human resources currently engaged in SWM activities (in both the public and private sectors) are generally inadequate.
Data Availability, Monitoring & Reporting	 A national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes, and SWM facilities, does not exist. The lack of reliable data and information is a significant constraint on the long-term planning, development and operation of a more sustainable SWM system.
Stakeholder Awareness & Communication	 Stakeholders do not have a sufficient awareness and understanding of their roles and responsibilities in achieving an integrated and cost-effective national SWM system.
	 A targeted national strategy and programme for on-going communications and consultations with, and participation of, all key stakeholders are not yet in place.
Financing / Cost Recovery	 The costs of constructing and operating SWM infrastructure are met almost entirely by GoB.
	 Capital expenditure is heavily reliant on financing from multilateral agencies, in particular from the IDB, and has been focused hitherto on the development of SWM infrastructure in the Western Corridor.
	 Waste collection and similar environmental services represent a significant expense and financial burden for local authorities.
	 Revenues from existing fees / taxes are not equitably and appropriately distributed amongst local authorities.
	 Apart from Belize City, none of the authorities has invested in new vehicles and equipment in recent years.
	 The present arrangements for financing and recovering the costs of SWM infrastructure and services are neither desirable from a policy perspective, nor financially sustainable in the long term, and are therefore in urgent need of reform.
Waste Prevention	 Most waste producers in Belize neither perceive nor bear the true costs of managing their wastes in an environmentally-sound manner, and so they have little reason or incentive to try and prevent or reduce the amount of waste they generate.
	 Product importers and suppliers, consumers and other waste generators are often not aware of the potential opportunities for, and benefits of, preventing and / or reducing wastes.



Table 9: Existing SWM System – Summary of the Main Problems & Deficiencies				
	• As a result, the potential for waste prevention at source is not being realised.			
Waste Recovery & Recycling	 As with waste prevention, because most waste producers in Belize pay little or nothing towards the costs of managing their wastes in an environmentally-sound manner, they and other economic actors have little incentive to recover / recycle materials from waste themselves, or to facilitate recovery and recycling of their wastes by others. Consequently, <i>recovery and recycling of MSW</i> currently occurs only on a very limited scale, and is focused on materials which are easy to sort manually and for which there is a ready market – mainly paper and board from commercial sources, plastics and metals, and glass bottles. Substantial increases in the recovery and recycling rate for MSW are likely to be achievable only through the widespread introduction of source segregation and separate collection of recyclable materials. Expansion of recovery and recycling activities appears to be constrained by a number of factors. These are described in Annex A. 			
Waste Segregation, Storage, Collection & Transport	 Waste collection and street cleaning services are the aspects of SWM which are of greatest visibility and importance to the general public and, at the moment, these create a rather poor impression in many areas of Belize, especially in suburban and rural areas. Existing MSW collection services suffer from numerous problems and deficiencies, in particular: Inadequate service coverage and quality; A lack of standardised waste storage containers of an appropriate size, type and quality which are capable of being mechanically emptied; Inappropriate and insufficient vehicles and equipment; Poor organisation and inefficient working methods; Inadequate maintenance of vehicles, equipment and containers; Poor condition of vehicles, equipment and containers; Except in a few areas, no systems for source-segregation, separate storage and collection of recyclable materials and hazardous wastes (including healthcare risk wastes). 			
Waste Treatment / Processing	 With certain notable exceptions, most solid wastes generated in Belize are currently disposed of without any form of processing or pre-treatment. Medical waste incinerators are installed at eight hospitals but only one is currently functioning. The provisions of the Environmental Protection Act and the Hazardous Waste Regulations relating to waste treatment and disposal are not being enforced effectively. Although the quantities of hazardous and difficult wastes generated in Belize are relatively small, the current situation is unsustainable, especially for a country which aspires to be a major destination for eco-tourism. Many of the technologies / systems available for treating hazardous and difficult wastes are expensive to procure and operate, especially at small scale. 			
Final Disposal	 Despite the existence of legislation prohibiting the dumping of wastes, most of the solid wastes generated outside the Western Corridor are disposed of in an uncontrolled manner, resulting in potentially serious adverse impacts on the environment. Some existing and old (non-operational) waste dump-sites and "hotspots" are not being closed, progressively remediated and restored. 			



3. STRATEGY FOR WASTE GOVERNANCE

In this Chapter, we present our strategic objectives and targets for *waste governance* and outline the specific actions and measures that we intend to implement to ensure these are achieved. As discussed in the preceding Chapter, the framework and resources for *waste governance* create the pre-conditions which influence the types and quantities of wastes generated, and *determine / regulate the way in which these are subsequently managed*. It is in this area where Belize faces the greatest challenges and most pressing needs for reform.

3.1 Policy Objectives and Targets for Waste Governance

To ensure that tangible and verifiable progress is made with reforming and improving the existing arrangements for waste governance, we have established a series of overall strategic policy objectives and targets. These have been extracted from the National SWM Policy and summarised in **Table 10**. The policy objectives are in essence the inverse of the "problem analysis" presented in **Annex A**.

3.2 Planned Actions for Improving Waste Governance

The actions we plan to implement in order to achieve the policy objectives and targets summarised in **Table 10** are described in **Table 11**.



Table 10: Strategic Policy Objectives and Targets for Waste Governance			
Policy Objectives	Target Date*		
Policy & Legislative Framework:			
GO 1 A comprehensive policy and strategy, addressing all key areas of performance for SWM, exist.	2015		
GO 2 National programmes / targets for achieving an integrated SWM system are developed and elaborated.	2018		
GO 3 National policies for the management of product-related and hazardous/difficult and international waste streams exist.	2018		
GO 4 Processes and procedures for formulating, implementing and monitoring the impact of legislation are efficient and transparent.	2018		
GO 5 Procedures for stakeholder consultations and participation in the process of drafting policies and legislation are effective.	2018		
GO 6 National legislation and standards are sufficiently developed to facilitate a comprehensive and integrated approach to SWM.	2018		
GO 7 Key words and terms used in SWM legislation are adequately defined and consistently applied.	2018		
GO 8 The interface between national SWM legislation and local regulations is clear and fully articulated.	2018		
GO 9 A strategy for compliance monitoring and enforcement exists.	2018		
GO 10 Penalties for non-compliance are appropriate and applied as a deterrent.	2018		
GO 11 Resources and procedures for monitoring and enforcement are sufficient and effective.	2018		
GO 12 The relevant regulatory agencies collaborate.	2018		
Institutional / Organisational Arrangements:			
GO 13 Institutional structures and related information systems and management procedures are efficient and effective.	2018		
GO 14 Institutional responsibilities are clearly and comprehensively defined / legally assigned.	2018		
GO 15 Legal competences of Ministries are clearly defined and do not overlap.	2018		
GO 16 The human and other resources available to public institutions involved in SWM are sufficient to fulfil their responsibilities and tasks effectively.	2021		
GO 17 The system for waste monitoring and enforcement is able to control waste flows and waste transport / processing / disposal activities effectively.	2021		
GO 18 Institutional functions and responsibilities for SWM at the national / local levels are well coordinated.	2021		
GO 19 Resources available at local level are sufficient for effective delivery of good quality SWM services.	2021		
GO 20 Institutional arrangements for inter-municipal cooperation with respect to SWM exist.	2018		
GO 21 Legal and organisational arrangements facilitate private sector participation in Municipal Solid Waste management.	2021		
Human Resources / Capacity:			
GO 22 A formal system for the education and on-going professional development of staff engaged in SWM-related activities exists.	2021		
GO 23 The number of staff employed by Government and local authorities in relation to SWM is sufficient.	2021		
GO 24 The capabilities of staff engaged in SWM-related activities employed by Government and local authorities are sufficiently developed.	2021		
GO 25 Health and safety of human resources engaged in SWM activities is a priority.	2018		
GO 26 Private sector producers and managers of wastes are sufficiently trained and experienced.	2021		
GO 27 The contributions of staff and workers, as demonstrated by the quality of SWM services, are viewed positively by Belizean society.	2021		
GO 28 Compensation paid to staff and workers engaged in SWM activities adequately reflects their contributions / value to Belizean society.	2021		



	Table 10: Strategic Policy Objectives and Targets for Waste Governance			
	Policy Objectives	Target Date*		
Data Availability, Monitoring & Reporting:				
GO 29	Data on waste quantities and flows, covering all areas / municipalities and all waste streams, are available.	2021		
GO 30	A national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes and SWM facilities, exists.	2021		
GO 31	Waste producers & SWM service providers, are obliged by law to collect, record & report data & information about the wastes they generate / manage.	2018		
Stakeh	older Awareness & Communication:			
GO 32	Stakeholder awareness and communications are regarded as a priority / need by Government decision-makers.	On-going		
GO 33	A targeted national strategy & programme for on-going communications & consultations with, and participation of, all key stakeholders are in place.	2018		
GO 34	The resources required for effective stakeholder communications are allocated and sufficient.	2018		
GO 35	SWM issues are sufficiently addressed within educational curricula and programmes.	2021		
GO 36	A focal point for implementation and coordination of a national stakeholder communications programme has been established and resourced.	2018		
Financi	ing / Cost Recovery:			
GO 37	User fees for SWM services and facilities are sufficient to recover the full costs (including investment costs) of managing wastes in an environmentally- sound manner.	2021		
GO 38	The full costs of managing wastes in an environmentally sound manner are known and recognised by local authorities and waste producers.	2018		
GO 39	Regulations / mechanisms for collecting fees / taxes for the provision of SWM services and facilities are enforced and effective.	2018		
GO 40	Revenues from fees / taxes are equitably and appropriately distributed to local authorities.	2018		
GO 41	Elected local government representatives are willing to introduce cost-covering charges for SWM services.	2018		
GO 42	The costs of developing and operating an environmentally sustainable SWM system are affordable for all members of Belizean society.	On-going		
Waste	Prevention:			
GO 43	Fees / charges for SWM services and facilities provide an incentive to prevent / reduce waste generation.	2021		
GO 44	Other economic incentives to prevent and reduce waste, and to invest in technologies that reduce waste, are available.	2018		
GO 45	Product suppliers, consumers and other waste generators are aware of the potential opportunities for, and benefits of, preventing and reducing wastes.	2018		
GO 46	Information on the opportunities and techniques for wastes prevention and reduction is readily available to waste generators.	On-going		

Note: * To be achieved by year-end.



	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
Policy GA 1	& Legislative Framework: Prepare, consult on and publish a comprehensive National Solid	GO 1, GO 2	On-going. Partially completed		
	areas of performance for SWM.				
GA 2	Prepare, consult on and publish specific policies for managing certain product-related, hazardous and difficult waste streams.	GO 1, GO 3	This action will elaborate on the general guidance contained in the National SWM Policy, and set out detailed guidance and the Government's intentions for managing specific waste streams which are costly, intrinsically hazardous and / or otherwise problematic to manage.		
GA 3	Review, consult on and reform existing national legislation and regulations relating to SWM.	GO 4, GO 5, GO 6, GO 7, GO 8	The Government will enact a new framework law, the "Sustainable Solid Waste Management Act", which will embed in law our long- term national goal and strategic objectives for SWM, give legal force to the Government's policies and principles set forth in the National SWM Policy, and generally facilitate a more comprehensive, integrated and sustainable approach to solid waste management.		
GA 4	Incorporate in law a general Duty of Care (with certain exemptions) on the part of any person who imports, produces, carries, keeps, treats or disposes of waste or, as a broker, has control of waste; Publish a detailed statutory code of practice on the responsibilities and actions required to comply with such duty of care.	GO 4, GO 5, GO 6	This action will place a legal obligation on anyone who produces, imports, keeps, stores, transports, treats or disposes of waste to take all reasonable steps to ensure that waste is: - Managed properly and in accordance with the law; - Transferred only to appropriately licensed people; and - When it is transferred, it is sufficiently well described to enable its safe recovery or disposal without endangering human health or harming the environment. It will also provide practical guidance for everyone subject to the		
GA 5	 Prepare, consult on and revise / enact secondary legislation for: Regulating specific waste-generating products, waste management activities and waste streams; and Prohibiting or otherwise controlling the import of products or materials which are potentially hazardous and / or difficult to recover and /or dispose of when discarded. 	GO 4, GO 5, GO 6	Duty of Care on the steps required to fulfil their obligations. This action will provide the necessary legal powers to regulate and control by statutory instrument particular waste-generating products, WM activities and waste streams, and the importation of products or materials which are potentially hazardous and / or difficult to recover and /or dispose of when discarded, including but not limited to packaging waste, ELVs, end-of-life tyres, WEEE, used mineral and synthetic oils, used batteries and accumulators (see section 4.1 below).		
GA 6	Repeal all existing legislative acts or instruments which are conflicting, irrelevant or obsolete.	GO 6, GO 7	This will be undertaken in conjunction with action GA 3 above.		
GA 7	Require that all local policies, regulations and by-laws relating to SWM are aligned and harmonised with national policies, legislation and regulations.	GO 8	This action will require local authorities to incorporate relevant national SWM legislation and standards into local regulations / by-laws within one year of their coming into effect.		
GA 8	Prepare, consult on and publish a strategy for compliance monitoring and enforcement.	GO 9, GO 11	This action will establish a set of clear priorities and actions for compliance monitoring, inspection and enforcement in relation to major waste producers, SWM facilities and WM service providers.		





	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
GA 9	Review and, where necessary, increase penalties for non- compliance to reflect the nature of the offences and potential / actual harm caused, and to create an appropriate deterrent.	GO 10	This action will ensure that penalties for non-compliance with SWM legislation and standards are proportionate to the nature of the offence and the harm caused, and are fair, consistent and flexible.		
GA 10	Actively promote collaboration between regulatory agencies, and provide sufficient resources and powers to tackle waste dumping, littering and other illegal activities effectively.	GO 9, GO 11, GO 12	This action will seek to ensure that regulatory agencies collaborate, and use their collective resources and powers to tackle waste dumping, littering and other illegal activities effectively.		
GA 11	Establish criteria and guidelines, and implement a programme, for annual inspections of all licensed waste management facilities.	GO 9, GO 11	The details of this action will be elaborated in the strategy for compliance monitoring and enforcement described in GA 8.		
GA 12	Examine a range of issues around prevention, detection and enforcement including sentencing guidelines, collaborative working and guidance to organisations engaged in waste management activities.	The a range of issues around prevention, detection and ement including sentencing guidelines, collaborative g and guidance to organisations engaged in waste ement activities.			
Institu	tional / Organisational Arrangements:				
GA 13	Establish an Inter-ministerial Steering Group, Chaired by the MNRA, to supervise, co-ordinate and monitor implementation of the National SWM Policy and this Strategy.	GO 13, GO 18	Besides the MNRA, the Steering Group will include representatives of the Ministries of Finance & Economic Development; Forestry, Fisheries & Sustainable Development; Health; Labour, Local Government & Rural Development; as well as the Belize Solid Waste Management Authority and the Department of Environment.		
GA 14	Review, consult on and reform existing institutional and organisational arrangements in order to establish a more streamlined governance structure for SWM which clearly delineates and assigns roles and responsibilities at national, local and organisational levels.	GO 13, GO 14, GO 15	The reformed institutional structure envisaged for solid waste governance is presented in Figure 18 below.		
GA 15	Reconfigure the DOE and strengthen the institutional arrangements and systems for environmental permitting, monitoring and enforcement throughout Belize (including all solid waste management operations and facilities).	GO 16, GO 17	The primary responsibilities and functions of a reconfigured and strengthened DoE are summarised in Table 12 below.		
GA 16	Reconstitute BSWaMA as an autonomous, wholly Government- owned corporation responsible for organising, procuring and supervising the provision of SWM infrastructure and services throughout Belize (including hazardous WM facilities and services).	GO 13, GO 14, GO 16, GO 18, GO 21	The primary responsibilities and functions of a reconstituted BSWaMA are summarised in Table 13 below.		
GA 17	Ensure that the human and other resources available to public institutions involved in SWM are sufficient to fulfil their legal responsibilities and assigned tasks effectively.	GO 16, GO 19	The Government recognises that public institutions involved in SWM often lack the human and other resources required to fulfil their legal responsibilities and assigned tasks effectively. This action will be implemented following completion of action GA 21.		
GA 18	Facilitate and incentivise cooperation between contiguous local authorities in order to realise economies of scale and other potential efficiencies in SWM service provision.	GO 19, GO 20	This action is essential to ensure that municipal SWM and public cleansing services can be procured and delivered cost-effectively. Incentives for contiguous local authorities to cooperate will be developed and implemented in conjunction with GA 41 below.		
GA 19	Introduce measures to encourage private sector participation in the development, delivery and operation of public WM	GO 20, GO 21	Unless there are compelling reasons for doing otherwise, the Government intends that public WM infrastructure and services will		





	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
	infrastructure and services wherever increased value in terms of service quality and / or cost-effectiveness can be achieved through the exploitation of private sector skills and resources.		generally be financed, developed and operated in partnership with appropriately qualified and experienced private SWM service providers.		
GA 20	Strengthen the system and procedures (including model forms of tender / contract adapted for use in Belize) used for procuring infrastructure and services for MSW collection / transport, treatment, disposal and street cleaning services throughout Belize.	GO 21	This action, together with action GA 16 above, will provide the foundation for implementing action GA 19.		
Human	Resources / Capacity:				
GA 21	Carry out a human resource and training needs assessment for public sector SWM institutions and functions, including monitoring, inspection and enforcement.	GO 23, GO 24	An in-depth assessment of the numbers and capacities of human resources required to perform various public SWM functions satisfactorily will be carried out. This action is required <i>inter alia</i> to enable informed decisions to be taken in respect of actions GA 10, GA 15, GA 16 and GA 17.		
GA 22	Establish national vocational qualifications and professional standards, and promote the establishment of an independent professional body for people engaged in SWM activities in both the public and private sectors.	GO 22, GO 25, GO 26, GO 27	This action will create a national system for offering and delivering specialised training in solid waste management, in order to promote greater technical and managerial competence and professional recognition at all levels. An independent national body will be given overall responsibility for developing appropriate training programmes and courses, for awarding vocational qualifications, and for promoting high professional standards.		
GA 23	In accordance with the provisions of the forthcoming Occupational Safety and Health Act 2014, develop, consult on and enact a sector regulation, supporting guidance and a detailed statutory code of practice on the Occupational Health and Safety of people engaged in SWM activities.	GO 24, GO 25	The health risks and hazards confronted by people engaged in SWM activities, especially manual workers and plant operatives, are much greater than those typically found in other sectors. This action aims to reduce those risks and achieve a high level of protection for people engaged in SWM activities.		
GA 24	Commission an independent review into the compensation, benefits and conditions of employment of public sector staff and workers engaged in SWM activities with the aim of ensuring that they reflect adequately the contributions / value of the workforce to Belizean society.	GO 28	The Government is aware of the crucial importance of attracting, retaining and motivating appropriately qualified and experienced staff and workers. This action, together with GO 21 and GA 22, is intended to be a first step towards improving the pay, skills and working conditions of public sector staff and workers involved in managing wastes, including those employed by local authorities.		
Data A	vailability, Monitoring & Reporting:				
GA 25	Establish a national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes, and SWM processes / facilities.	GO 29, GO 30	A web-based, national waste information system, supported by integrated systems and procedures for data classification, capture, verification and reporting, will be established and maintained by the Statistical Institute of Belize. As well as data series covering all main waste types and flows, details of licensed SWM facilities, etc., the system will incorporate a set of key performance indicators (KPIs) which will be used to measure and monitor progress with Strategy implementation, and provide the basis for progress reports to be published annually by BSWaMA (see action GA 33 below).		



	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
GA 26	In conjunction with the measure envisaged in GA 3 above, introduce a legally-binding obligation on waste producers (with the exception of householders and certain SMEs) and SWM service providers to collect, record and report data and information about the wastes they generate / manage.	GO 29, GO 31	This action will support the implementation of GA 25 above.		
GA 27	Require that all public SWM facilities of a significant size (e.g. a design capacity of 20,000 tons per annum or greater) are equipped with electronic weighbridges and databases that can be accessed and interrogated remotely.	GO 29, GO 30	A weighbridge is now available at the recently-opened regional landfill facility at Mile 24. Modern electronic weighbridges and the control systems are relatively inexpensive to purchase and install, and they provide invaluable information not only about day-to-day WM activities but also about long-term trends. We will therefore ensure that in future all public SWM facilities of a significant size are equipped with electronic weighbridges and databases that can be accessed and interrogated remotely by the responsible authorities.		
Stakeh	older Awareness & Communication:				
GA 28	Ensure that relevant stakeholders are involved and consulted at all stages in the development, implementation and subsequent review of the National Solid Waste Management Policy, Strategy and Plan.	GO 32	This action has already commenced and will be on-going over the life of the Strategy.		
GA 29	Prepare, consult on, adopt and implement a targeted strategy / programme for on-going communications and consultations with, and participation of, all key stakeholders.	GO 32, GO 33, GO 34	A targeted programme for stakeholder communications is under preparation.		
GA 30	Develop and implement a targeted education and awareness programme for the wider public (with special emphasis on schools / children).	GO 32, GO 35	This action is aimed at bringing about fundamental long-term changes in attitudes and behaviour in our society. Today's schoolchildren and students are tomorrow's opinion formers and decision-makers. Experience in other countries also shows that schoolchildren and students can exert considerable influence over the attitudes and behaviour of their parents and other older members of society. Priority and greater prominence will therefore be given to SWM and related health and environmental issues in educational curricula.		
GA 31	Make available sufficient financial and other appropriate resources to enable Planned Actions GA 28, GA 29, GA 30 and GA 33 to be implemented effectively.	GO 34, GO 36	Part of the revenue stream generated by action GA 38 below will be earmarked to cover the costs involved in realising this action.		
GA 32	Under the leadership of the Ministry of Education, Youth and Sports, take steps to ensure that SWM issues are sufficiently and appropriately addressed within educational curricula and programmes.	GO 35	This action will support the realisation of action GA 30 above.		
GA 33	Establish and resource a national focal point for implementation and coordination of the strategy / programmes foreseen by the NSWMP.	GO 36	A fully staffed and resourced national focal point will be established within the reconstituted BSWaMA (action GA 16), with a dedicated budget and the overall responsibility for planning, coordinating and implementing the stakeholder communications and education and awareness programmes in close cooperation with the Ministry of Education, Youth & Sports and other GoB departments / agencies.		



	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
Financ GA 34	Ting / Cost Recovery: Until 2020, continue to finance major investments in strategically essential SWM facilities and infrastructure through a combination of IFI / bilateral loans and resources from the State budget.	GO 42	This action represents a continuation of the approach which has been used to finance the development of SWM infrastructure in the Western Corridor, as a short-to-medium turn measure.		
GA 35	Over the medium-to-long term, allow the reconstituted BSWaMA envisaged by Strategic Action GA 16 and other public authorities / entities with legally mandated responsibilities for SWM to set their facility user fees / service charges at levels that enable them to accumulate sufficient capital reserves to be able to finance investments in new and replacement SWM facilities and infrastructure from their own budgetary resources and / or through long-term credits from IFIs.	GO 37, GO 38	This action, in conjunction with action GA 37, is aimed at putting SWM infrastructure and services on a financially stable and sustainable footing over the medium-to-long term by ensuring that the revenues generated and allocated for this purpose are sufficient to be able to cover the full costs (including capital depreciation / debt servicing) of developing and operating public facilities and services that will enable us to meet our strategic objectives and targets for managing solid wastes (see section 4.1 below).		
GA 36	Finance (fully or partly) the investments required for expanding and upgrading MSW collection and street cleaning services through private sector participation in the delivery of these services.	GO 42	In order to extend the coverage and improve the quality of MSW collection and street cleaning services, major new investment in waste storage containers, collection vehicles and other equipment is needed.		
GA 37	In line with the Polluter Pays Principle, progressively introduce / increase charges for the use of publicly owned / operated waste management facilities and services to levels which reflect the Long Run Marginal Cost (LRMC) of their provision and operation.	GO 37, GO 38 MO 2, MO 23, MO 32	An explanation of the Polluter Pays Principle, and its importance both as a revenue-generating mechanism and as an incentive to reduce waste, may be found in section 3.5 of the National SWM Policy. Estimates of the costs of achieving our strategic objectives and targets for managing MSW are presented in Chapter 7 below.		
GA 38	 Consult on, adopt and implement for a transitional period a system for cost recovery comprising: A separately itemised fee included in electricity supply bills sufficient to recover the full operating costs (OPEX) of managing household solid wastes; and A reformed environmental tax regime, a part of the revenues from which is earmarked to finance the capital costs (CAPEX) of the infrastructure, vehicles and equipment required to manage wastes in a sustainable manner. 	GO 42	 This action will continue whilst user fees for SWM facilities and services are gradually extended and increased to a level where their costs (including CAPEX) are fully covered by revenues and they become financially sustainable without subvention (action GA 37). Changes to the existing environmental tax regime are expected to include: Differential tax rates applied to certain goods (both imported and domestically-produced) which, when discarded, create a substantial burden on the environment and / or result in significant public expenditure for their environmentally-sound collection, treatment and disposal (see also planned action WMA 2 below; Hypothecating (earmarking) the resulting revenues to be used exclusively for the purpose of financing investments in SWM infrastructure, vehicles and equipment. Consideration will also be given to broadening the environmental tax base and channelling the resulting revenues to an extrabudgetary Waste Management Investment and Contingency Fund. 		



	Table 11: Planned Actions for Reforming and Improving Waste Governance				
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*		
GA 39	Introduce a legally-binding obligation on all producers of commercial, institutional and other non-residential wastes to have a contract ("service agreement") for the collection, transport and disposal of their wastes with a licensed service provider.	GO 37, GO 38, GO 39, GO 41	This action will be implemented in conjunction with actions GA 3 and GA 4 above, and will help to deter non-residential waste producers from employing unlicensed service providers, and ensure that such wastes are managed in a safe and environmentally-sound manner.		
GA 40	Assess and publish estimates of the full costs of managing the wastes covered by the National SWM Policy in an environmentally sound manner, and ensure that these are explained to / understood by local authorities and waste producers.	GO 38, GO 41, GO 42, GO 43 MO 2, MO 23, MO 32	This action is intended to support various other planned actions, in particular GA 37, GA 41, GA 43, WMA 3 and WMA 8 below.		
GA 41	Ensure that revenues from the user fees and taxes envisaged by actions GA 37 and GA 38 are equitably and appropriately distributed to those public authorities / entities with legally-mandated responsibilities for SWM.	GO 40, GO 41, GO 42	This measure will rectify any existing and unjustified regional / local disparities in the allocation and distribution of funds earmarked for developing and operating SWM infrastructure and services.		
GA 42	Develop and implement a subsidy / rebate scheme targeted at low-income groups that meet certain criteria and can provide reliable evidence that they cannot afford to pay full cost recovery charges for household waste management and public cleansing services.	GO 42	This measure will address any problems of affordability amongst low-income groups that may arise as a consequence of implementing action GA 37 above. For a further explanation and assessment of affordability, see section 7.5.2 below.		
Waste Prevention:					
GA 43	Prepare, consult on, publish and then implement a Waste Prevention Programme containing a range of measures for waste prevention and reduction.	GO 44, GO 45, GO 46	 The planned Waste Prevention Programme will contain a range of policies & measures for waste prevention and reduction, including: <i>Informational</i> policies and measures aimed at changing behaviour and making informed decisions; <i>Promotional</i> policies and measures, which incentivise behavioural change and provide financial and logistical support for beneficial initiatives; <i>Regulatory</i> policies and measures, which enforce limits on waste generation, expand environmental obligations and impose environmental criteria in public sector contracts. The Programme will be developed and implemented in conjunction with planned actions WMA 1, WMA 2, WMA 3 and WMA 4 below. 		
GA 44	Consider and consult on the possibility of introducing a levy on wastes disposed of at landfill facilities, the revenues from which would be earmarked and allocated for implementing the measures set out in the Waste Prevention Programme.	GO 43	Such a levy would not only help to finance the implementation of action GA 43, but also create a financial incentive to prevent, recover and pre-treat wastes. However, this action will need to be considered in the light of progress with implementing actions GA 8, GA 9 and GA 10 above – otherwise there is a risk that a landfill levy will lead to an increase in illegal waste dumping.		
GA 45	Introduce statutory powers to enable local authorities to take specific action to reduce wastes produced in their area.	GO 43, GO 46	This action is intended to support implementation of action GA 43 above.		

<u>Note</u>: * Further information may be found in *Annex D of the National Solid Waste Management Policy*.





Figure 18: Reformed Institutional Structure for Solid Waste Governance



 Table 12: Primary Responsibilities and Functions of a Reconfigured & Strengthened DoE

- Formulate and implement regulatory plans, policies and procedures to protect and enhance the environment as a whole, and to promote the sustainable management of natural resources;
- Grant and revoke authorisations / licences, with or without conditions, for the carrying out of any operation or activity relating to or which may have a significant impact on the environment;
- Formulate and implement a strategy for compliance monitoring and enforcement;
- Establish criteria and guidelines, and implement a programme, for annual inspections of all licensed operations and activities;
- Carry out enforcement actions as necessary, and in collaboration with other regulatory bodies as appropriate, to ensure compliance with legislation, regulations and standards falling within the Agency's jurisdiction;
- Carry out studies, research or investigations on any matter relating to the environment;
- Provide information and issue guidelines to the public and to commercial and other entities on matters relating to the environment;
- Ensure that international obligations entered into by the Government relating to matters regulated by the Agency are complied with;
- Advise the designated Minister on the formulation of policy in relation to matters regulated by the Agency, and in particular in relation to international obligations;
- Make or advise the designated Minister on the making of environmental standards, guidelines and regulations as well as on the formulation and implementation of contingency and emergency plans to safeguard the environment;
- Monitor the quality of the environment and for such purpose establish methodologies, and maintain and disseminate information related to the environment;
- Establish and maintain a national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes and SWM processes / facilities;
- Publish reports on the state of the environment;
- Ensure that environmental audits and environmental assessments prescribed by law are properly carried out;
- Provide support and advisory services relating to environment protection, to Government and local authorities in relation to the performance of their functions;
- Administer in accordance with policies and regulations on producer responsibility, the registration of businesses, products and exemption schemes, and the monitoring and enforcement of associated obligations.
- Provide, either alone or in collaboration with others, education, training and public awareness programmes relating to environmental protection, and the sustainable management of the environment and natural resources;
- Formulate and publish advice on best practices for protecting and enhancing the environment, and promote their application.

Integrated Skills

Table 13: Primary Responsibilities and Functions of a Reconstituted BSWaMA

- Plan, organize, procure, manage and operate / supervise integrated systems for managing wastes throughout Belize, including systems for the minimisation, storage / containment, collection, transport, sorting, reuse, utilisation, recycling, treatment and final disposal of solid and hazardous wastes;
- Plan, organize, procure, supervise and control the provision and operation of integrated systems for the pre-storage, packing and export of wastes to appropriately equipped and licenced facilities outside Belize, as may be necessary;
- Develop appropriate sites and facilities in accordance with national and international legislation and standards in order to ensure sustainable waste management;
- Remediate old waste dump sites and "hot spots" in accordance with national and international legislation and standards;
- Develop and adopt procedures and documentation (including model forms of tender / contract) for procuring infrastructure and services for MSW collection / transport, treatment, disposal and street cleaning services throughout Belize;
- Carry out studies, research or investigations on any matter relating to the management of wastes;
- Provide information and issue guidelines to the public and to commercial and other entities on matters relating to the management of wastes;
- Advise the designated Minister on the formulation of policy in relation to the sustainable management of wastes;
- Advise the designated Minister on the making of technical standards, guidelines and regulations as well as on the formulation and implementation of contingency and emergency plans for managing wastes;
- Monitor, maintain and disseminate information on the quality and performance of public SWM infrastructure and services throughout Belize;
- Provide support and advisory services relating to waste management, to Government and local authorities in relation to the performance of their functions;
- Provide, either alone or in collaboration with others, education, training and public awareness programmes relating to waste prevention and management;
- Formulate and publish advice on best practices for preventing and managing wastes sustainably.



4. STRATEGY FOR WASTE MANAGEMENT

This chapter presents the Government's strategy for the *physical handling of solid wastes after they have been generated*.

4.1 Policy Objectives and Targets for Waste Management

In order to establish a basis for assessing the technical options and projecting the system capacities required for physically managing solid wastes in an environmentally-sound manner, we have set a number of strategic policy objectives and targets for *waste management*. These have likewise been extracted from the National SWM Policy and are summarised in **Table 15**. In addition to the policy objectives shown in **Table 15**, we have also set targets for a managing a number of specific wastes / waste streams. These are presented in **Table 14**.

Table 14: Targets for Managing Specific Wastes / Waste Streams				
Waste Type/Stream	Target	To be Achieved by:		
MSW generation	Maximum 360 kg / capita / annum	On-going		
MSW going to landfill disposal	100% of collected MSW requiring final disposal is deposited in sanitary landfills	2021		
Collection of household and commercial waste	100% of household and commercial premises receive a regular service	2021		
Civic Amenity (CA) sites	Establish a nationwide network of CA sites	2018		
Separate Collection of recyclables from households	Commence service in urban areas with gradual roll-out	2021		
Separate Collection of bio- waste from households	Commence service in urban areas with gradual roll-out	2021		
Offering a service for	Provide drop-off points at CA sites	2018		
Hazardous Household Waste	Offer separate collection service (urban)	2021		
Tyres	Ban on landfilling of end-of-life tyres	2018		
Liquid wastes	Ban on landfilling of liquid wastes	2018		
Healthcare "risk" waste	Ban on landfilling of healthcare "risk" waste	2018		
Untreated wastes	Ban on landfilling of untreated wastes [in other countries, separate collection of recyclables is a form of treatment]	2021		
Packaging waste	Total recovery of at least 60% by weight	2021		
Batteries and accumulators	Ban on the import and sale of batteries containing more than permitted limits of Hg, Cd, Pb	2018		
	Efficient organisation of separate collection	2018		
Waste Electrical and Electronic Equipment (WEEE)	Ban on the import and sale of new electrical and electronic equipment containing Hg, Cd, Pb, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)	2018		
	Offering a system for the collection and recovery of WEEE at collection centres	2018		
	Recovery of at least 4 kg (~9 lbs) / capita / annum of WEEE from private households	2021		
End-of-Life vehicles (ELVs)	Recovery and processing for recycling of at least 95% of de-registered vehicles	2021		
Used Oils	Offering a system for the collection and recovery of used oils at collection centres	2018		



	Table 15: Strategic Policy Objectives and Targets for Waste Management							
	Policy Objectives	Target Date*						
Waste	Recovery and Recycling:							
MO 1	Government policy and support for secondary raw material and product markets exist.	2021						
MO 2	Fees / charges for managing and disposing of wastes provide an incentive to recover / recycle materials from waste.	2021						
MO 3	Legislation requiring the return of a wider range of empty beverage containers and other types of product packaging for re-use / recycling exists.	2018						
MO 4	Manufacturers, importers and distributors of products giving rise to specific / difficult wastes / waste streams are obliged to take-back the wastes resulting from their products for subsequent re-use / recycling.	2021						
MO 5	Long-term markets for recyclable materials exist.	On-going						
MO 6	Local / regional market outlets for a wider range of recyclable materials exist.	On-going						
MO 7	Costs incurred for segregation, collection and shipment do not inhibit the export of some recyclable materials.	On-going						
MO 8	Economic incentives to recover and recycle waste are available.	2021						
MO 9	Users of raw materials consider waste to be part of the material cycle.	2021						
MO 10	Product suppliers, consumers and other waste generators are aware of the potential opportunities for, and benefits of, recovering and recycling of wastes.	On-going						
Waste	Segregation, Storage, Collection and Transport:							
MO 11	Equipment and other resources for temporary containment, collection and transport of MSW and other wastes are adequate.	2021						
MO 12	Tariffs and charging mechanisms for waste collection services encourage waste segregation by waste producers.	2021						
MO 13	Arrangements for segregating and separately storing potentially hazardous and difficult wastes prior to collection are adequate.	2018						
MO 14	Systems for segregating and separately storing recyclable materials prior to collection are sufficiently developed.	2021						
MO 15	Systems for segregating and separately collecting biodegradable wastes are sufficiently developed.	2021						
MO 16	Systems for the transfer / bulk transportation of hazardous and difficult wastes to centralised treatment / disposal facilities are sufficiently developed.	2021						
MO 17	An integrated national system and supporting regulations for the segregation, separate storage and collection of hazardous wastes (including healthcare risk waste) exists.	2021						
MO 18	Methods / practices for the collection of MSW do not inhibit / prevent the efficient use of resources.	2018						
MO 19	A competitive market for the provision of various waste collection and transport services is fully developed.	On-going						
Waste	Treatment / Processing:							
MO 20	Legislation and standards governing the treatment / processing of wastes are sufficiently developed and enforced effectively.	2018						
MO 21	Facilities for the treatment / processing of wastes outside the Western Corridor comply with modern standards of design and operation.	2021						
MO 22	Staff and operatives engaged in waste treatment and processing activities are adequately trained and qualified.	2018						
MO 23	The financial cost of landfilling untreated waste, relative to the costs of waste treatment / processing, does not inhibit investment in new or upgraded treatment / processing facilities.	2018						
MO 24	Facilities for storing, treating, processing and / or exporting hazardous wastes exist and are functioning properly.	2021						
MO 25	Facilities for treating / processing slaughterhouse, international solid waste and other difficult wastes are sufficient.	2021						



Table 15: Strategic Policy Objectives and Targets for Waste Management								
	Policy Objectives							
MO 26	Facilities for reducing the volume of wastes going to landfill exist.	2021						
MO 27	Systems / facilities for processing of recovered packaging materials are sufficient.	2021						
MO 28	MO 28 Systems / facilities for processing of other product-related wastes streams (e.g. waste oils, ELVs, WEEE, etc) are sufficient.							
Final D	Disposal:							
MO 29	Legislation and standards governing the final disposal of wastes are adequate and properly enforced.	2021						
MO 30	Facilities / practices for the final disposal of wastes outside the Western Corridor comply with modern standards / best practices.	2021						
MO 31	Sufficient facilities for the environmentally-sound disposal of wastes exist.	2021						
MO 32	Tariffs / charges for the final disposal of wastes reflect the full costs of landfilling wastes in accordance with modern standards / best practices.	2021						
MO 33	Financial resources available for the identification, assessment, closure, remediation and restoration of all old waste dump sites and "hotspots" are sufficient.	On-going						

Note: * To be achieved by year-end.

4.2 Key Assumptions

4.2.1 Future Waste Quantities

The starting point for estimating the quantities of MSW that may be generated in future is the analysis of MSW generated in the Western Corridor undertaken in 2011. Using the results of this analysis, it is estimated that a total of around 100,000 metric tonnes (\sim 110,000 short tons) per annum of MSW is currently generated, of which approximately 70% is collected through an organised collection service (see section 2.2.1 above).

The generation of household and similar commercial and industrial solid wastes (together comprising MSW) is closely linked to *population size* and *economic prosperity* (GDP). For the purposes of assessing the options, future capacities required and associated costs for managing this waste stream, a baseline projection of future waste generation was developed based on the following assumptions:

- An average population growth rate of 2.7% per annum over the period covered by this Strategy;
- 100% correlation between waste generation and growth in GDP (assumed to be 3% per annum).

The above assumptions represent the highest of recently published population and GDP growth forecasts for Belize, and can therefore be regarded as a "worst case" scenario in terms of the prospective future generation of MSW and similar wastes¹⁷. If in fact waste generation grows at a significantly lower rate than growth in either population or GDP, then the future waste handling capacities required and related costs will be correspondingly lower. *This demonstrates one of the main benefits of measures to prevent and reduce wastes.*

Applying these assumptions to the estimated quantity of MSW currently generated, a projection of the quantities of MSW that may be generated in future was prepared and is presented in **Table 16**. The projected quantities include an allowance for the contribution to MSW generation made by visiting tourists.

Table 16: Projected Quantities of MSW Generated in metric tonnes per annum								
Year	2015	2020	2025	2030				
Corozal Urban	3,514	4,428	5,605	7,128				
Corozal Rural	7,455	9,674	12,584	16,407				
Orange Walk Urban	4,676	5,891	7,457	9,482				
Orange Walk Rural	7,809	10,134	13,183	17,187				
Belize City	22,042	28,379	36,654	47,482				
San Pedro	6,310	7,742	9,550	11,845				
Belize Rural	5,958	7,731	10,058	13,113				
San Ignacio	6,082	7,661	9,696	12,327				
Benque Viejo	2,111	2,660	3,369	4,285				
Belmopan	5,408	6,964	8,997	11,656				
Cayo Rural	8,984	11,659	15,167	19,774				
Dangriga	3,289	4,145	5,248	6,675				
Placencia	1,546	1,897	2,342	2,906				
Stann Creek Rural	5,194	6,740	8,767	11,431				
Punta Gorda	1,830	2,305	2,918	3,711				
Toledo Rural	6,161	7,995	10,401	13,560				
TOTAL MSW	98,369	126,004	161,995	208,968				

¹⁷ For further information, see World Population Prospects: The 2012 Revision,

http://esa.un.org/unpd/wpp/index.htm and http://www.worldbank.org/en/publication/global-economic-prospects/regional-outlooks/lac#2



4.2.2 Other Assumptions

The other key assumptions underlying the analysis of SWM options and scenarios presented later in this Chapter, and the capacity estimates and cost projections presented in Chapter 7 below are summarised in **Table 17**.

Table 17: Other Key Assumptions							
Parameter / Variable	Assumption						
Current average MSW collection rate	Urban – 80% by weight; Rural – 50% by weight						
Prices (ex-plant) of recyclable materials recovered	Metals - 75						
from MSW (BZD per metric tonne)	Paper & Board - 40						
	Glass - 0						
	Plastics (average) - 100						
	Compost - 0						
Average fee charged for managing commercial wastes	BZD 40 per 1,100 litre container (~ BZD 242 per metric tonne)						
Cost recovery	Full cost recovery (of OPEX only or OPEX + CAPEX – see below) is achieved in 2020						
Average household size ¹	4.06 persons						
Average household income ²	BZD 215 per capita per month (lowest income quintile)						
Future growth in GDP	3% per annum						
Future growth in household income	3% per annum						
Correlation of waste growth to GDP	100%						
Discount rate	7.5%						
Future price inflation	Not taken into account. All cost estimates and projections are expressed in constant (2014) prices						
Number of households served by one recycling container	25						
Proportion of total user fees for MSW management services actually collected ("fee collection rate")	80%						
Waste container depreciation period	10 years						
Vehicle depreciation period	7 years						

1. Based on data published by the Belize Statistical Institute.

2. Derived from Design of Cost Recovery Mechanism for the Western Corridor, Final Report, Hydroplan, May 2011.

In addition to the assumptions presented in **Table 17**, for the purposes of modelling and projecting waste flows and evaluating alternative strategic SWM scenarios, we have also made some key assumptions about the efficiency of various waste management processes, including material capture rates for waste segregation and separate collection. These are necessary to reflect the practicalities of introducing such systems to a public that has never been required to participate in such a system. These are shown in **Table 18**:

Table 18: Assumptions About the Efficiency of Various SWM Processes, % by weight										
Years 1-5 6-10 11-15 16-20										
Separate Collection Capture Rate	30%	50%	62%	75%						
Composting reject rate	15%	15%	15%	15%						
MRF reject rate	20%	15%	10%	10%						
Reuse of Belize Incinerator Bottom Ash ¹	30%	30%	30%	30%						
Belize Incinerator Fly Ash ²	3%	3%	3%	3%						

1. Assumed to be used for civil engineering purposes.

2. Deposited at Mile 24 hazardous waste landfill cell.

4.3 Technical Options and Strategic Scenarios for MSW Management

4.3.1 Technical Options

An illustrative overview of the *technical options for managing municipal and similar solid wastes* is presented in **Figure 20**. Brief descriptions of each of the technical options illustrated are provided in **Annex B**.

As may be seen, various options are available for the management of either *mixed solid waste* or of *materials separated from it for recovery/recycling or pre-treatment* prior to disposal. After waste prevention and re-use, the waste management hierarchy (see section 3.6 of the National SWM Policy) accords the highest preference to recycling, over energy recovery and disposal options.

For economic success, recycled products need to *find a market at a price that at least covers the cost of their recovery* (minus any subsidies). The price commanded by recycled materials is highly dependent on quality, with clean, well-sorted and contaminant-free secondary materials commanding a higher price than mixed, low quality or dirty material. Indeed, in many instances low quality recyclate has no market and so must be disposed of at cost. Experience has shown that for MSW, segregation of material for recycling at the point at which it is generated and discarded (i.e. at households and businesses) provides the highest degree of clean, contaminant-free material for recycling.

Two main types of waste management option can therefore be considered, depending on whether or not *source segregation and separate collection* of various waste components is undertaken – see **Figure 19**. A summary of the variants, main advantages and disadvantages of each option is presented in **Table 19**. Those options which are either already used, or are planned to be used, on a significant scale in Belize are highlighted in **red font**.



Figure 19: Technical Options Considered





Figure 20: Overview of Technical Options for Managing Municipal & Similar Solid Wastes



	Table 19: Waste Management Options, Main Variants, Advantages & Disadvantages											
Option	Main Variants	Main Advantages	Main Disadvantages									
Landfilling of untreated mixed wastes	• With / without landfill gas recovery	 If landfill gas is recoverable in sufficient quantities, this can be used for energy production If landfill gas is recovered, GHG emissions are significantly reduced 	 Can give rise to significant adverse environmental impacts Quantities of recoverable landfill gas diminish over time Environmentally unsustainable, especially on a large scale 									
Source segregation and separate collection of waste fractions for subsequent recovery / recycling	 With / without segregation of kitchen, garden and other clean organic wastes Kerbside collection of source-separated waste Delivery of recyclables to a CA site / HWRC 	 Much higher material capture rates are achievable Quality of materials collected for recycling is also much better 	 Usually significantly more expensive to establish and operate than collection of mixed waste Environmental impacts of additional collection activities 									
Transfer-loading	 Road / rail / marine transfer With / without waste compaction With / without pre-sorting of recyclables and screening of hazardous / difficult wastes With / without intermodal containerisation 	 Reduced transport costs compared with transporting wastes directly in collection vehicles over long distances Reduced pollution from transporting wastes Can also serve as a HWRC 	 High capital costs for rail / marine transfer (but lower operating costs than road transfer) Does not provide any final treatment of waste If not well located and designed, can give rise to adverse environmental impacts 									
Incineration (combustion) of mixed wastes and / or residual wastes from other treatment processes	 Mass-burn incineration with: Energy recovered as electricity Energy recovered as heat and power (CHP) Rotary kiln incineration (usually used for treating hazardous / difficult wastes) Fluidised bed combustion of refuse-derived fuel (RDF) 	 Little or no pre-treatment required Large reductions (~80%) in the volume of waste requiring landfilling are achievable Significant potential for use as a source of renewable energy Incinerator bottom ash (IBA) can be used in construction 	 High capital costs Low public knowledge / acceptance Incinerator fly ash should be managed as a hazardous waste 									
Advanced Thermal Treatment (non-combustion)	 Pyrolysis / gasification Plasma gasification Fluidised bed gasification of refuse- derived fuel (RDF) Mechanical Heat Treatment (e.g. autoclaving) 	 ATT technologies can be applied to produce energy, fuels and / or chemical products Pyrolysis / gasification are claimed to have lower emissions of pollutants than incineration ATT technologies are claimed to be economically viable at smaller scales than conventional incineration Plant designs are usually modular 	 Pre-treatment of wastes required When optimised for power generation, existing gasification and pyrolysis technologies are less energy efficient than modern mass-burn incineration technology Most Advanced Thermal Treatment technologies are not fully developed / proven on a large scale High capital costs 									



Table 19: Waste Management Options, Main Variants, Advantages & Disadvantages											
Option	Main Variants	Main Advantages	Main Disadvantages								
Mechanical Treatment for Recycling	 "Dirty" Materials Recovery Facility "Clean" Materials Recovery Facility 	 Reduces the volume of waste requiring landfilling, especially in the case of a "clean" MRF With a "clean" MRF, much higher material recycling rates are achievable 	 Quality of materials recovered by a "dirty" MRF is usually inferior to that of a "clean" MRF "Clean MRFs" require segregation and separate collection of recyclable materials 								
Biological Treatment for Recycling	 Composting: Open systems (windrows) In-vessel composting (IVC) Anaerobic digestion (AD) with: Power generation Heat recovery 	 Reduces the volume of waste requiring landfilling (20%-40%), especially if used in conjunction with separate collection of organic wastes Compost / digestate recovered can be used beneficially as a low-grade soil conditioner / fertiliser in agriculture / horticulture Biogas from AD can be combusted to provide heat, electricity (or both) Plant designs for IVC and AD are usually modular 	 Open windrow systems require large sites and can give rise to odour problems. Unless local markets exist for recovered compost / digestate, reductions in the volume of waste requiring landfilling are small compared with incineration. High capital costs for IVC and AD 								
Mechanical Biological Treatment (MBT)	 With landfilling of reject fraction With incineration of reject fraction as an RDF for energy recovery 	 > Uses a combination of proven technologies which can be configured to achieve different objectives > Reduces the biodegradability of the reject fraction > Reduces the volume of waste requiring landfilling, especially if the reject fraction is used as an RDF for energy recovery > Can remove additional recyclable materials from the waste stream 	 Lower capital costs but higher operational costs than some other treatment options MBT in itself does not result in the final treatment of waste Markets for outputs may be limited Unless local markets for outputs exist, reductions in the volume of waste requiring landfilling are small compared with incineration Where the reject fraction is used as an RDF for energy recovery, less energy efficient than modern mass-burn incineration technology 								



4.3.2 Strategic Scenarios

In order to evaluate different options and strategic scenarios for improving the management of municipal and similar solid wastes, a waste flows and costs model for Belize was developed. This model has many parameters which can be adjusted – such as the rate at which residents participate in separate collection schemes and the efficiency of different waste collection methods and treatment processes.

The key strategic waste management scenarios which were evaluated using the model are summarised in **Table 20**. As can be seen, each scenario comprises a different combination of options for collecting, transporting, treating and disposing of MSW, and for recovering the associated costs from households and commercial waste producers. Each scenario is intended to show the operational and financial effects of including or varying a particular option. Scenario 0 is based on the existing arrangements for collecting and disposing of MSW.

4.3.3 Preferred Scenario

Table 21 and **Table 22** present a comparison of the strategic SWM scenarios evaluated. A number of conclusions may be drawn from this analysis. These are:

- A scenario based on continuing with the existing arrangements for managing MSW would be significantly more expensive than any of the other scenarios considered. This is mainly due to the use of non-standardised, individual containers for storing household waste which have to be manually emptied and loaded into the collection vehicle. This has a serious adverse impact on the operational performance of collection vehicles and crews, which results in a corresponding increase in the costs for waste collection;
- Using local "low-cost" incinerators (without energy recovery) would be significantly more expensive than either constructing and operating local sanitary landfills, or transferring all collected wastes to the new regional landfill at Mile 24;
- Providing standardised, individual containers for every household in Belize would be substantially more expensive than a system based on a majority of households using standardised, communal containers for storing household waste. Even though standardised, individual containers can be mechanically emptied and loaded into the collection vehicle, this method of waste storage and collection is still significantly less efficient / cost-effective than a system based largely on the use of communal waste containers;
- The introduction of source segregation and separation of recyclable materials in urban areas using bring banks comprising four recycling containers for paper / board, glass, plastics and metals (each serving an average of 100 households) has only a limited adverse impact on the total cost of waste collection;
- Constructing and operating a waste-to-energy plant to serve Belize City (based on mass-burn technology producing electricity for supply to the grid) would increase the total costs for managing MSW (and monthly fee for households) substantially, and it is unlikely that this option would be economically viable.

Based on the analysis and comparison presented below, and after careful consideration of the *costs*, potential *social barriers* and the *environmental impacts* in each case, the Government has concluded that its *preferred scenario for the future management of MSW is a variant of Scenario 5*. This is developed and assessed further in Chapter 7 below. The projected waste flows under the preferred scenario for managing MSW are illustrated in **Figure 21**.



Table 20: Strategic Municipal SWM Scenarios Assessed											
Scenarios	0	1	2	3	4	5	6	7	8		
Use local landfills?	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes		
Transfer of all MSW collected to Mile 24 Regional Landfill?	No	No	No	Yes	No	No	No	No	No		
Use low-cost incinerators?	No	No	Yes	No	No	No	No	No	No		
Year for low-cost composting + separate collection of bio-waste	NI	NI	NI	NI	2020	2020	2020	2020	2020		
Use second hand trucks?	Yes										
Develop Civic Amenity (CA) sites?	Yes										
Year for Belize City Incinerator (with energy recovery)	NI	2020									
Year for introducing separate collection of recyclables (urban only)	NI	NI	NI	NI	2020	2020	2020	2020	2020		
Collection vehicle type used (RCV = Compactor Refuse Collection Vehicle)	RCV 4W										
Collection system used (C = Communal, I = individual)	I	С	С	С	С	0/100*	60/40*	80/20*	С		
Type of container for household waste ($C = Communal, N = None$)	Ν	С	С	С	С	0/100*	60/40*	80/20*	С		
Target date for 100% collection of Urban MSW	2020	2020	2020	2020	2020	2020	2020	2020	2020		
Target date for 100% collection of Rural MSW	2020	2020	2020	2020	2020	2020	2020	2020	2020		
Target date for rural waste to use compliant facilities	2020	2020	2020	2020	2020	2020	2020	2020	2020		
Target date for full cost recovery	2020	2020	2020	2020	2020	2020	2020	2020	2020		

<u>Notes:</u> NI means the option is Not Included in the scenario.

* These figures show the split between the use of mechanically-emptied communal 1100 litre bins (the first figure) and 140 litre bins for individual houses. For these scenarios, the analysis of costs shows the additional impact of using this type of collection system.



Table 21: Strategic Municipal SWM Scenarios Compared – All CAPEX and OPEX Recovered (a)												
Scenario	Capital Ex (BZD m	penditure illion) ^(b)		Affordability ^(d)	Mont	thly Fee per	Household (I	BZD)	Proportion of MSW landfilled			
	2013-19	2013-33	BZD	%	2015	2020	2025	2030	2015	2020	2025	2030
0	48	124	238.86	1.8	6.51	19.02	22.04	25.56	100%	100%	100%	100%
1	48	115	114.99	0.9	3.13	9.15	10.61	12.30	100%	100%	100%	100%
2	43	87	153.57	1.2	4.18	12.23	14.17	16.43	100%	52.8%	51.8%	51.0%
3	44	88	119.68	0.9	3.26	9.53	11.05	12.80	100%	100%	100%	100%
4	48	136	122.73	0.9	3.34	9.77	11.33	13.13	100%	92.8%	87.7%	84.6%
5 ^(e)	58	176	200.74	1.5	5.47	15.98	18.53	21.48	100%	92.8%	87.7%	84.6%
6 ^(e)	47	132	145.08	1.1	3.95	11.55	13.39	15.52	100%	92.8%	87.7%	84.6%
7 ^(e)	47	134	133.91	1.0	3.95	11.54	13.38	15.51	100%	92.8%	87.7%	84.6%
8	48	286	188.07	1.4	5.13	14.97	17.36	20.12	100%	65.3%	62.2%	60.2%

<u>Notes:</u> (a) Including the investments made prior to 2014.

(b) Including expenditure on replacements.

(c) Per metric tonne, net of revenue received from commercial waste producers.

(d) Percentage of per capita household income for lowest quintile with full cost recovery. The generally used criterion is 1% or less.

(e) For these options, the fee per container per week chargeable to offset the additional operating costs for individual containers would be BZD 1.21

Table 22: Composition of Average Incremental Cost (AIC), in BZD / metric tonne											
Scenarios 0 1 2 3 4 5 6									8		
AIC net of payments for commercial waste and private collections	238.86	114.99	153.57	119.68	122.73	200.74	145.08	133.91	188.07		
Gross AIC	242.95	138.33	170.92	142.30	144.87	210.75	163.75	154.32	200.05		
Collection (including CA Sites)	185.24	80.63	80.63	80.63	84.74	150.62	103.61	94.18	84.74		
Transfer	24.49	24.49	24.49	35.20	24.49	24.49	24.49	24.49	24.49		
Treatment	0.00	0.00	47.46	0.00	4.26	4.26	4.26	4.26	63.45		
Disposal	33.22	33.22	18.34	26.46	31.39	31.39	31.39	31.39	27.38		

Note: The "Average Incremental Costs" (AIC) are calculated by dividing the Present Value (PV) of the projected costs (or expenditures) for implementing each scenario by the PV of the projected waste quantities over the period 2015 – 2034. A discount rate of 7.5% has been used. Further information on AIC may be found here: http://www.worldbank.org/urban/solid wm/erm/Annexes/US%20Sizes/New%20Annex%204D.6.pdf


Figure 21: Projected Municipal Solid Waste Flows under the Preferred Scenario in 2030, in metric tonnes





4.4 Planned Actions for Improving Waste Management

The actions we plan to implement in order to achieve the policy objectives and targets for waste management summarised in 4.1 above are described in **Table 23**.



	Table 23: Planned Actions for Reforming and Improving Waste Management Strategic Action / Measure Main Related Strategic Objective(s) Explanatory Notes* ste Recovery & Recycling: A1 Introduce preferential tax treatment for specific 'low waste' products / processes and / or specific recyclable products / recycling processes (e.g. returnable / refillable packaging systems). MO 1 This action is intended to create economic incentives in support of actions GA 43, WMA 4, WMA 5 and WMA 8. The products / processes that will benefit from such preferential tax treatment will be elaborated in the planned Waste Prevention Programme. A 2 Introduce eco-contributions on specific products / materials (e.g. non-recyclable or difficult to recycle products) the revenues from which will be earmarked and allocated for implementing measures aimed at significantly increasing waste recovery and recycling. MO 1, MO 2, MO 3, MO 5 This action is intended to: - Create economic incentives in support of actions GA 43 and WMA 3; - Discourage consumption of products or materials which result in wastes which are costly or problematic to manage and / or give rise to unacceptable environmental impacts; - Generate revenues which will be used to finance actions WMA 3, WMA 5, WMA 6 and WMA 8 below. A 3 In conjunction with the measure envisaged in GA 43 above, establish (by agreement with industry and/or through legislation) MO 3, MO 4 The scope of the planned EPR schemes will include packaging waste, eIV 4, Sincenter and synthetic oils waste													
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*											
Waste WMA 1	Recovery & Recycling: Introduce preferential tax treatment for specific 'low waste' products / processes and / or specific recyclable products / recycling processes (e.g. returnable / refillable packaging systems).	MO 1	This action is intended to create economic incentives in support of actions GA 43, WMA 4, WMA 5 and WMA 8. The products / processes that will benefit from such preferential tax treatment will be elaborated in the planned Waste Prevention Programme.											
WMA 2	Introduce eco-contributions on specific products / materials (e.g. non-recyclable or difficult to recycle products) the revenues from which will be earmarked and allocated for implementing measures aimed at significantly increasing waste recovery and recycling.	MO 1, MO 2, MO 3, MO 5	 This action is intended to: Create economic incentives in support of actions GA 43 and WMA 3; Discourage consumption of products or materials which result in wastes which are costly or problematic to manage and / or give rise to unacceptable environmental impacts; Generate revenues which will be used to finance actions WMA 3, WMA 5, WMA 6 and WMA 8 below. The eco-contribution values levied on specific products / materials will be differentiated according to whether the resulting waste is inert, biologically active or hazardous. 											
WMA 3	In conjunction with the measure envisaged in GA 43 above, establish (by agreement with industry and/or through legislation) industry-financed and managed Extended Producer Responsibility (EPR) schemes for the recovery ('take-back') and recycling / treatment of certain types of product-related wastes.	MO 3, MO 4	The scope of the planned EPR schemes will include packaging waste, ELVs, end-of-life tyres, WEEE, used mineral and synthetic oils, waste batteries and accumulators, and unwanted pesticides and herbicides. To implement this measure, we intend to conclude a series of agreements (preferably voluntary, but with legislative backing if necessary) with producer groups or trade associations representing the producers, importers and distributors of the products giving rise to the above-listed waste categories, which will set out in detail: - The mutually agreed terms and arrangements for product waste management (including quantitative targets for prevention, collection, recovery and recycling); - The methods and indicators to be used for monitoring performance; and - The sanctions or other consequences if the agreed targets are not met. Part of the revenues generated by action WMA 2 will also be allocated to assist with meeting some of the initial costs of establishing and promoting the agreed EPR schemes. As a general principle, it is expected that the agreed EPR schemes will be <i>industry led and managed</i> , with minimal on-going involvement or intervention by the Government.											
WMA 4	Introduce / extend deposit refund schemes for re-usable and / or potentially recyclable products.	MO 3, MO 4, MO 8	This action will support the implementation of actions GA 43 and WMA 3, and will apply to certain packaging products, copier & printer cartridges, batteries & accumulators, tyres, ELVs & WEEE.											



	Table 23: Planned Actions for Reforming and Improving Waste Management Strategic Action / Measure Main Related Strategic Objective(s) Explanatory Notes* A 5 Provide economic incentives for locally manufactured recycled products / recycling processes. M0 1, M0 8 Part of the revenues generated by actions GA 38 and WMA 2 above will be made available to co-finance innovative investments in discarded product refurbishment / recycling facilities and the manufacture of products from recycled materials. IA 6 Reduce / remove any unnecessary economic or other barriers to the export of recycled products / recyclable materials. M0 7 We will consult with exporters of recycled products / recyclable materials with a view to identifying and removing / reducing any unnecessary economic or other export barriers. IA 7 Give preference to recycled / recyclable products and materials in public sector procurement rules and procedures. M0 1, M0 5, M0 9 In conjunction with action GA 43, the Government intends to give preference to recycled / recyclable products and materials when purchasing certain products and materials, as long as: - Such products and materials are of adequate quality for the intended use; and - The prices of such products and materials do not exceed the prices of their virgin equivalents by an unreasonable or unacceptable amount. This will apply initially to products and materials by an unreasonable or unacceptable amount. This will apply initially to products and materials revoreed from construction and demolition wastes, recycled paper and plastics, re- treaded tyres, recycled oils and waste-derived compost product													
	Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*											
WMA 5	Provide economic incentives for locally manufactured recycled products / recycling processes.	MO 1, MO 8	Part of the revenues generated by actions GA 38 and WMA 2 above will be made available to co-finance innovative investments in discarded product refurbishment / recycling facilities and the manufacture of products from recycled materials.											
WMA 6	Reduce / remove any unnecessary economic or other barriers to the export of recycled products / recyclable materials.	MO 7	We will consult with exporters of recycled products / recyclable materials with a view to identifying and removing / reducing any unnecessary economic or other export barriers.											
WMA 7	Give preference to recycled / recyclable products and materials in public sector procurement rules and procedures.	MO 1, MO 5, MO 9	 In conjunction with action GA 43, the Government intends to give preference to recycled / recyclable products and materials when purchasing certain products and materials, as long as: Such products and materials are of adequate quality for the intended use; and The prices of such products and materials do not exceed the prices of their virgin equivalents by an unreasonable or unacceptable amount. 											
			This will apply initially to products and materials recovered from construction and demolition wastes, recycled paper and plastics, re- treaded tyres, recycled oils and waste-derived compost products, and will be implemented through a modification of the existing procurement policies of GoB and other public sector institutions.											
WMA 8	Provide advice and guidance on methods / techniques for waste recovery / recycling (and the potential benefits thereof) to product importers / suppliers, consumers and other waste generators.	MO 9, MO 10	 Product importers / suppliers, consumers & other waste generators are often unaware of, or sufficiently well-informed about, available methods or techniques for waste recovery and recycling, and the potential environmental and economic benefits that these can bring. We will therefore, in cooperation with business & industry, seek to: Identify processes or products with significant scope for waste reduction, recovery and recycling; Gather data and information on available methods and techniques applicable to those particular processes and products; Promote & disseminate relevant information and advice to operators of such processes, and to suppliers and consumers of such products. 											
Waste	Segregation, Containment, Collection & Transport:													
WMA 9	Ensure that a regular and reliable MSW collection service is provided to all communities located within 300 yards of an all- weather road which is accessible by a purpose-designed waste collection vehicle.	MO 11, MO 14, MO 15, MO 18	This action will be implemented in conjunction with actions GA 3, GA 16 and GA 19 above, and in accordance with the Government's preferred scenario for the future management of MSW (see section 4.3.3 above).											
WMA 10	Prepare, consult on and publish a "Waste Management Design Guide" which provides specific advice on the design and installation of waste management infrastructure as an integral part of municipal, residential and commercial developments.	MO 11, MO 14, MO 15, MO 18	The Design Guide will address the issue of waste management in new developments and redevelopments of a residential, commercial or mixed (residential and commercial) nature, and <i>inter alia</i> will: – Detail the waste segregation, storage and collection requirements											



Table 23: Planned Actions for	or Reforming and Improvi	ng Waste Management
Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*
		 that designers and developers need to satisfy; Provide guidance for use by Local Authorities when assessing relevant planning applications; Address the unique waste management problems presented by tourist and high-density developments; Provide specific examples of good practice in each case.
WMA 11 In conjunction with actions GA 7, GA 16, GA 19 and WMA 10 above, require the use of standardised waste storage containers of an appropriate size, type and quality which are capable of being emptied mechanically.	MO 11, MO 14, MO 15, MO 18	The use of standardised wheeled containers will be obligatory for temporarily storing all types of MSW prior to collection, including segregated dry recyclable materials, bio-waste and other residual wastes. An internationally recognised standard, such as the EN 840 European Standard for mobile waste containers or the American ANSI Z245 standards for waste and recycling equipment, will be adopted for use throughout Belize.
WMA 12 Introduce source segregation and separate collection of recyclable materials from municipal and similar solid wastes in representative pilot areas.	MO 11, MO 14, MO 15, MO 18	The recovery of recyclable materials from wastes once they have become mixed is complex, expensive and inefficient in terms of actual vs. potential capture rates / yields of materials. This action is therefore intended to test the response of householders and businesses, and to optimise the methods and equipment to be used for segregation and separate collection of recyclable materials in Belize.
WMA 13 Expand source segregation and separate collection of recyclable materials for which there are viable long-term markets across all urban areas.	MO 11, MO 14, MO 15, MO 18	Based on the results of action WMA 12, , and in conjunction with the waste governance measures envisaged in GA 16, GA 19 and GA 20 above, source segregation and separate collection of recyclable materials (including bio-waste) will be progressively rolled-out across all urban areas.
WMA 14 Encourage the development of a network of drop-off / take-back centres at convenient locations in the more densely-populated urban areas of Belize.	MO 11, MO 14, MO 18	A 'drop-off / take-back centre' refers to a designated area or drop- off point where the public can deliver clean, source-segregated recyclable materials. Such centres are usually located in convenient places such as car parks, supermarkets, recreation areas, etc, and are equipped with labelled and colour-coded containers for receiving and temporarily storing different recyclable materials. This action will be implemented in conjunction with actions WMA 3 and WMA 22.
WMA 15 Install and operate transfer-loading systems where necessary and economically justifiable.	MO 11, MO 16, MO 19	It is intended that further waste transfer stations will be developed to service the SWM needs of communities located in the Northern and Southern Corridors, and some of the offshore islands. Feasibility studies to identify suitable sites, and assess the design requirements, technical options & associated costs in the Northern and Southern Corridors are in progress.



Table 23: Planned Actions for	or Reforming and Improvi	ng Waste Management
Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*
WMA 16 Establish and maintain a national system for temporarily storing, collecting (and treating) healthcare risk waste and other hazardous / difficult wastes, including international waste.	MO 13, MO 16, MO 17	This action will be undertaken in conjunction with the waste governance measures envisaged in GA 16, GA 19 and GA 20 above, and WMA 19 below. As a first step, we plan to commission a detailed study to assess the technical requirements & options, logistics and economic viability of establishing such a system, and the best way of procuring it.
Waste Treatment / Processing:		
WMA 17 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the treatment / processing of wastes.	MO 20, MO 21	 This action will be implemented in conjunction with the waste governance measures envisaged in GA 2, GA 5 and GA 11, and will <i>inter alia</i>: Establish criteria for classifying solid waste treatment facilities and processes / practices; Set technical standards for the siting, design, construction, operation and closure / decommissioning of waste treatment facilities; Establish the treatment activities / practices that require a permit and the conditions under which they must be conducted; Provide guidance on the suitability, efficacy and cost-effectiveness of different waste treatment technologies / processes; Provide guidance on monitoring the emissions / discharges from, and environmental effects of, waste treatment processes.
WMA 18 Introduce a mandatory requirement that staff and operatives engaged in waste treatment and processing activities are appropriately qualified and adequately trained.	MO 22	This action will be implemented in conjunction with the waste governance measures envisaged in GA 3, GA 4, GA 21 and GA 22 above.
WMA 19 Establish and maintain a national system for treating hazardous and difficult wastes, including international waste, in accordance with regulations and best practices.	MO 24, MO 25	See also action WMA 16 above. A simplified scheme for the treatment and disposal of hazardous waste is shown in Figure 22 below. It is likely that any national system for treating hazardous and difficult wastes will need to incorporate facilities for the high temperature incineration of certain organic wastes, and for stabilising / immobilising inorganic wastes prior to final disposal in a secure landfill. Such facilities will be costly to develop and operate, but are unavoidable if we are to apply the Proximity Principle (see section 3.3 of the National SWM Policy), adopt international standards / best practices for managing these waste streams and minimise the
		associated health risks and environmental impacts. In some cases, because of the very small quantities generated, the most economic management ention is likely to be expert for
		treatment and final disposal, although this will still be expensive.
WMA 20 Promote and incentivise the use of small-scale and home composting of bio-wastes in rural communities.	MO 26	This low-cost measure will be implemented in conjunction with actions GA 44 and WMA 13 above, and will help to reduce the amount of waste which is collected, transported and landfilled.



Table 23: Planned Actions for	or Reforming and Improvi	ng Waste Management
Strategic Action / Measure	Main Related Strategic Objective(s)	Explanatory Notes*
WMA 21 Develop and operate a network of facilities for reducing the volume of non-hazardous wastes going to landfill.	MO 23, MO 26, MO 27, MO 28	This action will be implemented in conjunction with actions GA 44, WMA 13 and WMA 14 above. Such facilities will include drop-off / take-back centres, Civic Amenity sites and "clean" MRFs (see Table 19 above).
WMA 22 Promote and incentivise the development and operation of systems and facilities for processing of recovered recyclable materials and product-related wastes streams.	MO 26, MO 27, MO 28	This action will be implemented in conjunction with actions WMA 1, WMA 3 and WMA 5 above.
Final Disposal:		
WMA 23 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the final disposal (landfilling) of wastes.	MO 23, MO 29, MO 30, MO 31	This action will be implemented in conjunction with the waste governance measures envisaged in GA 2, GA 5 and GA 11 above, and will be similar in scope and content to action WMA 17.
WMA 24 Develop and operate facilities for the final disposal (landfilling) of non-hazardous wastes generated outside the Western Corridor in accordance with regulations and best practices.	MO 30, MO 31	This action will be implemented in conjunction with the waste governance measures envisaged in GA 16, GA 19, GA 20 and GA 34 above. Feasibility studies to identify suitable sites, and assess the design requirements, technical options & associated costs in the Northern and Southern Corridors are on-going. The total landfill capacity required in future will be very much influenced by the extent to which the quantities of wastes requiring final disposal can be reduced through waste prevention, recovery and recycling. However, at this stage, and for the purposes of assessing the physical resource requirements and financial implications of the Government's preferred scenario for the future management of MSW, it has been assumed that two landfill facilities will be required to service the final disposal needs of the Southern Corridor, and one landfill facility to service the disposal needs of the Northern Corridor.
WMA 25 In close consultation with the responsible authorities, prepare and implement plans, and allocate sufficient resources, for the closure, remediation, restoration and return to beneficial use of waste dump sites and "hotspots".	MO 33	Once new sanitary landfill sites and waste treatment / processing facilities have been constructed and brought into operation, we will close, restore and return to some form of beneficial use the remaining waste dump sites and "hotspots". Generally speaking, excavating and processing materials from dump sites is expensive and can give rise to significant health hazards and adverse environmental impacts if not carried out properly. Therefore, unless detailed site investigations reveal a serious threat / risk to public health or valuable natural resources, <i>in situ</i> measures will be used for the remediation and restoration of these sites.

<u>Note</u>: * Further information may be found in *Annex D of the National Solid Waste Management Policy*.





Figure 22: Simplified Scheme for the Treatment and Disposal of Hazardous Wastes

5. STRATEGY MONITORING AND REVIEW

This National SWM Strategy and related National SWM Policy represent only the initial stage in what is ultimately a long-term process. Needs and circumstances relating to wastes management can and almost certainly will change. It is therefore vital that the Strategy is continually monitored and periodically reviewed and updated to ensure that our planned actions for delivering change and the underlying assumptions are still valid / appropriate, and that the timescales for achieving the strategic objectives and targets presented in sections 3.1 and 4.1, are still realistic.

5.1 Strategy Monitoring

In the context of Strategy implementation, the requirements for monitoring will arise in three main ways:

- Strategy implementation progress actually achieved in implementing the various non-technical and technical measures set out in this Strategy;
- Development of waste handling capacities the extent to which the capacities of infrastructure and systems for the physical management of wastes needed to meet the Government's policy objectives develop as planned;
- **Results** the results achieved in terms of the attainment of the qualitative objectives and quantitative targets set out in the Strategy (in particular, the targets contained in **Table 14**).

Special attention will be given to monitoring progress in:

- Limiting growth in wastes generation;
- Reducing environmental hazards and risks associated with waste management activities;
- Increasing the levels of waste recovery and recycling;
- Developing and operating new waste management systems and facilities.

Various quantitative performance indicators will be used to measure and monitor progress with Strategy implementation. These will include:

- *Waste production*, overall and by waste type;
- *Recovery and recycling rates*, overall and by waste type;
- *Recycling rates*, by material;
- Quantities of specific hazardous wastes produced;
- Quantities and types of waste landfilled.

5.2 Strategy Review

With regard to Strategy review and updating, summary reports on the progress achieved in implementing the Strategy will be prepared and published by BSWaMA at annual intervals. The Strategy itself will be reviewed and updated annually until 2021, and thereafter at 4-year intervals.



PART II STRATEGY IMPLEMENTATION PLAN



6. STRATEGY IMPLEMENTATION

For the purposes of Strategy implementation planning, the various planned actions and measures have been divided into:

- Short-term actions (2016 to 2018)
- Medium-term actions (2019 to 2021)
- Long-term actions (2022 to 2025)

These are summarised in sections 6.1 to 6.3 below. In the case of short-term actions, those considered to be top priority are **highlighted in bold**.

6.1 Short-Term Actions (2016 to 2018)

Short-Term Actions (2016 to 2018):

- GA 1 Prepare, consult on and publish a comprehensive National Solid Waste Management Policy, Strategy & Plan.
- GA 2 Prepare, consult on and publish specific policies for managing certain product-related, hazardous and difficult waste streams.
- GA 3 Review, consult on and reform existing national legislation and regulations relating to SWM.
- GA 4 Incorporate in law a general duty of care (with certain exemptions) and publish a detailed statutory code of practice on the actions required to comply with such duty of care.
- GA 5 Prepare, consult on and revise / enact secondary legislation for regulating specific wastegenerating products, WM activities and waste streams; and for controlling the import of products or materials which are potentially hazardous and / or difficult to recover and /or dispose of when discarded.
- GA 6 Repeal all existing legislative acts or instruments which are conflicting, irrelevant or obsolete.
- GA 7 Require that all local policies, regulations and by-laws relating to SWM are aligned and harmonised with national policies, legislation and regulations.
- GA 8 Prepare, consult on and publish a strategy for compliance monitoring and enforcement.
- GA 9 Review and, where necessary, increase penalties for non-compliance to reflect the nature of the offences and potential harm caused, and as an appropriate deterrent.
- GA 10 Promote collaboration between regulatory agencies, and provide sufficient resources and powers to tackle waste dumping, littering and other illegal activities effectively.
- GA 11 Establish criteria and guidelines, and implement a programme, for annual inspections of all licensed WM facilities.
- GA 12 Examine issues relating to prevention, detection and enforcement including sentencing guidelines, collaborative working and guidance to organisations engaged in WM activities.
- GA 13 Establish an Inter-ministerial Steering Group, Chaired by the MNRA, to supervise, coordinate and monitor implementation of the National SWM Policy and this Strategy.
- GA 14 Review, consult on and reform existing institutional and organisational arrangements.
- GA 15 Reconfigure the DOE and strengthen the institutional arrangements and systems for environmental permitting, monitoring and enforcement.
- GA 16 Reconstitute BSWaMA as an autonomous, Government-owned corporation responsible for organising, procuring and supervising the provision of SWM infrastructure and services throughout Belize.
- GA 17 Ensure that the human and other resources available to public institutions involved in SWM are sufficient to fulfil their legal responsibilities and assigned tasks effectively.
- GA 18 Facilitate and incentivise cooperation between contiguous local authorities in order to realise economies of scale and other potential efficiencies in SWM service provision.
- GA 19 Introduce measures to encourage private sector participation in the development, delivery and operation of public SWM infrastructure and services.
- GA 20 Strengthen the system and procedures used for procuring infrastructure and services for MSW collection / transport, treatment, disposal and street cleaning services throughout Belize.



Short-	Term Actions (2016 to 2018):
GA 21	Carry out a human resource and training needs assessment for public sector SWM institutions and functions, including monitoring, inspection and enforcement.
GA 23	Develop, consult on and enact a sector regulation, supporting guidance and a detailed statutory code of practice on the Occupational Health & Safety of people engaged in SWM activities.
GA 24	Commission an independent review into the compensation, benefits and conditions of employment of public sector staff and workers engaged in SWM activities.
GA 26	Introduce a legally-binding obligation on waste producers (with the exception of householders and certain SMEs) and SWM service providers to collect, record and report data and information about the wastes they generate / manage.
GA 27	Require that all public SWM facilities of a significant size are equipped with electronic weighbridges and databases that can be accessed and interrogated remotely.
GA 28	Ensure that relevant stakeholders are involved and consulted at all stages in the development, implementation and subsequent review of the National SWM Policy, Strategy and Plan.
GA 29	Prepare, consult on, adopt and implement a targeted strategy / programme for on-going communications and consultations with, and participation of, all key stakeholders.
GA 31	Make available sufficient financial and other appropriate resources to enable Planned Actions GA 28, GA 29, GA 30 and GA 33 to be implemented effectively.
GA 33	Establish and resource a national focal point for implementation and coordination of the strategy / programmes foreseen by the National SWM Policy & Strategy.
GA 38	Consult on, adopt and implement for a transitional period a system for cost recovery.
GA 39	Introduce a legally-binding obligation on all non-residential waste producers to have a service agreement for the management of their wastes with a licensed service provider.
GA 40	Assess and publish estimates of the full costs of managing the wastes covered by the National SWM Policy in an environmentally sound manner, and ensure that these are explained to / understood by local authorities and waste producers.
GA 41	Ensure that revenues from the user fees and taxes envisaged by Planned Actions GA 37 and GA 38 are equitably and appropriately distributed to public authorities / entities with responsibilities for SWM.
GA 42	Develop and implement a subsidy / rebate scheme targeted at low-income groups that cannot afford to pay full cost recovery charges for household WM $\&$ public cleansing services.
GA 43	Prepare, consult on, publish and then implement a Waste Prevention Programme containing a range of measures for waste prevention and reduction.
GA 44	Consider and consult on the possibility of introducing a levy on wastes disposed of at landfill facilities, the revenues from which would be earmarked for implementing the Waste Prevention Programme.
GA 45	Introduce statutory powers to enable local authorities to take specific action to reduce wastes produced in their local area.
WMA 4	Introduce / extend deposit refund schemes for re-usable and / or potentially recyclable products.
WMA 8	Provide advice and guidance on methods / techniques for waste recovery / recycling (and the potential benefits thereof) to product importers / suppliers, consumers and other waste generators.
WMA 10	Prepare, consult on and publish a "Waste Management Design Guide" which provides specific advice on the design and installation of WM infrastructure as an integral part of new developments.
WMA 1	5 Install and operate transfer-loading systems where necessary and economically justifiable.
WMA 17	7 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the treatment / processing of wastes.
WMA 18	3 Introduce a mandatory requirement that staff and operatives engaged in waste treatment and processing activities are appropriately qualified and adequately trained.
WMA 23	3 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the final disposal (landfilling) of wastes.



6.2 Medium-Term Actions (2019 to 2021)

Medium-Term Actions (2019 to 2021):

- GA 22 Establish national vocational qualifications & professional standards, and promote the establishment of a professional body for people engaged in SWM activities in both the public and private sectors.
- GA 25 Establish a national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes, SWM processes & facilities.
- GA 30 Develop and implement a targeted education and awareness programme for the wider public (with special emphasis on schools / children).
- GA 32 Under the leadership of the Ministry of Education, Youth and Sports, ensure that SWM issues are sufficiently and appropriately addressed within educational curricula and programmes.
- GA 34 Until 2020, continue to finance major investments in strategically essential SWM facilities and infrastructure through a combination of IFI / bilateral loans & resources from the Government budget.
- GA 36 Finance (fully or partly) the investments required for expanding and upgrading MSW collection and street cleaning services through private sector participation in the delivery of these services.
- GA 37 Progressively introduce / increase charges for the use of publicly owned / operated WM facilities and services to levels which reflect the full cost of their provision and operation.
- WMA 1 Introduce preferential tax treatment for specific 'low waste' products / processes and / or specific recyclable products / recycling processes.
- WMA 2 Introduce eco-contributions on specific products / materials (e.g. non-recyclable or difficult to recycle products) the revenues from which will be earmarked and allocated for implementing measures aimed at significantly increasing waste recovery and recycling.
- WMA 3 Establish (by agreement with industry and / or through legislation) industry-financed and managed Extended Producer Responsibility schemes for the recovery ('take-back') and recycling / treatment of certain types of product-related wastes.
- WMA 5 Provide economic incentives for locally manufactured recycled products / recycling processes.
- WMA 6 Reduce / remove any unnecessary economic or other barriers to the export of recycled products / recyclable materials.
- WMA 7 Give preference to recycled / recyclable products and materials in public sector procurement.
- WMA 9 Ensure that a regular and reliable MSW collection service is provided to all communities located within 300 yards of an all-weather road which is accessible by a purpose-designed waste collection vehicle.
- WMA 11 Require the use of standardised waste storage containers of an appropriate size, type and quality which are capable of being emptied mechanically.
- WMA 12 Introduce source segregation and separate collection of recyclable materials from municipal and similar solid wastes in representative pilot areas.
- WMA 13 Following completion of the measure envisaged in action WMA 12 above, expand source segregation and separate collection of recyclable materials [including bio-waste] for which there are viable longterm markets across all urban areas.
- WMA 14 In conjunction with action WMA 3 above, encourage the development of a network of drop-off / takeback centres at convenient locations in densely-populated urban areas.
- WMA 16 Establish and maintain a national system for storing, collecting (and treating see WMA 19 above) healthcare risk waste and other hazardous / difficult wastes, including international waste.
- WMA 19 Establish and maintain a national system for treating hazardous and difficult wastes, including international waste, in accordance with regulations and best practices.
- WMA 20 Promote and incentivise the use of small-scale and home composting of bio-wastes in rural communities.
- WMA 21 Develop and operate a network of facilities for reducing the volume of non-hazardous wastes going to landfill.
- WMA 22 Promote and incentivise the development and operation of systems and facilities for processing of recovered recyclable materials and product-related wastes streams.
- WMA 24 Develop and operate facilities for the final disposal of non-hazardous wastes generated outside the Western Corridor in accordance with regulations and best practices.
- WMA 25 Prepare and implement plans, and allocate sufficient resources, for the closure, remediation, restoration & return to beneficial use of waste dump sites and "hotspots".



6.3 Long-Term Actions (2022 to 2025)

Long-Term Actions (2022 to 2025):

GA 35 From 2021, allow BSWaMA and other public authorities / entities with responsibilities for SWM to set their user fees / service charges at levels that enable them to accumulate sufficient capital reserves to be able to finance investments in new and replacement SWM facilities and infrastructure.

6.4 Timetable for Implementation

An indicative timetable for implementing the short and medium term measures and actions summarised above, and meeting the targets contained in **Table 14** above, is presented in **Figure 23**. On-going or continuing actions / measures are indicated by bars with vertical grid lines.

6.5 **Responsibilities for Implementation**

The allocation of responsibilities for implementing all of the various measures and actions foreseen in this Strategy is indicated in **Table 24**.

This envisages *inter alia* that the Ministry of Natural Resources and Agriculture in cooperation with the Ministry of Forestry, Fisheries and Sustainable Development will have primary responsibility for *legal and institutional reforms*, BSWaMA and the Department of Environment will be primarily responsible for implementing the various *organisational and technical / operational changes*, and the Ministry of Finance and Economic Development will lead on implementing the *financial reforms*.



Figure 23: Indicative Timetable for Strategy Implementation

ID	Planned Actions / Measures	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
1	POLICY & LEGAL:											Ŷ	
2	GA 1 Prepare & adopt a National Solid Waste Management Policy, Strategy & Plan												
3	GA 2 Prepare specific policies for managing product-related hazardous and difficult wastes												
4	GA 3 Reform existing national legislation and regulations relating to SWM												
5	GA 4 Incorporate in law a general duty of care & publish a detailed statutory code of practice												
6	GA 5 Prepare secondary legislation regulating specific waste-generating products, WM activities & waste streams												
7	GA 6 Repeal all existing legislative acts or instruments which are conflicting, irrelevant or obsolete												
8	GA 7 Align local policies, regulations & by-laws relating to SWM with national policies, legislation & regulations												
9	GA 8 Prepare a strategy for compliance monitoring and enforcement												
10	GA 9 Review and, where necessary, increase penalties for non-compliance												
11	GA 10 Promote collaboration between regulatory agencies, & provide sufficient resources & powers		*********	*******	********	⊳							
12	GA 11 Implement a programme, for annual inspections of all licensed WM facilities			00000000	0000000000		0000000000	00000000	000000000	00000000	2000000000		
13	GA 12 Examine issues relating to prevention, detection and enforcement of WM legislation												
14	INSTITUTIONAL & ORGANISATIONAL:											Ψ.	
15	GA 13 Establish an Inter-ministerial Steering Group for implementing the National SWM Policy & Strategy												
16	GA 14 Reform existing institutional and organisational arrangements.												
17	GA 15 Reconfigure the DOE and strengthen systems for environmental permitting, monitoring & enforcement												
18	GA 16 Reconstitute BSWaMA as an autonomous, Government-owned corporation												
19	GA 17 Ensure that the human & other resources available to public SWM institutions are sufficient												
20	GA 18 Facilitate and incentivise cooperation between contiguous local authorities		0									⊳	
21	GA 19 Introduce measures to encourage private sector participation in public SWM infrastructure & services												
22	GA 20 Strengthen the system & procedures for procuring infrastructure & services for MSW management												
23	HUMAN RESOURCES / CAPACITY:						, 	7					
24	GA 21 Carry out a human resource & training needs assessment for public SWM institutions & functions												
25	GA 22 Establish national vocational qualifications & professional standards for SWM personnel												
26	GA 23 Develop & implement a sector regulation, guidance & code of practice on Occupational Health & Safety in SWM												
27	GA 24 Review compensation, benefits & conditions of employment of public sector staff in SWM												
28	DATA AVAILABILITY, MONITORING & REPORTING:		Y I									- V	
29	GA 25 Establish a national SWM data & information system												
30	GA 26 Require waste producers & SWM service providers to collect, record & report data												
31	GA 27 Require that all public SWM facilities of a significant size are equipped with electronic weighbridges												
32	STAKEHOLDER AWARENESS & COMMUNICATION:											-Y	
33	GA 28 Engage stakeholders in development & implementation of the National SWM Policy & Strategy				шппп								
34	GA 29 Prepare & implement a targeted stakeholder communications strategy / programme			1									
35	GA 30 Develop & Implement a targeted education & awareness programme for the wider public												
36	GA 31 Make available sufficient resources to implement GA 28, GA 29, GA 30 & GA 33 effectively	l m	μππ		ΠΠΠΠ								
37	GA 32 Ensure that SWM issues are sufficiently addressed within educational curricula & programmes												
38	GA 33 Establish & resource a national focal point for implementing the National SWM Policy & Strategy												

Key: On-going or continuing action / measure



Figure 22: Indicative Timetable for Strategy Implementation (continued)

ID	Planned Actions / Measures	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
39	FINANCING / COST RECOVERY:											Ψ	
40	GA 34 Until 2020, finance public SWM facilities & infrastructure through IFI / bilateral loans & the GoB budget												
41	GA 36 Finance investments for upgrading MSW collection & public cleansing services through private sector participation								шшц	шшц		>	
42	GA 37 Gradually increase charges for public WM facilities and services to levels which reflect their full cost												
43	GA 38 Consult on, adopt and implement a transitional system for cost recovery					1	1						
44	GA 39 Introduce a legal obligation on all non-residential waste producers to have a contract with a licensed SWM service provider			(
45	GA 40 Assess & publish estimates of the full costs of managing the wastes covered by the National SWM Policy			•									
46	GA 41 Ensure that revenues from user fees & taxes are equitably distributed to public SWM authorities / entities								шшц	uuuni		>	
47	GA 42 Implement a subsidy / SWM service charge rebate scheme for low-income groups												
48	WASTE PREVENTION:		Ý									Ψ	
49	GA 43 Prepare, consult on & implement a Waste Prevention Programme								шш	uuuni		>	
50	GA 44 Consider imposing a levy on landfilled wastes, in order to finance the Waste Prevention Programme	_	(
51	GA 45 Empower local authorities to take specific action to reduce wastes produced in their local area												
52	WASTE RECOVERY & RECYCLING:			·								Ψ	
53	WMA 1 Introduce preferential tax treatment for specific 'low waste' products / processes												
54	WMA 2 Introduce eco-contributions on specific non-recyclable or difficult to recycle products / materials												
55	WMA 3 Establish Extended Producer Responsibility schemes for certain product-related wastes						1						
56	WMA 4 Introduce / extend deposit refund schemes for re-usable and / or potentially recyclable products	_											
57	WMA 5 Provide economic incentives for locally manufactured recycled products / recycling processes								шшц	mm		2	
58	WMA 6 Reduce / remove economic or other barriers to the export of recycled products / materials												
59	WMA 7 Give preference to recycled / recyclable products and materials in public sector procurement												
60	WMA 8 Provide guidance on waste recovery / recycling to product importers / suppliers & consumers											>	
61	WASTE SEGREGATION, CONTAINMENT, COLLECTION & TRANSPORT:	_	ф —									Ψ	
62	WMA 9 Provide MSW collection services to all communities located within 300 yards of an all-weather road	_								mm			
63	WMA 10 Prepare & publish a guide on the design & installation of WM infrastructure in new developments	_											
64	WMA 11 Require the use of standardised waste containers which can be emptied mechanically	_								mmm		>	
65	WMA 12 Introduce source segregation & separate collection of recyclable materials in pilot areas	_											
66	WMA 13 After completion of WMA 12, expand source segregation & separate collection across all urban areas	_											
67	WMA 14 Encourage the development of a network of drop-off / take-back centres in urban areas	_				-							
68	WMA 15 Install and operate transfer-loading systems where necessary & economically justifiable	_											
69	WMA 16 Establish & maintain a national system for collecting healthcare & other hazardous wastes											2	
70	WASTE TREATMENT / PROCESSING:	_	'	r								Ψ	
71	WMA 1/ Enact & enforce a sector regulation & code of practice for the treatment / processing of wastes	_			1								
72	WMA 18 Introduce a requirement that personnel engaged in SWM activities are appropriately qualified / trained	_											
73	WMA 19 Establish and maintain a national system for treating hazardous and difficult wastes	_											
74	WMA 20 Promote the use of small-scale & home composting of bio-wastes in rural communities	_					1						
75	WMA 21 Develop a network of facilities for reducing the volume of non-hazardous wastes going to landfill	_					1	1					
76	WMA 22 Promote systems & facilities for processing of recyclable materials & product-related wastes	_								шшш		>	
77	FINAL DISPOSAL:	_	'						'				
78	WMA 23 Enact & enforce a sector regulation & code of practice governing landfilling of wastes	_											
/9	WMA 24 Develop racinities for disposing of non-nazardous wastes generated outside the Western Corridor	_					1	-					
80	WMA 25 Prepare & implement plans for remediation & return to beneficial use of waste dump sites & "hotspots"												

Key: On-going or continuing action / measure



	Table 24: Allocation of Responsibilities for Strategy Implementation																					
PI	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
Policy	& Legislative Framework:																					
GA 1	Prepare, consult on and publish a comprehensive National Solid Waste Management Policy, Strategy & Plan.	*	*	~	~	~	~		•	1	~					~	~		1	~	~	~
GA 2	Prepare, consult on and publish specific policies for managing certain product-related, hazardous and difficult waste streams.	*	~	*	~	*	~		•	*	*					*	~	✓	✓	~		
GA 3	Review, consult on and reform existing national legislation and regulations relating to SWM.	•	~	~	~	~	~		~	~	~					~	~	~	✓	✓		
GA 4	Incorporate in law a general duty of care (with certain exemptions) and publish a detailed statutory code of practice on the actions required to comply with such duty of care.	•	~	~	~	~	~		~	~	~					~	~					
GA 5	Prepare, consult on and revise / enact secondary legislation for regulating specific waste-generating products, WM activities and waste streams; and for controlling the import of products or materials which are potentially hazardous and / or difficult to recover and /or dispose of when discarded.	~	~	~	~	~	~		~	•	~					~	~					
GA 6	Repeal all existing legislative acts or instruments which are conflicting, irrelevant or obsolete.	•	~						~	~												
GA 7	Require that all local policies, regulations and by- laws relating to SWM are aligned and harmonised with national policies, legislation and regulations.						•									~						



	Table 24: Allocation of Responsibilities for Strategy Implementation																					
PI	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authoritv (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
GA 8	Prepare, consult on and publish a strategy for compliance monitoring and enforcement.	1	1	1					1	•	~					1	1					
GA 9	Review and, where necessary, increase penalties for non-compliance to reflect the nature of the offences and potential harm caused, and as an appropriate deterrent.	~	~	~					✓	•	~					~	~					
GA 10	Promote collaboration between regulatory agencies, and provide sufficient resources and powers to tackle waste dumping, littering and other illegal activities effectively.	~	•	~					~	~	~					~						
GA 11	Establish criteria and guidelines, and implement a programme, for annual inspections of all licensed WM facilities.			~					~	•						~						
GA 12	Examine issues relating to prevention, detection and enforcement including sentencing guidelines, collaborative working and guidance to organisations engaged in WM activities.	*	•	*					~	*	~					*						
Institu	tional / Organisational Arrangements:																					
GA 13	Establish an Inter-ministerial Steering Group, Chaired by the MNRA, to supervise, co-ordinate and monitor implementation of the National SWM Policy and this Strategy.	•	~	~	~	~	~	~	~	~	~											
GA 14	Review, consult on and reform existing institutional and organisational arrangements.	•	×	1	×	1	×	1	1	~	×											



	Table 24: Allocation of Responsibilities for Strategy Implementation																					
P	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
GA 15	Reconfigure the DOE and strengthen the institutional arrangements and systems for environmental permitting, monitoring and enforcement.	~	•			1	~		*	~												
GA 16	Reconstitute BSWaMA as an autonomous, wholly Government-owned corporation responsible for organising, procuring and supervising the provision of SWM infrastructure and services throughout Belize.	•	~	•		*	•		*	•												
GA 17	Ensure that the human and other resources available to public institutions involved in SWM are sufficient to fulfil their legal responsibilities and assigned tasks effectively.	•	~	~	~	~	~	~	~	✓	~					~						
GA 18	Facilitate and incentivise cooperation between contiguous local authorities in order to realise economies of scale and other potential efficiencies in SWM service provision.					~	•		~							~						
GA 19	Introduce measures to encourage private sector participation in the development, delivery and operation of public SWM infrastructure and services.					~	~		•							~			~			
GA 20	Strengthen the system and procedures used for procuring infrastructure and services for MSW collection / transport, treatment, disposal and street cleaning services throughout Belize.					~	~		•							~						



	Table 24: Allocation of Responsibilities for Strategy Implementation																					
PI	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authoritv (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
Human	Resources / Capacity:																					
GA 21	Carry out a human resource and training needs assessment for public sector SWM institutions and functions, including monitoring, inspection and enforcement.			~			~	~	•	~	~					~						
GA 22	Establish national vocational qualifications and professional standards, and promote the establishment of an independent professional body for people engaged in SWM activities in both the public and private sectors.			~			•	~	~	~	~					~	~		~			
GA 23	Develop, consult on and enact a sector regulation, supporting guidance and statutory code of practice on the Occupational Health & Safety of people engaged in SWM activities.			•			*	*	~	*	~					*	1		*			
GA 24	Commission an independent review into the compensation, benefits and conditions of employment of public sector staff and workers engaged in SWM activities.			✓		~	•	~	~	*	~					*						
Data A	vailability, Monitoring & Reporting:																					
GA 25	Establish a national system for classifying, regularly collecting, processing, analysing and disseminating data and information on the sources, nature, quantities and fate of wastes, and SWM processes / facilities.			•					*	•					•	*	*	~	*			



	Table 24: All	ocat	ion o	f Re	spon	sibili	ties	for S	trate	gy I	mple	men	tatio	n								
Pi	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authoritv (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
GA 26	Introduce a legally-binding obligation on waste producers (with the exception of householders and certain SMEs) and SWM service providers to collect, record and report data & information about the wastes they generate / manage.		•						~	~					~		>	~	~			
GA 27	Require that all public SWM facilities of a significant size are equipped with electronic weighbridges and databases that can be accessed and interrogated remotely.								•													
Stakeh	older Awareness & Communication:																					
GA 28	Ensure that relevant stakeholders are involved and consulted at all stages in the development, implementation and subsequent review of the National SWM Policy, Strategy and Plan.	~	×	*	*	*	*		•	*	1					~	1		~	✓	*	1
GA 29	Prepare, consult on, adopt and implement a targeted strategy / programme for on-going communications and consultations with, and participation of, all key stakeholders.	~	*	*	*	~	~		•	~	*					~						
GA 30	Develop and implement a targeted education and awareness programme for the wider public (with special emphasis on schools / children).							•	~											~	~	~
GA 31	Make available sufficient financial and other appropriate resources to enable Planned Actions GA 28, GA 29, GA 30 and GA 33 to be implemented effectively.	•				~		~	~													



	Table 24: All	ocat	ion o	f Re	spon	sibili	ties	for S	trate	gy I	mple	emen	tatio	n								
Pi	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government, Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authoritv (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
GA 32	Under the leadership of the Ministry of Education, Youth and Sports, ensure that SWM issues are sufficiently and appropriately addressed within educational curricula and programmes.							•	~	~												
GA 33	Establish and resource a national focal point for implementation and coordination of the strategy / programmes foreseen by the National SWM Policy & Strategy.	~	*	*	~	~	~	*	•	~	~				~	~						
Financi	ng / Cost Recovery:																					
GA 34	Until 2020, continue to finance major investments in strategically essential SWM facilities and infrastructure through a combination of IFI / bilateral loans and resources from the Government budget.	~				•			~													
GA 35	From 2021, allow BSWaMA and other public authorities / entities with responsibilities for SWM to set their user fees / service charges at levels that enable them to accumulate sufficient capital reserves to be able to finance investments in new and replacement SWM facilities and infrastructure.	~				•	~		~							~						
GA 36	Finance (fully or partly) the investments required for expanding and upgrading MSW collection and street cleaning services through private sector participation in the delivery of these services.	~				~	~		•							~			~			



	Table 24: Al	locat	ion o	f Re	spon	sibili	ties	for S	trate	gy I	mple	men	tatio	n								
PI	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government Bural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
GA 37	Progressively introduce / increase charges for the use of publicly owned / operated WM facilities and services to levels which reflect the full cost of their provision and operation.	*				*	~		•							~						
GA 38	Consult on, adopt and implement <i>for a transitional period</i> a system for cost recovery.	✓				~	~		•			~	~	~		✓	~	~			✓	
GA 39	Introduce a legally-binding obligation on all non- residential waste producers to have a service agreement for the management of their wastes with a licensed service provider.	~				~	~		•			~	~	~		~	~	~				
GA 40	Assess and publish estimates of the full costs of managing the wastes covered by the National SWM Policy in an environmentally sound manner, and ensure that these are explained to / understood by local authorities and waste producers.	*				*	~		•			~	~	~		~	~	~				
GA 41	Ensure that revenues from the user fees and taxes envisaged by Planned Actions GA 37 and GA 38 are equitably and appropriately distributed to those public authorities / entities with legally-mandated responsibilities for SWM.					•	~		~							~				0100000000000		
GA 42	Develop and implement a subsidy / rebate scheme targeted at low-income groups that cannot afford to pay full cost recovery charges for household WM & public cleansing services.					•	~		*			*				~						



	Table 24: All	ocat	ion o	f Re	spon	sibili	ties	for S	trate	gy I	mple	men	tatio	n								
Pli	Institutions / Stakeholders anned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government, Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
Waste	Prevention:																					
GA 43	Prepare, consult on, publish and then implement a Waste Prevention Programme containing a range of measures for waste prevention and reduction.	~	~	✓		~	~		•	~	~					~	 Image: A start of the start of	~	~	~	~	<
GA 44	Consider and consult on the possibility of introducing a levy on wastes disposed of at landfill facilities, the revenues from which would be earmarked for implementing the Waste Prevention Programme.	~	✓	~		✓	✓		•	~	~					~	~	~	~			
GA 45	Introduce statutory powers to enable local authorities to take specific action to reduce wastes produced in their local area.	~	~				•		~	✓						✓						
Waste	Recovery & Recycling:																					
WMA 1	Introduce preferential tax treatment for specific 'low waste' products / processes and / or specific recyclable products / recycling processes.	~	~			•			~	~		~					~	~				
WMA 2	Introduce eco-contributions on specific products / materials (e.g. non-recyclable or difficult to recycle products) the revenues from which will be earmarked and allocated for implementing measures aimed at significantly increasing waste recovery and recycling.	*	~			•			~	~		*					•	~				



Table 24: Al	locat	ion o	f Re	spon	sibili	ties	for S	trate	gy Iı	mple	men	tatio	n								
Institutions / Stakeholders Planned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government. Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
WMA 3 Establish (by agreement with industry and/or through legislation) industry-financed and managed Extended Producer Responsibility schemes for the recovery ('take-back') and recycling / treatment of certain types of product- related wastes.	~	~			•			~	~							~	~				
WMA 4 Introduce / extend deposit refund schemes for re- usable and / or potentially recyclable products.	~	1			•			1	*							*	✓				
WMA 5 Provide economic incentives for locally manufactured recycled products / recycling processes.	~	~			•			~	~							✓	~				
WMA 6 Reduce / remove any unnecessary economic or other barriers to the export of recycled products / recyclable materials.	~	~			•			~	*		~					-	~				
WMA 7 Give preference to recycled / recyclable products and materials in public sector procurement.	~	~	~	~	•	~	~	~	~	~	~				~						
WMA 8 Provide advice and guidance on methods / techniques for waste recovery / recycling to product importers / suppliers, consumers and other waste generators.								•	*		~					*	*				



Table 24: Al	locat	ion o	f Re	spon	sibili	ties	for S	trate	gy Iı	mple	men	tatio	n								
Institutions / Stakeholders Planned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government, Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
Waste Segregation, Containment, Collection & Transport:																					
WMA 9 Ensure that a regular and reliable MSW collection service is provided to all communities located within 300 yards of an all-weather road which is accessible by a purpose-designed waste collection vehicle.	~					~		•							~			~			
WMA 10 Prepare, consult on and publish a "Waste Management Design Guide" which provides specific advice on the design and installation of WM infrastructure as an integral part of new residential and commercial developments.	~					~		•							~						
WMA 11 Require the use of standardised waste storage containers of an appropriate size, type and quality which are capable of being emptied mechanically.	~					~		•							*						
WMA 12 Introduce source segregation and separate collection of recyclable materials from municipal and similar solid wastes in representative pilot areas.	~					~		•							~						
WMA 13 Following completion of the measure envisaged in action WMA 12 above, expand source segregation and separate collection of recyclable materials [including bio-waste] for which there are viable long-term markets across all urban areas.	*					✓		•		•					*		*	*		*	



Table 24: All	locat	ion o	f Re	spon	sibili	ties	for S	trate	gy Iı	mple	men	tatio	n								
Institutions / Stakeholders Planned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government, Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
WMA 14 In conjunction with action WMA 3 above, encourage the development of a network of drop- off / take-back centres at convenient locations in densely-populated urban areas.	*	٨.						•	•						٨.	*	•		<		*
WMA 15 Install and operate transfer-loading systems where necessary and economically justifiable.								•	~									~			
WMA 16 Establish & maintain a national system for storing, collecting (and treating – see WMA 19 above) healthcare risk waste and other hazardous difficult wastes, including international waste.			✓		>			•	*	>						✓	*	*			
Waste Treatment / Processing:																					
WMA 17 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the treatment / processing of wastes.			*					*	•	~						*	*	*	*		
WMA 18 Introduce a mandatory requirement that staff and operatives engaged in waste treatment and processing activities are appropriately qualified and adequately trained.			✓			*		*	•	~					*	~	*	*			
WMA 19 Establish and maintain a national system for treating hazardous and difficult wastes in accordance with regulations and best practices.			~		~			•	~	~						 Image: A start of the start of	~	~			
WMA 20 Promote and incentivise the use of small-scale and home composting of bio-wastes in rural communities.	 Image: A start of the start of	~						•	~	~					~				~	✓	



Table 24: Al	locat	ion o	f Re	spon	sibili	ties	for S	trate	gy I	mple	men	tatio	n								
Institutions / Stakeholders Planned Actions / Measures	Ministry of Natural Resources and Agriculture (MNRA)	Ministry of Forestry, Fisheries and Sustainable Development	Ministry of Health	Ministry of Energy, Science & Technology and Public Utilities	Ministry of Finance and Economic Development	Ministry of Labour, Local Government, Rural Development	Ministry of Education, Youth & Sports	Belize Solid Waste Management Authority (BSWaMA)	Department of Environment (DOE)	Belize Agricultural Health Authority (BAHA)	Comptroller of Customs	Public Utilities Commission	Belize Electricity Limited (BEL)	Statistical Institute of Belize	Local Authorities	Chamber of Commerce & Industry	Industrial/Commercial Entities	WM Service Providers	Environmental NGOs	Householders	The Public
WMA 21 Develop and operate a network of facilities for reducing the volume of non-hazardous wastes going to landfill.					~			•	~	~					~	~	~	~			
WMA 22 Promote and incentivise the development and operation of systems and facilities for processing of recovered recyclable materials and product- related wastes streams.					*			•	~	~					*	*	~	~			
Final Disposal:																					
WMA 23 Develop, consult on, enact and enforce a sector regulation, supporting guidance and a detailed statutory code of practice governing the final disposal (landfilling) of wastes.		~	~					~	•	~						~	~	~	~		
WMA 24 Develop and operate facilities for the final disposal of non-hazardous wastes generated outside the Western Corridor in accordance with regulations and best practices.	~				~			•	~						~			~			
WMA 25 Prepare and implement plans, and allocate sufficient resources, for the closure, remediation, restoration & return to beneficial use of waste dump sites and "hotspots".	~		*		*			•	*	~					*			*			

<u>Key:</u> • = Primary responsibility \checkmark = Significant contributory role

7. **RESOURCE AND FINANCIAL IMPLICATIONS**

7.1 Institutional and Human Resource Requirements

Substantial institutional and human resources will be required in order to implement this Strategy, and these are likely to fluctuate markedly over time. These relate primarily to implementation of the legislative reforms, and institutional and organisational measures required on the one hand, and development and supervision of the systems and infrastructure for physically managing wastes on the other. Additional human resources will be required at all levels including engineers, professionally-qualified managers, technicians and skilled workers.

An assessment of the institutional / human resources and skills needed to implement the Strategy will be undertaken once the detailed decisions regarding the institutional and organisational arrangements for managing wastes have been taken, in particular the extent to which the private sector will be involved in the delivery and operation of solid waste management infrastructure and services.

In this respect, a distinction will need to be drawn between the institutional and human resources required to:

- Undertake limited duration tasks such as preparing detailed implementation plans for sub-components of the Strategy, or planning, procuring and supervising the construction of new public waste management equipment, facilities and services.
- Undertake on-going functions such as monitoring and enforcement under "steady state" operating conditions.
- > Meet peaks in workload associated with on-going functions.

Many of the resources needed to implement limited duration tasks could be brought in from the private sector, but those required to undertake on-going functions are likely to require additional resources to be permanently assigned.

Meeting peaks in the workload associated with on-going functions, especially during the early years of Strategy implementation, will be the most difficult to cope with in terms of institutional resource planning and provision. Peaks in workload can probably be met to some extent through out-sourcing, but in many cases this will only provide a partial solution.

7.2 Physical Resource Requirements for Waste Management

While considerable progress has been made in recent years in developing state-of-the-art infrastructure for managing solid wastes in some areas of the country (notably along the Western Corridor and the islands of Ambergris Caye and Caye Caulker), continuing growth in population and the amount of waste generated will require further investments in SWM equipment, facilities and systems to be made over the next 20 years.

By far the greatest requirements for additional waste handling capacities will be in respect of *Municipal Solid Waste (MSW)* – see **Figure 24** and **Table 25**. The growth projections shown are based on the preferred SWM scenario discussed in section 4.3.3, and the assumptions presented and discussed in section 4.2.1 above.

With regard to *other waste streams*, there is insufficient data to be able to make an accurate and reliable assessment of the waste handling methods and capacities required to manage these in a safe and environmentally-sound manner. However, it is evident from the limited information available and presented in section 2.2 that the Government will eventually need to invest in equipment and facilities for receiving, storing, collecting, transporting, treating and safely disposing of a range of hazardous and difficult waste (including international wastes).





Figure 24: Requirements for Additional MSW Handling Capacities

7.3 Capital Investment Costs (CAPEX)

The projections of handling capacities presented in **Table 25** have been used to estimate the magnitude and timing of the capital investment costs (CAPEX) required in order to achieve our strategic objectives and targets for municipal solid wastes management (see section 4.1 above). These are summarised in **Table 26**.

As might be expected, by far the largest part of the estimated total investment costs relates to the expansion and upgrading of waste collection services (\sim 64%), and the development of additional landfill facilities (\sim 23%). As noted earlier, these costs will be particularly sensitive to the future growth in generation of MSW and the proportion of this waste stream that is recoverable / actually recovered.

7.4 Operating Costs (OPEX)

Table 26 also presents estimates of the annual cash operating costs associated with the provision and operation of the upgraded and additional waste handling systems and facilities required. The costs presented in these tables take account of the revenue from sales of recovered materials.

As with CAPEX, by far the largest part of the estimated total annual operating costs over the Strategy period relates to the provision of waste collection services (~78%), followed by waste transfer and final disposal (~20%). These results are not surprising, and are in line with the experience of other countries that operate modern, high quality MSW collection and disposal systems. These estimates also serve to demonstrate two important points:

- Hitherto, expenditure on MSW collection equipment and services has fallen far short of that required to provide a universal, high quality collection service throughout Belize;
- Given the dominance of the costs associated with waste collection services, it is important to adopt collection methods and practices which maximise the performance / cost-effectiveness and minimise the costs of delivering these services.



Table 25: Projected MSW	Handling	Capacities	Required	(in metric	tonnes per	annum of	available	capacity),	2015-2034	ŧ.	
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2034
MUNICIPAL SOLID WASTE											
Generated:											
From households	74,840	79,167	83,743	88,585	93,706	99,123	104,853	110,915	117,327	124,109	217,712
Commercial and non-hazardous industrial	23,528	24,164	24,816	25,486	26,174	26,881	27,607	28,352	29,117	29,904	39,033
TOTAL	98,369	103,330	108,559	114,071	119,880	126,004	132,460	139,267	146,444	154,013	256,744
Collected:											
From households	53,506	61,112	69,420	78,484	88,363	99,123	104,853	110,915	117,327	124,109	217,712
Commercial and non-hazardous industrial	18,078	19,686	21,367	23,125	24,962	26,881	27,607	28,352	29,117	29,904	39,033
TOTAL	71,584	80,798	90,787	101,608	113,325	126,004	132,460	139,267	146,444	154,013	256,744

Table 26: F	Projections	of Capital	Investmen	ts Require	ed & Annua	al Operatir	ng Costs (i	n `000 BZ[), 2015-2	034*		
Year	2013-14	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025-34
MUNICIPAL SOLID WASTE												
Capital Investments (CAPEX):		_			_					_	_	
Collection	0	14,693	1,971	2,137	2,375	2,492	7,050	3,429	7,585	2,643	2,774	70,040
CA sites	0	1,400	0	0	0	0	0	0	0	0	0	0
Transfer	11,443	1,000	1,691	0	0	0	0	0	200	200	0	400
Treatment	0	0	0	0	0	0	6,800	0	0	0	0	0
Final Disposal (landfill)	12,170	6,455	0	0	0	0	6,467	0	0	0	0	17,126
TOTAL	23,613	23,548	3,662	2,137	2,375	2,492	20,318	3,429	7,785	2,843	2,774	87,566
Annual Operating Costs (OPEX):												
Collection	0	8,881	10,077	11,374	12,780	14,303	15,953	17,738	18,646	19,605	20,615	275,523
CA sites	0	165	165	165	165	165	165	165	165	165	165	1,483
Transfer	991	1,294	1,570	1,697	1,834	1,981	2,354	2,455	2,560	2,671	2,789	35,916
Treatment	0	0	0	0	0	0	1,061	1,068	1,076	1,084	1,093	13,275
Final Disposal (landfill)	578	775	1,224	1,312	1,406	1,507	1,628	2,083	2,143	2,207	2,259	37,632
Less revenue from sale of materials	0	0	0	0	0	0	-378	-397	-417	-438	-460	11,564
TOTAL	1,569	11,115	13,035	14,548	16,185	17,957	20,782	23,111	24,174	25,294	26,460	352,266

Note: * Figures for 2013-14 relate to costs already incurred for facilities in the Western Corridor developed as part of the Belize Solid Waste Management Project.

7.5 Financing and Cost Recovery

7.5.1 Investment Financing

As indicated in section 7.3 above, the development of additional / upgraded waste management systems and facilities will require a series of capital investments to be made at different times over the next 20 years. Assessing how the various investments required might be financed involves consideration of three main questions:

- > Who will be responsible for making these investments (the *investors*)?
- > Who will provide the capital for these investments (*financing sources*)?
- How will the investment costs and recurrent expenditures be recovered (cost recovery)?

In the short-term at least, it is anticipated that *investors* in the new or upgraded systems and facilities for managing solid wastes will continue to be predominantly from the public sector in the form of the MNRA / BSWaMA and the local authorities. However, as explained further below, there is no fundamental reason why the private sector could not play a much larger role as investors in the infrastructure and equipment required to manage MSW and other waste streams more sustainably in future.

In principle, capital to finance further investments could be raised or provided from one or a combination of the following *financing sources*:

- Through private sector participation (domestic and / or foreign) in the form of equity capital;
- Long-term loan capital from commercial financing institutions (domestic and / or foreign);
- Long-term loan capital from International Financing Institutions (IFIs) e.g. the Caribbean Development Bank (CDB), the Inter-American Development Bank (IDB), the European Investment Bank (EIB), and the World Bank;
- Long-term loan capital from *bilateral funding institutions* e.g. the German Development Bank (KfW Entwicklungsbank);
- By issuing fixed term bonds or loan stock;
- Transfers from the regular GoB budget;
- Capital grants from international and bilateral development agencies, e.g. the EU / European Development Funds (EDFs) operating under the Cotonou Agreement, United States Agency for International Development (USAID), Canadian International Development Agency (CIDA), the UK's Department for International Development (DfID), the United Nations Development Programme (UNDP).

These are reviewed briefly below. Further information about aid agencies operating in the Caribbean Region can be found in **Annex D**.

Private Sector Participation

In all OECD countries, private sector organisations are major stakeholders in wastes management, but this is not the case in Belize where most SWM facilities and services are provided by the public sector.

Besides injecting large-scale investment capital for the provision of facilities, private sector participation can fulfil a variety of objectives including improving operational efficiency, improving the technical and managerial capacity of a municipal service organisation, reducing the need for State subsidies, or insulating the operation of waste management facilities from short-term political changes.



There is a range of options for private sector participation in the provision of municipal waste management services. At one end, the municipality or public authority retains full responsibility for operations, maintenance, financing and risk whilst, at the other, the private sector assumes a significant level of responsibility for these functions. The main options for private sector participation can be distinguished by how the responsibility for such functions as asset ownership and the provision of capital for investment are allocated between the public and private sectors. In practice, hybrids of these various models can be designed to meet the specific requirements of a particular project, public authority or private sector firm.

Whichever approach is used, private sector participation in financing investments usually involves equity or risk capital. This is provided by the investor in the expectation that returns on the investment over time will be greater than if the funds had been put in a safer form of investment, such as government securities. The higher expected returns compensate the investor for the greater levels of risk involved. Large investments are seldom financed solely through equity capital. These are typically financed through a combination of equity and loan capital.

Commercial Financing Institutions

These comprise various kinds (banks, venture capital funds, etc) and are extensive providers of investment capital for waste management facilities and services in OECD countries. While such institutions sometimes provide risk capital in return for acquiring an equity interest in a company or specific investment project, they are more usually involved in providing loan capital.

The terms and conditions offered for the provision of loan capital are influenced by several factors such as the duration of the loan, the financial status of the borrower, the quality of any security provided by the borrower and the lender's own cost of capital. However, the dominant influence tends to be the potential financial risk associated with a particular investment project i.e. whether the project will be able to generate revenues sufficient to ensure that the loan is repaid together with interest payments over the life of the investment.

Commercial financing institutions are rarely willing to finance 100% of the capital investment costs of a project through the provision of loan capital. The investor usually has either to finance a significant part of these costs from own resources, and / or find other sources of capital finance.

International Financing Institutions (IFIs)

These are able to offer fairly attractive terms for investments intended to establish or improve environmental facilities or infrastructure (so-called 'soft' loans). IFIs that operate in Belize include the Caribbean Development Bank (CDB), the Inter-American Development Bank (IDB), the European Investment Bank (EIB), and the World Bank Group.

In general, applications for capital investment financing to an international financing institution will need to have the official approval and a supporting sovereign guarantee from the Government. Most of the international financing institutions will only lend to government institutions or to corporate entities having clearly defined objectives, management and decision-making structure, which are operated along commercial lines. Also, some institutions have a minimum size of loan. For example, the EIB will only directly finance loans of EUR 1.5 million or greater. These constraints tend to limit the scope for IFI participation in financing capital investments to those projects of a fairly substantial size. In addition, considerable resources and time are usually needed to develop and negotiate an IFI loan.



Bilateral Funding Institutions

Many countries, including most of those in Europe, the USA, Japan and Canada, provide financial assistance to developing and transition countries through so-called bilateral financing institutions. These differ in their areas of interest and modus operandi but, in general, operate along similar lines and with similar constraints to the international financing institutions.

The largest bilateral financing institution operating in Belize is the United States Agency for International Development (USAID).

Fixed Term Bonds / Loan Stock

While these can in principle be an attractive way of securing long-term finance for some types of investment, these are generally legally complicated and also expensive to arrange and administer. For this reason, they are usually only worth considering for very large investment projects.

GoB Budget

It is probable that, for the short-to-medium term, a significant part of the capital investments required to expand and upgrade the systems for managing MSW will continue to be financed through transfers from the GoB budget. However, support from central government on such a large scale is unlikely to be sustainable over the longer and so alternative sources of financing will need to be increasingly exploited (as has been the case in all developed countries) in order to gradually reduce the current dependency on high levels of state subsidy.

However, even over the longer term, it may be necessary for the Government to provide sovereign guarantees for international / bilateral loans in order to finance the construction of major new or upgraded facilities for collecting, treating and disposing of MSW.

Capital Grants

Grants are non-reimbursable funds provided mainly for technical cooperation programs. Grants for capital investment purposes are less common, and are usually only made on a small scale to NGOs or in conjunction with long-term loans to micro and small businesses.

Future Financing

In the short-to-medium term (until 2021), we anticipate that major investments in strategically essential SWM facilities and infrastructure will continue to be financed through a combination of IFI and / or bilateral loans and transfers from the GoB budget. Over the longer term, we intend to allow public providers / operators of SWM infrastructure and services to set their tariffs at levels that enable them to generate sufficient revenue and capital reserves to be able to finance investments in new and replacement SWM facilities from their own budgetary resources and / or through long-term credits from IFIs.

Likewise, we intend that the investments required for expanding and upgrading waste collection and street cleaning services will be financed (fully or partially) through private sector participation in the delivery of these services. In all OECD countries, private sector organisations are major stakeholders in wastes management, but this is not the case in Belize where most WM facilities and services are currently provided and financed by the public sector. Besides injecting substantial investment capital for the provision of facilities, private sector participation can fulfil a variety of objectives including improving operational efficiency, improving the technical and managerial capacity of a municipal service organisation, reducing the need for government subsidies, or insulating the operation of waste management facilities from short-term institutional changes.

7.5.2 Cost Recovery and Affordability

Cost Recovery

Generally speaking, the ability to finance the necessary investments in new or upgraded waste management systems and facilities depends ultimately on generating reliable and predictable revenue streams (cash flows) that are sufficient to:

- Service and repay any loans (that may be denominated either in local and / or foreign currencies);
- Meet the recurrent costs incurred during operation;
- Meet any costs of facility closure, restoration and after-care; and
- In the case of private equity investors, provide a return on capital that is commensurate with the investors' opportunity cost of capital and the risks involved.

In line with the Polluter Pays Principle (see section 3.5 of the National SWM Policy), the investment and other costs should eventually be recovered from waste producers, either through the fees paid by the users of waste management facilities and services and / or through the prices paid by consumers of products that give rise to wastes.

In order to give a broad indication of the possible impacts of the increased costs for implementing this Strategy on the fees that should be paid by the users of MSW management facilities and services, we have calculated the Average Incremental Costs¹⁸ (AIC) of providing waste management infrastructure and services to enable the targets for managing MSW presented in **Table 14** above to be met. These costs, which take account of the time value of money, are shown in **Table 27** and indicate the <u>average user fees</u> (expressed in 2013 values) that would need to be charged in order to recover all the CAPEX and OPEX over the period of the Strategy, including costs already incurred for facilities in the Western Corridor developed as part of the Belize Solid Waste Management Project.

Table 27: Average Increm	ental Costs of MSW M	anagement Services (BZ	D/tonne)
Service Component	All CAPEX + OPEX	Future CAPEX + OPEX	OPEX only
Waste Storage & Collection ¹	150.62	150.62	114.89
Transfer	24.49	17.21	15.54
Treatment ²	4.26	4.26	1.57
Final Disposal	31.39	23.42	13.26
TOTAL MSW	210.75	195.51	145.27
Cost to Households ³	200.74	182.69	123.20

1. Including CA sites.

2. Net of revenues received from sale of recovered materials.

3. After deduction of revenue received from commercial waste fees.

The Government and local authorities currently subsidise the costs of MSW management, and the current fee payable by households does not come even close to recovering the full costs of service provision. It is estimated that this subsidy currently amounts to around 80% of the total cost. We therefore intend that this subsidy will gradually be phased out over a period of five years so that full cost recovery (of OPEX only or OPEX + CAPEX – see below) is achieved by the end of 2020.

¹⁸ The "Average Incremental Costs" (AIC) are calculated by dividing the Present Value (PV) of the projected costs (or expenditures) for achieving the targets for managing MSW, by the PV of the projected MSW quantities over the period 2013/14 – 2034. A discount rate of 7.5% has been used. Further information on AIC may be found here: http://www.worldbank.org/urban/solid_wm/erm/Annexes/US%20Sizes/New%20Annex%204D.6.pdf



We have calculated the average user fees required to recover the costs of MSW management on three bases:

- All CAPEX and OPEX are recovered, including the major investments made in the Western Corridor prior to 2014;
- > Only future CAPEX and OPEX are recovered, i.e. investments from 2014 onwards;
- > Only OPEX is recovered.

In each case, we have then calculated the annual and monthly fee per capita, monthly fee per household and, if the fee were to be collected by adding it to the electricity tariff, the additional fee per kilowatt-hour supplied. The results are shown in **Table 28**.

Cost recovery by linking the fee for MSW management services to the electricity tariff is the system which was operated by the City of Tbilisi, Republic of Georgia, between July 2011 and June 2013. A brief description of the fee collection system and related experience in Tbilisi is presented in the text box immediately following **Table 28**.

Affordability

Affordability is interpreted as the price that household waste producers can afford to pay without jeopardizing their ability to meet other basic needs. Affordability is mainly the ability-to-pay, which is assessed by an analysis of available statistical data. On the other hand, *willingness-to-pay* is a subjective personal judgement based on one's financial capacities, attitude to the service and consequences of avoiding payment. Willingness-to-pay is assessed through service user surveys.

The *macro-affordability* threshold is determined as the percentage of average household income for the region that is considered reasonable as payment for MSW management services. *Micro-affordability* is determined as the percentage of average household income for the lowest quintile income group. The adoption of affordability thresholds is useful for determining the appropriate tariff levels for public services, since these provide an objective assessment of the affordability of a proposed level of payment / cost recovery.

World Bank data show that fees for waste management services worldwide for countries in the upper middle to lower middle income range represent between 0.75 and 1.5 % of per capita household income (the higher percentage is for the lower income countries). **Table 28** also presents the affordability ratios for the lowest quintile income group of the average user fees required to recover the costs of MSW management on the three tariff bases defined above.

These suggest that affordability for the lowest household income group may become an issue of concern only if all CAPEX and OPEX are recovered through user fees, and as GoB and local authority subsidies are progressively phased out. If indeed affordability becomes an issue for this income group, then the Government will consider introducing a support scheme targeted at low-income groups that cannot afford to pay full cost recovery tariffs for municipal SWM services (e.g. through a fee rebate scheme for qualifying households).


Table 28: Projected Average Fees Required to Achieve Different Levels of Cost Recovery for MSW Management, 2015-2034											
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2034
Monthly per capita household income (BZD)	157.0	161.7	166.5	171.5	176.7	182.0	187.4	193.1	198.8	204.8	275.3
All CAPEX & OPEX Recovered:											
Annual fee per capita, BZD	16.18	22.28	28.22	34.04	39.78	47.28	48.69	50.16	51.66	53.21	71.51
Monthly fee per capita, BZD	1.35	1.86	2.35	2.84	3.31	3.94	4.06	4.18	4.31	4.43	5.96
Monthly fee per household, BZD	5.47	7.53	9.54	11.51	13.45	15.98	16.46	16.95	17.46	17.99	24.17
Fee per kWh, BZD	0.02468	0.03397	0.04304	0.05192	0.06067	0.07211	0.07427	0.07650	0.07879	0.08116	0.10907
Affordability Ratio, %	0.6%	0.8%	1.0%	1.2%	1.3%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Future CAPEX & OPEX Recovered:				_							
Annual fee per capita, BZD	14.73	20.27	25.68	30.98	36.20	43.02	44.32	45.64	47.01	48.42	65.08
Monthly fee per capita, BZD	1.23	1.69	2.14	2.58	3.02	3.59	3.69	3.80	3.92	4.04	5.42
Monthly fee per household, BZD	4.98	6.85	8.68	10.47	12.24	14.54	14.98	15.43	15.89	16.37	22.00
Fee per kWh, BZD	0.02246	0.03092	0.03917	0.04725	0.05522	0.06562	0.06759	0.06962	0.07171	0.07386	0.09926
Affordability Ratio, %	0.6%	0.7%	0.9%	1.1%	1.2%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
Only OPEX Recovered:											
Annual fee per capita, BZD	9.93	13.67	17.32	20.89	24.41	29.01	29.88	30.78	31.70	32.66	43.89
Monthly fee per capita, BZD	0.83	1.14	1.44	1.74	2.03	2.42	2.49	2.57	2.64	2.72	3.66
Monthly fee per household, BZD	3.36	4.62	5.85	7.06	8.25	9.81	10.10	10.40	10.72	11.04	14.83
Fee per kWh, BZD	0.01515	0.02085	0.02641	0.03186	0.03724	0.04425	0.04558	0.04695	0.04836	0.04981	0.06694
Affordability Ratio, %	0.4%	0.5%	0.6%	0.7%	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%



CASE EXAMPLE

Cost Recovery for MSW Management Services in Tbilisi, Republic of Georgia

The traditional system for recovering the costs of MSW management services based on fixed per capita monthly payments requires a comprehensive and accurate database of the population served and an efficient fee collection system. These are seldom available in developing / transition countries. Rapid and large-scale migration to the capital city, where there are better opportunities for employment, results in a high proportion of the total population being unregistered for payment of waste fees, but which is nevertheless using MSW management services on an extensive scale. Under this system, fees actually collected rarely exceed 50% of the total amount payable. This was the situation faced by the Municipal Government of Tbilisi, which was also under pressure to improve the quality and coverage of MSW management services.

To try and overcome this problem, in July 2011, the Municipal Government replaced the traditional fee of 2.5 GEL per capita per month with a fee defined as 5 Tetri (3 US cents, 0.05 GEL) per kWh of electricity consumed. At the same time, half of the fee for the socially most vulnerable part of the population was covered by the Municipal Government.

The philosophy / assumption underlying this change were that wealthier households tend to consume more electricity and also generate more waste, and should therefore pay more for MSW management services. Households in Tbilisi consume about 800-850 million kWh of electricity annually and, at this level, the new fee would generate income of around GEL 40 million (~USD 23 million) annually, compared with a total amount *theoretically* payable under the traditional system of around GEL 33 million.

However, although the new system was successful in achieving its financial objectives, it proved to be unpopular especially among households that rely heavily on electricity for cooking and heating. It was also claimed that many of those households with high incomes rely less on electricity than those with lower incomes, because wealthier households can afford to install domestic gas central heating systems. The SWM fees for households that use electricity for heating reached 20-40 GEL (11-22 USD) per month, and this led to increasing unpopularity and opposition to the new system amongst such households. An attempt to reduce the opposition was made in 2012 when the SWM fee was reduced to 2.5 Tetri per kWh consumed for the period from November to March.

Following a change of Government in 2012, the system linking the SWM fee directly to electricity consumption was discontinued in June 2013. The SWM fee is now fixed at 2.5 GEL per capita per month and is applicable to a maximum 4 members of a family (or 10 GEL / family / month). However, the SWM service fee is still invoiced and collected using the billing system of the electricity company (Telasi).



ANNEX A EXISTING SOLID WASTE MANAGEMENT ARRANGEMENTS - PROBLEM ANALYSIS -



Belize - Existing Solid Waste Management Arrangements - Problem Analysis						
Core Problem	Core Problem = The existing system for managing solid wastes in Belize is financially and environmentally unsustainable.					
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects			
1. Policy & Legislative Framework	 b. Key Problems 1.1 Existing national policy / strategy on SWM is not yet sufficiently developed to facilitate preparation and implementation of an integrated and cost-effective national SWM system. 1.2 Existing national legislation relating to SWM is not effective. 1.3 Enforcement of legislation relating to SWM is not effective. 	 A comprehensive policy and strategy, addressing all key areas of performance for SWM, does not exist. 1.1.2 Programmes / targets for achieving an integrated SWM system are not yet sufficiently developed / elaborated. 1.1.3 Policies for the management of specific / difficult waste streams do not exist. 1.2.1 Processes and procedures for formulating, implementing and monitoring the impact of legislation are not efficient or transparent. 1.2.2 Current arrangements and procedures for stakeholder consultations and participation in the process of drafting policies & legislation are not effective. 1.2.3 Legislation & standards relating to SWM are not sufficiently developed to facilitate a comprehensive & integrated approach to SWM. 1.2.4 Key words & terms used in SWM legislation are not adequately defined & / or applied consistently. 1.2.5 The interface between national SWM legislation and local regulations is not clear / fully articulated. 1.3.1 Enforcement is not considered to be a priority. 1.3.2 Penalties for non-compliance are not appropriate and / or not applied as a deterrent. 1.3.3 Resources and procedures for monitoring and enforcement are insufficient and ineffective. 1.3.4 The various regulatory agencies do not collaborate. 	 No comprehensive sectoral basis is available for determining SWM priorities, performance requirements or targets. Regional / local strategies & plans for SWM have not been prepared. Local authorities do not have the resources and capacities to implement SWM legislation and standards. Stakeholder resistance to the introduction of new SWM legislation. Confusion regarding the meaning and intention of SWM legislation. Standards relating to SWM are difficult to implement and enforce effectively. Wastes are not always managed in accordance with best practices / techniques. Littering & illegal dumping in areas not receiving waste collection service. Uncontrolled dumping of wastes, including potentially hazardous wastes. The Department of Environment is not able to monitor and control SWM facilities / processes / activities adequately. 			



Belize - Existing Solid Wa	ste Management Arrangements - Problem An	alysis
Core Problem = The existing system for managi	ng solid wastes in Belize is financially and env	vironmentally unsustainable.
A. Area/Activity B. Key Problems	C. Principal Causes	D. Principal Effects
 Institutional / Organisational Arrangements 2.1 Existing institutional / organisational arrangements are not optimal for an integrated and cost-effective national SWM system. 	 2.1.1 Existing institutional structures and related information systems & management procedures are fragmented and inefficient / ineffective. 2.1.2 Institutional responsibilities are not clearly & comprehensively defined / legally assigned. 2.1.3 In some cases, legal competences of Ministries are not clearly defined and / or overlap. 2.1.4 The human and financial resources available to existing institutions are not sufficient to deliver an integrated & efficient SWM system. 2.1.5 The existing enforcement system is not able to control waste generation and transport / processing / disposal activities effectively. 2.1.6 Institutional functions & responsibilities for SWM at the national / local levels are not well coordinated. 2.1.7 Resources available at local level are insufficient for effective delivery of SWM services. 2.1.8 Institutional arrangements for intermunicipal cooperation with respect to SWM do not exist. 2.1.9 Existing legal and organisational arrangements for private sector participation in Municipal Solid Waste management are 	 Confusion / overlap of functions & responsibilities. Insufficient co-ordination and cooperation between Government institutions. Lack of continuity in approach. Failures / deficiencies in decision-making & task implementation. Human resources are insufficient and not prepared for such tasks, and are not motivated. SWM activities are not regulated effectively. Private sector involvement in decision making and performance in SWM is limited. The scope for economies of scale & other potential efficiencies in service provision are not exploited. The potential benefits of competition in service provision are not realised in all branches / areas of waste management.
3. Human Resources 3.1 Existing numbers & capacities	3.1.1 The number of staff employed by	> SWM activities are not planned, managed
/ Capacity of human resources engaged in SWM (in both the public and	Government and local authorities in relation to SWM is insufficient.	or regulated effectively.Inadequate specification and supervision
private sectors) are inadequate.	3.1.2 The capabilities of staff engaged in SWM- related activities employed by Government	of the provision of SWM infrastructure & services.
	and local authorities are not sufficiently developed.	 Private sector waste producers do not apply best SWM practices and techniques.
	3.1.3 Health & safety of human resources engaged in SWM activities is not a priority.	 SWM service providers do not apply best practices and techniques.
	3.1.4 Private sector waste producers and some	Staff & workers are not motivated to



	Belize - Existing Solid Wa	ste Management Arrangements - Problem An	alysis
Core Problen	n = The existing system for managing	ng solid wastes in Belize is financially and en	vironmentally unsustainable.
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects
		 managers of wastes are not sufficiently trained and / or experienced. 3.1.5 The contributions of staff and workers engaged in SWM activities are not recognised / viewed positively by Belizean society (low status). 3.1.6 Compensation paid to staff and workers engaged in SWM activities does not reflect adequately their contributions / value to Belizean society. 	 perform efficiently. Health and safety risks are greater than need be.
4. Data Availability, Monitoring & Reporting	4.1 Available data & information on the sources, nature, quantities and fate of wastes, and SWM facilities, is not sufficiently comprehensive and reliable to be able to regulate & manage wastes effectively.	 4.1.1 Historical data on wastes & SWM do not exist. 4.1.2 Existing data do not cover all areas / municipalities or all waste streams (focus on western corridor). 4.1.3 A national system for classifying, regularly collecting, processing, analysing & disseminating data & information on the sources, nature, quantities and fate of wastes, and SWM facilities, does not exist. 4.1.4 Waste producers and SWM service providers, are not obliged (by law) to collect, record and report data and information about the wastes they generate / manage. 	 A comprehensive and reliable statistical basis for planning, management and control of SWM facilities and services does not yet exist. A comprehensive and consistently reliable basis for monitoring & reporting of all SWM activities and performance does not exist. Data & information relating to specific / problematic waste streams is inadequate and / or unavailable (e.g. packaging wastes; WEEE; ELVs). Information available to stakeholders is insufficient.
5. Stakeholder Awareness & Communication	5.1 Stakeholders do not have a sufficient awareness and understanding of their roles & responsibilities in achieving an integrated and cost-effective national SWM system.	 5.1.1 Stakeholder awareness and communications are not regarded as a priority / need by Government. 5.1.2 A targeted national strategy / programme for on-going communications & consultations with, and participation of, all key stakeholders are not yet in place. 5.1.3 Resources required for effective stakeholder communications are not allocated / sufficient. 5.1.4 SWM issues are not sufficiently addressed within existing educational curricula and programmes. 5.1.5 A focal point for implementation and 	 Stakeholders are not identified / engaged. National policy & strategy for SWM are not communicated effectively to all stakeholders. Government intentions and policy objectives with respect to SWM are not recognised &/or widely understood by all stakeholders. Responsibilities & duties with respect to SWM are not recognised and / or accepted by all stakeholders. Communication between different stakeholder groups is not developed. Waste management is not perceived as an



Belize - Existing Solid Waste Management Arrangements - Problem Analysis						
Core Problem	Core Problem = The existing system for managing solid wastes in Belize is financially and environmentally unsustainable.					
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects			
		coordination of a national stakeholder communication programme has not been established / equipped.	 economic as well as an environmental activity. General awareness and understanding of SWM issues throughout society do not yet exist. Realisation of necessary SWM facilities and other changes in existing SWM systems / practices may be prevented / delayed due to a lack of stakeholder awareness and understanding. 			
6. Financing / Cost Recovery	6.1 The revenue flows from existing SWM fees and other sources are insufficient to be able to meet the full costs of providing an integrated and environmentally sustainable national SWM system.	 6.1.1 Existing fees / taxes for SWM services & facilities are not sufficient to recover the full costs of managing wastes in an environmentally-sound manner. 6.1.2 The full costs of managing wastes in an environmentally sound manner are not known and / or understood by local authorities and waste producers. 6.1.3 Existing regulations / mechanisms for collecting fees / taxes for the provision of SWM services & facilities are not enforced / effective. 6.1.4 Revenues from existing fees / taxes are not equitably and appropriately distributed [to local authorities]. 6.1.5 Elected local government representatives are reluctant to introduce cost-covering charges for SWM services (for political reasons). 6.1.6 The full costs of developing and operating an environmentally sustainable SWM system are not affordable for some members of Belizean society. 	 A sustainable basis for financing the development and operation of an integrated and cost-effective national SWM system does not yet exist. Waste producers do not perceive or bear the full costs of managing their wastes in an environmentally-sound manner [polluter pays principle]. Manufacturers, importers and distributors of products giving rise to specific / problematic wastes / waste streams do not perceive or bear the costs of managing such wastes / waste streams in an environmentally-sound manner [polluter pays principle]. There is no incentive for the private sector to invest in new SWM infrastructure / systems or services. 			



Belize - Existing Solid Waste Management Arrangements - Problem Analysis					
Core Probler	m = The existing system for managi	ng solid wastes in Belize is financially and en	vironmentally unsustainable.		
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects		
7. Waste Prevention	7.1 The potential for waste prevention at source is not being realised.	 7.1.1 Existing fees / taxes for SWM services & facilities provide little or no incentive to avoid / reduce waste generation. 7.1.2 Economic incentives to avoid and reduce waste are not available. 7.1.3 Product suppliers, consumers and other waste generators are not aware of the potential opportunities for, and benefits of, avoiding and / or reducing wastes. 7.1.4 Information on the opportunities & techniques for wastes prevention and reduction is not readily available to waste generators. 	 Clean technologies are not considered or widely applied. Measures aimed at waste prevention have no basis for effective implementation due to lack of economic incentives and communication between stakeholders. Resources, including the resources for SWM, are not used efficiently with both actual & potential economic & environmental consequences. The current / future volumes of waste requiring handling, processing and disposal are / will be greater than need be. The resource requirements for handling, processing and disposing of wastes are / 		
8. Waste Recovery & Recycling	8.1 The potential for greater waste recovery and recycling is not being realised.	 8.1.1 Government policy and support for secondary raw material markets do not exist. 8.1.2 Existing fees / taxes for managing and disposing of wastes provide little or no incentive to recover / recycle materials from waste. 8.1.3 Existing legislation to encourage the return of empty beverage containers is not wide enough in scope. 8.1.4 Manufacturers, importers and distributors of products giving rise to specific / problematic wastes / waste streams are not obliged to take-back the wastes resulting from their products for subsequent re-use / recycling. 8.1.5 Stable, long-term markets for some types / grades of recyclable materials do not exist. 8.1.6 Domestic market outlets for most types / grades of recyclable materials do not exist or are very weak. 8.1.7 Costs incurred for collection, segregation and shipment discourage the export of some 	 will be higher than need be. The recovery of some types / grades of potentially recyclable materials is not financially viable under prevailing conditions. Technologies and techniques for waste recovery and recycling are not widely applied. Facilities for recovery, re-processing and recycling of some types of recyclable material are limited. Resources, including the resources for SWM, are not used efficiently with both actual & potential economic & environmental consequences. The current / future volumes of waste requiring handling, processing and disposal are / will be greater than need be. The resource requirements for handling, processing and disposing of wastes are / will be higher than need be. 		



	Belize - Existing Solid Waste Management Arrangements - Problem Analysis					
Core Problem	n = The existing system for managing	ng solid	d wastes in Belize is financially and en	vironmentally unsustainable.		
A. Area/Activity	B. Key Problems		C. Principal Causes	D. Principal Effects		
		8.1.8 8.1.9 8.1.10	recyclable materials. Economic incentives to recover and recycle waste are not available. Users of raw materials do not consider waste to be part of the material cycle. Product suppliers, consumers and other waste generators are not aware of the potential opportunities for, and benefits of, recovery and recycling of wastes.			
9. Waste Segregation, Storage, Collection & Transport	9.1 Existing methods / systems for the temporary storage, collection and transport of wastes are not efficient / cost- effective.	 9.1.1 9.1.2 9.1.3 9.1.4 9.1.5 9.1.6 9.1.7 9.1.8 9.1.9 	Existing equipment and other resources for temporary storage, collection and transport of MSW are inadequate. Existing mechanisms for recovering the costs of providing waste collection services do not encourage waste segregation by waste producers. Existing arrangements for segregating and separately storing potentially hazardous wastes prior to collection are inadequate. Systems for segregating & separately storing recyclable materials prior to collection are not sufficiently developed. Systems for the segregation & separate collection of biodegradable wastes are not sufficiently developed. Systems for the transfer / bulk transportation of some types of waste to centralised treatment / disposal facilities are not sufficiently developed. An integrated national system for the segregation, separate storage and collection of hazardous wastes (including healthcare risk waste) does not exist. Current methods / practices for the collection of MSW inhibit / prevent the efficient use of resources. A competitive market of service providers for various waste collection services is not fully developed.	 Increased health / environmental risks from improper segregation / storage. Opportunities for economically viable recovery / recycling of some recyclable materials cannot be realised. The scope for economies of scale in the operation of centralised waste treatment / processing facilities cannot be exploited. The costs of MSW collection service provision are / will be higher than need be. Existing arrangements for the provision of MSW collection services are financially unsustainable in the long run. Existing providers of waste collection services have little incentive to become more efficient. 		



	Belize - Existing Solid Waste Management Arrangements - Problem Analysis					
Core Problem	Core Problem = The existing system for managing solid wastes in Belize is financially and environmentally unsustainable.					
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects			
10. Waste Treatment / Processing	10.1 Wastes generated are not treated / processed efficiently and in accordance with best practices.	 10.1.1 Legislation and standards governing the treatment / combustion of wastes are not sufficiently developed / enforced effectively. 10.1.2 Existing facilities for the treatment / processing of wastes outside the Western Corridor do not comply with modern standards of design and operation. 10.1.3 Staff and operatives engaged in waste treatment and processing activities are not adequately trained. 10.1.4 The low financial cost of landfilling untreated waste, relative to the costs of waste treatment / processing, inhibits investment in new or upgraded treatment / processing facilities. 10.1.5 Facilities for treating / processing hazardous wastes do not exist / are not functioning. 10.1.6 Facilities for treating / processing slaughter and other difficult wastes are insufficient. 10.1.8 Existing systems / facilities for processing of recovered packaging materials are not sufficient. 10.1.9 Existing systems / facilities for processing of other product-related wastes streams (e.g. waste oils, ELVs, WEEE, etc) are not sufficient. 	 Enhanced pollution & hazard potential from such facilities. Some wastes are treated / burnt in inadequate / inappropriate facilities. Significant risks to the health / safety of operatives handling wastes, and to other people entering waste disposal sites. Methods higher up the waste management hierarchy are not utilised sufficiently. Significant pollution / potential health risks from the disposal of some types of untreated waste to landfill. 			



	Belize - Existing Solid Waste Management Arrangements - Problem Analysis					
Core Problem	n = The existing system for managin	ng solid wastes in Belize is financially and en	vironmentally unsustainable.			
A. Area/Activity	B. Key Problems	C. Principal Causes	D. Principal Effects			
11. Final Disposal	11.1 Wastes requiring final disposal are not always disposed of in accordance with best practices.	11.1.1 Legislation and standards governing the final disposal of wastes are inadequate / not properly enforced.	Continuing environmental burdens and risks to health from existing and old waste dump sites and "hotspots".			
	11.2 Some existing and old (historical & non-operational) waste dump-sites and "hotspots" are not being closed, progressively remediated and restored.	 11.1.2 Existing facilities / practices for the final disposal of wastes outside the Western Corridor do not comply with modern standards / best practices. 11.1.3 The number of existing facilities for the environmentally-sound disposal of wastes is not sufficient. 11.1.4 Existing tariffs / charges for the final disposal of wastes do not reflect the full costs of landfilling wastes in accordance with modern standards / best practices. 11.2.1 Financial resources available for the identification, assessment, closure, remediation and restoration of all old waste dump sites & "hotspots" are not sufficient. 	 Continued illegal dumping in some areas. Significant adverse impacts on the landscape and amenity values. Adverse impacts on tourism. The siting, design, operation & after-care of final disposal facilities are not always in accordance with international standards. 			



ANNEX B

WASTE MANAGEMENT TECHNOLOGIES & TECHNIQUES



In this **Annex B**, we provide brief descriptions of the various technologies and techniques presented as *technical options for managing solid wastes* in section 4.3.1. Where relevant, the main outputs for each tonne of input waste treated using a particular technology or technique are also provided. However, these are only *indicative* – the actual mass balance of a process will vary considerably depending on the composition of the input waste, system scale / configuration and other factors.

Landfilling of Wastes

Landfill can be defined as the *controlled disposal of waste on land* with little or no pretreatment. As such, it is distinguished from *dumping*, which is characterised by the absence of control of the disposal operations and a lack of management of the dump site and its emissions into the environment. Waste dumping has been phased out in the Western Corridor, but is still the main method of solid waste disposal elsewhere in Belize.

Landfilling of biodegradable wastes results in the formation of *landfill gas* and *leachate*. The methane emitted in landfill gas is thought to represent the main greenhouse gas impact of MSW management. As the least favoured option in the waste management hierarchy, landfill should be reserved for stabilised wastes from which no further value may be economically recovered. Landfill gas (LFG) may be collected and either disposed of by flaring or used as a fuel.

LFG is composed of approximately equal amounts of carbon dioxide (CO₂) and methane (CH₄), plus traces of some other substances (usually less than 1% by volume). It is theoretically possible for one tonne of mixed Municipal Solid Waste (MSW) to produce up to 400 m³ of gas during the time it is decomposing. The length of time over which LFG will be generated within a landfill depends upon a variety of factors, in particular the nature and composition of the waste, the placement methods and local climatic conditions. High levels of gas production typically occur over a 10-15 year period, starting about 6 months after the waste is deposited. Under certain conditions, generation of LFG can continue for 50 years or more, although such a long period is unlikely under the climatic conditions prevailing in Belize.

The calorific value of LFG is typically around half that of natural gas and so, under favourable conditions, it can be economically attractive (and environmentally beneficial) to abstract and recover LFG for subsequent utilisation. LFG can be used in three ways:

- As a direct source of heat energy, in kilns, boilers and furnaces, if there is a suitable customer or user nearby;
- For the generation of electricity using reciprocating or turbine engines, either for use locally or for sale to a third party;
- > For upgrading to higher quality fuel such as liquefied gas (often bottled).

Besides reducing the damaging effects of emissions from landfill sites, utilisation of LFG brings the additional benefit of displacing power or fuels produced from (non-renewable) fossil sources.

All components of MSW are currently acceptable for landfilling, including residual fractions remaining after the separation of materials for recycling and the residues from pre-treatment processes such as incineration and MBT.

Segregation and Separate Collection of Recyclable Materials

There is an increasing recognition of the benefits *of segregating and collecting waste in separate fractions*, allowing easy diversion and recovery of glass, metals, paper and board for recycling, and biodegradable waste for composting or anaerobic digestion. It is possible to separate mixed waste mechanically or manually at a centralised sorting plant, and this



can be successful for recovery of dry recyclables. But it is not possible to obtain uncontaminated biodegradable waste in this way. The success of composting and anaerobic digestion plants depends heavily on production of good quality usable compost and this requires source-separated kitchen, garden and other clean organic wastes.

There are a variety of methods of source segregation and separate collection. The first schemes to be introduced were '*bring' systems* which require the householder or other waste producer to deliver materials to a HWRC / CA site or to bottle, can and paper banks located at supermarkets or other convenient locations. However, higher collection rates can be achieved with *kerbside collection* and this is now increasing in many parts of Europe and North America. This requires householders to place kitchen and garden waste or dry recyclables in a separate box, bag or container. Some schemes collect *mixed (commingled) dry recyclables* which are then separated either by the collection staff as they load the materials into the collection vehicle, or at a centralised *Materials Recovery Facility* (MRF). Other schemes require the householder to sort the waste into different compartments or containers. Some schemes collect separated waste simultaneously with residual ("black bag") waste, whereas others make separate trips using different vehicles.

Segregation and separate collection of recyclable materials is already being practiced on a small / intermittent scale in a few areas of Belize.

Transfer-loading

Transfer-loading refers to the process by which waste collection vehicles discharge their loads at a facility (transfer station) where they are subsequently transferred into larger vehicles or other transport medium for onward transport. While transfer stations differ significantly in terms of size and design, they all serve the same basic purpose – consolidating waste from multiple smaller collection vehicles into larger, high-volume transfer vehicles for more economical shipment to a distant treatment or final disposal facility. This also reduces fuel consumption and collection vehicle maintenance costs, plus produces less overall traffic, air emissions, and road wear. In addition, a transfer station can also provide:

- An opportunity to screen waste prior to treatment or final disposal;
- Flexibility in selecting waste treatment / disposal options;
- > A facility that can serve as a HWRC or CA site.

At many transfer stations, operatives screen incoming wastes on conveyor systems, tipping floors, or in receiving pits. Waste screening has two aims: separating recyclables from the waste stream and identifying any wastes that might be inappropriate for treatment or disposal at the destination facility (e.g. hazardous wastes or materials, white goods, whole tyres, auto batteries, infectious waste).

Although cost-effectiveness will vary according to local circumstances (in particular the average payload of the waste collection vehicles used and the average travel times to the treatment / final disposal facility), transfer stations generally become economically viable when the hauling distance to the treatment / final disposal facility is greater than 20 to 30km.

Transfer stations already operate in Belize City and San Ignacio / Santa Elena, and will be introduced in Belmopan, San Pedro and Caye Caulker in the near future.



Incineration (combustion)

The most widely practised and proven alternative to landfilling is *mass-burn incineration*, where bulk MSW is burnt with little or no pre-treatment¹⁹. Modern MSW incinerators recover energy released by the combustion process. Energy recovered from waste combustion can replace the need for electricity and / or heat from other sources. The net climate change impacts of incineration depend on how much fossil-fuel carbon dioxide is released – both at the incinerator itself and in savings of fossil fuel from conventional energy sources displaced by incineration. The main residue from incineration is a stable inorganic ash representing ~90% of the original input mass, which has virtually no capacity to produce methane when disposed of in landfills. Incineration may therefore be considered as a landfill pre-treatment technique.

Incinerators typically operate at scales of over 100,000 tonnes waste per year and require input waste within a fairly narrow range of calorific value (CV). The costs are usually offset to a significant extent by revenues from energy sales. With an operational life of 20-30 years, incinerators need an assured supply of waste within specified composition ranges. Waste management planners therefore need to take careful account of the impact of recycling activities on the availability and composition of waste destined for incineration under long-term contracts. For example, extensive recycling of paper or plastics may result in a residual waste enriched in food and garden wastes that would be less suitable for incineration.



There are several combustion options available for *Refuse-Derived Fuel* (RDF), made from paper, plastics and other combustible materials separated from bulk MSW. RDF may be burnt in dedicated combustors co-firing wood, peat or coal, or as a fuel supplement in cement kilns or coal-fired power stations. Although developed in the early 1980s, RDF technology is only gradually becoming more widely deployed.

¹⁹ Mass-burn incineration is also often referred to as "Energy-from-Waste" (EfW).



An advantage of RDF over mass-burn incineration is that, because the waste is sorted and shredded before combustion, the combustion equipment can be smaller, less robust and therefore less expensive.

Advanced Thermal Treatment (non-combustion)

Along with the combustion technologies outlined above, there is increasing interest in the application of *advanced thermal treatment* (ATT) technologies for the processing and recovery of MSW and similar wastes. Although not new concepts, it is only in relatively recent years that technologies such as pyrolysis and gasification have been commercially applied to the treatment of MSW.

In contrast to combustion, *pyrolysis* is the thermal degradation of a substance in the absence of oxygen. This process requires an external heat source to maintain the temperature required. Typically, lower temperatures of between 300°C to 850°C are used during pyrolysis of materials such as MSW. Untreated mixed MSW is usually not appropriate for pyrolysis and typically would require some mechanical preparation and separation of glass, metals and inert materials (such as rubble) prior to processing the remaining waste. In general, pyrolysis processes tend to require consistent feedstocks and there is a very limited track record of commercial-scale pyrolysis plants accepting MSW anywhere in the world.

The products produced from pyrolysing materials are a solid residue and a synthesis gas (syngas). The solid residue (sometimes described as a char) is a combination of noncombustible materials and carbon. The syngas is a mixture of gases (combustible constituents include carbon monoxide, hydrogen, methane and a broad range of other VOCs). A proportion of these can be condensed to produce oils, waxes and tars. The syngas typically has a net calorific value (NCV) of between 10 and 20 MJ/Nm³. If required, the condensable fraction can be collected by cooling the syngas, potentially for use as a liquid fuel. One key issue for use of syngas in energy recovery at ATT facilities are the problems related to tarring. The deposition of tars can cause blockages and other operational challenges and has been associated with plant failures and inefficiencies at a number of pilot and commercial scale facilities.





Gasification can be considered as a process between pyrolysis and combustion in that it involves the partial oxidation of a substance. This means that oxygen is added but the amounts are not sufficient to allow the fuel to be completely oxidised and full combustion to occur. The temperatures employed are typically above 650°C. The process is largely exothermic but some heat may be required to initialise and sustain the gasification process.

Untreated mixed MSW is usually not appropriate for gasification and typically would require some mechanical preparation and separation of glass, metals and inert materials (such as rubble) prior to processing the remaining waste. The main product is a syngas, which contains carbon monoxide, hydrogen and methane. Typically, the gas generated from gasification will have a net calorific value (NCV) of 4-10MJ/Nm³. For reference, the calorific value of syngas from pyrolysis and gasification is far lower than natural gas, which has a NCV of around 38MJ/Nm³. As noted above, a key issue for use of syngas in energy recovery at ATT facilities are the problems related to tarring.

The application of a higher temperature secondary processing phase may be used to 'crack' the tars and clean up the syngas prior to application in energy recovery systems. This process is sometimes referred to as 'syngas clean up' or 'polishing' and could enable higher efficiency energy recovery than applicable through other waste thermal treatment processes. It should be noted however that most commercial gasification facilities processing MSW-derived feedstocks utilise a secondary combustion chamber to burn the syngas and recover energy via a steam circuit, and whilst this is not incineration, the differences between the processes in practical and efficiency terms are much more modest. The other main product of gasification is a solid residue of non-combustible materials (ash) which contains a relatively low level of carbon.

Some *plasma gasification technologies* are examples of where a high temperature (electric arc) method is applied potentially at various stages of the gasification process (in different configurations). Plasma, or other very high temperature thermal processing, can be applied to fuse the ash from the process into an inert (glassy) residue and crack the tars to generate a relatively clean syngas. There are several initiatives seeking to achieve high energy recovery efficiencies using gas engines and hydrogen fuel cells linked to gasifiers.





Mechanical Heat Treatment (MHT) is a relatively new term used to describe configurations of mechanical and thermal, including steam, based treatment technologies. The generic purpose of these processes is to separate a mixed waste stream into several component parts, to give further options for recycling, recovery and in some instances biological treatment. The processes also sanitise the waste, by destroying bacteria present, and reduce its moisture content. The most common system being promoted for the treatment of MSW using MHT is based around a thermal autoclave. Autoclaving has been used for many years to sterilise hospital and surgical equipment using the action of steam and pressure. This technology is also in common use for the sanitisation treatment of some clinical wastes, and for certain rendering processes for animal wastes, prior to sending to landfill. Its application to MSW is a relatively recent innovation. However, the commercial experience on this feedstock has made considerable progress in recent years and is expanding in Europe at present.

Mechanical Treatment for Recycling

Recycling diverts components of the waste stream for reusing the materials contained within them. Some materials can be recovered mechanically from bulk-collected MSW, such as metals recovered in incinerator ash and metals and glass recovered by MBT processes. The subsequent clean-up of these materials for recycling is relatively straightforward and so there may be a market for them. To obtain higher quality of material requires segregation from other wastes at source. This is usually essential for paper and plastics recycling, and for all wastes, a higher price and better market access is usually achieved for sourcesegregated materials.

A typical *Materials Recovery Facility* (MRF) employs manual processing and/or semiautomatic processing for sorting recyclables from waste and preparing them in a form suitable for use by a materials reprocessor. A MRF is typically equipped with conveyors, trommel (rotary screen) separators (for removal of fine particles and permitting size separation) picking lines where manual operators remove recyclable materials, and baling equipment. Other equipment includes weighbridges, storage containers, fork-lift trucks, and some MRFs may be equipped with magnetic separators, eddy current separators and machines for the detection and separation of plastics by polymer type. There are various options for the equipment layout of a MRF depending on the degree of source-separation already performed by the householder. Generally, well-separated recyclables require less processing at a 'clean' MRF than unsorted, mixed recyclables at a 'dirty' MRF.

'Dirty' MRFs, which receive unsegregated waste, are widely used in the USA, where sink disposal units are often used for disposing of kitchen wastes which would otherwise end up in the household waste stream. 'Dirty' MRFs have not achieved widespread deployment in Europe because of contamination of recyclable materials in the waste stream and its impact on material values in volatile markets. In most cases, 'clean' MRFs are designed to separate commingled recyclables into their individual material streams and prepare them for sale into the commodity markets. Experience suggests that MRFs below an annual capacity of 80-100,000 tonnes will not achieve optimal operating costs. Facilities of this scale are needed to achieve economies of scale but also to justify investment in more automated and sophisticated sorting equipment that will help maximise the value of the recovered materials. A 'dirty' MRF can typically recover between 5 and 25% by weight of the incoming material as recyclables, whereas a 'clean' MRF can usually recover more than 90% depending on the origin and quality of the input material.





Biological Treatment for Recycling

Biological treatment processes are typically used for processing and recovering sourceseparated kitchen, garden and other clean organic wastes.

Composting makes use of micro-organisms to oxidise biodegradable wastes to carbon dioxide and water vapour, using oxygen in the air as the oxidising agent. A humus-like residue is left that is then used as a soil conditioner in agriculture or land reclamation or possibly as a growing medium in gardening or horticulture. Use of compost may have beneficial effects on greenhouse gas fluxes by replacing other products like fertiliser and peat and may also lead to increased storage of carbon in the soil (carbon sequestration).

Industrial scale composting can be undertaken in open heaps that are turned and mixed mechanically (windrows), or alternatively in closed vessels with internal mixing and aeration. Composting can, of course, be undertaken with minimal equipment at home in



most houses with suitable garden space. Efficient source segregation of food, garden and other organic wastes destined for centralised composting is an absolute prerequisite if the resultant compost is to be of sufficient quality for marketing.





Like composting, anaerobic digestion (AD) is a biological process, but it takes place in sealed vessels in the complete absence of air (i.e. under anaerobic conditions). The process converts biodegradable waste to a biogas containing methane and carbon dioxide. The biogas is then used as a fuel, potentially displacing fossil-fuels. AD is essentially a controlled and accelerated decomposition process using the same types of micro-organisms that produce methane in landfills. The volume-reduced solid residue (digestate) is used like compost, but usually only after a period of maturation by composting. Clean source-segregated feedstock is essential if the matured digestate is to be suitable for marketing as a quality product for use in agriculture or horticulture.



Mechanical Biological Treatment (MBT)

Mechanical Biological Treatment (MBT) is a generic term describing a series of integrated processes which include the mechanical sorting of waste followed by a phase of biological treatment. The first MBT plants were developed with the aim of reducing the environmental impact of landfilling residual waste. MBT therefore compliments, but does not replace, other waste management technologies such as recycling and composting as part of an integrated waste management system.

The outputs from an MBT process are typically recovered recyclables, a Refuse Derived Fuel (RDF) and low quality, stabilised 'compost-like output' (CLO). A key advantage of MBT is that it can be configured in a variety of ways to achieve the required recycling, recovery and biodegradable municipal waste (BMW) diversion performance. Recyclables recovered from an MBT process are normally of much lower quality than those from source-segregated waste, due to greater levels of mixing and increased potential for contamination with other materials. CLO is lower quality than compost produced from segregated biodegradable waste and some regulatory bodies recommend landfilling CLO, requiring less volume and generating fewer methane emissions than landfilling of the original, untreated waste.





Recycling of Waste Electrical and Electronic Equipment (WEEE)

Recycling of Waste Electrical and Electronic Equipment (WEEE or E-waste) is a specialist part of waste management. It is a rapidly growing sub-sector due largely to the implementation of the European Union WEEE Directive in Europe. There are ten broad categories of WEEE outlined within the WEEE Directive, namely:

- Large household appliances e.g. fridges, cookers, microwaves, washing machines and dishwashers.
- Small household appliances e.g. vacuum cleaners, irons, toasters and clocks.
- IT and telecommunications equipment e.g. personal computers, copying equipment, telephones and pocket calculators.
- Consumer equipment e.g. radios, televisions, hi-fi equipment, camcorders ad musical instruments.
- Lighting equipment e.g. straight and compact fluorescent tubes and high intensity discharge lamps.
- Electrical and electronic tools e.g. drills, saws and sewing machines, electric lawnmowers.
- Toys, leisure and sports equipment e.g. electric rains, games consoles and running machines.
- Medical devices e.g. (non-infected) dialysis machines, analysers, medical freezers and cardiology equipment.
- Monitoring and control equipment e .g. smoke detectors, thermostats and heating regulators.
- > Automatic dispensers e.g. hot drinks dispensers and money dispensers.

Large household appliances (e.g. ovens, fridges, washing machines) typically make up over 40% of WEEE but there are large volumes of other equipment such as IT equipment (mainly computers), TVs, small household appliances (e.g. kettles and hair dryers), electrical tools, digital watches, electronic toys and medical devices. Such items contain a wide variety of materials e.g. an average TV contains 6% metal and 50% glass, whereas a cooker is 89%



metal and only 6% glass. Other materials found include plastics, ceramics and precious metals.

The treatment of WEEE can vary enormously according to the category of WEEE and technology that is used. Some treatment facilities utilise large-scale shredding technologies, whilst other use a disassembly process, which can be either manual or automated. The main options / routes for recycling of WEEE are shown schematically in the flow diagram presented below.



Main Recycling Options / Routes for WEEE



Processing of End-of-Life Vehicles (ELVs)

In countries with a fairly large national vehicle park, once vehicles become 'end-of-life', they generally follow the processing and disposal route depicted in the diagram presented overleaf and summarised below:

Step 1: If the vehicle can still be driven, then it is usually driven to a vehicle dismantler who will pay for the vehicle. Alternatively the vehicle may be towed, either privately or by the dismantler.

Step 2: Materials and parts e.g. tyres, batteries are removed provided it is financially worthwhile to do so. Parts may be cleaned for resale and materials are separately collected. Some ELVs may be processed by 'itinerant collectors' who remove and take high value materials before passing the vehicle on.

Step 3: Materials collected by the dismantler are periodically collected and transported to an appropriate facility for further processing and treatment, e.g. smelter, where secondary material is produced for sale.

Step 4: The dismantled ELV may be crushed (where it makes economic sense to bulk up the load for transport to a shredder) using a number of methods such as shearing, baling or flattening (either with a mechanical flattener or the jib of a crane). Such activities may occur at the dismantler or at a dedicated site (a scrapyard or feeder site).

Step 5: Ultimately, the ELV ends up at a shredder, a mechanical device which breaks the vehicle into small pieces that are subsequently divided and sorted into ferrous metal, a heavy fraction (non-ferrous metal (NFM) fraction) and light fraction (fluff).

Step 6: The ferrous fraction is relatively pure, having been removed from other material using magnetic separation after shredding. Total impurities are between 0.5-1.0% by weight, consisting primarily of some fines, rust and non-ferrous metals (principally copper). The ferrous fraction is transported for further processing in an electric arc furnace, where it is made into a secondary material for resale.

Step 7: The NFM fraction consists of aluminium, lead, copper, zinc, etc as well as other materials, such as glass, rubber and some plastics²⁰. It is transported to a heavy media separation plant (HMSP) for further processing. This plant uses a series of flotation tanks in which the density of the water is adjusted using ferro-silicon and magnetite to separate out non-ferrous metals from other material (plastics, etc) on the basis of differences in density. Separated aluminium is usually dried to stop it oxidising in air. All separated metals are then transported for further processing in the home country or overseas.

Step 8: After separation of the NFM fraction, the remaining material is known as 'fluff' and typically consists of dirt, rubber, light plastics and fabrics. Most commonly, the fluff fraction is transported to landfill although, in some cases, the fluff fraction may undergo some form of further processing to recover, for example, plastics for recycling or energy recovery in a cement kiln, municipal solid waste (MSW) incinerator or blast furnace.

There are no vehicle shredders currently operating in Belize and, given the relatively small size of the national vehicle park and domestic supply of ELVs, it is unlikely that a shredder would be economically viable. Consequently, after, dismantling, most vehicle hulks are exported for further processing and recovery.

²⁰ Composition of the NFM fraction is variable depending on the composition of the infeed material and the chosen operating settings of the shredder. An operator who also has a heavy media separation plant (HMSP) is more likely to produce a lower grade NFM fraction, knowing that it will be processed at the HMSP. Metal content can vary by 50%.



Summary Overview of ELV Processing & Disposal Route





ANNEX C PRINCIPLES OF GOOD GOVERNANCE FOR PUBLIC SECTOR AGENCIES



There have been numerous attempts at defining what is meant by "good governance" and the qualities and characteristics that this expression embodies. For example, the UNDP notes that:

"Good governance is, among other things, participatory, transparent and accountable. It is also effective and equitable. And it promotes the rule of law. Good governance ensures that political, social and economic priorities are based on broad consensus in society and that the voices of the poorest and the most vulnerable are heard in decision-making over the allocation of development resources."

A more comprehensive definition is provided by Article 9.3 of the most recent version of the Cotonou Agreement²¹ which states as follows:

"In the context of a political and institutional environment that upholds human rights, democratic principles and the rule of law, good governance is the transparent and accountable management of human, natural, economic and financial resources for the purposes of equitable and sustainable development. It entails clear decision-making procedures at the level of public authorities, transparent and accountable institutions, the primacy of law in the management and distribution of resources and capacity building for elaborating and implementing measures aiming in particular at preventing and combating corruption".

Belize is a signatory to the Cotonou Agreement.

In the context of public sector bodies / agencies, good governance generally involves the application of the following key principles:

- 1. *Government and public sector agency relationship* the agency's relationship with the government is clear.
- 2. *Management and oversight* the agency's management and oversight are accountable and have clearly defined responsibilities.
- 3. *Organisational structure* the agency's structure serves its operations.
- 4. *Operations* the agency plans its operations to achieve its goals.
- 5. *Ethics and integrity* ethics and integrity are embedded in the agency's values and operations.
- 6. *People* the agency's leadership in people management contributes to individual and organisational achievements.
- 7. *Finance* the agency safeguards financial integrity and accountability.
- 8. *Communication* the agency communicates with all parties in a way that is accessible, open and responsive.
- 9. *Risk management* the agency identifies and manages its risks.

Attention to these principles helps to ensure that an agency has appropriate systems and structures to fulfil its mandate and accountability obligations, and achieve a high level of organisational performance. Under each principle, the matrix presented overleaf details the requirements for organisational performance and accountability, the means for achieving them and proposed methods for monitoring their achievement.

²¹ Downloadable from <u>http://ec.europa.eu/europeaid/where/acp/overview/documents/devco-cotonou-consol-</u> <u>europe-aid-2012_en.pdf</u>



GOVERNANCE PRINCIPLES	REQUIREMENTS	OPERATIONS	MONITORING
	What is required to achieve organisational performance and accountability?	How do you achieve it?	How do you monitor your progress towards good governance?
 Government and public sector agency relationship 	1.1 An approved document defines the respective responsibilities and accountabilities between the Chief Executive Officer (CEO), the Agency Supervisory Board & the responsible Minister	1.2 Processes and procedures exist to manage communications and other interactions between the CEO, the Board, the Minister and other parliamentary representatives	1.3 Communications and other interactions are recorded and monitored
 Management and oversight 	 2.1 A document defines roles, responsibilities and accountability for all relevant levels of management (e.g. those involved in setting the organisation's key strategic goals and outcomes and monitoring organisational performance) 2.2 Where standing committees exist, the relationships between the parties are clearly defined 	 2.3 A strategic plan outlines the organisation's key strategic goals and outcomes and outputs 2.4 Operational plans and programmes of work exist that define critical success factors and outline how key strategic goals and outcomes will be accomplished at all levels of the organisation 2.5 A delegations framework defines levels of authority 	2.6 Performance measures and indicators are defined and monitored for the organisation's strategic goals
3. Organisational structure	3.1 Policies ensure that the organisation's structure serves its key strategic goals and outcomes	3.2 Processes exist to manage structural change and the relationships between business units	3.3 Performance measures and indicators identify how well the structure delivers against strategic plans
4. Operations	4.1 Policies enable operations to deliver against the organisation's key strategic goals and outcomes	 4.2 The organisation's operational plans and programmes of work support the organisation's key strategic goals and outcomes and are regularly adjusted to changes in strategic and environmental imperatives 4.3 Infrastructure is in place to enable the organisation to implement its operational plans 4.4 A proper and adequate record is maintained of the performance of the organisation's operations as aligned with its key strategic goals and outcomes 	 4.5 Business process and outcome- specific key performance indicators (KPIs) track the organisation's performance against its strategic and operational plans 4.6 Regular and <i>ad hoc</i> performance evaluations and audits are conducted



GOVERNANCE PRINCIPLES	REQUIREMENTS	OPERATIONS	MONITORING			
	What is required to achieve organisational performance and accountability?	How do you achieve it?	How do you monitor your progress towards good governance?			
5. Ethics and integrity	5.1 The organisation's values and behaviour reflect the ethics prescribed in Article 121.(1) of the Belize Constitution, and define the standards of official conduct and professional behaviour expected of all employees	 5.2 The organisation's ethics and integrity risks are identified and policies and operational processes address them (e.g. procurement, conflict of interest) 5.3 People management frameworks define the response to unethical behaviour 5.4 Processes are in place to provide supervision and assistance and enable follow up of non-compliance (e.g. through public interest disclosure) 	5.5 A structured process is in place to monitor official conduct and professional behaviour (e.g. compliance audit, performance management)			
6. People	6.1 Policies enable the attraction, retention and effective management of people	 6.2 Plans ensure that processes, decisions and actions are based on the principles of fairness, equity and diversity, as well as consistent, transparent, impartial and open for review 6.3 People management frameworks cover the whole employment continuum 	 6.4 Structured procedures are in place to monitor adherence to human resource policies and processes 6.5 Feedback processes identify issues in people management practices 			
7. Finance	 7.1 Finance policies define the key strategic goals and outcomes for which the organisation's finances must be employed 7.2 A formal audit charter specifies roles and responsibilities, composition and structure of all audit functions 	 7.3 Processes ensure the proper recording of financial transactions consistent with applicable accounting standards 7.4 Financial operations contribute towards the organisation's key strategic goals and outcomes and uphold the highest level of integrity 	7.5 Structured processes are in place to monitor and audit financial performance against budget and key strategic goals, both at executive level as well as by an independent audit committee.			



GOVERNANCE PRINCIPLES	REQUIREMENTS	OPERATIONS	MONITORING
	What is required to achieve organisational performance and accountability?	How do you achieve it?	How do you monitor your progress towards good governance?
8. Communications	 8.1 Communication policies ensure the organisation's communications are open, accessible and responsive 8.2 Policies ensure information is disseminated through correct channels, in a timely manner and to the right target group 	 8.3 Processes ensure proactive, transparent and responsive internal and external communications 8.4 Processes assist in complying with legislation on record keeping, public interest disclosure and freedom of information, in safeguarding the confidentiality and integrity of information, and in preventing unauthorised, false or premature disclosure 	8.5 An audit strategy exists to monitor compliance with communication policies and strategies
9. Risk management	9.1 Policies exist for the governance and management of material risks (e.g. reputational, financial or physical, including occupational safety and health)	 9.2 The organisation's risk exposure is evaluated and remediation plans are implemented 9.3 Preventive measures for key risk categories are in place 	9.4 Procedures are in place to monitor incidents from the identified risk categories (data analysis)



ANNEX D AID AGENCIES OPERATING IN THE CARIBBEAN REGION



Insert in the PDF version