GUAM ENVIRONMENTAL PROTECTION AGENCY
AHENSIAN PRUTEKSION LINA'LA GUAHAN

EDDIE BAZA CALVO, GOVERNOR OF GUAM | RAY TENORIO, LT. GOVERNOR OF GUAM | ERIC M. PALACIOS, ADMINISTRATOR | YVETTE CRUZ, DEPUTY ADMINISTRATOR

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2014 APR 30 AM 9:42

April 29, 2014

32-14-1589

Judith T. Won Pat, Ed.D.
Date 4.30.14
Time 8:30am
Received by

Honorable Judith T. Won Pat, Ed.D.
Speaker
32nd Guam Legislature
155 Hessler Place
Hågatña, Guam 96910

Håfa Ådai, Speaker Won Pat:

Pursuant to Resolution 32-189, the Guam Environmental Protection Agency (Guam EPA) is pleased to transmit the Guam Zero Waste Plan (Volumes 1 & 2). Guam EPA appreciates the support of *I Liheslaturan Guåhan* in their recognition of the guiding principles of sustainable materials management and their call for the adoption of a comprehensive Zero Waste Plan.

Should you have any question, please contact Ms. Conchita SN Taitano at 300-4751; or via email at: conchita.taitano@epa.guam.gov.

Sincerely,

ERIC M. PALACIOS
Administrator

Cc: Senators, 32nd Legislature
Attachments

GUAM LEGISLATURE
CENTRAL FILES

ACKNOWLEDGEMENT RECEIPT
Received by:
Time: 4:25 PM
Date: 4/29/14

1589

I MINA' TRENTAI DOS NA LIHESLATURAN GUÅHAN
2013 (FIRST) Regular Session

Resolution No. 189-32(COR)

Introduced By:

T.R. Muña Barnes
R. J. Respicio
J.T. Wonpat
V.A. Ada
B.J. Cruz
A.A. Yamashita
B. McCreadie
T. Morrison

Relative to Adopting Zero Waste as a guiding principle for Sustainable Materials Management and Supporting the Creation and Adoption of a Zero Waste Plan For Guam in order to preserve the Lanyon landfill for generations to come.

Jul 17 PM 2:17

BE IT RESOLVED BY THE COMMITTEE ON RULES OF *I MINA' TRENTAI DOS NA LIHESLATURAN GUÅHAN:*

WHEREAS, I Liheslaturan Guåhan recognizes and acknowledges the clear connection between waste reduction, recycling, resource recovery and beneficial reuse issues and the need to change unsustainable consumption and production patterns while protecting and managing the natural resource base of economic and social development; and

WHEREAS, I Liheslaturan Guåhan finds that based on recent estimates, the expected life of the landfill will be 35-40 years, with the Military as a customer and 45-50 years without the Military. The life span of the landfill can be extended only with

effective implementation of **waste reduction, recycling, resource recovery** and **beneficial reuse programs**; and

WHEREAS, I Liheslaturan Guåhan recognizes that its work in establishing the Recycling Revolving Fund, Recycling Enterprise Zones at the Port Authority of Guam, and the Guam Beverage Recycling Act of 2010 were all steps towards the eventual establishing of a sustainable zero waste community for Guam; and

WHEREAS, developing and implementing a zero waste strategy should be measured, evaluated and achieved by utilizing current and accepted methodologies, such as environmental systems management and life cycle analysis, to support science based policies and operations; and

WHEREAS, Guam's limited and valuable land resource and fragile environment must be preserved and protected. The protection of the environment, both terrestrial and aquatic, stimulation of the economy, and distribution of equity can be achieved by promoting waste reduction, recycling, resource recovery and beneficial reuse through Zero Waste practices in the public and private sectors; and

WHEREAS, the use of the term "zero waste" includes "Zero Solid Waste", "Zero Hazardous Waste", "Zero Toxics" and "Zero Emissions." The goals of "zero waste" embody the need for a closed-looped waste management system, in which waste is a sign of inefficiency and the entire concept of waste should be eliminated; and

WHEREAS, waste should be thought of as a "residual product" or simply a "potential resource" for beneficial reuse to counter the basic acceptance of waste as a normal course of events. Zero Waste strategies consider the entire life-cycle of products, processes and systems in the context of a comprehensive systems understanding of our interactions with nature and the search for inefficiencies at all stages; and

WHEREAS, Zero Waste is a community-based model that aims to eliminate or minimize landfill disposal by the application of simple solutions and sustainable materials management systems that are healthy for our people, and our island; and

WHEREAS, The Association of State and Territorial Solid Waste Management Officials has endorsed developing a Zero Waste Strategy, a significant component in implementing a comprehensive (waste) materials management program for small island developing states like Guam through both regulatory and cooperative environmental governance; and

WHEREAS, Because of its mission the Solid Waste Management Authority will have the primary responsibility for implementing the Guam Zero Waste Plan and developing the outreach and educational components required to educate and inform the public; and

WHEREAS, the Guam Environmental Protection Agency and its Division of Air and Land should work collaboratively with the Solid Waste Management Authority, and the Office of the Governor to synchronize its permitting process so that it will reflect and incorporate Zero Waste principals into all of permitting and monitoring functions and systems; and

WHEREAS, Zero Waste is a critical stepping stone to other necessary steps in the effort to protect health, improve equity, and reach sustainability. Zero Waste can be linked to sustainable agriculture, permaculture, architecture, energy, industrial, economic and community development; and

WHEREAS, a Zero Waste strategy supports all three of the generally accepted goals of sustainability, that is, environmental protection as well as economic and social well-being. Environmental protection is enhanced by reducing (ideally to zero) hazardous and solid wastes to nature and by reducing the need for energy generation and hydrocarbon extraction. Economic well-being is improved by enabling organizations to identify inefficiencies in processes, products and services and thereby to find cost-saving solutions to them.

WHERAS, Social well-being is enhanced through efficiency improvements that allow more resources to be available for all. In addition, more complete use of "wastes" may additionally create jobs in return logistics and reprocessing activities; and

WHEREAS, I Liheslaturan Guåhan finds that the concept of "sustainable materials management," within the last several years, has increasingly captured the attention of environmental managers and the public. As recent discussions have focused on energy efficiency, resource conservation, the release of greenhouse gases, climate change and toxins, it has become increasingly clear that the way we manage and use materials, across their full life cycle, has a critical effect on the world's environmental health; and

WHEREAS, the United States Environmental Protection Agency has described the importance of how we manage materials in its report, Sustainable Materials Management: The Road Ahead (2009). In the report, EPA argued that, to ensure a sustainable society, we need to rethink how we manage materials – and indeed which materials we use by looking at the full life cycle of materials from extraction to production to use to disposal; and

WHEREAS, I Liheslaturan Guåhan is committed to protecting and enhancing environmental quality now and for future generations; and

WHEREAS, over one hundred thousand of tons of materials are generated in Guam each year by residents, businesses, organizations, and institutions, and approximately 85% of this amount is sent for landfill disposal; and

WHEREAS, the placement of materials in landfills can cause damage to human health, wastes natural resources, and irresponsibly transfers liabilities to future generations; and

WHEREAS, waste prevention, reuse, recycling, and composting are material management options that conserve resources while reducing environmental impacts; and

WHEREAS, increased recycling, permaculture and composting will increase the cost-efficiency of local publicly supported recycling facilities and programs; and

WHEREAS, increased recycling saves energy, water, natural resources, reduces air and water pollution, reduces the damage caused by extracting resources from the environment, and reduces the need for landfill facilities; and

WHEREAS, a resource recovery based economy will sustain, on a per-ton basis, up to ten times more jobs than land filling or incineration, and these jobs will be more productive and meaningful; and

WHEREAS, increasingly, U.S. and international governments and organizations are adopting the policy that the financial responsibility of collecting, recycling, and disposing of materials belongs with producers and importers; and

WHEREAS, recognizing that voluntary recycling goals have not, and in all probability cannot, achieve waste elimination; and

WHEREAS, the Zero Waste philosophy accepts that the earth's ability to support life is finite and that natural resources must be used in the most efficient and sustainable way possible; and

WHEREAS, the guiding principles of Zero Waste are: managing resources instead of waste; conserving natural resources through waste prevention and recycling; turning discarded resources into jobs and new products instead of trash; promoting products and materials that are durable and recyclable; and discouraging products and materials that can only become trash after their use; and

WHEREAS, I Liheslaturan Guåhan calls for the creation and implementation of a Guam Zero Waste Plan; and now therefore be it

RESOLVED, that the Committee on Rules of *I Mina' Trentai Dos Na Liheslaturan Guåhan* does hereby, on behalf of the people of Guam, call for the Guam Zero Waste Plan to be designed to achieve the initial goal of increasing waste diversion for the Government of Guam and for the island as a whole, to 60% or better

by the year 2016. The ultimate goal of the Guam Zero Waste Plan is to eliminate waste by 2022, thereby preserving the current landfill for generations to come, before having to spend the hundreds of millions of dollars in resources needed to build another landfill, and be it further

RESOLVED, that the Speaker and the Chairperson of the Committee on Rules certify, and the Legislative Secretary attest to, the adoption hereof, and that copies of the same be thereafter transmitted to the following officials: the President of the Recycling Association of Guam, the Administrator of the Guam Environmental Protection Agency, to the Administrator of the Air and Land Division of the Guam Environmental Protection Agency, to the Administrator, Operations Manager and members of the Board of the Solid Waste Management Authority, to the Special Assistant to the Governor of Guam for the Office of the Military Build Up, to the Western Regional Office of Economic Adjustment, of the Department of Defense, to the Vice President of Matrix Consulting, to the members of the Board of the Association of the State and Territorial Solid Waste Managers, to the Administrator of Region Nine of the United States Environmental Protection Agency, to the President of the Association of Pacific Island Legislatures, to the Pacific Island Regional Recycling Initiative of the Council of Micronesian Chief Executives, to the Director-General of the Secretariat of the Pacific Regional Environment Programme, to the Office of Congresswoman Bordallo, and to the Honorable Edward J.B. Calvo, I Maga'lahen Guåhan.

DULY AND REGULARLY ADOPTED BY THE COMMITTEE ON RULES OF *I MINA' TRENTAI DOS NA LIHESLATURAN GUÅHAN* ON THIS DAY OF JULY 2013.

JUDITH T. WON PAT, Ed.D.
Speaker

RORY J. RESPICIO
Chairperson, Committee on Rules

TINA ROSE MUÑA BARNES
Legislative Secretary

ONEGUAM

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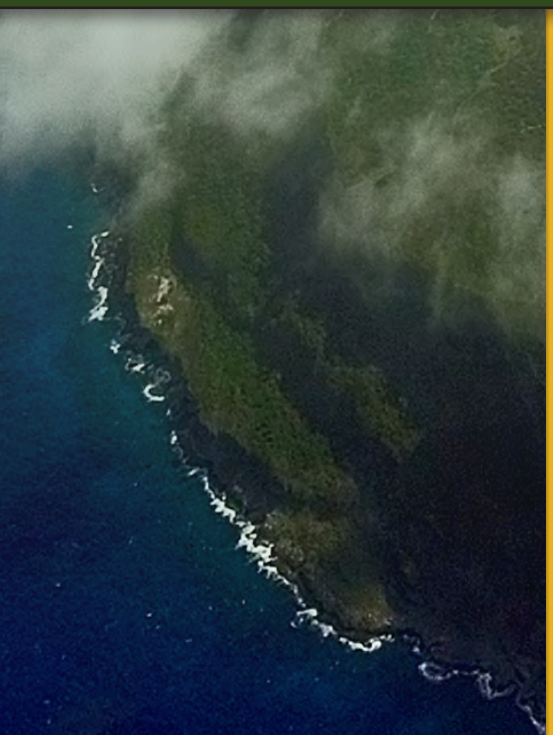
Volume I:

Guam Zero Waste Plan



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REACHING FOR ZERO:

A BLUEPRINT FOR ZERO WASTE IN GUAM

JUNE 2013

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free

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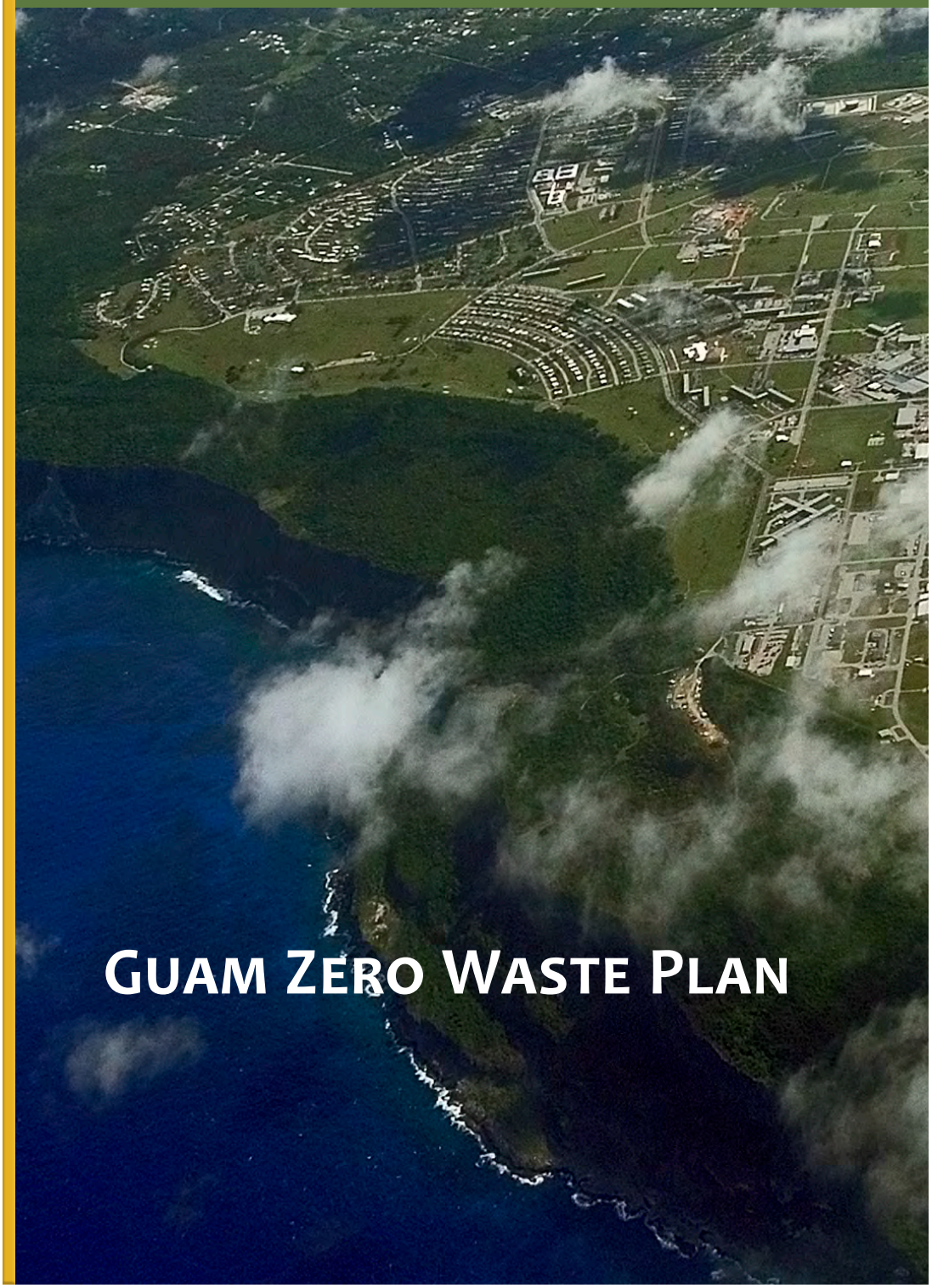
Executive Summary



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

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EXECUTIVE SUMMARY

The Chinese philosopher Lao-tsu said "A journey of a thousand miles beings with a single step." This "Blueprint for Zero Waste" provides a critical first step as well as a path to help the Government of Guam (GovGuam) and people of Guam realize a vision of Zero Waste to preserve the environment for Guam's children and the future.

Visioning

The most important part of any long journey is having a vision for the future. On February 7, 2012 representatives of the Office of the Governor of Guam and key public and private-sector solid waste stakeholders met at the Ricardo J. Bordallo Governor's Complex in Adelup for a Zero Waste Visioning Session. During the Visioning Session stakeholder input was sought regarding solid waste diversion opportunities and Zero Waste options with respect to the development of an overall Zero Waste Plan for Guam.

Key Strategies

During the Visioning Session, Stakeholders emphasized the importance of implementing the following key strategies.

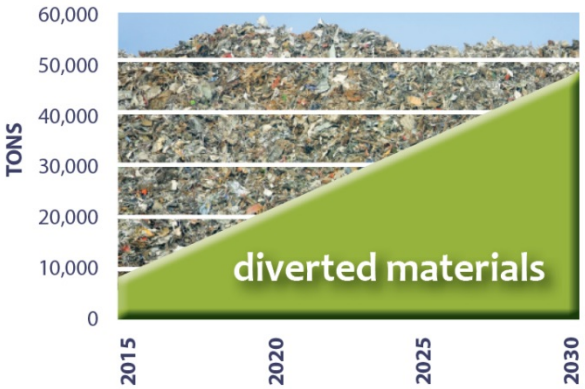
- **Develop targets**: Work with the Guam Legislature, GovGuam agencies and **Guam** Council of Mayors to put a framework in place to achieve Zero Waste.
- **Walk the talk:** One of the most important keys to achieving the goal of Zero Waste is leadership. Legislation and policies that favor Zero Waste should be adopted.
- **Use incentives in the right place:** A continuous and constantly adapting flow of initiatives, solutions and ideas are going to be required to achieve the goal of Zero Waste.
- **Develop infrastructure for recycling and resource recovery:** Although some initial help will be needed for GovGuam to get a Zero Waste Program operational, If the incentives are in the right place the private-sector and markets will assist in building and operating the infrastructure.
- **Implement a marketing campaign**: Publicize the Zero Waste Program to educate, engage and inspire the community.
- **Develop an effective enforcement process**: Fund the necessary enforcement personnel, educate volunteers and follow through with fines and penalties.

Zero Waste Implementation Strategy

Fifteen Zero Waste initiatives selected from an initial list of a wide variety of upstream, midstream, and downstream source diversion options suggested by stakeholders on Guam are evaluated in this Zero Waste Plan. From a practical perspective, the legislation, policies, programs and infrastructure needed to implement the fifteen initiatives described in this document cannot be implemented all at once. Therefore, the use of a phased approach over a 20-year planning period is recommended to implement an island-wide Zero Waste Program.

The recommended phased approach focuses on an initial phase (Phase I: Present through 2015) for implementing those initiatives that will allow GovGuam and industry stakeholders to build a strong Zero Waste foundation, followed by subsequent phases (Phase II: 2016 through 2020; Phase III: 2021 through 2025; and Long-Term: 2025 and Beyond) that provide additional time to foster public/private partnerships, raise funds, and allocate staffing in support of additional initiatives. The development of a well-integrated Zero Waste system on Guam will be an evolving process, and there will be political, technical, marketing, financial, and educational issues to address at each step.

Landfill Diversion Potential



Diversion of landfill waste, which is an over-arching goal of Guam's Zero Waste Plan, will be achieved with the implementation of the initiatives detailed in this plan. Typically, diversion successes increase as new or expanded programs mature due to increased operational efficiencies, greater public participation/acceptance, and established markets. A conservative estimate of the materials diverted from landfilling ranges from approximately 8,700 tons in 2015 (a 21% diversion rate) to 48,400 tons in 2030 (a 37% diversion rate). In the United States, the national landfill diversion rate is 34%. Many communities have achieved over 50% landfill diversion and San Francisco, a leading Zero Waste community, has achieved 80% landfill diversion. Achievement of similar percentages on Guam are likely to be tempered by low overall quantities (which increases unit costs and limits market leverage), limited local markets and high overseas transportation costs.

Job Creation Potential and Small Business Opportunities

Zero Waste is an economic development tool as well as an environmental tool. Reuse, recycling, composting, and source reduction offer direct and substantial development opportunities. Both public and private sector jobs, many of which are small business opportunities, will be created with the implementation of a Zero Waste Program for Guam. Up to 4 full-time equivalent (FTE) GovGuam (i.e., public sector) jobs will be created for the duration of the Zero Waste planning period; as many as 7 FTEs may be needed during the first two years of implementing the Zero Waste Program. In the private sector, as many as 7 new FTEs will be created in 2015 with up to 37 FTEs by 2030 for materials processing on Guam. Additional off-island jobs will also be created for secondary processing and remanufacturing.

Economic Impacts

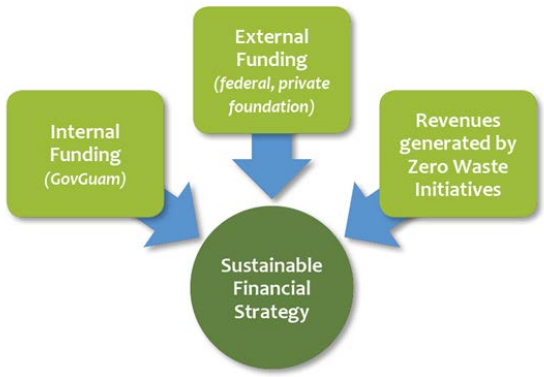
Programmatic-level economic impacts from the implementation of a Zero Waste Program on Guam using the initiatives evaluated in this plan were developed and are shown in Table ES-1. Costs estimated included potential expenses for program development and implementation, potential revenues generated from materials resale, and avoided landfill disposal costs. While the avoidance of landfill disposal costs does not represent a tangible revenue stream, these savings go directly to the bottom line of any solid waste management program, and are one of the primary long-term benefits of implementing a Zero Waste Program. The economic impacts shown in Table ES-1 are feasibility-level estimates for planning purposes only and will vary depending on implementation timing, sequencing of initiatives, and actual economic conditions existing in the marketplace at the time of implementation.

TABLE ES-1. PROGRAMMATIC-LEVEL ECONOMIC IMPACTS (ALL COSTS SHOW IN 2013 $) [NOTE 1]

	Baseline	2015	2020	2025	2030
PHASE I (Present through 2015)					
Estimated Potential Revenues	$-0-	$134,600	$179,800	$273,700	$226,700
Estimated Avoided Landfill Costs	$-0-	$1,204,000	$2,512,200	$4,027,400	$4,411,900
Estimated Program Costs	$1,476,700	$725,800	$739,200	$746,700	$746,700
Net Estimated Revenue (Cost)	↓$1,146,700	↑ $612,800	↑ $1,593,200	↑$3,554,400	↑ $3,891,900
PHASE II (2016 through 2020)					
Estimated Potential Revenues	$-0-	$-0-	$106,700	$263,700	$347,100
Estimated Avoided Landfill Costs	$-0-	$-0-	$155,600	$384,900	$412,900
Estimated Program Costs	$-0-	$-0-	$3,383,500	$677,400	$1,010,600
Net Estimated Revenue (Cost)	$-0-	$-0-	↓$3,123,100	↓$28,800	↓ $250,600
PHASE III (2021 through 2025)					
Estimated Potential Revenues	$-0-	$-0-	$-0-	$65,000	$187,300
Estimated Avoided Landfill Costs	$-0-	$-0-	$-0-	$308,500	$602,700
Estimated Program Costs	$-0-	$-0-	$-0-	$151,100	$87,400
Net Estimated Revenue (Cost)	$-0-	$-0-	$-0-	↑$92,400	↑ $328,000

[1] *Feasibility-level costs for planning purposes only. Summary revenues/costs of all Zero Waste initiatives by Phase and Milestone Year. Detailed information regarding suggested phasing of initiatives presented in Volume I, Section 5. Detailed cost estimates for each Zero Waste Initiative provided in Volume II.*

The information presented in Table ES-1 clearly demonstrates that when both potential estimated revenues (i.e., material sales) and avoided landfill costs are considered, the aggregated initiatives expected to be implemented by GovGuam in Phase I and III are revenue positive throughout the planning period, with the exception of initially capitalizing on large initiative. The Phase II initiatives, which will most likely be developed by the private and non-profit sectors will need to off-set capital and annual cost expenditures with facility tip fees, grant funding and other resources.



Funding Strategy

The long-term savings and economic benefits from implementing a Zero Waste program will eventually dwarf the initial investment. However, while the long-term savings of Zero Waste programs may be significant, many of the program initiatives require several years of investment before savings can be achieved.

The use of a combination of internal (i.e., GovGuam) and external (i.e., federal and private foundation) funding sources to build a sustainable financial strategy is recommended. Initially, from a practical perspective, a combination of a landfill tipping fee surcharge and a Gross Receipts Tax (GRT) Rate surcharge is a potentially reasonable approach to funding a Zero Waste Program for Guam. Over time, the use of a more diversified funding strategy, which potentially includes the addition of revenues generated by the various Zero Waste initiatives implemented and grant awards, should be phased-in.

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This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

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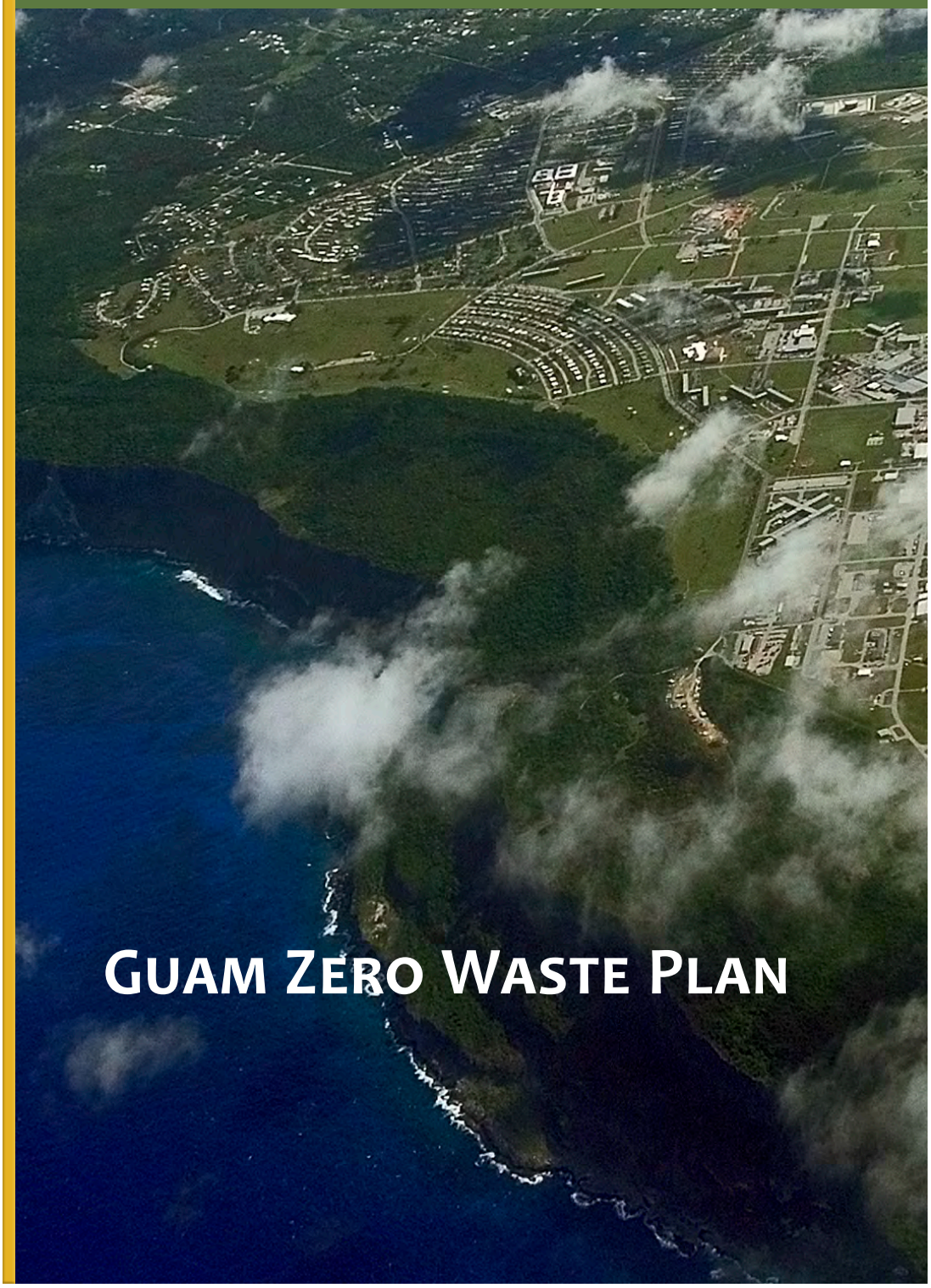
1. Introduction



Guam Zero Waste Plan

GOVERNOR'S SEAL ISLAND OF GUAM

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1. INTRODUCTION

As with all successful endeavors, once you know where you are going, the rest is relatively easy. Zero waste is no longer a fringe concept that only a few radical activists are promoting – it's a permanent and key part of the international sustainability movement. The purpose of this "Blueprint for Zero Waste" is to provide a recommended path to help the government and people of Guam realize a vision of Zero Waste to preserve the environment for Guam's children and the future.

About Zero Waste

Zero Waste is a goal – like the manufacturing goal of Zero Defects and the safety goal of Zero Accidents. The aim of Zero Waste is to reduce waste generated and materials discarded by effectively managing resources before they become waste. Many communities across the world have established a Zero Waste path that starts out modestly and builds as resources, awareness and commitment grow. Guam can do the same. It's time to move solid waste management practices on Guam in a different direction. As Governor Calvo and Lieutenant Governor Tenorio noted in Blueprint 2020 "*…if we limit ourselves to what we've always known, then we tie the next generation to the problems we've been facing for years.*" Fortunately, Zero Waste isn't something that we need to invent from scratch. One of the longest-running, most successful Zero Waste models of all is Nature, in which the by-product of one system is feedstock for another system and nothing is wasted.

Zero Waste is a holistic approach to addressing the problem of unsustainable resource flows. Zero Waste encompasses waste eliminated at the source through product design and producer responsibility, and waste reduction strategies further down the supply chain such as recycling, reuse and composting. Communities and governments that implement Zero Waste Programs are striving to switch from long-term waste management through disposal or incineration to value-added resource recovery systems that will help build sustainable local economies.

Guam's Zero Waste Story So Far

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste Program. This process was initiated by both necessity and desire. The necessity is due to a solid waste management system in crisis with limited landfill space, high disposal costs, and an impending significant population increase due to the United States (U.S.) Department of Defense (DOD) plans to build-up the military's presence on the island. The desire comes from a deeply-rooted regard that the people of Guahan have for nature and planet earth, and a determination to preserve the environment for their children and the future.

Recognizing that no single initiative or strategy can be put into place to achieve Zero Waste, GovGuam decided to initiate the development of a "Master Plan" to chart a course toward waste minimization and environmental sustainability for the island. With that decision, the development of a Zero Waste Plan with multiple strategies and initiatives aimed at developing a Zero Waste Program for Guam began in earnest.

What the Rest of the World is Doing with Zero Waste

Zero waste has spread around the globe to all levels of society – from nongovernmental organizations (NGOs) and recycling coalitions to municipal, state, regional and national governments and to major international businesses. Zero waste policies and programs have been adopted by governments from Africa and Australia to Europe and the United States. Major international businesses that have adopted and achieved Zero Waste targets include Toyota, DuPont Inc., Honda Motor Corporation, Hewlett-Packard, Kimberley Clark and Xerox Corporation.

Organization of this Plan

This Blueprint for Zero Waste is organized into two volumes and the following primary sections:

Volume I

- Section 1 presents the purpose of the Zero Waste Plan (Plan or Blueprint) and describes the document organization.
- Section 2 provides an overview of the Visioning process and results.
- Section 3 provides a summary of the Zero Waste Initiatives evaluated in detail during the development of the Plan.
- Section 4 summarizes existing conditions relevant to developing and implementing a Zero Waste Program on Guam.
- Section 5 presents a "blueprint" of key steps recommended to create a successful Zero Waste Program on Guam.
- Section 6 summarizes marketing and communication strategies that can be implemented to get the word out about Guam's Blueprint for Zero Waste.
- Section 7 presents a number of important ancillary activities that should be considered to improve the efficiency and success of Guam's Zero Waste Program.
- Tables and figures supplement information presented in text and are located throughout the document.

Volume II

- Volume II contains technical memoranda and white papers referenced in Volume I.

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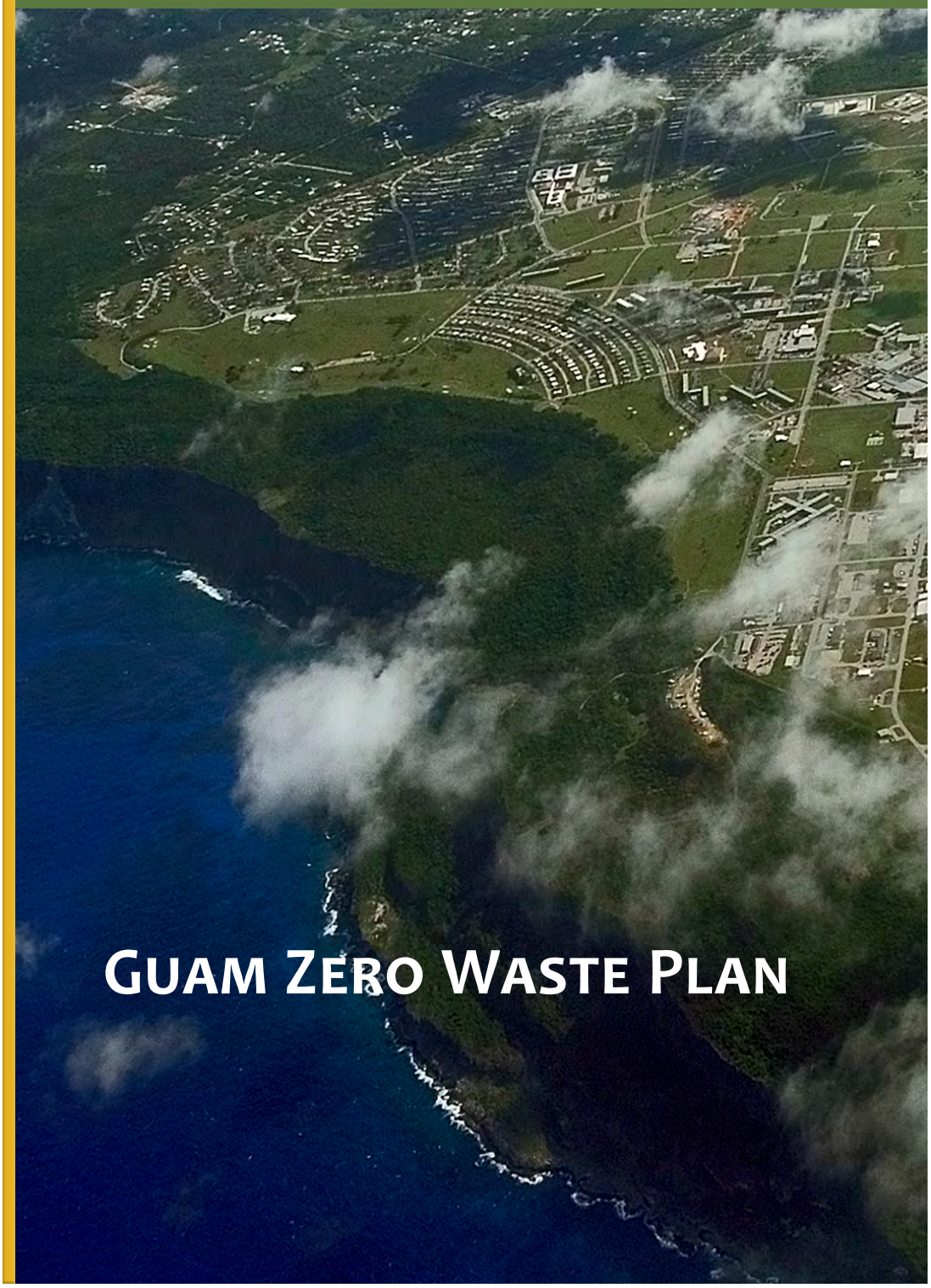
2. Vision for the Future



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

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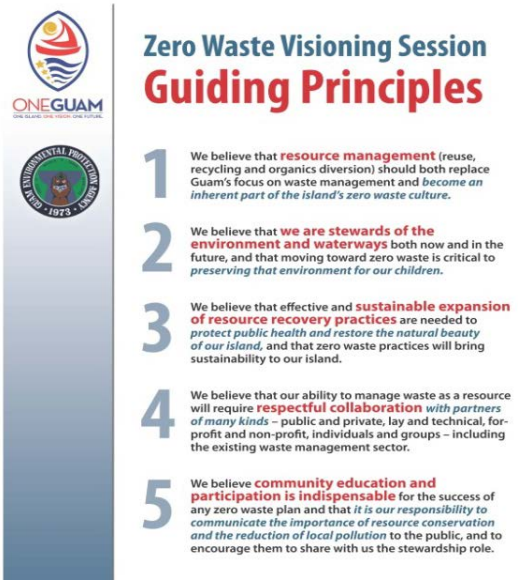
2. VISION FOR THE FUTURE

On February 7, 2012 representatives of the Office of the Governor of Guam and key public and private-sector solid waste stakeholders met at the Ricardo J. Bordallo Governor's Complex in Adelup for a Zero Waste Visioning Session. The purpose of the Visioning Session was to seek stakeholder input on solid waste diversion opportunities and Zero Waste options with respect to the development of an overall Zero Waste Plan for Guam.

Stakeholders

In January 2012, an invitation was issued by the Governor's Office to key public and private sector solid waste stakeholders on Guam to participate in a Visioning Session. Over 90% of the participants invited attended the session. Attendees included representatives of the:

- Federal and Territorial Government: Guam Legislature, Governor's Office/Guam Military Buildup Office, Guam Environmental Protection Agency (GEPA), Guam Solid Waste Authority (GSWA), Mayors' Council of Guam (MCOG), Guam Economic Development Authority, Guam Department of Public Works (GDPW), U.S. Environmental Protection Agency, Region 9 (USEPA), DOD's Office of Economic Adjustment (OEA), U.S. Navy and U.S. Air Force;
- Universities and Schools: University of Guam and Guam Community College;
- Community Organizations and Nonprofits: Recycling Association of Guam, Guam Chamber of Commerce, Guam Contractors Association and i*Recycle; and
- Secondary Materials Handlers and Waste Disposal Facilities.



The Stakeholders were well informed about the status and availability of solid waste diversion options that currently exist on Guam. An overwhelming majority favored source reduction, recycling, and composting and expressed a desire for increased development of these programs based on the positive environmental and economic benefits.

Strategic Vision

A strategic vision with long term goals and objectives was developed for the Zero Waste Plan by representatives from the Governor's Office, GEPA and USEPA. This strategic vision was translated into guiding principles utilized by Stakeholders to facilitate and influence the discussions which occurred throughout the Visioning Session.

Throughout the Visioning Session, the Stakeholders engaged in Interactive "brainstorming" sessions to discuss new and/or expanded solid waste diversion opportunities and Zero Waste options that could potentially be implemented on Guam.

From Waste Management to Waste Elimination

The focus of the Visioning Session was to come up with viable options that could be implemented to reduce the volume of solid waste being disposed of and create a sustainable Zero Waste Program on Guam through:

- Upstream Source Reduction Options;
- Midstream Reuse Options; and
- Downstream Recycling and Organics Diversion Options.

A complete list of the upstream, midstream and downstream options that were identified during the Visioning Session by Stakeholders is provided in Volume II, Technical Memorandum 1. These options were subsequently screened by representatives of the Governor's Office, GEPA and USEPA to develop a focused list of fifteen Zero Waste initiatives to be evaluated in a Zero Waste Plan. The list of initiatives selected for evaluation is summarized in Section 3.0.

Key Strategies

The most important part of any long journey is having a vision for the future. During the Visioning Session, Stakeholders emphasized the importance of implementing the following key strategies.

- **Develop targets**: Work with the Guam Legislature, GovGuam agencies and Guam Council of Mayors to put a framework in place to achieve Zero Waste.
- **Walk the talk**: One of the most important keys to achieving the goal of Zero Waste is leadership. Legislation and policies that favor Zero Waste should be adopted.
- **Use incentives in the right place**: A continuous and constantly adapting flow of initiatives, solutions and ideas are going to be required to achieve the goal of Zero Waste.
- **Develop infrastructure for recycling and resource recovery**: Although some initial help will be needed for GovGuam to get a Zero Waste Program operational, If the incentives are in the right place the private-sector and markets will assist in building and operating the infrastructure.
- **Implement a marketing campaign**: Publicize the Zero Waste Program to educate, engage and inspire the community.
- **Develop an effective enforcement process**: Fund the necessary enforcement personnel, educate volunteers and follow through with fines and penalties.
- **Plan for success**: Involve the community, build broad public and political support, employ the right people to turn the Plan into action, and celebrate your success!

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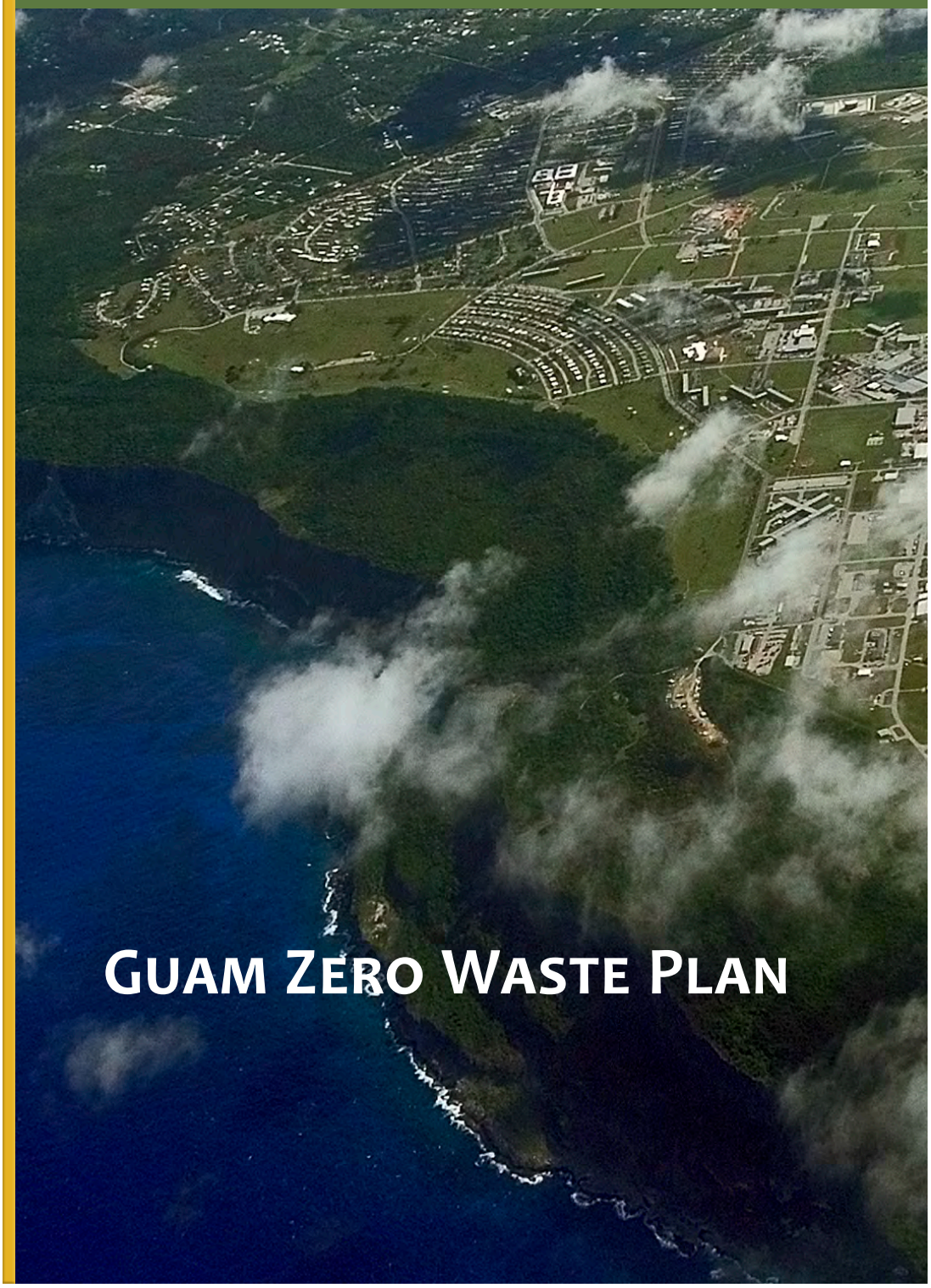
3. Summary of Initiatives



Guam Zero Waste Plan

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3. SUMMARY OF INITIATIVES

As previously discussed in Section 2, a complete list of the upstream, midstream and downstream Zero Waste options originally identified during the Visioning Session by Stakeholders is provided in Volume II, Technical Memoranda 1. The suggestions that came out of the Visioning Session were subsequently screened by representatives of the Governor's Office, GEPA and USEPA to develop a focused list of fifteen zero waste initiatives that were subjected to a detailed analysis and evaluation during the development of this Plan. Table 3-1 presents a summary of the fifteen initiatives evaluated in the detailed analysis.

TABLE 3-1. SUMMARY OF FIFTEEN INITIATIVES EVALUATED IN THE PLAN

Initiative	Summary Description	Volume II
UPSTREAM		
Green/Environmentally Preferable Purchasing (EPP)	Implement a Green/Environmentally-Preferable Purchasing Program for GovGuam agencies that initially focuses on the acquisition of environmentally-preferable office paper and electronic office equipment, and expands later to include additional materials. Pilot projects and a green meeting policy are also recommended.	White Paper A
Extended Producer Responsibility (EPR)	Develop an effective EPR Program on Guam that focuses initially on electronics and packaging waste, and expands later to include additional items.	White Paper B
Pay-As-You-Throw (PAYT)	Implement a PAYT trash pricing structure and collection system for bundled trash and recycling curbside collection service to Guam's single-family residents, and expands later to multi-family homes.	White Paper C
Plastic Bag Disposal Ban	Implement a disposal ban that restricts single-use, disposable plastic bags by retail and wholesale businesses.	White Paper D
MIDSTREAM		
Used Building Material Facility	Develop a UBM facility to help divert household items and used building materials generated from construction and demolition projects on Guam.	White Paper E
"3R" Requirements for Public Buildings	Establish "reduce-reuse-recycle"requirements for the demolition, renovation and/or operation of public buildings on Guam.	White Paper F
Greening Roadway Pavement Systems	Implement "Green" roadway pavement systems requirements on Guam by encouraging the modification of highway specifications to prioritize use of recycled materials (e.g., tires, glass, mulch and compost) in highway construction and erosion control activities.	White Paper G

TABLE 3-1. SUMMARY OF FIFTEEN INITIATIVES EVALUATED IN THE PLAN (CONTINUED)

Initiative	Summary Description	Volume II
DOWNSTREAM		
Illegal Dumping & Litter Control Enforcement	Expand existing regulations, regulatory programs and volunteer programs to enforce/add to litter control and illegal dumping regulations.	White Paper H
Composting/Organics Processing Facility	Establish a composting/organics processing facility (i.e., a new commercial composting operation) that accepts yard waste and soiled cardboard.	White Paper I
Construction & Demolition Debris Processing Facility	Develop a small C&D debris processing/transfer facility equipped with mobile processing capacity for clean wood, aggregate and metals that can either be deployed to project sites or used at a stationary processing/ transfer site to increase on-island capacity for processing source-separated C&D materials on a batch basis.	White Paper J
Construction & Demolition (C&D) Diversion Policy	Create a mandatory C&D debris diversion policy that establishes minimum standards for the diversion of materials in the waste stream that have economically-sustainable markets, and contains enforcement provisions if the standards are not met.	White Paper K
GLOBAL		
Zero Waste Association of Guam	Create a professional association of public, non-profit, and private sector stakeholders by building on existing organizations whose mission is to promote and support waste diversion infrastructure, programs, and policies in pursuit of zero waste goals on Guam.	White Paper L
Zero Waste Grant Program	Create a Zero Waste Grant Program to provide financial resources to public, private and non-profit organizations for research, development and/or operation of new waste diversion pilot projects, programs or infrastructure.	White Paper M
Education & Outreach Program	Initiate an island-wide Zero Waste Education and Outreach Program to explain, promote, and incentivize participation in Guam's Zero Waste Program.	White Paper N
Evaluation of Funding Sources	Evaluate sustainable funding sources that can be used to cover the net costs associated with implementing a Zero Waste Program on Guam.	White Paper O

The key to economic growth through zero waste is through the recovery of discarded materials and by creating value to them through the development of enterprises and markets that view those materials as a valuable commodity. Source reduction, reuse, repair, recycling, and organics diversion offer direct and substantial opportunities for communities.

White papers which detail the results of the analysis conducted on each zero waste initiative are located in Volume II. It should be noted that these papers focused on each independent initiative without considering overlap with other potential zero waste initiatives. Assessment of overlapping initiatives is considered in Section 5 where a phased and integrated approach to implementing the initiatives is presented. As a result, the ultimate achievement of economic and environmental benefits and impacts may be staggered at different intervals than presented in the White Papers.

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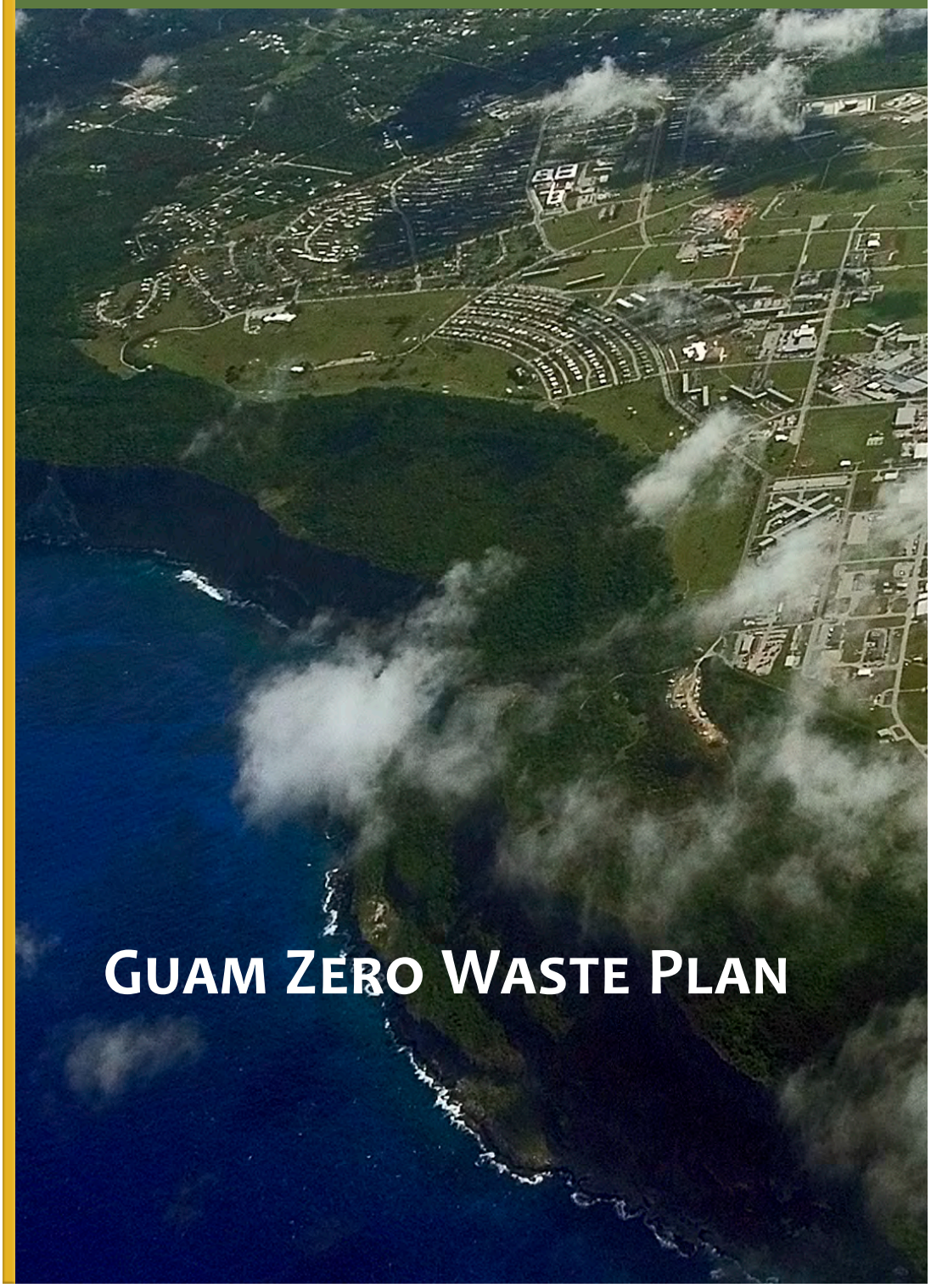
4. Existing Conditions and Future Projections



Guam Zero Waste Plan

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4. EXISTING CONDITIONS AND FUTURE PROJECTIONS

Guam, a U.S. territory nearly 6,000 miles away from the U.S. mainland west coast and almost 3,700 miles away from the shores of Hawaii, is near Asia, which is currently one of the most populous and dynamic regions in the world. It is this proximity to major Asian countries of economic and political importance that provides Guam with two major economic drivers: military and tourism (Guam Visitors Bureau, 2013).

This section describes existing conditions that are relevant to developing and implementing a Zero Waste Program on Guam over the next 20 years. Past and current development has taken a toll on Guam's delicate environmental balance, and there is concern about impacts of future growth. Existing and future projected conditions described include a summary profile of Guam's existing solid waste management infrastructure; waste disposal quantity estimates; future solid waste generation projections, diversion potential and recovered material market conditions.

Overview of Solid Waste Management Programs and Infrastructure

The disposal of municipal solid waste (MSW) presents challenges for most communities, and is an especially difficult challenge on Guam. The majority of nonhazardous solid waste on Guam is currently disposed of in the Layon Landfill, which is a Subtitle D landfill permitted under the Resource Conservation and Recovery Act (RCRA). Construction and demolition (C&D) debris, cardboard, green wastes (i.e., biodegradable yard waste such as tree branches and vegetation), tires, electronic wastes (e-wastes), appliances and other materials are banned from disposal at the Layon Landfill. C&D debris and green wastes, when disposed of legally, can be taken to one of two GEPA-permitted hardfills (e.g., Primos Northern and Eddie Cruz) that were open to the general public and operating on the island when the Guam Zero Waste Plan was developed. The military also currently operates hardfills on Guam for their exclusive use.

Recycling is not mandated for commercial entities or residents on Guam. When it occurs, the recycling of cardboard, paper, metal cans, plastics, tires, appliances, e-waste and other scrap is accomplished by various secondary material handlers in private industry. There are multiple, decentralized recycling programs on Guam that supported the 2011 municipal solid waste diversion rate of 17.85%. These range from private recyclers (e.g., Pyramid and PayLess Supermarkets) to public/private partnerships and non-profit programs (e.g., i*Recycle and the Habitat for Humanity of Guam). These programs include direct source reduction, reuse, recycling and wood mulching. Other programs, such as those offered by the Recycling Association for Guam (RAG) and the University of Guam (UOG) Center for Island Sustainability provide education and outreach that raises waste diversion awareness for specific audiences.

The GSWA, a public agency autonomous from the Government of Guam, provides trash collection for single-family residential customers, maintains three convenience stations where residents can drop off trash for disposal and cardboard and glass for recycling; collects bulky items and white goods (i.e., discarded major appliances) from customers; and manages the contracts for the operations of a commercial hauler transfer station and the Layon Landfill (GSWA, 2013). Private hauling companies are contracted with to haul trash from commercial, institutional and multi-family homes. Commercial tipping fees at the Layon Landfill are currently $174.57/ton. Residential collection fees are $30.38/month for per single-family address. Residential customers

may also take household waste to one of three transfer stations on the island and pay $7.50 for disposal of up to 3 cubic yards of waste or $15.00 for disposal of from 3 to 6 cubic yards of waste.

Although not currently a solid waste management disposal option on Guam, an application to build and operate a Waste to Energy facility is reportedly under review by GEPA. Waste to Energy facilities are operated in many locations worldwide, are particularly attractive in island settings, and may be a viable disposal option on Guam in the future.

Projected Population Growth

In 2006, the DOD announced a military project, referred to on Guam as the "Buildup." The goals of this project are two-fold: one is to boost military capability in Asia and focus U.S. diplomatic and military attention on the region and the other is to shift thousands of U.S. Marines from the Japanese island of Okinawa. With the imminent relocation of thousands of DOD military and civilian personnel to the island from Japan and the limited amount of space available for disposal of solid wastes on land, the development and implementation of a Zero Waste Program on Guam has become even more critical.

According to the 2010 U.S. Census, Guam had a population of 159,358, representing a relatively small increase of 2.9 percent from the population of 154,805 reported in the 2000 Census (U.S. Census Bureau, 2012). For the purposes of this Zero Waste Plan, population growth estimates were developed for the baseline year 2012 and milestone planning years 2015, 2020, 2025 and 2030 using the following information:

- An induced population growth due to the relocation of 5,000 U.S. Marines from Okinawa to Guam;
- A predicted stable growth rate of 0.29% annually plus the Military Buildup Induced population increase years 2014 through 2024; and
- A stabilized growth rate of 0.29% annually using the projected 2024 population base for years 2025 through 2030.

Detailed information regarding the information used and development of the projected population growth is included in Volume II, Technical Memorandum 2.

Solid Waste Quantity Estimates

The tracking of disposal volumes began in earnest on Guam only recently. In 2012, Guam disposed of approximately 90,000 tons of solid waste at the Layon Landfill. Approximately 70% of that waste disposed of at the Layon Landfill came from non-residential sources, and the remaining 30% was from residential sources (Anderson, 2013). Measurement reporting of the volume of construction & demolition waste and green waste hauled to hardfills available to the public on Guam is less well-defined.

For the purposes of this Zero Waste Plan, in August 2012 solid waste quantity estimates were developed for the baseline year 2012 and milestone planning years 2015, 2020, 2025 and 2030 based on national and military waste generation and composition data, as well as population projections.

Table 4.1 summarizes the range of waste generation estimates for municipal solid waste (MSW) and non-MSW during the baseline and milestone years.

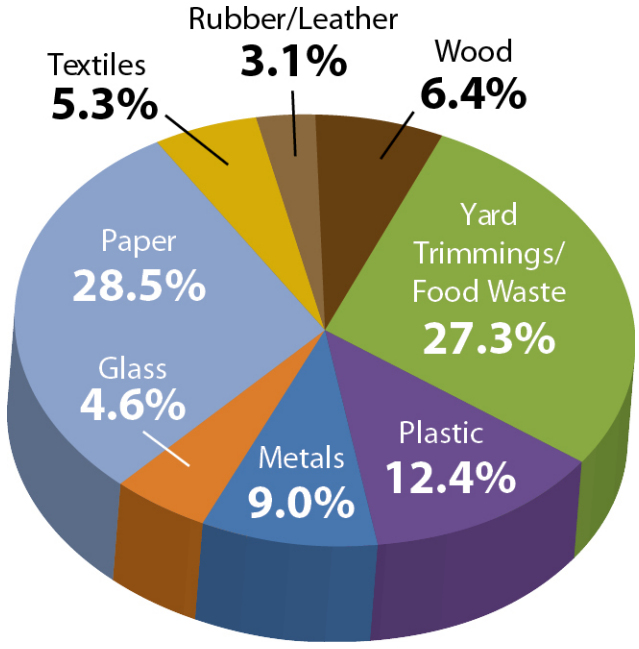
TABLE 4-1. PROJECTED SOLID WASTE GENERATION (TONS/YEAR)

Year	MSW (1)		NON-MSW (2)		TOTAL SOLID WASTE	
	Low	High	Low	High	Low	High
2012 (Baseline)	129,000	154,000	82,000	86,000	211,000	240,000
2015	144,000	171,000	91,000	97,000	235,000	268,000
2020	169,000	200,000	105,000	112,000	274,000	312,000
2025	144,000	171,000	91,000	96,000	235,000	267,000
2030	146,000	172,000	92,000	97,000	238,000	269,000

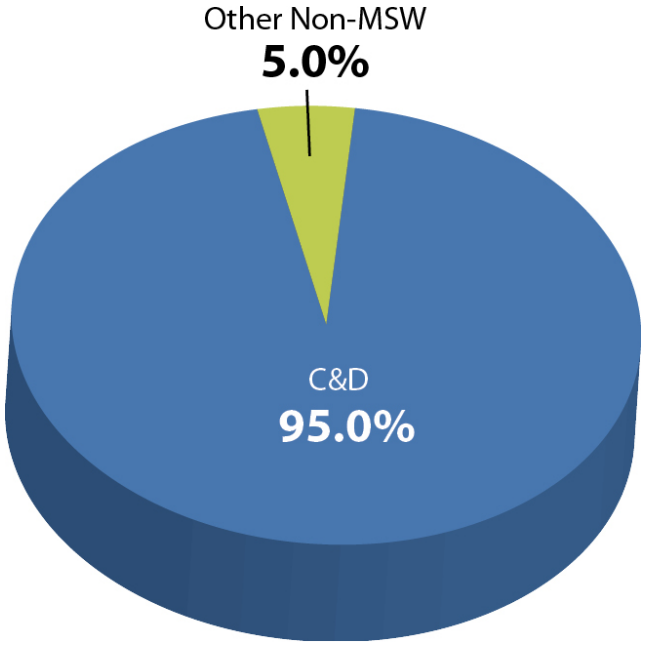
1. A low to high range of pounds per capita/day (ppcd) rates for MSW generation developed using findings from the USEPA (4.43 ppcd) and GEPA (5.28 ppcd).
2. A similar range developed for non-MSW generation projections using USEPA and Naval Facilities Engineering Command measurements for C&D (2.80 and 7.4 ppcd, respectively).

As noted, the total solid waste quantities are expected to peak in 2020, and then fall off in 2025 and 2030. This estimate is tied to the population projections (discussed previously), which show a peak in the island's growth at the mid-point of the planning period due to the military build-up. These findings are represented in projected diversion quantities presented in subsequent sections of this Plan.

The figures below illustrate the assumed, relative composition of MSW and non-MSW streams on Guam in 2012.



ASSUMED MSW COMPOSITION (% by weight)



ASSUMED NON-MSW COMPOSITION (% by weight)

Detailed information regarding the information used and development of solid waste generation quantities is included in Volume II, Technical Memorandum 2. While the information used and estimates developed are a reasonable guide for initially evaluating Zero Waste initiatives, material quantities on Guam may vary over time. It should be noted that in November 2012, an intensive effort was undertaken by GEPA and USEPA to measure solid waste generation and recycling efforts on Guam. Because the detailed analysis of initiatives for the Zero Waste Plan was well underway, the solid waste and recycling information collected during this effort was not used to develop the solid waste quantity and composition estimates included in this Section of the Plan. However, the November 2012 information collected and methodology used to collect the data was reviewed, and is discussed further in Section 7. Recommendations for expanding on-going data collection and measurement efforts to the full solid waste stream and improving the completeness and accuracy of data by collecting critical waste characterization data are provided in Volume II, Technical Memorandum 3.

Secondary Material Market Conditions

As materials are recovered from the waste stream, markets are needed to put these materials to productive use. There are two recovered material markets available for diverted materials: on-island markets and off-island markets.

On-Island Markets

On-island materials markets typically present the best opportunities in terms of regulating how recycling business is conducted, and offering diversion incentives and disposal disincentives. With an on-island market, there are no overseas shipping costs and the sale of material is not vulnerable to the wide price fluctuations experienced on the worldwide secondary material markets. On-island recovery provides more local jobs than shipping off the island along with potentially more tax revenues. On-Island markets at the current time include:

- **Untreated wood:** chipped/mulched for use as landscaping, soil erosion stabilization material and composting.
- **Green waste, wet cardboard, limited amounts of mixed paper:** used as a source for limited (mostly passive) composting.
- **Food waste:** diverted to pig farms as feed.
- **Glass:** crushed and used for landfill roads, alternative landfill cover, and as utility backfill.

Off-Island Markets

Materials sent off-island for recycling include metals from Guam's successful metal recovery program (including aluminum beverage cans from i*Recycle), old cardboard containers, limited quantities of other recovered paper, polyethylene terephthalate (PET) and high-density polyethylene (HDPE) plastic containers, car and truck batteries, tires and electronics. Shipping materials to markets off island introduces added complexities including:

- Baling to increase transportation efficiencies;
- Limited processing to minimize hazards;

- Transport requirements/costs including Port Authority of Guam charges, shipping costs and port charges at the receiving port; and
- Secondary processors and manufacturing end-markets whose pricing is subject to global influences and are very dynamic.

Opportunities and Constraints

A materials market conditions analysis (included in Volume II, Technical Memorandum 4) completed for this Plan indicates that as of December 2012, the following market conditions exist.

- Revenue-positive off-island markets exist for metals, aluminum beverage containers, cardboard and computer components (excluding monitors).
- Revenue-negative off-island markets exist for mixed paper and plastics #1/#2 that could potentially improve with greater quantities from an island-wide curbside recycling program.
- Glass crushing is provided on-island for use/give-away with no revenue generation.
- Limited to no revenues are available mulched/chipped wood.
- No markets have really been developed for compost and no active systems are in place.
- Guam's natural limestone provides a ready source of inexpensive, virgin aggregate making the revenue potential for aggregate products low.
- Many Guam recyclables are being marketed in Asia.
- Shipping lines bid transportation costs for containers on a case by case basis; these rates vary by current conditions, commodities, destinations and costs for fuel - most materials are shipped in 40-foot containers unless weight is an issue.
- In general, Chinese shipping lines transporting to ports in China have much lower costs than other shipping lines transporting to the west coast of the U.S.
- Port charges ranging from $700 to $800 per load are applied at both export and import points.

Additionally, it is important to note that the Port Authority of Guam may waive export port charges on non-containerized metal loads. The statutory authority for this waiver presented in Title 12, Guam Code Annotated, Section 58147 (12 GCA 58147) technically applies to all recyclables materials. It also exempts shipping and recycling businesses from the Guam Use Tax Law on revenues earned from recycling. The waiver does not appear to be applied for all materials, however, and represents an economic incentive (between $700 and $800 per load) for greater recycling on Guam.

Finally, it is important to remember that even with revenue negative recovered materials, a key benefit associated with waste diversion is the avoided landfill disposal costs. When these savings are considered in terms of real dollars, the economics of recycling many materials improves to a sustainable or near-sustainable level.

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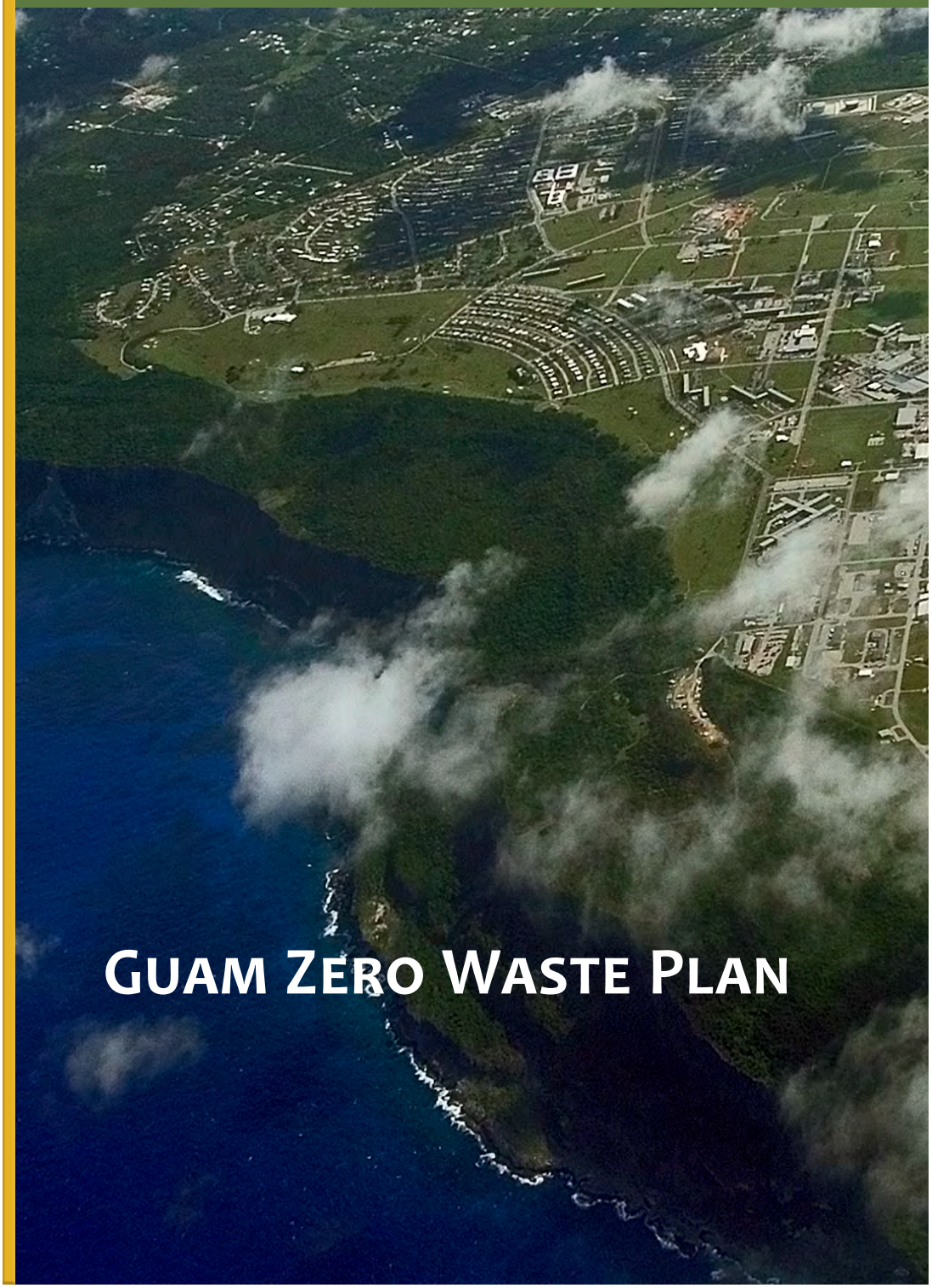
5. The Blueprint



Guam Zero Waste Plan

GOVERNOR'S SEAL ISLAND OF GUAM

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5. THE BLUEPRINT

While numerous initiatives and improvements to Guam's current solid waste system have been evaluated to assess the best strategy for a long-term Zero Waste Program over a 20-year planning period, all of the legislation, regulations, policies, programs and infrastructure described in this document cannot be practically implemented at once. The development of a Zero Waste Program will be an evolving process, and there will be political, technical, marketing, financial and educational issues to address at each step. The following approach focuses on a recommended initial phase for implementing those initiatives that will allow GovGuam and industry stakeholders to build a strong Zero Waste foundation, followed by subsequent phases that provide additional time to foster public/private partnerships, raise funds and allocate staff in support of additional initiatives.

Recommended Implementation Strategy

The blueprint is guided largely by the goals established for, and Zero Waste options developed during the February 2012 Zero Waste Visioning Session. This session emphasized the need to provide Zero Waste leadership on Guam, incentives, infrastructure, education and enforcement. The criteria used to establish the recommended phasing of initiatives include:

- Ability to build a strong foundation of GovGuam agency staffing, organized industry stakeholders, funding and public education;
- Relative ease of implementation;
- Ability to increase the quantity of waste diverted away from landfill disposal; and
- Synergies with stakeholders from the private and non-profit sectors and the military to leverage resources, increase efficiencies, and improve market influence.

Based on these criteria, the implementation strategy summarized in the graphic below and described in more detail in this section of the Guam Zero Waste Plan and the documents provided in Volume II is recommended.

Phase I (Present through 2015)

The activities recommended for Phase I implementation should be undertaken immediately, with the intention of full implementation within the first two years of the planning period. Especially time-sensitive will be the conversion to a pay-as-you-throw (PAYT) trash pricing system and initiation of territorial legislation that will form the primary foundation of Guam's Zero Waste Program. Specifically, Phase I activities should include:

- Implement PAYT for Guam's single-family residents;
- Expand/formalize the Zero Waste Association of Guam (ZWAG);
- Expand on-going data measurement activities;
- Pass legislation for the Guam Zero Waste Law;
- Establish a Guam Zero Waste grant program
- Ban single-use plastic bags
- Implement a Green/EPP Program for GovGuam Agencies;
- Initiate an island-wide Zero Waste Education and Outreach Program; and
- Improve enforcement of existing litter control and illegal dumping laws.

Details on the recommended Phase I activities follow.

1) Implement PAYT Trash Pricing for Guam's single-family residents (implemented by GSWA) – GSWA is currently evaluating the addition of curbside recyclables collection to its current single-family service area (and, if it proceeds, will roll-out this service in late 2013/early 2014). Significant advantages will occur if these programs are implemented simultaneously:

   - Savings will be achieved by purchasing fewer recycling carts (the 96-gallon trash carts made available by homes that choose to down-size with PAYT could instead be used for recycling).
   - GSWA can plan for, purchase, and implement both PAYT and curbside recycling programs at once (saving staff resources).
   - Residents can adapt to both new programs at the same time (rather than having major changes occur at two separate times).
   - See Volume II, White Paper C for more detailed information.

2) Expand/Formalize the Zero Waste Association of Guam (implemented by volunteer, industry stakeholders, MCOG and GovGuam agency membership). This may be a new or expanded association formed from the existing RAG, i*Recycle and UOG Center for Island Sustainability organizations and other waste diversion stakeholders. The ZWAG will ideally bolster (and occasionally push) GovGuam's overall Zero Waste leadership and is expected to play key roles in both the Phase I and III legislation, which they will likely champion, and implementation of the Guam Zero Waste Grant initiative. Other activities that the ZWAG will provide key support with includes:

- Implementing a Zero Waste Education and Outreach program;
- Planning of new Used Building Material, C&D Debris, and Compost facilities (especially in identifying and supporting other organizations that might develop and operate);
- Annual data measurement and litter control/illegal dumping enforcement efforts;
- On-going review and updates/revisions to the Guam Zero Waste Plan; and
- See Volume II, White Paper L for more detailed information.

3) Expand Data Measurement (on-going implementation by GEPA with support from USEPA) – Accurate information on what kinds of materials are generated and where is of critical importance. In 2013, GEPA will complete its second annual measurement process for the preceding year. By its very nature, data collection, analysis and reporting is an evolving process that takes multiple years to develop to the point where a strong majority of data is captured and captured accurately. During Phase I it is recommended that GEPA:

- Refine its methodology to capture missing programs/facilities, collect data from additional sources to "check" reported quantities, and minimize any potential double-counting.
- Analyze collected data to interpret waste generation as well as diversion, calculate per-person/day generation and disposal rates and track historical trends.
- Add new material streams to more fully measure diversion within the overall solid waste stream – including food waste, C&D, military waste, litter clean-up and marine debris.
- Further details and recommendations regarding data measurement are provided in Volume II, Technical Memorandum 3.

4) Initiate Legislation for the Guam Zero Waste Law (policy developed by ZWAG with significant support from the MCOG and regulatory implementation by GEPA with support from ZWAG and the MCOG) – Successfully introducing and shepherding a new bill through the Guam Legislature and subsequently developing sound implementing regulations will be a relatively major effort that will most likely be led by members of ZWAG with assistance from the MCOG and other industry stakeholders. While the backbone of the legislation should be to establish a sustainable Zero Waste funding source (discussed in more detail later in this section), given the effort involved in introducing and passing legislation, the bill will ideally:

- Adopt solid waste diversion goals that will be used as the criteria to measure the Zero Waste Program. While establishing an end goal for the year 2030 is very important, it will also be helpful to set intermediate targets for the years 2015, 2020 and 2025.
- Establish a funding source for the initial phase of Zero Waste Program development. A combination of a small surcharge to both the landfill tipping fee and the Guam Gross Receipts Tax is one potential way to initially fund the development of Guam's Zero Waste Program (the specifics of this recommendation is discussed at the end of Section 5).
- Establish the Guam Zero Waste Grant program. The grant program will include:
  - Funding source (generated from the sources described above)
  - Grant parameters – it is recommended that approximately $250,000/year will be available which is equivalent to ten $25,000 grant awards each year)

  - Grant staffing – it is expected that GEPA staff would have oversight but that ZWAG members would volunteer time to establish grant requirements, review application, track and report project outcomes
  - Legislation should allow modifications of the grant program exclusive of funding sources or amounts with GEPA approval only (i.e., further legislation not required)
  - See Volume II, White Paper M for more detailed information.
- Establish GovGuam staffing – described later in the "Job Creation Potential" subsection.
- Implement a Single-Use Plastic Bag Ban – this effort will be based on Pay-Less Supermarkets' current program and is expected to be implemented with minimal political obstacles or resource requirements. The effective date may vary over time for single-use bags used by an increasing number of retailers and other businesses. More details on this program can be found in Volume II, White Paper D.

5) Implement Green/EPP Procedures for GovGuam Agencies (implemented by GEPA and GDOA) – The development of new EPP procedures for office paper and electronics will be an important early step to demonstrate GovGuam's Zero Waste leadership and raise awareness about all aspects of diversion, including buying recycled-content/low waste/low toxicity products and services. This program can be implemented without legislation and will ultimately be a model for schools, other institutions and businesses to emulate. See Volume II, White Paper A for more detailed information.

6) Initiate an Island-Wide Zero Waste Education and Outreach Program (implemented by GEPA with support from the MCOG, ZWAG and other industry stakeholders) – As public education and outreach are critical to all aspects of Guam's Zero Waste Program, implementation should start immediately and be as broad as possible, ideally including the military. Initial activities should include development of a program brand, website and social media campaign; a public survey; and development of an island-wide strategy that addresses new residents and businesses as well as tourists. Subsequent activities will be determined by GovGuam's progress in implementing the Phase I and II recommendations. See Volume II, White Paper N for more detailed information.

7) Improve Enforcement of Existing Litter Control Laws (implemented by GEPA and GDPW with significant support from the MCOG, ZWAG, and other volunteer groups) – Tied closely with public education efforts, this program will strengthen the incentive for diversion by making illegal dumping less available. It will also demonstrate GovGuam's Zero Waste leadership and better maintain the beauty of Guam's environment. See Volume II, White Paper H for more detailed information.

Phase II (2016 through 2020)

The activities recommended for Phase II include those initiatives that will require time to build support among industry stakeholders and potential non-profit and private sector organizations that may ultimately develop and operate future waste diversion facilities. These initiatives need to be preceded by the establishment of credible GovGuam and ZWAG leadership and an effective public education program. Also included in Phase II are recommended review and update of initiatives implemented in Phase I. Specifically, Phase II activities should include:

- Support Development of Multi-Stakeholder Reuse and Processing Facilities
  - Used Building Material Facility
  - C&D Debris Processing Facility
  - Compost Facility
- Expand Existing Programs
  - PAYT to Small Multi-Family Homes
  - ZWAG services (possibly including staff)
  - Green/EPP (add additional materials)
- Review/Update Guam Zero Waste Plan (five-year review cycle)

Details on the recommended Phase II activities follow.

1) Support Development of Multi-Stakeholder Reuse and Processing Facilities (*implemented by GEPA with support from the MCOG and ZWAG*) – It is unlikely that GovGuam or the villages will capitalize and/or operate these facilities. Both GovGuam and the MCOG can play an important role in creating incentives for private-sector development, feasibility studies, clarifying regulatory requirements, land ownership/use partnerships, materials marketing assistance and educating the public about opportunities provided at each facility. It is recommended that GovGuam and the MCOG encourage development of multi-sector partnerships and focus on fostering the development of:

   - Used Building Material Facility – to accept for reuse/resale household items, used building materials and miscellaneous materials generated by contractors involved in the construction and demolition/deconstruction of both civilian and military projects (this may be a new facility or an expansion of an existing program such as Habitat for Humanity of Guam). See Volume II, White Paper E for more detailed information.
   - C&D Debris Processing Facility – to serve all or a portion of the island's C&D waste stream, this facility is expected to initially accept source-separated clean wood, lead-free aggregate and metals for diversion. This may be a new, mobile facility or an expansion of existing hardfill operations. See Volume II, White Paper J for more detailed information.
   - Compost Facility – to initially process yard waste and soiled cardboard generated by residents, businesses and institutions, this facility may be developed to eventually accept food waste, manures, biosolids, etc. This may be a new facility or an expansion of existing hardfill operations. See Volume II, White Paper I for more detailed information.

2) Expand Existing Programs – By the mid-point of Phase II, several Phase II initiatives (noted below) will be ready for expansion. While the specific impacts of these programmatic expansion efforts were not specifically analyzed in the Plan, he value of continuous improvement (i.e., on-going review, refinement and growth) is important in all goals worth pursuing, including Guam's Zero Waste goals.

   - PAYT – variable trash pricing should be explored for small multi-family homes (such as duplexes, triplexes and quadplexes). See Volume II, White Paper C for more detailed information.
   - ZWAG – this organization should be firmly established and ready to expand its services (as well as dues and membership base) such as an annual conference, workshops and advocacy of Phase III legislation (this may also require the addition of part-time staff). See Volume II, White Paper L for more detailed information.
   - Green/EPP Program – at this time any pilot programs should be taken full-scale, cooperative purchasing with other governmental agencies should be in place and additional materials may be added. See Volume II, White Paper A for more detailed information.

3) Review/Update the Guam Zero Waste Plan (implemented by GEPA collaborating with GSWA, GDPW and ZWAG) – On at least a five-year cycle, the Guam Zero Waste Plan should be thoroughly reviewed for consistency and applicability to conditions, constraints and opportunities that have evolved on Guam during the previous five year period and to re-evaluate diversion potentials, revenues/avoided landfill costs and other costs. An update should be developed to confirm or revise the Plan, program and infrastructure policies for the next five years.

Phase III (2021 through 2025)

The activities recommended for Phase III include those initiatives that will likely be implemented through new legislation as well as those that will require more extensive research and planning. Specifically, Phase III activities should include:

- Pass legislation to revise the Guam Zero Waste Law (or develop new statute)
- Implement Extended Producer Responsibility (EPR) Policy
- Develop C&D Diversion Policy
- Implement "3R" Waste Minimization Standards for Building Construction and Renovation;
- Implement Greening Roadway Pavement System recommendations;
- Expand PAYT to large multi-family units; and
- Review/Update Guam Zero Waste Plan (five-year review cycle)

Details on the recommended Phase III activities follow.

1) Initiate Legislation for a Revised Guam Zero Waste Law (*policy developed by ZWAG, MCOG and industry stakeholders with technical support if needed from GEPA, GSWA, GDPW – regulatory implementation by*

GEPA with support from ZWAG) – As noted for the original statute in Phase I, successfully introducing and shepherding a new bill through the Guam Legislature and subsequently developing sound implementing regulation will be a relatively major effort that will most likely be led by the MCOG, members of ZWAG and other industry stakeholders. The key components of this law are expected to include:

- Implement EPR policy for e-waste and packaging (possibly pallets) – this effort should build-upon the existing EPP program and involve a comprehensive coalition-building effort with material/product-specific stakeholders from the manufacturing, recycling and collection sectors. See Volume II, White Paper B for more detailed information.
- C&D Diversion Policy – once the Used Building Material and C&D Debris Processing Facilities are established, Guam should implement an island-wide policy requiring minimum levels of diversion on C&D projects (the effective date may vary over time for increasingly smaller projects and more materials. See Volume II, White Paper K for more detailed information.

2) Implement "3R" Waste Minimization Standards for Building Construction & Renovation (implemented by GEPA and GDPW). Ideally, these standards may be developed without legislation and will likely involve the operation of pilot projects to test which materials and which purchasing, reuse and recycling/composting strategies are most effective on Guam. If legislation is required, green building standards should be incorporated in the Revised Guam Zero Waste Law legislation also addressed during Phase III. See Volume II, White Paper F for more detailed information.

3) Implement Greening Roadway Pavement System recommendations (implemented by GDPW and GEPA). Implementation of these specifications will further drive diversion by strengthening local markets (may initially target tires, glass, wood mulch and compost). Their implementation during Phase III will be more feasible as equipment capacities for processing these materials has been developed and GovGuam agencies have time to research other highway department specifications and build partnerships with local material processors See Volume II, White Paper G for more detailed information.

4) Expand PAYT – Variable trash pricing should be explored for large multi-family homes (those not yet addressed through previous programming).

5) Review/Update the Guam Zero Waste Plan (implemented by GEPA with support from GSWA, GDPW and ZWAG) – As noted under Phase II and applicable to next five-year window.

Long-Term (Beyond 2025)

Long-term activities are expected to include the expansion of existing policy and programs to continually expand the scope of Zero Waste practices and move towards Guam's Zero Waste goals. As for all previous phases, it is possible that periodic review of the Guam Zero Waste Plan will identify additional and varied plan priorities as

new conditions develop on Guam; recommended actions should be adjusted accordingly. At this time, the most likely long-term next steps are expected to include:

PHASE I
PRESENT - 2015

PHASE II
2015 - 2020

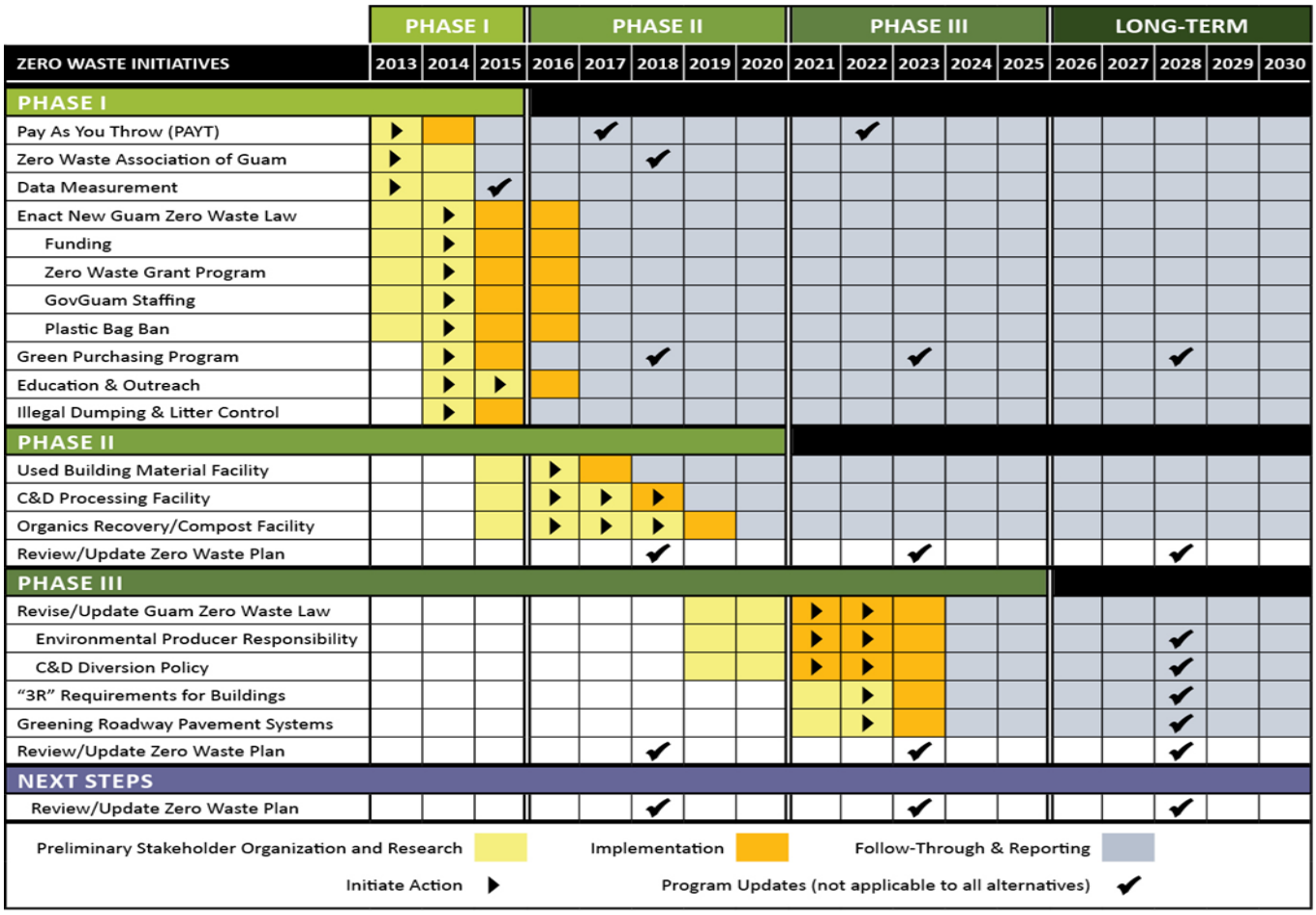
PHASE III
2021 - 2025

LONG TERM
2025 AND BEYOND

- Expand Green/EPP Program, EPR and C&D Diversion Policies (add additional materials);
- Expand "3R" Waste Minimization Standards for Building Construction and Renovation to include additional sustainable design, construction and operation requirements (see Section 7 for additional information) and Greening Roadway Pavement System recommendations by prioritizing the use of additional recycled materials; and
- Review/Update the Guam Zero Waste Plan (five-year review cycle).

Suggested Implementation Timeline

Following is a suggested timeline for implementation of the Zero Waste Blueprint described herein.



Benefit 1. Landfill Waste Diversion Potential

Diversion of landfill waste is the over-arching goal of Guam's Zero Waste Plan, and can be achieved with the initiatives described herein. In the United States, the national landfill diversion rate is 34%. Many communities

have achieved over 50% landfill diversion and San Francisco, a leading Zero Waste community, has achieved 80% landfill diversion.

Typically, diversion success increases as new or expanded programs mature due to increased operational efficiencies, greater public participation and established markets. When multiple programs are operated at the same time, there may be some overlap of diversion activities. Table 5.1 summarizes the diversion potential estimated for the Zero Waste initiatives evaluated in this Plan, based on the timing of implementation and synergy with one another. The detailed basis for the information contained in Table 5.1 (following) is provided in the Volume II White Papers.

TABLE 5.1. ESTIMATED WASTE DIVERSION POTENTIAL FOR ZERO WASTE INITIATIVE IMPLEMENTATION [1, 2] TONS/YEAR UNLESS OTHERWISE NOTED, ROUNDED TO NEAREST 100 TONS)

	BASELINE	2015	2020	2025	2030
PHASE I (Present through 2015)					
Build a Strong Foundation					
Add Residential PAYT	-0-	1,500	6,000	6,000	6,900
Build ZWAG[9]	---	---	---	---	---
Pass Guam Zero Waste Law					
✓ Grant program[2]	-0-	6,300	7,300	18,800	19,000
✓ Plastic bag ban		100	1,300	1,200	1,400
Implement Green/EPP[9]	---	---	---	---	---
Initiate Education & Outreach[9]	---	---	---	---	---
Improve Litter Control & Illegal Dumping Enforcement [4]	-0-	800	2,000	2,600	3,600
PHASE II (2016 through 2020)					
Develop New Infrastructure[5]					
Used Building Materials Facility	-0-	-0-	1,400	2,700	3,300
C&D Debris Processing Facility[4]	-0-	-0-	800	1,400	1,700
Compost Facility	-0-	-0-	1,700	4,800	4,300
PHASE III (2021 through 2025)					
Growing the Zero Waste Program					
Pass New Zero Waste Law					
✓ EPR[6, 7]	-0-	-0-	-0-	400	1,100
✓ C&D Diversion Policy[6,7]		-0-	-0-	2,400	3,000
Implement 3R Requirements for Buildings	-0-	-0-	-0-	400	1,600
Greening Roadway Pavement Systems	-0-	-0-	-0-	1,100	2,500
Estimated Tons Diverted with New Initiatives (in addition to existing diversion)	-0-	8,700	20,500	41,800	48,400
ESTIMATE OF DIVERSION POTENTIAL[8] (% by weight)	18%	21%	25%	35%	37%

[1] *These estimates summarize detailed analysis completed for individual Zero Waste Initiatives provided in the Volume II White Papers. See Volume II for further information regarding specific White Papers.*

[2] Due to the recommended implementation schedule, tonnages may be diverted later than shown in Volume II White Papers. While tonnages do vary over time, the differential has less to do with increasing population/waste generation than with program maturation.
[3] Diverted tons associated with Guam Zero Waste Grant Program may duplicate some tons estimated for other programs in this table, but this overlap is unknown and has not been accounted for at this time.
[4] Not all tons collected through Litter & Illegal Dumping Enforcement efforts will be diverted.
[5] Facilities most likely owned and operated by the private or non-profit sectors.
[6] Tons associated with the C&D processing facility assumes a small facility accepting only 25% of the building waste generated on Guam a larger facility would divert greater quantities.
[7] Adjustments were made to account for duplication with other programs (EPR – plastic bags were banned in Phase I, C&D Diversion Policy – Used Building Material and C&D Processing Facility tons were diverted in those line items)
[8] Based on reported recycling rate of 17.85% in 2011 (GEPA's 2012 Recycling in Focus Fact Sheet) and projected solid waste generation levels on Guam (Volume II, Technical Memorandum 2). Beyond the baseline year of 2012, the percentages shown are in addition to 2012 diversion rates.
[9] Not all Zero Waste Initiatives (i.e., Education & Outreach, etc.) generate direct landfill diversion quantities. However, implementation of these Initiatives is critical to achieving a strong Zero Waste Foundation. These Initiatives have significant, but indirect influence over the increased diversion quantities shown for other Zero Waste Initiatives and are essential to the ultimate success of Guam's Zero Waste Plan.

Table 5.1 illustrates expected progress towards Guam's Zero Waste goals through the implementation of the initiatives evaluated. Relatively conservative estimates were made throughout the analyses conducted for each initiative in terms of both levels of implementation and diversion successes such that the Plan is both practical in its recommendations and reasonable to put in place. It is possible that higher diversion levels can be achieved by:

- Applying Guam-specific data to verify the most effective strategies (e.g., waste composition data to target the "best bang for your buck" materials in each program);
- Implementing initiatives earlier than recommended in the Blueprint (e.g., bringing an active compost facility on-line by 2015);
- Expanding programs as soon as possible (especially growing the PAYT program to include multi-family homes);
- More aggressively leveraging of stakeholder resources (e.g., working with the military and helping ZWAG to take an even more active role in implementing initiatives); and
- Robustly enforcing policy (e.g., littering, bans and diversion mandates) and reporting results of all programs (to better catalyze public support).

Increased diversion will extend the life of Guam's new Layon Landfill, thereby delaying the schedule for closure and post-closure activities, which will allow for additional time to develop a financial reserve to address closure and post-closure activities. As discussed in more detailed in this Section of the Plan and also in the Volume II White Papers and Technical Memoranda, additional benefits of increased waste diversion include, but are not limited to the:

- Generation of jobs which tend to be higher-paying positions than those traditionally associated with waste disposal;
- Creation of small business and public-private partnership opportunities;
- Generation of revenues through materials sales/resale;
- Significant and usually permanent diversion of waste and materials away from disposal;
- Saving natural resources and virgin materials through reuse and recycling;

- A reduction in greenhouse gas emissions, water and air pollution; and
- Preservation of local ecosystems, especially marine ecosystems.

Regular updates to the Guam Zero Waste Plan will be essential to evaluating progress and adjusting short-term strategies, such as modifying program targets or accelerating Zero Waste Programming. While long-term planning is essential to establish goals, priorities and strategies, many variables (population, the market place, on- and off-island economics, etc.) are so dynamic that quantity, revenues/landfill savings and cost projections need to be re-evaluated every few years to have real value.

Benefit 2. Job Creation Potential and Small Business Opportunities

Zero waste is an economic development tool as well as an environmental tool. Reuse, recycling, composting and source reduction offer direct and substantial development opportunities. Discarded materials are a resource that can create jobs and lead to the formation of new businesses (Institute for Local Self-Reliance [ISLR], 2002). Some sources have documented that employment per ton of recycled material can be ten times greater than disposed waste, and employment per ton of mulched/composted material can be two times greater (ISLR, 2002 and 2013; Cascadia, 2009). Job growth has been shown to have dramatic potential in the future, showing that if our national waste diversion rate increases to 75%, as many as 1.5 million new jobs would be created in the United States (Tellus, 2008; Recycling Works!, 2011).

Most of the Zero Waste initiatives evaluated in this Plan will require GovGuam staffing increases for program planning, implementation, enforcement and/or oversight. Many of the waste diversion activities will also create a significant number of materials processing jobs in the private sector. These jobs represent an additional economic benefit, and are discussed in more detail in the White Papers presented in Volume II for each Zero Waste initiative. A summary of the overall job creation potential and business opportunities follows.

Job Creation Potential

Both public and private sector jobs will be created with the implementation of a Zero Waste Program for Guam. The GovGuam job requirements needed to implement the Zero Waste initiatives range from periodic ZWAG meeting attendance and on-going program monitoring to a full-scale re-structuring of residential collection fees and island-wide litter control/illegal dumping enforcement and a Zero Waste education and outreach program. When combined across the board, the stand-alone analyses described in Volume II, White Papers identifies the need for 4 to 6 Full-time equivalents (FTEs) across GEPA, GSWA, GDPW and Guam Department of Administration (GDOA). These staff requirements vary over the planning period but will likely be reduced if multiple initiatives are implemented in an integrated manner that creates greater efficiencies and opportunities for resource

sharing than each individual initiative would alone. It is likely that the GovGuam staffing needs to implement an integrated Zero Waste Program to include:

- GEPA: staffing of 3 to 4 FTEs for programs implemented in tandem or sequentially to build off one another;
- GSWA: staffing of less than 1 FTE for the first year or two of PAYT program development only;
- GDPW: staffing of less than 1 FTE for enforcing plastic bag ban, waste minimization standards for building construction and renovation and greening roadway pavement. Staffing is expected to be reduced once the programs mature and stakeholders become more educated and acceptance for the Zero Waste Program grows);
- GDOA: staffing of less than 1 FTE for initial development of the Green/EPP Program and EPR Policy only; GDOA may also be able to accommodate with existing staff; and
- GovGuam staffing requirements are summarized in the estimated economic costs included later in this Section and are described in more detail for each initiative in the White Papers provided in Volume II.

The potential for creating private and non-profit sector jobs is notably greater than those estimated for GovGuam agencies. These jobs will most likely be created downstream of specific diversion programs and as such, are not included in the Zero Waste initiative cost estimates. Volume II, Technical Memorandum 5 provides summary of these jobs based on the probable timing of their implementation and overlap with one another. The job creation potential for new processing jobs in the private and non-profit sectors over the projected implementation period could range from as many as 7 new FTEs in 2015 up to 37 FTEs by 2030 for reuse activities, primary recyclables processing, local composting and local C&D processing on Guam. Additional off-island jobs would be created for secondary processing and manufacturing (especially for e-waste).

Job creation estimates were based on a limited number of available regional and national studies for new jobs required to meet material collection and processing needs. The estimates provide a general approximation of jobs potential, but should not be construed as a definitive projection. Cultural, geographic and economic conditions on Guam may well alter the actual number of new jobs ultimately generated by the various waste diversion initiatives evaluated. Volume II, Technical Memorandum 5 includes a description of the resources utilized in the analysis.

Public-Private Partnership Opportunities

As GovGuam and local village governments are not expected to become directly involved with materials management, local processing jobs will be created primarily in the private sector and to a lesser extent in the non-profit sector. The most obvious opportunities for public-private partnerships exist with the following initiatives evaluated in the Zero Waste Plan:

- Used Building Material Facility
- C&D Debris Processing Facility
- Compost/Organics Recovery Facility
- Greening Roadway Pavement Systems

In each of these initiatives, a GovGuam agency can partner with private/non-profit owners to facilitate various aspects of new program development or facility operation. GovGuam agencies are well-suited at providing pre-development planning services, clarifying regulatory requirements, and facilitating land ownership/use partnerships, materials marketing assistance and educating the public about program and facility services. Advantages of public-private partnerships are numerous and include, but are not limited to, fully leveraging equipment and facilities; increasing quantities managed/reducing operating costs; and allocating risks to the private sector that is better equipped to manage it.

Small Business Opportunities

Many material diversion operations (i.e., recycling, reuse and remanufacturing) tend to be small or medium-sized businesses. The recycling, reuse and remanufacturing industries as a whole are very diverse and include a wide variety of service and product businesses, from those that collect and process all sorts of materials to those that reuse materials or manufacture with recycled content. The industry also supports businesses in public education, consulting, transportation, brokering, and retailing of recycled products. Recycling businesses are structured in every form imaginable, from sole proprietorships and corporations to joint ventures and non-profit enterprises. In the world of Zero Waste, small business opportunities are almost unlimited. However, some types of businesses are easier to start than others. Only a very small percentage of products on the market today are truly new inventions (USEPA, 2013).

Benefit 3. Revenue Generation from Material Recovery Sales

As has already been noted, Zero Waste is an economic development tool as well as an environmental tool. Reuse, recycling, composting and source reduction offer direct and substantial development opportunities for communities. In addition to its job creation potential, many waste diversion activities will generate direct revenues from materials sold to those reusing salvaged materials, secondary processors or manufacturers both on Guam and off-island.

Estimating revenues for both local and off-island materials sales was especially challenging as pricing fluctuates dramatically in some markets, overseas shipping costs are unavailable for most non-traditional materials and private sector recyclers consider pricing data to be proprietary. The market analysis described in Volume II, Technical Memorandum 4 includes an indication of relative pricing and shipping costs for traditional materials in late 2012. These values will fluctuate/change over time. Additional information detailed

information regarding estimated revenue generation from material sales made for each initiative are described in the White Papers presented in Volume II.

General revenue estimates are summarized in Table 5.2 and are based on the implementation schedule recommended in the Blueprint. These revenues will be earned by whichever party accomplishes diversion (e.g., GSWA for PAYT, grantees for the grant program, Guam Bureau of Statistics and Plans for coastal clean-up, GEPA for litter control and illegal dumping enforcement, private/non-profit contractors for C&D, etc.). While these estimates are intended to provide an approximation of revenue potential, additional data will be needed to confirm actual earnings (especially for the Phase II facilities) during a particular period. Costs are presented in 2013 dollars ($).

TABLE 5.2. ESTIMATED REVENUE GENERATION FROM MATERIAL RECOVERY SALES FOR ZERO WASTE INITIATIVE IMPLEMENTATION [1,2] (IN 2013 $, ROUNDED TO THE NEAREST 100 TONS)

	BASELINE	2015	2020	2025	2030
PHASE I (Present to 2015)					
Build a Strong Foundation					
Add Residential PAYT [3]	$-0-	$(143,600)	$(548,400)	$(574,500)	$(652,400)
Build ZWAG [4]	---	---	---	---	---
Pass Initial Zero Waste Law					
✓ Zero Waste Grant Program	$-0-	$254,500	$297,600	$763,000	$770,300
✓ Plastic Bag Ban	$-0-	$-0-	$-0-	$-0-	$-0-
Implement Green/EPP[4]	----	---	---	---	---
Initiate Education & Outreach[3,4]	---	---	---	---	---
Improve Litter Control and Illegal Dumping Enforcement	$-0-	$23,700	$71,000	$85,200	$108,800
PHASE II (2016 to 2020)					
Develop New Infrastructure					
Used Building Material Facility [5]	$-0-	$-0-	$73,600	$182,500	$268,300
C&D Debris Processing Facility [5]	$-0-	$-0-	$11,700	$21,000	$24,800
Compost Facility [5]	$-0-	$-0-	$21,400	$60,200	$54,000
PHASE III (2021 to 2025)					
Growing the Zero Waste Program					
Pass Revised Zero Waste Law					
✓ EPR[3]	$-0-	$-0-	$-0-	$(90,800)	$(250,300)
✓ C&D Diversion Policy	$-0-	$-0-	$-0-	$19,000	$39,000
Implement 3R Requirements for Buildings	$-0-	$-0-	$-0-	$6,800	$24,000
Greening Roadway Pavement	$-0-	$-0-	$-0-	$-0-	$-0-

[1] *Feasibility-level costs for planning purposes only. These estimates summarize detailed analysis completed for individual Zero Waste Initiatives provided in the Volume II White Papers. See the Volume II, White Papers for detailed technical and cost-related information for the fifteen Zero Waste Initiatives.*

[2] *Due to the recommended implementation schedule, tonnages may be diverted later than shown in Volume II White Papers. While tonnages (and therefore revenues) do vary over time, the differential has less to do with increasing population/waste generation than with program maturation and an erratic market place.*

[3] *Not all material sales generate positive revenues. For example, traditional materials (PAYT program), e-waste, etc., currently have no local markets and have to be shipped overseas at a net cost, but avoided landfill costs more than off-set this factor for most programs.*

[4] *Not all Zero Waste Initiatives (i.e., ZWAG, Education & Outreach, etc.) generate direct material sales and corresponding revenue. However, implementation of these Initiatives is critical to achieving a strong Zero Waste Foundation. These Initiatives have significant, but indirect influence over increased diversion and corresponding positive material sales/revenues of the other Zero Waste Initiatives and the ultimate success of Guam's Zero Waste Plan.*

[5] *Facilities most likely owned and operated by the private or non-profit sectors.*

Key observations from Table 5.2 include:

- Only material sales revenues are included. Other revenues streams are not included (such as facility tipping fees likely charged by private sector operators at the C&D processing and compost facilities).
- Not all material sales generate positive revenues. For example, traditional materials (PAYT program), e-waste, etc., currently have no local markets and have to be shipped overseas at a net cost, but avoided landfill costs more than off-set this factor for most programs.
- Future development of local markets for these materials would significantly improve earnings potential.

Benefit 4. Avoided Landfill Disposal Costs (Savings)

The primary benefit of implementing a Zero Waste Program on Guam is the diversion of significant quantities of materials from landfill and hardfill disposal. While the avoidance of landfill disposal does not represent a tangible revenue stream, these savings go directly to the bottom line of any solid waste management program. Additionally, avoided landfill disposal cost savings are often responsible for providing a Zero Waste Program with an overall net zero (or even revenue-generating) operation and should always be considered when evaluating the potential for, and success of, any program that includes diversion.

Estimating avoided landfill costs has the same challenges as those identified for estimating quantities, and requires the same collection of Guam-specific data to ultimately verify the accuracy of the numbers estimated. As this estimate is also tied to landfill and hardfill disposal (also referred to in this Plan as tip fees), changes in those fees will directly impact avoided disposal costs (i.e., if disposal costs increase, the savings from avoiding landfill disposal also increases. The costs summarized in Table 5.3 provide a reasonable projection of savings generated by each of the Guam Zero Waste Plan initiatives.

TABLE 5.3. ESTIMATED AVOIDED LANDFILL DISPOSAL COSTS (SAVINGS) FOR ZERO WASTE INITIATIVE IMPLEMENTATION [1, 2, 3] (IN 2013 $, ROUNDED TO NEAREST 100 TONS)

	BASELINE	2015	2020	2025	2030
PHASE I (Present to 2015)					
Build a Strong Foundation					
Add Residential PAYT	$-0-	$263,200	$1,034,300	$1,052,700	$1,209,800
Build ZWAG [4]	---	---	---	---	---
Pass Initial Zero Waste Law					
✓ Zero Waste Grant Program	$-0-	$769,500	$900,000	$2,307,000	$2,329,200
✓ Plastic Bag Ban	$-0-	$22,900	$220,000	$213,800	$244,400
Implement GovGuam Green/EPP [4]	---	---	---	---	---
Initiate Education & Outreach [4]	---	----	---	---	---
Improve Litter Control & Illegal Dumping Enforcement	$-0-	$148,400	$357,900	$453,900	$628,500
PHASE II (2016 to 2020)					
Develop New Infrastructure					
Used Building Material Facility [5]	$-0-	$-0-	$49,100	$94,600	$113,800
C&D Debris Processing Facility [5]	$-0-	$-0-	$27,300	$49,000	$57,800
Compost Facility[5]	$-0-	$-0-	$79,200	$241,300	$241,300
PHASE III (2021 to 2025)					
Growing the Zero Waste Program					
Pass Revised Zero Waste Law					
✓ EPR	$-0-	$-0-	$-0-	$94,900	$262,700
✓ C&D Diversion Policy	$-0-	$-0-	$-0-	$85,600	$106,400
Implement 3R Requirements for Buildings	$-0-	$-0-	$-0-	$15,800	$56,000
Greening Roadway Pavement	$-0-	$-0-	$-0-	$112,200	$177,600
ESTIMATED TOTAL AVOIDED LANDFILL SAVINGS	$-0-	↑$1,204,000	↑$2,667,800	↑$4,720,800	↑$5,427,500

[1] *Feasibility-level costs for planning purposes only. These estimates summarize detailed analysis completed for individual Zero Waste Initiatives provided in the Volume II White Papers. See Volume II for further information technical and cost details for each Zero Waste Initiative.*

[2] *Due to the recommended implementation schedule, tonnages may be diverted later than shown in Volume II White Papers. While avoided costs do vary over time, the differential has less to do with increasing population/waste generation than program maturity and rising disposal tip fees.*

[3] *Based on 2013 Layon Landfill tip fees of $174.57/ton and estimated average hardfill tip fees of $35/ton (held constant for all time periods).*

[4] *Not all Zero Waste Initiatives (i.e., EPP, Education & Outreach, etc.) lead to direct landfill cost savings. However, implementation of these Initiatives is critical to achieving a strong Zero Waste Foundation. These Initiatives have significant, but indirect influence over increased diversion and the correlate to the landfill cost savings that are predicted for the other Zero Waste Initiatives and are essential to the ultimate success of Guam's Zero Waste Plan.*

[5] *Facilities most likely owned and operated by the private or non-profit sectors.*

Key observations from Table 5.3 include:

- The tip fees were held constant to be consistent with providing cost/revenue values at a flat 2013 $ level. While costs are expected to rise, it is likely that the Layon Landfill tip fee will rise significantly (GSWA has proposed a $225/ton commercial disposal rate for 2015) – this will generate much higher landfill savings than is described above.
- Landfill savings associated with the EPR program was measured at the Layon Landfill rate. If disposal rates for hazardous wastes at a RCRA Subtitle C facility had been used, the avoided costs would have been significantly higher.
- Avoided landfill costs will increase notably as programs grow and are expanded over time (especially PAYT).
- Any potential increase in facility tip fees associated with funding the Zero Waste Program (a proposed funding strategy is presented at the end of this Section) will also increase avoided landfill costs for all initiatives whose diverted materials would otherwise be managed at the Layon Landfill.

Benefit 5. Human Health and Environmental Impacts

The purpose of Zero Waste is to eliminate waste at the source through product design and producer responsibility, and implement waste reduction strategies further down the chain such as source reduction, reuse, recycling and composting. Governments and communities that implement Zero Waste plans, programs and strategies aim to switch from waste disposal to value-added resource recovery systems that will help build sustainable local economies.

The human health and environmental impacts realized by implementing a Zero Waste Program on Guam will be positive and measurable. Some of the most important benefits include:

- Significant and usually permanent diversion of waste and materials away from disposal;
- Saving natural resources and virgin materials through reuse and recycling;
- A reduction in greenhouse gas emissions, water and air pollution; and
- Preservation of local ecosystems, especially marine ecosystems.

A detailed list of the beneficial impacts created by implementing each initiative evaluated in the Guam Zero Waste Plan is presented in the white papers contained in the White Papers presented in Volume II.

Impact 1. Estimated Economic Costs

One of the scope requirements for the Guam Zero Waste Plan was to estimate programmatic-level costs to implement the initiatives evaluated in the Plan. Table 5.4 summarizes the estimated total costs to implement each initiative evaluated for this Guam Zero Waste Plan over a 20-year planning period. Detailed cost estimate information for each Zero Waste initiative can be found in the Volume II White Papers and in Technical Memorandum 6. Costs estimated include labor for program development and on-going implementation, as well

as some operational costs. Additionally, estimated private/non-profit sector costs for the Phase II facilities (not all of which will be operated by GovGuam) is also included.

Estimating the cost of initiatives presented in the Guam Zero Waste Plan was challenging as design and operating parameters are only generally defined, quantities are approximated, and opportunities for partnerships to increase efficiencies and reduce costs are unknown. The costs estimates provided in Table 5.4 (following) provide a feasibility-level estimate of the relative investment required for each initiative. It is noted that refinements to these estimates – to consider actual design capacities, equipment shipment to Guam, operating expenses and other costs – will be needed before actual implementation. The actual costs incurred will depend upon the sequencing of initiatives. Cost estimate assumptions made for each initiative are described in the White Papers provided in Volume II. Costs are presented in 2013 dollars.

TABLE 5.4. ESTIMATED COSTS FOR ZERO WASTE INITIATIVE IMPLEMENTATION [1, 2]
(IN 2013 $, ROUNDED TO NEAREST $100)

	BASELINE	2015	2020	2025	2030
PHASE I (Present to 2015)					
Build a Strong Foundation					
Residential PAYT[3]	$1,034,000	$-0-	$-0-	$-0-	$-0-
Build ZWAG	$-0-	$6,700	$6,700	$6,700	$6,700
Pass Initial Zero Waste Law					
✓ Grant Program	$18,700	$268,700	$287,500	$287,500	$287,500
✓ Plastic Bag Ban	$18,700	$18,700	$13,300	$13,300	$13,300
Implement Green/EPP	$35,600	$143,700	$143,700	$151,200	$151,200
Initiate Education & Outreach	$72,500	$46,500	$46,500	$46,500	$46,500
Improve Litter Control & Illegal Dumping Enforcement	$297,200	$241,500	$241,500	$241,500	$241,500
PHASE II (2016 to 2020)					
Develop New Infrastructure [4]					
Used Building Material Facility	$-0-	$-0-	$713,400	$175,600	$351,400
C&D Debris Processing Facility	$-0-	$-0-	$494,100	$274,000	$356,400
Compost Facility	$-0-	$-0-	$2,177,900	$227,800	$302,800
PHASE III (2021 to 2025)					
Growing the Zero Waste Program					
Pass Revised Zero Waste Law					
✓ EPR	-0-	$-0-	$-0-	$18,700	$18,700
✓ C&D Diversion Policy	$-0-	$-0-	$-0-	$18,700	$18,700
Implement 3R Requirements for Buildings	$-0-	$-0-	$-0-	$81,700	$50,000
Greening Roadway Pavement	$-0-	$-0-	$-0-	$32,000	$-0-
ESTIMATED TOTAL COSTS	$1,476,700	$725,800	$4,124,600	$1,575,200	$1,844,700

[1] *Feasibility-level costs for planning purposes only. These estimates summarize detailed analysis completed for individual Zero Waste Initiatives provided in the Volume II White Papers. See Volume II for further information regarding specific White Papers.*
[2] *Due to the recommended implementation schedule, costs may be incurred earned later than shown in Volume II White Papers. While costs do vary over time, the differential has less to do with increasing population/waste generation than with the stages of program development (i.e., initial development and capitalization versus on-going implementation of a mature program).*
[3] *When PAYT is initially introduced, it is likely that 96-gallon trash carts currently in use by many current customers will be taken out of service. These carts will have many years of use left, however, and can be used for expanding PAYT to new multi-family customers later in the planning period (especially small multi-family units). It is expected that this cart exchange would be coupled with other methods (such as maintaining other existing multi-family containers but decreasing the collection frequency) to implement PAYT at no significant cost increase in the future.*
[4] *Facilities most likely owned and operated by the private or non-profit sectors.*

Key observations from Table 5.4 include:

- Costs are limited to GovGuam costs with the exception of the Phase II facilities (Used Building Material, C&D Debris Processing and Compost Facilities).
- Most program costs are higher initially and in part reflect elevated staffing needs for pre-implementation planning, legislation and research. Typically labor costs are reduced once the program is operational.
- GovGuam agency staffing is a key component of most initiatives and is the primary cost estimated for the ZWAG, Plastic Bag Ban, EPR Policy, C&D Diversion Policy, Waste Minimization Standards for Building Construction and Renovation and Greening Roadway Pavement System initiatives.

Individual program costs include:

- PAYT: GSWA efforts to set/approve new rates, purchase and deliver new 32- and 64-gallon trash carts.
- Zero Waste Grant Program: an assumed $250,000 grant amount each year.
- Green/EPP Program: a price premium on green purchases of $125,000/year (may be reduced if the premium is lower or lower quantities of targeted office paper and electronics are purchased).
- Education and Outreach Program: planning, graphic design, a public survey and miscellaneous supplies.
- Litter Control and Illegal Dumping Enforcement costs: staffing, equipment lease, materials and supplies; disposal fees for non-diverted materials are waived.
- Phase II facilities: assumes private ownership/operations and the co-location and expansion of existing facilities and labor based on GEPA rates (it is likely that these rates over-estimate this cost item and require adjustment). Additional property and building space needs include (assumes utility and road infrastructure to these properties is existing):

    - Used Building Material Facility: 1-acre facility site and a 3,500 square foot (SF) building;
    - C&D Debris Processing Facility: 1-acre facility site and 500 SF building; and
    - Compost Facility: 4-acre facility site and 2,500 SF building.

The financial model developed to estimate the costs included in this Zero Waste Plan are included in Volume II, Technical Memorandum 6.

Impact 2. New Legislation, Regulations & Policies Needed

A comprehensive legislative and regulatory framework is needed to support some of the Phase I and III Zero Waste initiatives. GEPA will be instrumental in developing and implementing many new policies and programs that support Guam's future Zero Waste Program efforts. While it is possible that the Governor's Office requests the input of GEPA on certain legislative efforts and that GEPA strongly supports these bills, GEPA staff will, in general, not be able to actively pursue legislation. The same will be true of other Guam governmental department staff such as GDPW, GSWA and GDOA. As a result, it will be critical for other public, private, non-profit and individual stakeholders to both introduce bills and take the lobbying lead. These efforts would ideally be coordinated by the new/expanded Zero Waste Association of Guam.

Some of the most important legal and regulatory needs include:

- An (initial) Guam Zero Waste Law that establishes the following:
    - A Zero Waste goal and a directive to the territorial government to implement an island-wide Zero Waste Program;
    - Funding for Guam's Zero Waste Program including the Zero Waste Grant Program;
    - A provision to hire additional GovGuam staff resources; and
    - A directive to implement a single-use Plastic Bag Ban.
- Comprehensive Green/EPP Legislation: to use GovGuam's purchasing power to create markets for recycled, reused and waste preventing products. The federal government has made significant strides in this area and has produced purchasing guides for use by state and local governments.
- Strengthen Guam's Litter Control Laws to provide for consistent and meaningful enforcement, and the Solid Waste Management Act to establish mandatory performance targets and to be consistent with a Zero Waste goal.
- Other legislation/implementing regulations for:
    - A bigger and better bottle bill for Guam to reduce the amount of waste that must be managed;
    - Shipping waiver for recyclers; and
    - Quarantine regulations for the Coconut Rhinoceros Beetle.

More details regarding the legislation needed to accomplish the recommended implementation strategy summarized above and a summary of the activities that will be required to pass a bill in the legislature and subsequently develop new implementing regulations for the new statute(s) is provided in Volume II, Technical Memorandum 7. Examples of Zero Waste legislation language can be found throughout electronic documentation referenced in Volume II, Technical Memorandum 8.

Impact 3. Impact of Increased Diversion on Annual Tip Fee Revenues

As Guam plans for a Zero Waste future and increases its focus on achieving higher diversion and recycling rates, the impact on the current solid waste management program, which is supported in large part by the tipping fees collected at the Layon Landfill (through the commercial transfer station under contract to GSWA) and three permitted hardfills, will create financial implications that must be evaluated. With declining annual tip fee revenues due to a projected decrease in disposal, side effects of a phenomenon referred to by some in the solid waste management industry as the "death spiral" will occur and must be managed.

If the Zero Waste Program is successful and the landfill diversion rates projected in Table 5-1 are met, the avoided disposal costs shown in Table 5-3 will result in a directly proportional amount of funding that will no longer be available to fund existing solid waste management obligations. This presents a dilemma for GovGuam, because future projected tip fee revenues, in part, were intended to help cover the amortization payment structure/schedule for the bonds issued to fund the construction of the Layon Landfill.

Alternatives that may have to be considered to potentially mitigate the negative impacts from the decreased availability of funding for the Layon Landfill may include a combination of any of the following:

- Increase landfill tipping fees to cover the shortfall;
- Scale back the size of the new landfill, thereby reducing future construction and long-term O&M costs;
- After the existing Consent Decree is complete and the Layon Landfill is transferred back to GovGuam to manage, GovGuam should conduct a cost-benefit analysis on the feasibility of permanently privatizing landfill operation and maintenance activities to lower operating costs; and
- Refinance existing bond structure to accommodate a longer term and lower payment schedule.

This is a significant potential issue for the Government of Guam and the GSWA. According to GSWA's spring 2012 Rate Setting Model, debt service payments for the Layon Landfill will increase to $15.7 million in September 2013, of which $3.7 million annually is expected to be paid by "other sources", principally a portion of Guam's Section 30 revenues. Total revenues for GSWA are projected at $21.4 million for 2013, increasing to $24.9 million by 2015. These revenue levels assume a commercial tipping fee of $225 per ton, and residential collection costs increasing from $30 per month in 2012 to $45 per month in 2015. The financial summary of the Rate Setting Model is shown in Table 5-5. As shown in the Table, it is anticipated that the proposed rate structure could result in a deficit of almost $5.5 million for the year. Additionally, the residential collection service currently operates at a substantial deficit of almost $3 million annually.

TABLE 5-5. SUMMARY OF GSWA'S SPRING 2012 RATE SETTING MODEL RESULTS[1]

2013 ESTIMATES[2]	
REVENUES	
Disposal Tipping Fees	$14,167,234
Residential Collection Fees	$7,345,200
Self-Haul Fees	$309,000
Other Revenues	$32,651
Uncollectable Accounts	$(430,429)
TOTAL REVENUES	↑ *$21,423,656*
EXPENSES	
Administration[1]	$1,743,140
Landfill Ops/Related Activities	$2,872,880
Residential Collection	$10,323,743
Net Debt Service	$11,980,494
Total Expenses	↓ $26,920,257
SURPLUS (DEFICIT)[1]	↓ $(5,496,601)

[1] *Restated from the Guam Solid Waste Authority Receiver's Quarterly Report to the Federal Court, dated July 18, 2012, Rate Setting Model Spring 2012, Tab 11d, Full Government Reimbursement Rate Option (Gershman, Brickner & Bratton, Inc., 2012).*

[2] *The Rate Setting Model projects a deficit of $3.7 million for 2013 under the Full Government Reimbursement Model. However, the model appears to calculate the deficit based solely upon revenues and direct operating costs, which does not account for GSWA's cost of administration of $1.7 million.*

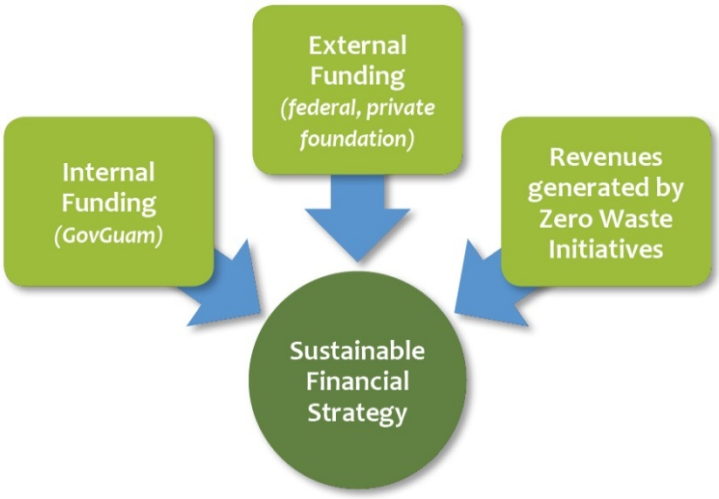
In the simplest terms, the successful implementation of a Zero Waste Program could result in diversion of 8,700 tons of waste from the Layon Landfill in 2015, more than 9% of the total tonnage projected by GSWA in their Rate Setting Model. As discussed in Table 5.5, this equates to $1.2 million in avoided tipping fees at the current rate of $174.57 per ton, and $1.55 million at GSWA's projected 2013 tipping fee assumed in the spring 2012 Rate Setting Model of $225 per ton. As the Zero Waste program becomes more successful, diverted tonnage could approach 50,000 tons by 2030, though some of this tonnage would be from building materials, which are not accepted at the Layon Landfill.

In order to offset this reduction in revenue, a profit-motivated owner would typically reduce expenses or raise service costs (revenues). Reducing expenses could take the form of reduced hours of operation, termination of some staff positions, a reduction in benefits or a renegotiation of the operator's contract. Some of these strategies may not be politically acceptable, while others may be affected by outside influence such as the Federal Court system.

Funding Strategy

No Zero Waste Plan would be complete without a discussion regarding funding. The long-term savings and economic benefits from implementing a Zero Waste Program will eventually dwarf the initial investment. However, while the long-term savings of Zero Waste Programs may be significant, many of the program initiatives require multiple years of investment before savings are seen.

The use of a combination of internal and external funding sources to build a sustainable financial strategy is recommended. Although external grant funds may be available in some cases to assist with initial capital costs for facilities and equipment, ongoing operational expenses for the Zero Waste Program will most likely need to be funded through internal funding sources. Additionally, because external grant funds can take a considerable amount of lead time to obtain, this funding source may also not be available during funding of the early phases of the Guam Zero Waste Program.



A summary of various funding strategies that GovGuam could utilize, in whole or in part, to fund the Zero Waste Program is summarized herein and presented in more detail in Volume II, White Paper O. Over time, the use of a more diversified funding strategy, which potentially includes the addition of revenues generated by the various Zero Waste initiatives implemented and grant awards, should be evaluated.

Landfill Tipping Fee Surcharge

All landfills charge a tipping fee or "gate" fee. A small increase in the fee paid per ton by commercial customers (who pay tipping fees for Layon Landfill-bound waste at GSWA's contracted commercial transfer station) and in the service fees paid by residents who receive curbside trash collection can generate significant fees. For example, during 2012 approximately 89,500 tons of solid waste was disposed of at the Layon Landfill, including MSW from 17,000 homes, waste collected through GSWA's convenience centers and commercial waste (Anderson, 2013). The potential funding impacts of a 1% to 5% increase over current tipping fees/collection rates are summarized in Table 5-6 below. As shown, a 1% increase in commercial tipping fees would generate more than $106,000, while a 5% increase would generate more than $530,000 in funding. Similarly, an increase of 1% in residential collection costs would generate more than $61,000 in annual funding, while a 5% increase would generate more than $300,000 in annual funding.

TABLE 5-6. POTENTIAL ZERO WASTE PROGRAM FUNDING FROM LANDFILL TIPPING FEE SURCHARGE

SERVICE TYPE	BASIS	UNITS	FEE	PER	FUNDS GENERATED
Commercial[1]	61,000	Tons	1%	Ton	$106,488
Commercial[1]	61,000	Tons	2%	Ton	$212,975
Commercial[1]	61,000	Tons	3%	Ton	$319,463
Commercial[1]	61,000	Tons	4%	Ton	$425,951
Commercial[1]	61,000	Tons	5%	Ton	$532,439
Residential[2]	17,000	Homes	1%	Year	$61,200
Residential[2]	17,000	Homes	2%	Year	$122,400
Residential[2]	17,000	Homes	3%	Year	$183,600
Residential[2]	17,000	Homes	4%	Year	$244,800
Residential[2]	17,000	Homes	5%	Year	$306,000

1: *Transfer Station Tip Fees, commercial collections shown in tons*
2: *Curbside Collection Fees, residential collections show by number of houses/accounts serviced.*

A combination of residential and commercial fees dedicated to Zero Waste is one approach available to GovGuam to fund a program which can have a positive effect on Guam's solid waste management practices. For example, a 3% fee for both commercial and residential customers would generate just over $500,000 annually. Additional revenue could be generated if transfer station fees are also increased. the 2012 GSWA Rate Setting Model identifies $14.2 million in tipping fees and $7.3 million from residential collections. Increasing the tipping fee by 5% would generate additional revenue of more than $700,000.

Gross Receipts Tax Surcharge

According to the Governor's FY 2013 budget request (GovGuam 2013), revenues are expected to exceed $693.7 million. Expected revenue sources include:

- Income Tax – $412,892,666;
- Business Privilege – $218,282,984;
- Federal Sources – $50,669,528;
- Other Taxes – $3,619,372;
- Other Sources – $ 8,274,204.

Among these sources, the Business Privilege Tax also referred to as the Gross Receipts Tax or (GRT) offers the next highest potential as an internal source of funds to support the Zero Waste Program. The use of privilege taxes (also known as occupational taxes) to generate public program income is common throughout the United States. Some local communities (such as Boulder, Colorado) leverage an occupational tax on trash haulers specifically to fund its Zero Waste Program.

As stated in the Governor's FY 2013 budget, the GRT is projected to generate $218.3 M in 2013 at the present tax rate of 4.0%. As shown in Table 5-7, every 0.1% incremental increase in the GRT rate would produce an incremental increase in revenues from the GRT of just over $218,000. Incremental changes to the GRT could generate significant funding for the implementation of the Zero Waste Program. Every incremental increase in the GRT rate would produce an estimated $218,000 for Zero Waste Programs.

TABLE 5-7. POTENTIAL ZERO WASTE PROGRAM FUNDING FROM GRT RATE INCREASE

GRT RATE	INCREMENTAL REVENUE
4.0%	$-0-
4.1%	$218,283
4.2%	$436,566
4.3%	$654,849
4.4%	$873,132
4.5%	$1,091,415

From a practical perspective, a combination of a landfill tipping fee surcharge and a GRT Rate surcharge dedicated to funding a Zero Waste Program is another reasonable approach to funding this program. A more detailed discussion regarding creating a sustainable funding strategy is presented in Volume II, White Paper O.

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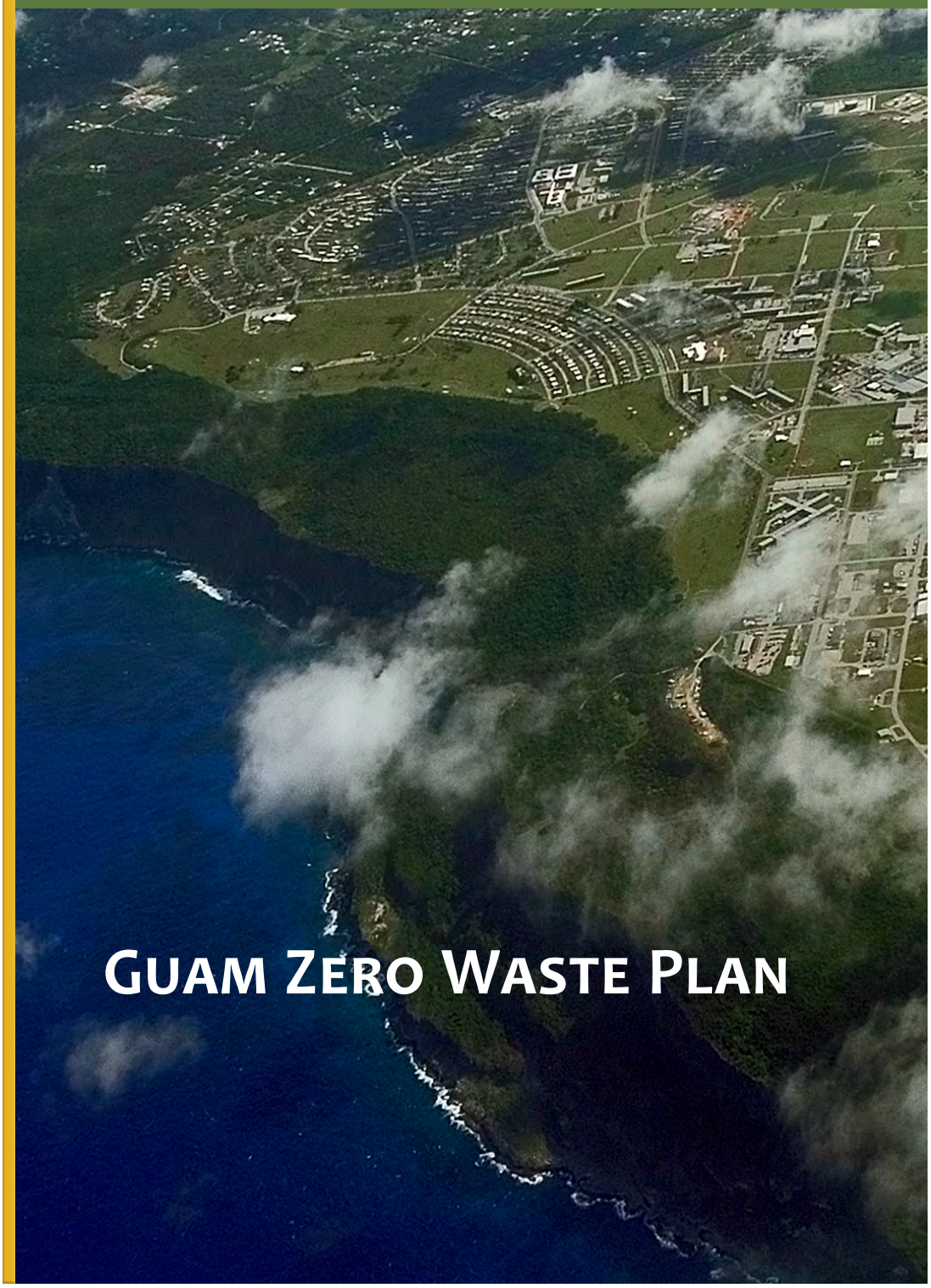
6. Education, Outreach and Public Awareness



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6. EDUCATION, OUTREACH AND PUBLIC AWARENESS

Most of the Zero Waste initiatives identified in the Zero Waste Plan have a public education and outreach component. Many different marketing and communication strategies can be implemented to get the word out about Guam's Blueprint for Zero Waste. There are numerous volunteer and business programs currently in place to promote recycling and Zero Waste awareness on the island of Guam. Non-profit organizations and volunteers have accomplished much of the public education and outreach efforts on Guam to date. To reach higher levels of diversion and the goals of Zero Waste, a formal public education program needs to be established, which requires staff, budget, supplies, outside expertise, and political and institutional support.

Establishing an education program will need permanency of funding and staffing. Fortunately for the Zero Waste Program, there is an existing network of education and outreach providers to draw from including the MCOG, RAG, i*Recycle, GEPA and its public relations program, USEPA, the local recycling community and GSWA as well as committed academic resources from the UOG faculty, students and its Center for Island Sustainability. While all of the potential providers in the network are important, the MCOG is likely the most influential in ensuring a successful education and outreach program, and it will be very important to work closely with the Village mayors.

An education, outreach and public awareness program which gives careful consideration given to the unique characteristics specific to Guam, including distinct language and cultural considerations, the influence of the MCOG, large military presence, large influx of people moving to Guam, tourism and hospitality industries, local media, and existing businesses must be developed. A summary of the immediate actions which need to be implemented with respect to implementing an education, outreach and public awareness campaign include:

- Form a Public Education and Outreach Advisory Committee consisting of members of stakeholder groups
- Hire part-time staff dedicated the Outreach program
- Conduct community relations surveys

- Develop a strategy
- Develop program logo, brand and graphics
- Develop program identity and branding
- Continue and build-upon current education and outreach efforts
- Consider developing incentives with monetary rewards and public recognition awards for the villages to participate
- Develop information for Guam newcomers
- Develop information systems to support tourists' understanding of Guam's Blueprint for Zero Waste
- Integrate existing tourism and hospitality and military education and outreach efforts into the campaign
- Launch a website and social media campaign to link with supporters

An implementation strategy which discusses each of the actions identified above is presented in more detail in Volume II, White Paper N.

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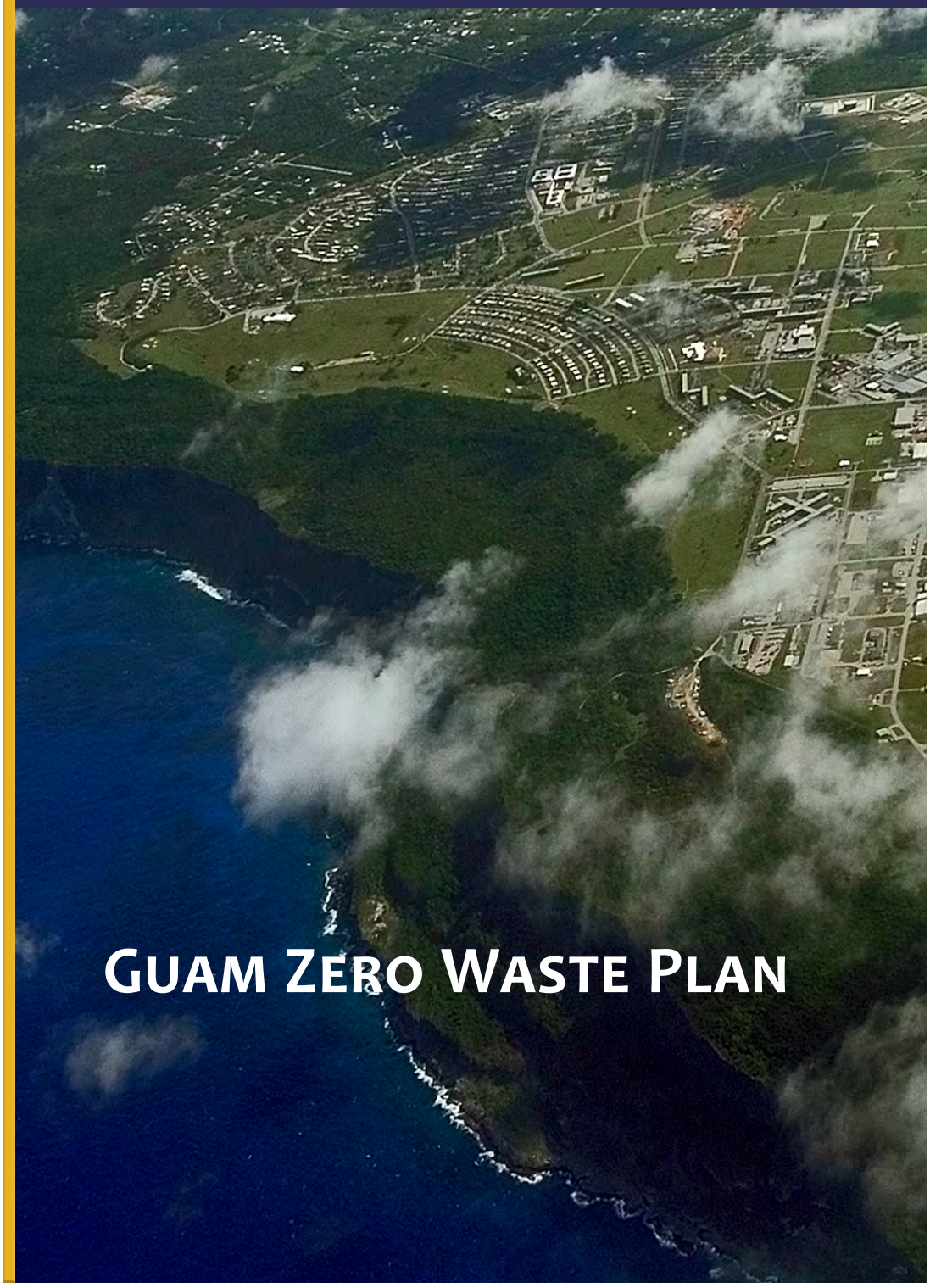
7. Measuring Success and Next Steps



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7. MEASURING SUCCESS AND NEXT STEPS

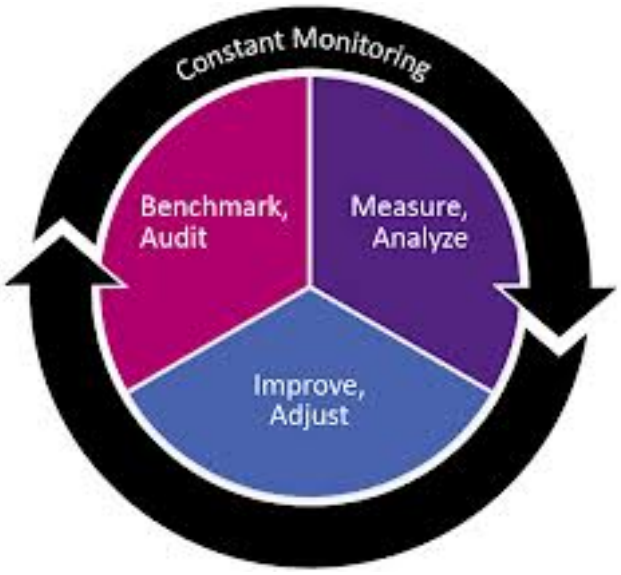
You can't manage what you don't measure. This old management saying is as true today as when the thought was first developed. Unless you measure something you don't know if it is getting better or worse. With a clearly established metric for success, you can monitor and review progress. Implementing a philosophy of continuous improvement and having a strong "can do!" attitude will go a long way is helping the government and people of Guam realize their goal of Zero Waste and preserve the environment for Guam's children and the future.

Measuring Success

To ensure that Guam's Zero Waste Program is optimally effective, the following activities should be implemented to measure its success.

Data Collection and Measurement

The collection of accurate data is an essential starting point for any source diversion program, including a Zero Waste Program, because of its role in identifying obstacles, opportunities, efficiencies and progress. The collection of accurate data is also very important with respect to justifying future grant fund requests for the Zero Waste Program. Data collection and measurement is an on-going process that begins with establishing a baseline data set that is subsequently used as a basis of comparison for future program measurement. In 2012, Guam's MSW diversion rate (primarily recycling) was measured for the first time, and a rate of 17.85% by weight was calculated for calendar year 2011 (GEPA, 2012). This work was completed by GEPA with support from USEPA. Current measurement efforts do not include C&D materials, and these materials need to be added to support comprehensive measurement and evaluation of the Zero Waste Plan over time. Detailed recommendations for expanding on-going data collection and measurement efforts in the future include:



- Adding organics data, construction & demolition debris and reuse materials;
- Using export data to improve accuracy; and
- Reporting by recyclers to promote successful diversion efforts.

Capture of material currently not measured is critical to the tracking of overall zero waste efforts on Guam. Also critical to the success of the on-going data collection and measurement activities, as well as the overall zero waste efforts on Guam will be the completion of a comprehensive waste characterization study as soon as

possible. See Volume II, Technical Memorandum 3 for a detailed evaluation of Guam's current measurement program and recommended improvements/future actions related to the measurement program.

Monitoring and Review

Regular updates to the Guam Zero Waste Plan will be essential to evaluating progress and adjusting short-term strategies, such as modifying program targets or accelerating Zero Waste Programming. While long-term planning is essential to establish goals, priorities and strategies, many variables are so dynamic that quantity, revenues/landfill savings and cost projections need to be re-evaluated every few years to have real value.

Continuous Improvement

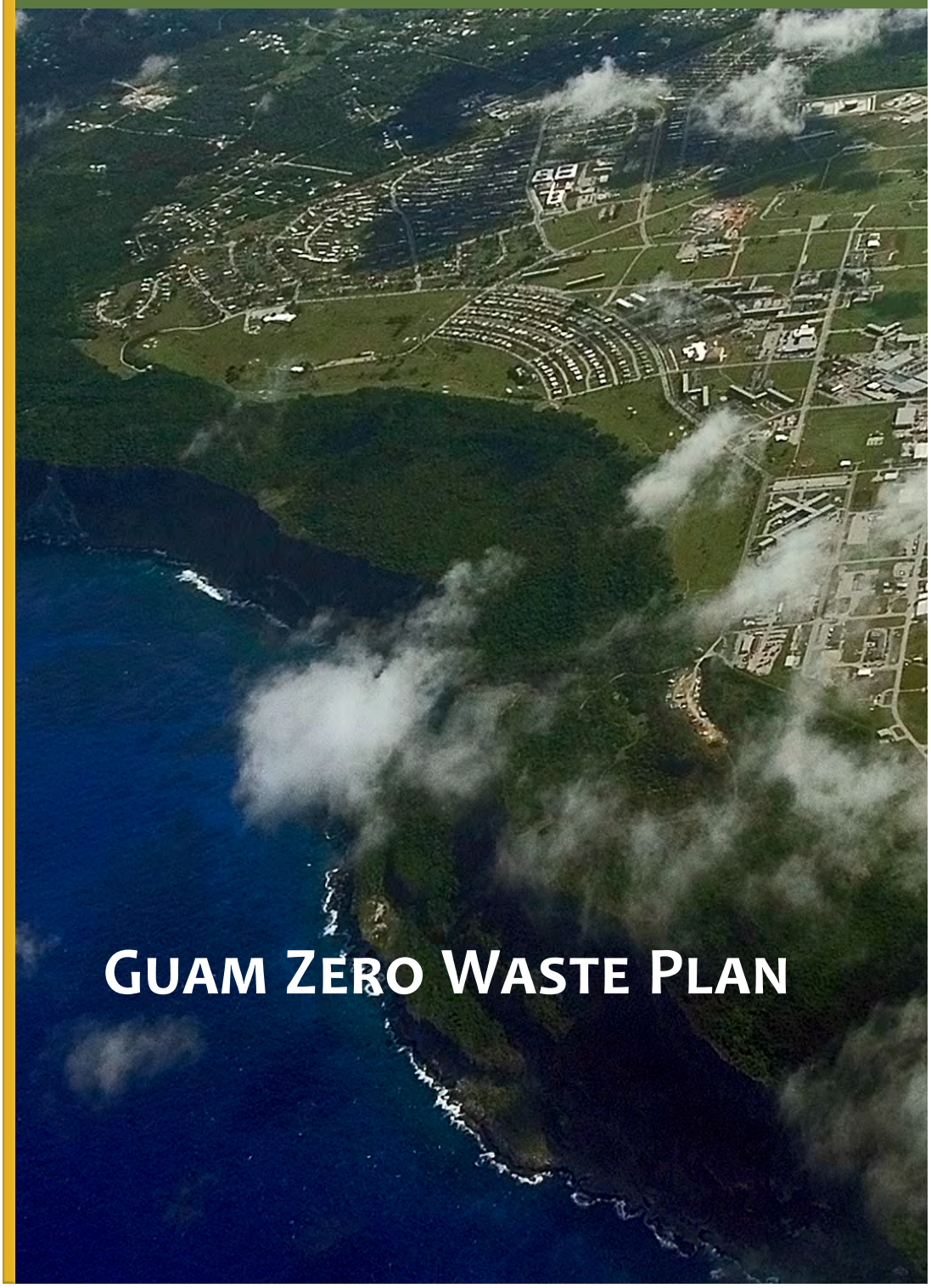
Simply put, continuous improvement is an ongoing effort to improve. Continuous improvement efforts include incremental improvement over time and breakthrough improvement all at once. It will be essential for GovGuam to continuously improve the Zero Waste Program, share the information that is collected with stakeholders and the public, publicize successes, and keep enthusiasm for Zero Waste efforts high.

Next Steps

Section 5 of this Plan identifies key steps recommended to create a successful Zero Waste Program on Guam, there are also a number of important ancillary activities that GovGuam and its stakeholders should consider undertaking to improve the efficiency and success of Guam's Zero Waste Program. These include:

- Make an early commitment to the Guam Zero Waste Plan, beginning with the establishment of Zero Waste goals, adopting this Plan and collaborating with Zero Waste stakeholders from the public, private and non-profit sectors.
- Obtain appropriate legal counsel review of all policy and funding strategies suggested in this Plan.
- Complete a comprehensive, Guam-specific waste characterization study as soon as possible to obtain a defensible, robust set of baseline data. Among other benefits, this will allow GovGuam to ensure that the appropriate materials are being targeted for diversion, and will allow for a more accurate determination of where the most significant payoff for investment (i.e., "bang for the buck") is likely to occur.
- Consider additional policies and programs to support organics diversion (e.g., curbside collection, regulatory clarifications for processing, and ban disposal in all facilities).
- Consider additional policies to incentivize diversion of hardfill materials – address any unenforced permitting regulations, increased hardfill disposal fees.
- Pursue partnership opportunities with all sectors to share equipment, property, staffing, including the military (especially for C&D diversion).
- Conduct feasibility studies for processing facilities to more definitively identify costs.
- Develop local markets, especially for compost and recycled C&D materials.
- A separate study to determine how GovGuam could go about requiring that public buildings on Guam meet the U.S. Building Council's Leadership in Energy and Environmental Design (LEED) requirements or a similar program.
- Begin working with the Micronesian Chief Executives (MCEs) to export Guam's Zero Waste success and support other regional Zero Waste goals and initiatives.

8. References



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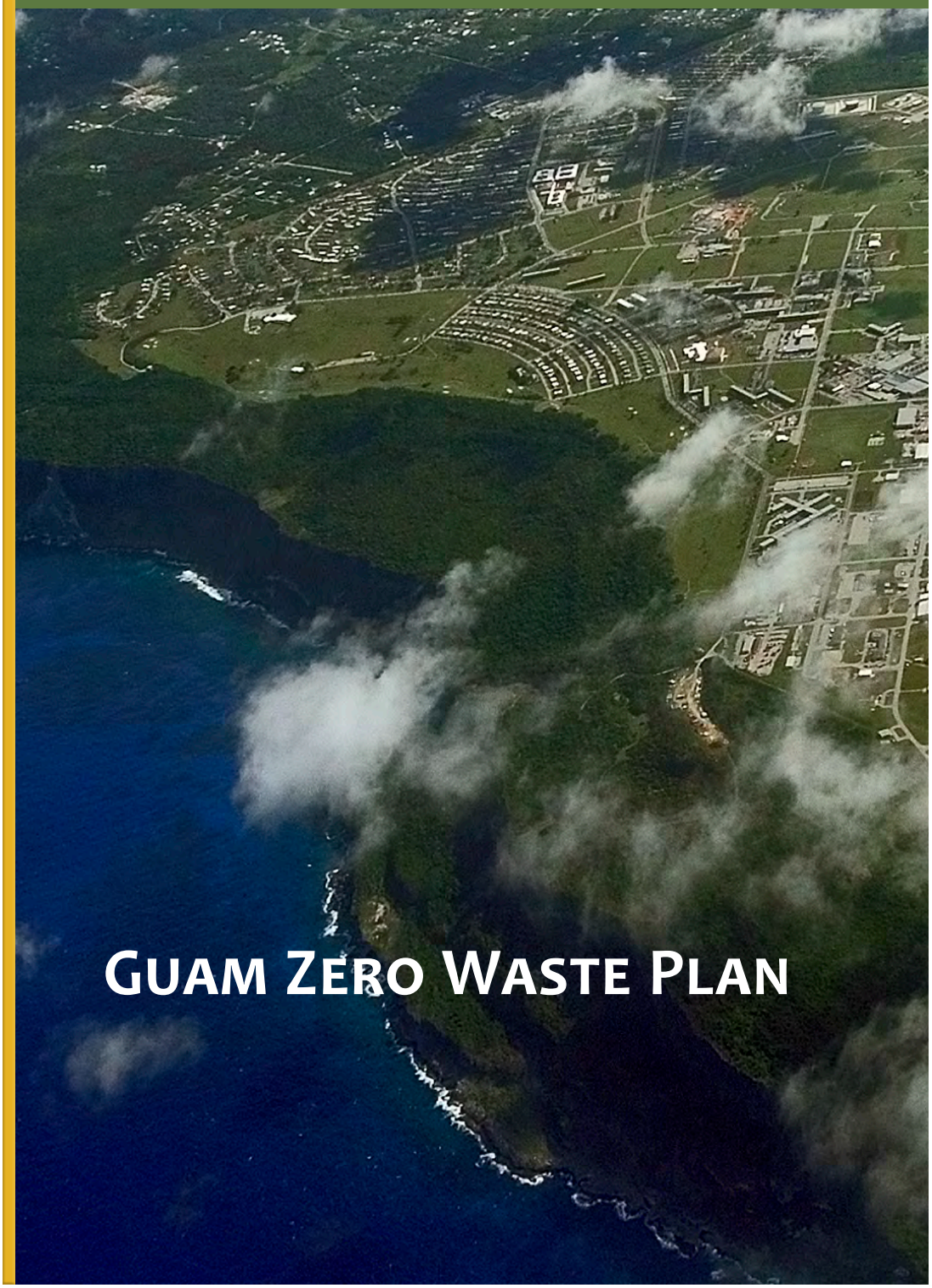
Acronyms



Guam Zero Waste Plan

GOVERNOR'S SEAL
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ACRONYMS

C

C&D	construction and demolition

D

DOD	United States Department of Defense

E

EPP	Green/Environmentally Preferable Purchasing
EPR	Extended Producer Responsibility
e-wastes	Electronic wastes

F

FTE	full-time equivalent

G

GCA	Guam Code Annotated
GDPW	Guam Department of Public Works
GDOA	Guam Department of Administration
GEPA	Guam Environmental Protection Agency
GovGuam	Government of Guam
GRT	Gross Receipts Tax
GSWA	Guam Solid Waste Authority

H

HDPE	High density polyethylene

L

LEED	Leadership through Energy and Environmental Design

M

MCOG	Mayors' Council of Guam
MSW	municipal solid waste
MCEs	Micronesian Chief Executives

N

NAVFAC	Naval Facilities Engineering Command
NGOs	Non-governmental organizations

O

OEA	Office of Economic Adjustment

P

PAYT	pay-as-you-throw
PET	polyethylene terephthalate plastic
Plan	Zero Waste Plan
ppcd	pounds per capita per day

R

RAG	Recycling Association for Guam
RCRA	Resource Conservation and Recovery Act

S

SF	square foot

U

U.S.	United States
UOG	University of Guam

Z

ZWAG	Zero Waste Association of Guam

Matrix
DESIGN GROUP

ONEGUAM

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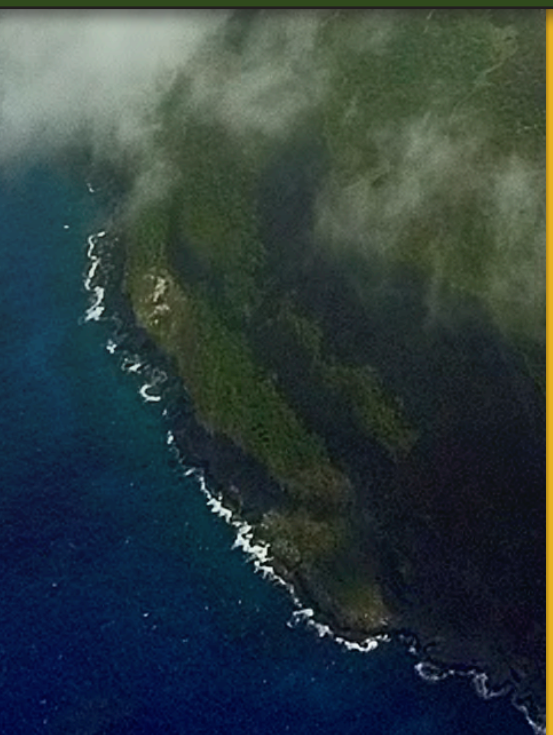
Volume II:

Guam Zero Waste Plan

Technical Memoranda and White Papers



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REACHING FOR ZERO:

VOLUME II

TECHNICAL MEMORANDA AND WHITE PAPERS

June 2013

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

*This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on **100% Recycled Post-Consumer** Waste – Process Chlorine Free.*

VOLUME II

TECHNICAL MEMORANDA AND WHITE PAPERS

INDEX

Technical Memoranda:

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2 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections
3 Data Collection and Measurement Recommendations
4 Markets for Recovered Material
5 Basis for Job Creation Potential Estimates
6 Financial Model
7 Legislation Recommendations and Process
8 Data and Document Index

White Papers:

A Green/Environmentally Preferable Purchasing Program
B Extended Producer Responsibility
C Pay-As-You-Throw Trash Pricing Policy
D Plastic Bag Disposal Ban
E Used Building Materials Facility
F Reduce, Reuse, Recycle (“3R”) Requirements for Building Demolition, Renovation, and Operation
G Greening Roadway Pavement Systems
H Illegal Dumping and Litter Control
I Compost Facility
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N Education and Outreach
O Creating a Sustainable Funding Strategy for a Zero Waste Future on Guam

Please see the next page.

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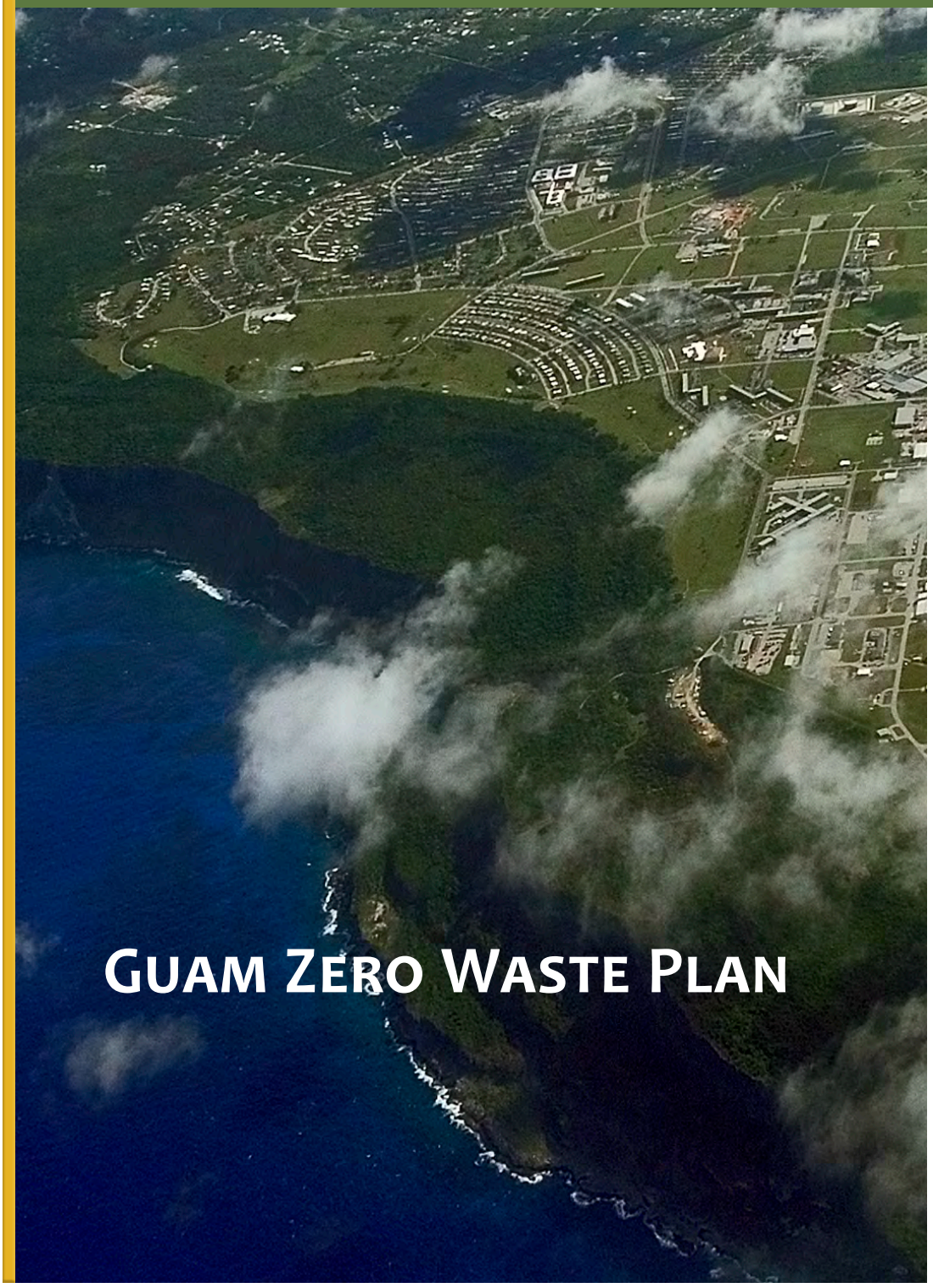
Technical Memoranda

Technical Memoranda



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

Please see the next page.

TECHNICAL MEMORANDUM 1

ZERO WASTE VISIONING STAKEHOLDER MEETING CONCULSIONS

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Memorandum

To: Mark Calvo, Guam Military Buildup Office
Carol Perez, Guam Military Buildup Office

From: Celeste Werner, Matrix Design Group, Inc.
Julie Carver, Matrix Design Group, Inc.

Date: March 22, 2012

Subject: **Task Order GR0706-08-03-10-01, Deliverable 2.1:**
Zero Waste Visioning Stakeholder Meeting Conclusions Memo

On February 7, 2012 representatives of the Office of the Governor of Guam and key public and private-sector solid waste stakeholders met from 10:00 a.m. to 4:00 p.m. at the Ricardo J. Bordallo Governor's Complex in Adelup for a Zero Waste Visioning Session. The purpose of the Visioning Session was to seek stakeholder input on solid waste diversion opportunities and zero waste alternatives with respect to the development of an overall Zero Waste Plan for Guam.

An invitation (see Attachment A) developed by the Guam Military Buildup Office (Buildup Office) and Matrix Design Group, Inc. (Matrix) was issued inviting participation in the Visioning Session. Over 90% of the participants invited attended the session (see Attachment B).

Mark Calvo, the Director of Military Buildup began the meeting by welcoming attendees, explaining the purpose of the Visioning Session and identifying the Government of Guam's (GovGuam's) strategic vision and long-term goals for the Zero Waste Plan, which are identified in Attachment C. The strategic vision, long-term goals and objectives for the Zero Waste Plan were developed by the Buildup Office, Guam Environmental Protection Agency (Guam EPA), U.S. Environmental Protection Agency, Region 9 (USEPA 9) and Matrix prior to the Visioning Session.

The Visioning Session then continued with a Zero Waste video presentation (available at www.one.guam.gov under the "Zero Waste" Visioning tab) and a PowerPoint presentation (Attachment D) by Matrix. Interactive "brainstorming" sessions were held during the presentations with meeting participants to discuss what new or expanded policies, programs and/or infrastructure projects could

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be implemented on Guam to reduce the volume of solid waste being disposed of and create a sustainable Zero Waste Vision on Guam through:

- Upstream Source Reduction Options
- Midstream Reuse Options
- Downstream Recycling and Organics Diversion Options

A complete list of the Upstream, Midstream and Downstream Options that were identified during the Visioning, including the "Top 5" options identified in each category as selected by the meeting participants is provided as Attachment E to this memo.

The options identified by stakeholders during the Visioning will be one of several factors considered by Matrix in identifying an initial universal list of zero waste alternatives, screening criteria and criteria importance to prioritize the relative importance of zero waste alternatives considered for implementation, and the subsequent selection by GovGuam of a short-list of alternatives for detailed analysis under Phase 3 of the project work.

Attachments

A. Invitation to the Zero Waste Visioning Session
B. Zero Waste Visioning Session Sign-in Sheet
C. GovGuam's Strategic Vision for the Zero Waste Plan
D. Zero Waste Visioning Session PowerPoint Presentation
E. Upstream, Midstream and Downstream Options Identified on February 7, 2012

Attachment A. Invitation to the Zero Waste Visioning Session

Please see the next page.

EDDIE BAZA CALVO
Governor

RAY TENORIO
Lieutenant Governor

Office of the Governor of Guam

January 20, 2012

Re: ***Zero Waste Visioning Session***

Hafa Adai Everyone:

Solid waste management on the Island of Guam is in transition, with many challenges to contend with. On behalf of the Government of Guam, the Office of the Governor requests your participation in a ***Zero Waste Visioning Session on Tuesday, February 7th, 2012 from 10 a.m. to 4 p.m. at the Large Conference Room Ricardo J. Bordallo Governor's Complex in Adelup.***

What is Zero Waste?

Zero Waste is a way of looking at the waste stream that goes beyond waste disposal. Instead of seeing used materials as garbage in need of land disposal, discarded items are viewed as valuable resources. Under a Zero Waste plan, "trash" represents jobs, financial opportunities, and raw material for new products. Zero Waste strategies consider the entire life-cycle of products, processes and systems. Zero Waste represents a fundamentally different approach to waste management, provides sustainable alternatives to landfilling and incineration, and broadens responsibility for the solutions.

Why Zero Waste?

Implementing a Zero Waste Plan is good for the environment and the economy, and will help to preserve resources and a healthy environment for future generations. According to the report "Wasting and Recycling in the United States 2000" on a per-ton basis, sorting and processing recyclables sustains ten times more jobs than landfilling or incineration.

What is the Purpose of the Zero Waste Visioning Session?

The Office of the Governor is committed to environmental sustainability, including improving overall solid waste management policies and practices for the benefit of the people of Guam. To assist us with this effort, we have contracted with Matrix Design Group (Matrix) to complete a comprehensive Zero Waste Plan, which includes an alternatives analysis and detailed recommendations for implementing this important plan. Developing a successful Zero Waste Plan with a clear set of long-term goals requires defining the Government of Guam's vision for future solid waste management activities in terms of fundamental objectives and strategic direction. The purpose of the Visioning Session will be to work with key solid waste management stakeholders on Guam to build a consensus regarding goals and regional objectives, and to identify which zero waste alternatives are most relevant to Guam. In the near future, Matrix representatives will be contacting key stakeholders as part of this project.

We value your opinion and hope that you'll be able to join us on February 7th. Please RSVP to julie_carver@matrixdesigngroup.com and carol.perez@guam.gov by January 27, 2012 to confirm your participation in the Visioning Session.

Sincerely,

Mark G. Calvo
Special Assistant to the Governor
Guam Buildup Office

Please see the next page.

Attachment B. Zero Waste Visioning Session Sign-in Sheet

Please see the next page.

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Matrix DESIGN GROUP

Meeting: Zero Waste Visioning *Please Sign In* **Date:** 2/7/2012

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9					
10					

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Matrix DESIGN GROUP

Meeting: Zero Waste Visioning **Please Sign In** **Date:** 2/7/2012

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Meeting: Zero Waste Visioning **Please Sign In** **Date:** 2/7/2012

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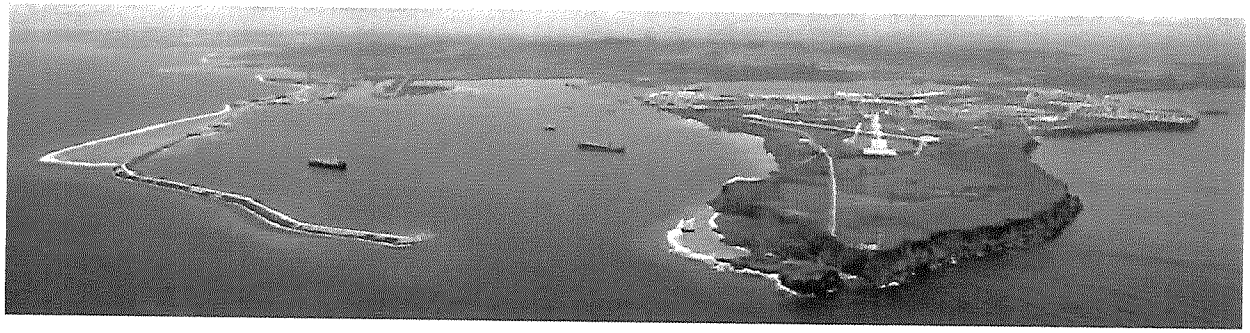

Matrix DESIGN GROUP

Meeting: Zero Waste Visioning **Please Sign In** **Date:** 2/7/2012

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Matrix DESIGN GROUP

Meeting: Zero Waste Visioning *Please Sign In* **Date:** 2/7/2012

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7					
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Please see the next page.

Attachment C. GovGuam's Strategic Vision for the Zero Waste Plan

Please see the next page.

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GUAM ENVIRONMENTAL PROTECTION AGENCY · 1973 ·

Zero Waste Visioning Session
Guiding Principles

1 We believe that **resource management** (reuse, recycling and organics diversion) should both replace Guam's focus on waste management and ***become an inherent part of the island's zero waste culture.***

2 We believe that **we are stewards of the environment and waterways** both now and in the future, and that moving toward zero waste is critical to ***preserving that environment for our children.***

3 We believe that effective and **sustainable expansion of resource recovery practices** are needed to ***protect public health and restore the natural beauty of our island,*** and that zero waste practices will bring sustainability to our island.

4 We believe that our ability to manage waste as a resource will require **respectful collaboration** ***with partners of many kinds*** – public and private, lay and technical, for-profit and non-profit, individuals and groups – including the existing waste management sector.

5 We believe **community education and participation is indispensable** for the success of any zero waste plan and that ***it is our responsibility to communicate the importance of resource conservation and the reduction of local pollution*** to the public, and to encourage them to share with us the stewardship role.

Matrix DESIGN GROUP

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GUAM ENVIRONMENTAL PROTECTION AGENCY · 1973 ·

Zero Waste Visioning Session

"House Rules"

1. This is a VISIONING session…**the sky is the limit**… *please think BIG picture.*
2. Stay within the framework of the **Zero Waste Guiding Principles.**
3. Turn the ringer on your **cell phones & pagers off.**
4. **Be courteous and show respect** to all participants in this meeting.
5. **Do not interrupt** when others are speaking **or engage in private conversations.**
6. Remember: **There is no such thing as a bad idea...** there are simply ideas that need further development.
7. **If you have an idea, tell us!** Don't hold back because of physical or budget constraints. We'll never get to the goal line if we can't envision the goal!!
8. **Stick to the topic at hand**…when you have the floor, do not ramble or go off-subject.
9. **Be respectful of time limits** on comments and avoid speeches and grandstanding.
10. **Disagreements should be regarded as problems to be solved** rather than battles to be won.

REMEMBER: VISIONING is part of a bigger process. The ideas that we discuss here today will influence but not dictate the plan that ultimately is developed.

Matrix DESIGN GROUP

Attachment D. Zero Waste Visioning Session
PowerPoint Presentation

Please see the next page.

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Guam
Zero Waste Visioning

Turning Challenges into Opportunities

Matrix DESIGN GROUP

Meeting Agenda

- Welcome and Introductions
- Meeting Purpose
- Zero Waste Presentation
- The Visioning Process
- Group Breakout Session #1
- Group Breakout Session #2
- Group Breakout Session #3
- Prioritizing Guam's Zero Waste Opportunities
- Open Forum
- Next Steps & Wrap Up

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Welcome and Introductions

Matrix DESIGN GROUP

What is the Purpose of this Meeting?

- The Government of Guam has contracted with Matrix Design Group to develop a Zero Waste Plan
- What is Zero Waste? Zero waste:
  - Focuses on waste diversion options that reduce the need for disposal (i.e., reduction, reuse, recycling and/or organics diversion)
  - Minimizes the need for disposal (i.e., landfilling and/or incineration)
- We are seeking stakeholder input on alternatives for consideration in the Plan

Guam's Zero Waste Guiding Principle #1

We believe that resource management (reuse, recycling & organics diversion) should both replace Guam's focus on waste management & become an inherent part of the island's zero waste culture

Guam's Zero Waste Guiding Principle #2

We believe that we are stewards of the environment and waterways both now and in the future, and that moving toward zero waste is critical to preserving that environment for our children

Guam's Zero Waste Guiding Principle #3

We believe that effective and sustainable expansion of resource recovery practices are needed to protect public health and restore the natural beauty of our island, and that zero waste practices will bring sustainability to our island

Guam's Zero Waste Guiding Principle #4

We believe that our ability to manage waste as a resource will require respectful collaboration with partners of many kinds – public and private, lay and technical, for-profit and non-profit, individuals and groups – including the existing waste management sector

Guam's Zero Waste Guiding Principle #5

We believe community education & participation is indispensible for the success of any zero waste plan & that it is our responsibility to communicate the importance of resource conservation & the reduction of local pollution to the public, & to encourage them to share with us the stewardship role

Zero Waste Video Presentation

The Visioning Process

- The sky is the limit…please think BIG picture.
- Anything goes – as long as the con is consistent with the Guiding Principles.
- Turn your cell phones & pagers off.
- Be courteous and show respect to all.
- Do not interrupt others or engage in private conversations.
- There is no such thing as a bad idea.
- If you have an idea, tell us! Don't think about physical or budget constraints right now.

Visioning Session House Rules

- Stick to the topic at hand.
- Be respectful of time limits on comments.
- Disagreements should be regarded as problems to be solved rather than battles to be won.
- VISIONING is part of a bigger process. The ideas that we come up with here today will influence but not dictate the plan that ultimately is developed.

Three Group Breakout Sessions

What new or expanded policies, programs or infrastructure could Guam implement to create its zero waste vision through - ?

- "Upstream" Source Reduction Options (Session #1)
- "Midstream" Reuse Options (Session #2)
- "Downstream" Recycling & Organics Diversion Options (Session #3)

Each Breakout Group Needs to…

- Select a reporter
- Work quickly to develop as many options for Guam as possible
  - You'll only have 15 minutes in first sessions
  - You do not need to prioritize your options
- Report group results at the end of the session
- Use maps to describe results as needed

Remember . . .

- Anything goes!

  (as long as it is consistent with the Guiding Principles)

- Money is no object!

  (don't limit your brainstorming because of potential cost)

- You can make everybody happy!

  (don't limit your brainstorming based on public acceptance or political will)

- Who cares if it works?!

  (we do – but not today – feasibility is a worry for the solid waste planners later on)

Group Breakout Session #1

"Upstream" or
Waste Reduction Options

How Do We Generate Less Waste in the First Place?

- We can choose to reduce the amount of waste we generate
  - Buy “less”
  - Buy selectively - re-useable, recyclable & compostable products
  - Share the wealth with manufacturers
  - Creative incentives for others to reduce
- We can also reduce by importing less “stuff” – *everything that comes on to the island must eventually be managed*

Environmentally Preferable Purchasing (EPP)

- EPP = policy for purchasing goods & services that reduce human health & environmental impacts compared to other options
- Procurement specifications for waste reduction, recycled content, re-usability, recyclability &/or compostability
- Uses the buying power of government & businesses to create the demand for “green” products & services

Do you know what our governments spend on goods & services each year?
Federal - $300B
State/local combined - more than $1T

Extended Producer Responsibility (EPR)

- EPR = policy of "encourag(ing) manufacturers to design environmentally-friendly products by holding (them) responsible for the costs of managing their products at end of life"
- E-waste, thermometers, batteries, carpet, etc.
- Reduces burden on local governments
- Corrects market signals by changing product $$

EPR example = European Green Dot program
(23 countries – 130K companies – 460B items)

British Columbia EPR – beverage containers, printed paper, packaging, antifreeze, used oil, filters, e-waste, batteries, light bulbs, paint, pharmaceuticals, tires

Variable Rate Pricing (PAYT)

- PAYT = policy for charging households for how much waste they generate as an incentive to get them to recycle more & "trash" less
- Utility-type pricing & creates equity amongst generators
- Gives pricing control to residents
- Relatively easy to implement
- Single most effective recycling incentive – over 7k US communities using PAYT currently

Midland Park, NJ – reduced household costs from $464 to $243/year for trash collection & disposal

Fort Worth, TX – reduced disposal costs by $7M by implementing PAYT

Brainstorming Session #1

Group Breakout Session #2

"Midstream" or Reuse Options

One Man's Waste is Another Man's Treasure

- How can we (or others) re-utilize our "stuff" before it really becomes waste?
- Reuse, repair & repurposing – how can we do more?
  - Thrift stores
  - Used building material programs/facilities
  - Food donation programs
  - Innovative "libraries" for sharing resources
- Who are our partners?
  - Individuals & businesses
  - Non-profit organizations
  - Hospitality industry
  - Food service industry
  - Military

Reuse & Repair Examples

Reuseables Depot & Thrift Store (Arcata, CA)

Boulder, CO Resource Yard "Tool Library"

Trash…or Treasure?

Habitat for Humanity ReStore

Food Donated by Food Services & Hospitality Industries

ATLANTA COMMUNITY FOOD BANK

Our mission is to fight hunger by Engaging Educating and Empowering our community.

More Reuse & Repair Examples!

Donated Personal Hygiene Products from Hotel Industry to 3rd World Counties

Clean the World®

Donations from Hotel Industry & Business to Needed Families (Bridging - MN)

Brainstorming Session #2

Group Breakout Session #3

"Downstream" or Recycling and Organics Diversion Options

Now We've Got Waste – What Are We Going to Do With It?

- If it can't go to the landfill, where will it go? (infrastructure)
- How will it get there? (program)
- How will our people know? (program)
- How will we encourage them to recycle? (policy)

EO 13514 requires federal agencies to divert at least 50% of non-hazardous solid waste & 50% C&D by FY2015

Infrastructure

- Traditional materials recovery facilities (MRFs)
  - Sort, clean & bale to reduce transportation costs & to improve quality & increase market revenues

Honolulu earned $1.5M in recyclables revenues in FY2011

- Organics recovery facilities
  - For yard waste, wood, food waste, food-contaminated paper
  - Mulching/chipping, composting, anaerobic digestion
- C&D transfer/processing facilities
- Other facilities
  - Household hazardous waste (HHW)
  - Hard-to-Recycle (HTR) - Styrofoam, plastic wrap, textiles, books, shoes, etc.
  - Reuse – furniture, fixtures, used building materials, etc.

Infrastructure (con't)

Boulder, CO MRF, Public Drop-Site & HHW Facility

San Jose, CA Anaerobic Digestion/In-Vessel Composting Facility (2012)

Infrastructure (con't)

South Gate, CA C&D Facility (Interior Removal Specialists)

Maui, HI Co-Composting Facility (yard waste, WWTP biosolids & FOG)

Nantucket, MA

- Island 30 miles on east cost US
- 10K population
- Major tourist destination
- Landfill contaminated & running out of space (tip fees $177-$372/ton)
- MRF for traditional, HTR & C&D materials
- In-vessel composting for organics & biosolids
- Private contractor operates all facilities
- Nearly 90% diversion
- Plans for future landfill mining

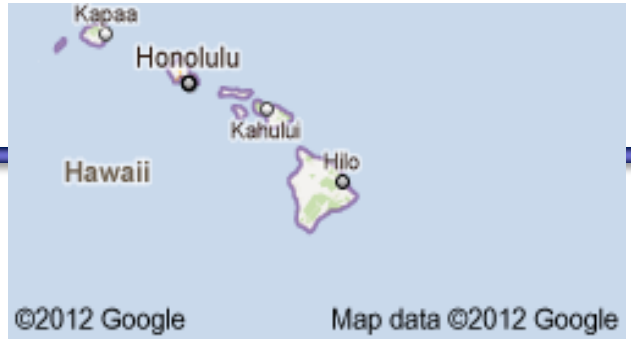
Programs

- Collection
  - Curbside collection - recyclables & organics
  - Reduce frequency of curbside trash collection
  - More drop site collections – recyclables, organics
  - More bulky & metallic collections

Every other week trash collection - Toronto, ON; Portland, OR; Renton, WA; Christchurch, NZ
Every monthly/on-call trash collection - Boulder, CO; Arcata, CA

- Special Waste – for materials without regular collection (e-waste, tires, HHW, etc.)
- Education, education, education

Honolulu, HI



- Island-wide automated 3-cart residential collection system – recyclables, yard waste & trash
- Trash collected weekly
- Single-stream recyclables - every other week
- Yard waste – every other week
- Participation rate - 70%
- Recycling rate - 52%
- Future plans – add food waste to curbside collection & reach 75% diversion

Nova Scotia, Canada

- 950k population
- Native nation – Mi'kmag
- Relies heavily on tourism
- Curbside recyclables collection to all households
- Curbside yard/food waste collection to 94% households
- 75% C&D diversion mandate (Halifax)
- 2015 goal – generate only 1.8 lbs/person-day

(US generated 4.4 lbs/person-day MSW in 2010)

Champaign, IL

- University town
- “Municipalized” recycling
- Contract operations
- City bought carts
- Implemented user fees
- Developed “Feed the Thing” brand

City of CHAMPAIGN

FEED THE THING

Policies

- Incentives – household & green biz awards

The RecycleBank program pays households in retail coupons based on amount they recycle

- Mandates

Seattle, WA mandates recycling/organics collection for residents/businesses

North Carolina requires restaurants/bars that sell alcoholic beverages to recycle all containers

San Diego requires 50% C&D diversion on large projects

- Material Bans

American Samoa, Maui, Kauai & Hawaii have banned plastic shopping bags

WI disposal bans glass/metal/plastic containers, OCC, ONP, OP, e-waste, YW, automotive, appliances

- Funding Sources – user fees, advanced disposal fees, landfill tip fee surcharges, litter/single use taxes

Hawaii notes that "free" trash & recycling leads to lower recycling rates (no incentive to recycle)

Christchurch, NZ

- Population 350K
- EPP & EPR (incl packaging)
- PAYT
- Recycling ordinance for new MFU & commercial
- Yard waste disposal ban
- Every other week trash collection
- 2020 goal – landfill only 1.9 lbs/person-day incl C&D

(US landfilled 2.9 lbs/person-day MSW only in 2010)

Brainstorming Session #3

Prioritizing Guam's Zero Waste Opportunities

Open Forum

- Is Guam ready to shift their focus toward a zero waste culture?
- We've discussed a lot of ideas today during the Zero Waste Visioning Process.
- Did we miss anything?
- If so, this is your chance to tell us about it!

Wrap Up and Closing

- Thank you for joining us today.
- Please remember that VISIONING is part of a bigger process.
- The ideas that we come up with here today will influence but not dictate the Zero Waste Plan that ultimately is developed.
- If you have questions or would like to talk more, please contact:
  - Mark.calvo@guam.gov
  - julie_carver@matrixdesigngroup.com

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Please see the next page.

Attachment E. Upstream, Midstream and Downstream Options Identified on February 7, 2012

Please see the next page.

Session 1: Upstream

Visioning Recommendation	Votes
Require that the Government lead by example/be a role model	11
Require GovGuam to use EPP & EPR programs and tax incentives for private-sector use of EPP & EPR	8
Expand "Pay as You Throw" requirement	8
Increase farming/Encourage food production on island/Implement a "Go Local, Buy Local" program	8
Provide tax incentives for buying recycled equipment	8
Establish mandates for schools to use EPP programs & implement recycling programs	7
LEED deconstruction and reuse	5
Biosolids composting and incentivize use of local compost	5
Reduce use and/or ban import of Styrofoam/plastic bags	4
Establish EPP requiring use of minimum recycled material content	4
Go digital: require GovGuam to go paperless/increase use of e-readers	2
Use/mandate use of biodegradable items (e.g., dishes, etc.)	2
Double-sided printing	2
Establish enterprise fund for zero waste	2
Establish Alternative Energy Policy & Clean Fuel requirements/encourage car pools, bike to work, etc. programs	1
Establish public-private Zero Waste Advisory Coalition to govern zero waste	1
Incentivize use of recycled material in new construction (minimum requirement)	1
Implement a concept similar to the 30/20/20 campaign (reduce water use by 30% and electricity use 20% by 2020)	
Packaging reduction policy	
Mandate use of LEED sustainable design and construction techniques by GovGuam	
Provide legislation mandating use of less packaging materials/control use of excess packaging	
Impose import tax on produce with excessive packaging	
Provide incentives for using less packaging materials/recycled or biodegradable packaging materials	
Control excess packaging from uncontainerized ships	
Increase industry requirements for upstream	
Require that the Government eliminate use of plastic water bottles	
Establish EPR requirements for new vehicles and used newspaper	
Create legislation mandating 1/2% fee for end of life for every item arriving via airport or port	
Develop incentives to assist with social change in implementing zero waste	
Allowance for government specs for reuse materials	
Higher use tax on non-recyclable products	
Better education on what is happening with recycling on the island	
Enforce/incentivize zero waste behavior and recycling	
Import fees for imported fertilizer	
Enforce existing solid waste master plan update requirements and have substantive, quantitative, realistic goals	
Government leadership and enforcement	

Session 1: Upstream

Visioning Recommendation	Votes
Provide media education program & press releases for zero waste	
Youth programs/involvement to encourage change	

EPP: Environmentally Preferable Purchasing
EPR: Expanded Producer Responsibility
LEED: Leadership in Engineering and Environmental Design

Session 2: Midstream

Visioning Recommendation	Votes
Require that the Government lead by example/be a role model	11
Strip/shred waste tires & reuse in playground equipment, exercise tracks & courts, asphalt, artificial reefs	9
LEED deconstruction and reuse	5
Provide tax incentives for companies that reuse discarded materials	5
Establish repair training programs for appliances and computers	4
Pallet reuse: Make furniture and composting bins	4
Establish a book/DVD/VHS reuse library	3
Public-private partnerships: stage recycled materials on public properties during national disasters/ Styrofoam reuse	3
Support/encourage use of thrift store, reuse stores, flea markets & swap meets	3
Encourage hospitality industry reuse of furniture/liquidation sales	2
Implement Green Stamp-like reuse/recycling incentive program with raffles & free giveaways	2
Establish enterprise fund for zero waste	2
Establish public-private Zero Waste Advisory Coalition	1
Food waste to hog farmers	1
Thrift store establishment + tax free/insurance free use of free-cycle (internet based exchange program)	1
Subsidize waste exchange and reuse programs	1
Drop off points for items in need of repair	
School uniform reuse program	
Hold village rummage sales (monthly/semi-annually?)	
Food bank donations from hospitality industry and festivals	
Hold recycled art event/Recycle Festivals where only recycled items are used/Annual Recycling Festival	
Reuse fluorescent bulbs	
Funding for students to create ideas on how to reuse waste	
Reuse metal drums (e.g. BBQs)	
Reuse #3 - #7 plastics/plastic chipping for reuse in furniture production	
Establish "Restore" type establishment for construction items	
Reuse/recycle carpet	
Partner with/establish regional recycling & reuse programs throughout CMNI/Palau	
Job training for repair technologies	
Mandate use of LEED sustainable design and construction techniques by GovGuam	
Recycle/reuse empty cargo containers	
Develop incentives to assist with social change in implementing zero waste	
Better education on what is happening with recycling on the island	
Develop a list for reuse of items	
Enforce/incentivize zero waste behavior and recycling	
Enforce existing solid waste master plan update requirements and have substantive, quantitative, realistic goals	
Promote use of rechargeable batteries	
Government leadership and enforcement	

Session 2: Midstream

Visioning Recommendation	Votes
Paint donations to schools, DPW, etc	
Create one-stop recycling/reuse campus on Guam	
Provide media education program and press releases for zero waste	
Youth programs/involvement to encourage change	
Building deconstruction and fee for C&D diversion	

C&D: Construction and demolition debris
CMNI: Commonwealth of Northern Mariana Islands
DPW: Department of Public Works
LEED: Leadership in Engineering and Environmental Design

Session 3: Downstream

Visioning Recommendations	Votes
Require that the Government lead by example/be a role model	11
Establish regional compost facilities/streamlined permit requirements/general permit concept for local composting facilities	8
More enforcement of consequences for illegal dumping	7
Anaerobic digestion of sewage biosolids	7
Biosolids composting and incentivize use of local compost	5
Mandate multi-bin recycling of residential and commercial	5
LEED deconstruction and reuse	5
Create policies and incentives for advanced disposal waste (ex e-waste)	5
Food waste diversion	4
Work with Matson and enhance partnerships to assist in shipping recyclables off island	4
K-12 education on zero waste	4
MRF Program or MRF to handle all recyclables on island?	4
Change legislation so that existing Bottle Bill can be implemented by the private sector	3
Establish mandatory 100% curbside recycling for residential & commercial	3
Establish publicized "List of Shame" for litter/diversion transgressions	3
Enforce existing policies & programs/create an "environmental police" enforcement group	3
Advanced disposal fees for HTR materials	2
Expand education programs	2
Establish enterprise fund for zero waste	2
Establish composting facility for green waste, FOG, cardboard (consider public-private partnership)	2
Implement Green Stamp-like reuse/recycling incentive program with raffles & free giveaways	2
Provide grants to/for Green organizations for litter cleanup enforcement	2
Biodiesel production from used oil or grease	2
Crush glass: Use as landfill daily cover and sub base in pavement	2
Establish a HHW collection & reuse store/overall waste exchange program	2
Provide infrastructure Improvements: Road access for garbage trucks	1
Provide incentives for composting/mulching	1
Crush concrete use in aggregate	1
Develop markets for construction & demolition debris	1
Every other week trash pickup	1
WTE: Keep option open	1
Receive lower lease rates on government land used for composting	1
Collect used oils for diversion	1
Add recyclables at transfer stations	1
Tie Collection of garbage fee to utility bill	1

Session 3: Downstream

Visioning Recommendations	Votes
EPP: Biosolid Exchange EPP for products from co-composted biosolids	1
Establish public-private Zero Waste Advisory Coalition	1
Backyard and on-farm composting	1
Strict enforcement and screening of solid waste	
Better education on what is happening with recycling on the island	
Single stream recycling equipment	
Recycle antifreeze, car batteries, e-waste (refurbish), toner cartridges	
Shred plasticized wastes and reuse for lawn siding, tracks	
Recycle rebar out of concrete	
EPA baler back in action	
Advanced composting of materials/waste	
Enforce/incentivize zero waste behavior and recycling	
Enforce existing solid waste master plan update requirements and have substantive, quantitative, realistic goals	
Develop recycling education programs for villages/annual fairs, social events	
Deputize green army/empower residents for cleanup and enforcement for cleanup and enforcement	
Recycle-based budgeting	
Develop accurate road and address system for residential collection	
Enforcement and incentive for recycling program at households and businesses	
Centralized recyclable drop sites around island	
Trash court with list of shame in newspaper and on TV	
Government leadership and enforcement	
Buy mobile aggregate crusher/mulcher that can be used island-wide	
Anaerobic digestion of biosolids from WWTP	
Create one-stop recycling/reuse campus on Guam	
Establish public private zero waste advisory coalition to govern zero waste	
Complete feasibility studies on HTR and universal waste	
Utilize Dept of Corrections labor for recycling programs	
Provide media education program & press releases for zero waste	
Establish advance disposal fees	
Youth programs/involvement to encourage change	
Convert old landfill into reusable land	
Building deconstruction and fee for C&D diversion	
Establish legislation imposing tax on new tires and white goods	
Partner with/establish regional recycling & reuse programs throughout CMNI/Palau	
Mandate use of LEED sustainable design and construction techniques by GovGuam	

Session 3: Downstream

Visioning Recommendations	Votes
Public education materials offered in different languages	
Start/expand manufacturing on island to increase demand for diverted materials	
Recycle/reuse empty cargo containers	
Rebate program for recycled items	
Compost cardboard on-island instead of shipping off for recycling	
Battery collection and diversion	
Offer FOG collection & reuse	

C&D: Construction and Demolition Debris
EPA: Environmental Protection Agency
EPP: Environmentally Preferable Purchasing
FOG: Fats, Oils, and Grease
HHW: Household Hazardous Waste
HTR: High Temperature Reactor
LEED: Leadership in Engineering and Environmental Design
MRF: Materials Recovery Facilities
WTE: Waste to Energy
WWTP: Waste Water Treatment Plant

Please see the next page.

TECHNICAL MEMORANDUM 2

2010 BASELINE MEASUREMENT DATA AND 20-YEAR WASTE QUANTITY PROJECTIONS

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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Memorandum

Via Email

To: Mark Calvo, Government of Guam
Carol Perez, Government of Guam

From: Celeste Werner, Julie Carver & Laurie Batchelder Adams

Date: August 24, 2012

Subject: Task Order GR0706-08-03-10-01, Deliverable 1.1:
2010 Baseline Measurement Data and 20-Year Waste Quantity Projections

---

The purpose of this technical memorandum is to provide the Government of Guam (GovGuam) with the information required under Task Order GR0706-08-03-10-01, Deliverable 1.1, which includes:

Waste Generation Estimates

- Quantity estimates for municipal solid waste (MSW) and non-MSW generated during the baseline year 2010; and
- Quantity projections for MSW and non-MSW generated during milestone planning years 2012, 2015, 2020, 2025 and 2030.

Waste Diversion Estimates

- Diversion potential for MSW and non-MSW during milestone planning years 2012, 2015, 2020, 2025 and 2030.

METHODOLOGY

For the purposes of the Guam Zero Waste Plan, population-based solid waste disposal generation and diversion estimates were used. The population, solid waste generation rate and solid waste diversion projection estimates and assumptions used to develop these estimates are summarized below and explained in further detail in Appendixes A, B and C, respectively, provided at the end of this technical memorandum.

Population Estimates

For the purposes of the Guam Zero Waste Plan, population estimates were calculated using the following equation:

Population A + Population B = Population C

Where:

(1) Population A = Guam's traditional/existing population, as of/based on the 2010 U.S. Census Data for Guam with a predicted "organic" growth rate of 0.29% annually. The 2010 population includes existing military (active-duty and civilians) living on and off-base on Guam as of 2010.

(2) Population B = An estimated Military Build-Up induced population increase based on best-available information at the time this technical memorandum was prepared. The military build-up population increase was calculated for the years 2014 through 2030, with the buildup induced population peaking in 2019 through 2021. After 2024, a stable growth rate of 0.29% annually was assumed. It must be noted that plans for the military buildup have not been finalized, and these projections are subject to change.

(3) Population C = Population estimates used in the Guam Zero Waste Plan.

The following table summarizes the population estimates used for the baseline and milestone years in the Guam Zero Waste Plan.

POPULATION ESTIMATE

Year	Population A	Population B	Population C
Baseline	159,358	0	**159,358**
2015	161,216	16,745	**177,961**
2020	163,570	42,785	**206,355**
2025	165,959	11,058	**177,017**
2030	168,383	11,219	**179,602**

Further details on the population estimates are provided in Appendix A.

Solid Waste Generation Estimates

Guam-specific waste measurement data was not available when this technical memorandum was developed. For the purposes of the Guam Zero Waste Plan, solid waste generation rates were assumed as follows:

(1) A low to high range of per capita/day (ppcd) rates for MSW generation projections developed using findings from the USEPA (4.43 ppcd) and Guam EPA (5.28 ppcd);

(2) A low to high range of ppcd rates for non-MSW generation projections using USEPA and NAVFAC measurements for C&D (2.80 and 7.4 ppcd, respectively);

(3) USEPA and NAVFAC waste composition information for both the common waste categories and for individual materials types; and

(4) A non-C&D/non-MSW fraction representing primarily wastewater treatment plant biosolids using a USEPA projection of 2%.

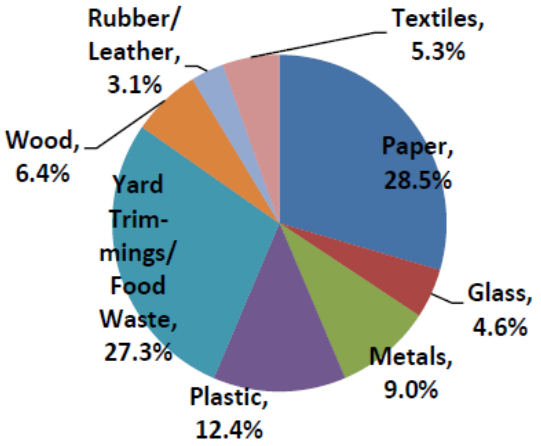
Based on the above assumptions and population estimates, the following table summarizes the projected range of solid waste generation estimates for MSW and non-MSW used for the baseline and milestone years in the Guam Zero Waste Plan.

PROJECTED SOLID WASTE GENERATION (tons/year)

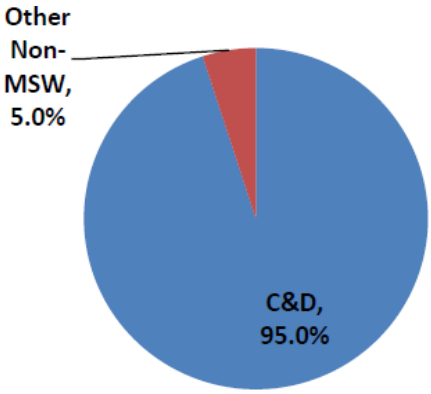
Year	MSW		NON-MSW		TOTAL SOLID WASTE	
	Low	High	Low	High	Low	High
2010	129,000	154,000	81,000	86,000	210,000	240,000
2012	129,000	154,000	82,000	86,000	211,000	240,000
2015	144,000	171,000	91,000	97,000	235,000	268,000
2020	169,000	200,000	105,000	112,000	274,000	312,000
2025	144,000	171,000	91,000	96,000	235,000	267,000
2030	146,000	172,000	92,000	97,000	238,000	269,000

The figures below illustrate the assumed, relative composition of MSW and non-MSW streams.

ASSUMED MSW COMPOSITION
(% by weight)



ASSUMED NON-MSW COMPOSITION
(% by weight)



Further details on the population estimates are provided in Appendix B.

Solid Waste Diversion Potential Estimates

Finally, a range of solid waste diversion potentials were assessed for each material type in both the MSW and non-MSW streams estimated above during the milestone years. These results (detailed in Appendix C) will support the Zero Waste Plan alternatives analysis, which

will evaluate infrastructure, programs and policies that target one or more materials and affect waste diversion in different ways. The diversion potential applied to all materials in preparation for subsequent analyses was 5%, 10%, 25%, 50%, 75% and 100%.

OBSERVATIONS AND LIMITATIONS

As the quantity calculations are based on total projected population, all tonnage estimates increase through 2020, then taper off. This reflects fluctuations in the size of both active duty and civilian military during the zero waste planning period, which is expected to peak between 2020 and 2021.

As noted above, these quantity estimates and projections are based on actual measurements made both on Guam and on the mainland U.S., and are somewhat limited by lack of industry data for non-MSW waste. These limitations may impact the deliverable results in the following ways:

- May not fully represent Guam quantities or composition - for example, Guam is expected to have more vegetative, shipping, tourism and military waste than other parts of the U.S.
- May not capture road/bridge or landscaping debris as USEPA values for C&D are generally limited to building-related waste
- May not capture non-MSW accurately (especially biosolids and industrial waste) - as neither island nor literature data address these streams effectively
- Plans for the military buildup on Guam have not been finalized. As a result, the quantities of construction and demolition materials generated both directly by the military and by induced growth could be greater than projected. Waste quantity estimates should be reviewed and adjusted if necessary as the plans for the military buildup are finalized.
- Although the Department of Defense recently updated their Integrated Solid Waste Management Plan for Guam, that information was not available for review or use during the development of the Guam Zero Waste Plan. The Governor's Office should request a copy of this document as soon as it is available and consider adjusting the quantities herein based on that plan, as appropriate.

While these results should be updated in the future with Guam-specific data, they are a reasonable starting point for analyzing the diversion potential in the island's total solid waste stream and will provide a useful foundation for future zero waste analyses.

DEVIATIONS FROM TASK ORDER STATEMENT OF WORK

Matrix's Statement of Work was based on the assumption that relatively complete MSW, C&D, biosolids and industrial actual measured quantity data would be provided for this analysis. In the absence of that data, GovGuam directed Matrix to use published generation and composition data (Email from Mark Calvo, GovGuam to Celeste Werner, Matrix dated May 18, 2012). Reasonable data is available for MSW and construction/demolition (C&D) debris - biosolids and industrial waste generation has not been well-studied by the waste industry. The analysis included herein was primarily completed using available literature and case study values for MSW and C&D materials. Additionally, the Statement of Work included

2011 instead of 2012 in the milestone year projections analysis. As this analysis was completed during the second half of 2012, we have projected quantities for the current year.

Guam Total Population Estimate Years 2011 Through 2030

Year	Population A	Population B	Population C
2011	159,358	0	**159,358**
2012	159,821	0	**159,821**
2013	160,285	0	**160,285**
2014	160,750	15,257	**176,007**
2015	161,216	16,745	**177,961**
2016	161,684	16,745	**178,429**
2017	162,154	16,759	**178,913**
2018	162,625	42,643	**205,268**
2019	163,097	42,785	**205,882**
2020	163,570	42,785	**206,355**
2021	164,045	42,785	**206,830**
2022	164,521	13,178	**177,700**
2023	164,999	13,178	**178,178**
2024	165,478	11,026	**176,504**
2025	165,959	11,058	**177,017**
2026	166,441	11,090	**177,531**
2027	166,924	11,122	**178,047**
2028	167,409	11,155	**178,564**
2029	167,895	11,187	**179,082**
2030	168,383	11,219	**179,602**

Population A	Based on 2010 U.S. Census Data for Guam with predicted "organic" growth rate of 0.29% annually. Includes existing military (active duty + civilians) on and off-base currently on Guam per April 15, 2012 email from Carol Perez (GovGuam) to Celeste Werner (Matrix).
Population B	Buildup Induced Population Increase (see next tab for back-up) years 2014 thru 2024 with stabilized growth rate of 0.29% annually using 2024 population base for years 2025 thru 2030.
Population C	**Population A + Population B = total Population used to project solid waste generation rates in Appendix A.**

Military Buildup Population Estimate Years 2011 Through 2024

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Comments
Active Duty Marine Corps	0	0	250	750	750	750	5000	5000	5000	5000	5000	5000	5000	See Note 1
Marine Corps Dependants	0	0	70	210	210	210	1400	1400	1400	1400	1400	1400	1400	See Note 2
Active Duty Navy	0	0	0	0	0	0	0	0	0	0	0	0	0	See Note 3
Navy Dependants	0	0	0	0	0	0	0	0	0	0	0	0		See Note 3
Active Duty Army	0	0	50	50	50	50	630	630	630	630	630	630	0	See Note 3
Army Dependants	0	0	0	0	0	0	951	951	951	951	951	951	0	See Note 3
Civilian Military Workers	0	0	39	116	116	124	875	875	875	875	875	875	875	See Note 4
Civilian Military Worker Dependants	0	0	38	113	113	113	750	825	825	825	825	825	825	See Note 5
Off-Island Construction Workers	0	0	6000	6000	6000	6000	10000	10000	10000	10000	0	0	0	See Note 6
Dependants of Off Island Construction Workers	0	0	1680	1680	1680	1680	2800	2800	2800	2800	0	0	0	See Note 7
Subtotal Direct	0	0	8126	8919	8919	8926	22406	22481	22481	22481	9681	9681	8100	
Off-Island Workers	0	0	3657	4013	4013	4017	10083	10117	10117	10117	1743	1743	1458	See Note 8
Dependants of Off Island Workers	0	0	3474	3813	3813	3816	10153	10187	10187	10187	1755	1755	1468	See Note 9
Subtotal Indirect	0	0	7131	7826	7826	7833	20236	20304	20304	20304	3497	3497	2926	
Total Population Increase Induced as a Result of DOD Buildup	0	0	15257	16745	16745	16759	42643	42785	42785	42785	13178	13178	11026	

5000

Note 1: 5000 Marines expected to be permanently stationed on Guam as cited in April 27, 2012 email from Mark Calvo(GovGuam) forwarded to Celeste Werner (Matrix) titled "MB NEWS RELEASE". Per Mark Calvo email of April 16, 2012 to Celeste Werner, Marine buildup estimated to start in 2014 with 5% of Marine population arriving on Guam, gradually builds up in 2015-2017 with 15% of Marine population, peaks at 100% of Marine population in 2018 and stabilizes at 5000 through 2024. Buildup timing provided in email from Mark Calvo to Celeste Werner on

Note 2: Ratio relationship of Dependents: Marines = 0.28:1.0 established based on April 16, 2012 email from Mark Calvo (GovGuam).

Note 3: Same numerical values as those cited in the FEIS (unconstrained scenario) used. Start date changed from FEIS date of 2010 to revised start date of 2014 and duration revised to reflect a longer (i.e., 10 year) buildup duration.

Note 4: Ratio relationship of Civilian Military Workers: Marines = 0.155:1.0 for Years 2014 thru 2017 and 0.165:1.0 for years 2018 thru 2024 used (functionally similar to original FEIS ratio relationship)

Note 5: Ratio relationship of Civilian Military Worker Dependents: Marines = 0.15:1.0 for Years 2014 thru 2017 and 0.165:1.0 for years 2018 thru 2024 used (functionally similar to original FEIS ratio relationship)

Note 6: employment as a result of the proposed action (same as FEIS footnote).

Note 7: Ratio relationship of Dependents of Off-Island Construction Workers: Off-Island Construction Workers = 0.95:1.0 used (functionally equivalent to FEIS ratio relationship).

Military Buildup Population Estimate Years 2011 Through 2024

Note 8: Ratio relationship of Off-Island Workers : Subtotal Direct = 0.45:1.0 for Years 2014 thru 2021 then 0.18: 1.0 for Years 2022-2024 used (functionally equivalent to FEIS ratio relationship).

Note 9: Ratio relationship of Dependents of Off-Island Workers: Off-Island Workers = 0.95:1.0 used (functionally equivalent to FEIS ratio relationship).

APPENDIX B - SOLID WASTE GENERATION PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

COMPOSITION % BY WEIGHT		2,010		2012		2015		2020		2025		2030	
POPULATION[a]		159,358		159,821		177,961		206,355		177,017		179,602	
MUNICIPAL SOLID WASTE MSW Generation Range[b]		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***28.5%***	***37,000***	***44,000***	***37,000***	***44,000***	***41,000***	***49,000***	***48,000***	***57,000***	***41,000***	***49,000***	***41,000***	***49,000***
Cardboard/Kraft Paper	11.6%	*15,000*	*18,000*	15,000	18,000	17,000	20,000	19,000	23,000	17,000	20,000	17,000	20,000
Office/High Grade/Shreds	2.1%	*3,000*	*3,000*	3,000	3,000	3,000	4,000	4,000	4,000	3,000	4,000	3,000	4,000
Newsprint	4.0%	*5,000*	*6,000*	5,000	6,000	6,000	7,000	7,000	8,000	6,000	7,000	6,000	7,000
Magazines	0.6%	*1,000*	*1,000*	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	10.2%	*13,000*	*16,000*	13,000	16,000	15,000	17,000	17,000	20,000	15,000	17,000	15,000	18,000
Glass	***4.6%***	***6,000***	***7,000***	***6,000***	***7,000***	***7,000***	***8,000***	***8,000***	***9,000***	***7,000***	***8,000***	***7,000***	***8,000***
Clear Glass Containers	3.7%	*5,000*	*6,000*	5,000	6,000	5,000	6,000	6,000	7,000	5,000	6,000	5,000	6,000
Other Glass	0.9%	*1,000*	*1,000*	1,000	1,000	1,000	2,000	2,000	2,000	1,000	2,000	1,000	2,000
Metals	***9.0%***	***12,000***	***14,000***	***12,000***	***14,000***	***13,000***	***15,000***	***15,000***	***18,000***	***13,000***	***15,000***	***13,000***	***16,000***
Ferrous	6.8%	*9,000*	*10,000*	9,000	10,000	10,000	12,000	11,000	14,000	10,000	12,000	10,000	12,000
Aluminum	1.4%	*2,000*	*2,000*	2,000	2,000	2,000	2,000	2,000	3,000	2,000	2,000	2,000	2,000
Other Non-Ferrous	0.8%	*1,000*	*1,000*	1,000	1,000	1,000	1,000	1,000	2,000	1,000	1,000	1,000	1,000
Plastic	***12.4%***	***16,000***	***19,000***	***16,000***	***19,000***	***18,000***	***21,000***	***21,000***	***25,000***	***18,000***	***21,000***	***18,000***	***21,000***
PET #1 Bottles	1.1%	*1,000*	*2,000*	1,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
HDPE #2 Bottles	0.3%	*0*	*0*	0	0	0	1,000	1,000	1,000	0	1,000	0	1,000
Plastic Film/Wrap/Bags	1.6%	*2,000*	*2,000*	2,000	2,000	2,000	3,000	3,000	3,000	2,000	3,000	2,000	3,000
Other Plastics	9.4%	*12,000*	*14,000*	12,000	14,000	14,000	16,000	16,000	19,000	13,000	16,000	14,000	16,000
Yard Trimmings/Food Waste	***27.3%***	***35,000***	***42,000***	***35,000***	***42,000***	***39,000***	***47,000***	***46,000***	***54,000***	***39,000***	***47,000***	***40,000***	***47,000***
Food	13.9%	*18,000*	*21,000*	18,000	21,000	20,000	24,000	23,000	28,000	20,000	24,000	20,000	24,000
Yard Waste	13.4%	*17,000*	*21,000*	17,000	21,000	19,000	23,000	22,000	27,000	19,000	23,000	19,000	23,000
Wood	***6.4%***	***8,000***	***10,000***	***8,000***	***10,000***	***9,000***	***11,000***	***11,000***	***13,000***	***9,000***	***11,000***	***9,000***	***11,000***
Rubber & Leather	***3.1%***	***4,000***	***5,000***	***4,000***	***5,000***	***4,000***	***5,000***	***5,000***	***6,000***	***4,000***	***5,000***	***5,000***	***5,000***
Tires	1.3%	*2,000*	*2,000*	2,000	2,000	2,000	2,000	2,000	3,000	2,000	2,000	2,000	2,000
Other Rubber & Leather	1.8%	*2,000*	*3,000*	2,000	3,000	3,000	3,000	3,000	4,000	3,000	3,000	3,000	3,000
Textiles	***5.3%***	***7,000***	***8,000***	***7,000***	***8,000***	***8,000***	***9,000***	***9,000***	***11,000***	***8,000***	***9,000***	***8,000***	***9,000***
Other MSW	***3.4%***	***4,000***	***5,000***	***4,000***	***5,000***	***5,000***	***6,000***	***6,000***	***7,000***	***5,000***	***6,000***	***5,000***	***6,000***
MSW Subtotal	***100.0%***	***129,000***	***154,000***	***129,000***	***154,000***	***144,000***	***171,000***	***169,000***	***200,000***	***144,000***	***171,000***	***146,000***	***172,000***

APPENDIX B - SOLID WASTE GENERATION PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

COMPOSITION % BY WEIGHT		2,010		2012		2015		2020		2025		2030	
POPULATION[a]		159,358		159,821		177,961		206,355		177,017		179,602	
NON-MUNICIPAL SOLID WASTE Non-MSW Generation Range		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
C&D [c,d]	***95.0%***	***77,000***	***82,000***	***78,000***	***82,000***	***86,000***	***92,000***	***100,000***	***106,000***	***86,000***	***91,000***	***87,000***	***92,000***
Aggregate	57.0%	*46,000*	*49,000*	47,000	49,000	52,000	55,000	60,000	64,000	52,000	55,000	52,000	55,000
Wood	23.8%	*19,000*	*21,000*	19,000	21,000	22,000	23,000	25,000	27,000	22,000	23,000	22,000	23,000
Misc C&D Waste	14.3%	*12,000*	*12,000*	12,000	12,000	13,000	14,000	15,000	16,000	13,000	14,000	13,000	14,000
Other Non-MSW [e]	***5.0%***	***4,000***	***4,000***	***4,000***	***4,000***	***5,000***	***5,000***	***5,000***	***6,000***	***5,000***	***5,000***	***5,000***	***5,000***
Non-MSW Subtotal	***100.0%***	***81,000***	***86,000***	***82,000***	***86,000***	***91,000***	***97,000***	***105,000***	***112,000***	***91,000***	***96,000***	***92,000***	***97,000***
TOTAL SOLID WASTE		***210,000***	***240,000***	***211,000***	***240,000***	***235,000***	***268,000***	***274,000***	***312,000***	***235,000***	***267,000***	***238,000***	***269,000***

a Population based on GovGuam analysis of civilian population (April 15, 2012 communication from Carol Perez) & expected growth of existing military personnel (active duty & civilians)

b Municipal solid waste (MSW) generation range based on USEPA estimation of 4.43 pounds per capita-day (ppcd) in *"Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010"* & Guam EPA estimation of 5.28 ppcd in *"Guam 2006 Integrated Solid Waste Management Plan"*

Low MSW generation **4.43** ppcd High MSW generation rate **5.28** ppcd

c Non-MSW generation range based USEPA's estimation of 2.8 ppcd for building-related C&D waste in *"Characterization of Building-Related Construction and Demolition Debris in the United States"* (by Franklin Associates, June 1998 - excludes road, bridge & land clearing debris) and on NAVFAC's adoption of 7.4 ppcd in "Final Report - Recycling and Solid Waste Diversion Study for DOD Bases, Guam" (by HDR/Hawaii Pacific Engineers, April 2010) for total solid waste (i.e., 7.4 ppcd minus USEPA's 4.4 ppcd for non-MSW). C& D was estimated by NAVFAC to be about 38% of the total waste stream (or 95% of the non-MSW stream), which supports the C&D ppcd rate noted below

Low non-MSW **2.80** ppcd High non-MSW generation **2.97** ppcd

d C&D composition based on USEPA's estimate in *"Materials Characterization Paper in Support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials That Are Solid Waste Construction and Demolition Materials - Building-Related C&D Materials" (by Franklin Associates, February, 2011 - excludes road, bridge & land clearing debris)*

e In addition to C&D, non-MSW is expected to include wastewater treatment plant biosolids and industrial waste. While biosolids data is not readily available for Guam, the USEPA presented findings in its "Biosolids Generation, Use, and Disposal in the United States" (September 1999) that projected a generation rate of about 0.14 ppcd - this equates to about 2% of the total waste stream (or 5% of the non-MSW stream). As Guam industry waste (primarily tourism and military) are likely accounted for largely in MSW and C&D waste, a non-MSW generation rate of approximately 2% was used

Apparent inconsistencies in sums may exist due to rounding errors

APPENDIX C - 2012 SOLID WASTE DIVERSION POTENTIAL PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

POPULATION	159,821		POTENTIAL DIVERSION LEVELS											
MUNICIPAL SOLID WASTE	Total		5%		10%		25%		50%		75%		100%	
MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***37,000***	***44,000***	***2,000***	***2,000***	***4,000***	***4,000***	***9,000***	***11,000***	***19,000***	***22,000***	***28,000***	***33,000***	***37,000***	***44,000***
Cardboard/Kraft Paper	15,000	18,000	1,000	1,000	2,000	2,000	4,000	5,000	8,000	9,000	11,000	14,000	15,000	18,000
Office/High Grade/Shreds	3,000	3,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000
Newsprint	5,000	6,000	0	0	1,000	1,000	1,000	2,000	3,000	3,000	4,000	5,000	5,000	6,000
Magazines	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	13,000	16,000	1,000	1,000	1,000	2,000	3,000	4,000	7,000	8,000	10,000	12,000	13,000	16,000
Glass	***6,000***	***7,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***	***7,000***
Clear Glass Containers	5,000	6,000	0	0	1,000	1,000	1,000	2,000	3,000	3,000	4,000	5,000	5,000	6,000
Other Glass	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Metals	***12,000***	***14,000***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***4,000***	***6,000***	***7,000***	***9,000***	***11,000***	***12,000***	***14,000***
Ferrous	9,000	10,000	0	1,000	1,000	1,000	2,000	3,000	5,000	5,000	7,000	8,000	9,000	10,000
Aluminum	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Non-Ferrous	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Plastic	***16,000***	***19,000***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***8,000***	***10,000***	***12,000***	***14,000***	***16,000***	***19,000***
PET #1 Bottles	1,000	2,000	0	0	0	0	0	1,000	1,000	1,000	1,000	2,000	1,000	2,000
HDPE #2 Bottles	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plastic Film/Wrap/Bags	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Plastics	12,000	14,000	1,000	1,000	1,000	1,000	3,000	4,000	6,000	7,000	9,000	11,000	12,000	14,000
Yard Trimmings/Food Waste	***35,000***	***42,000***	***2,000***	***2,000***	***4,000***	***4,000***	***9,000***	***11,000***	***18,000***	***21,000***	***26,000***	***32,000***	***35,000***	***42,000***
Food	18,000	21,000	1,000	1,000	2,000	2,000	5,000	5,000	9,000	11,000	14,000	16,000	18,000	21,000
Yard Waste	17,000	21,000	1,000	1,000	2,000	2,000	4,000	5,000	9,000	11,000	13,000	16,000	17,000	21,000
Wood	***8,000***	***10,000***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***4,000***	***5,000***	***6,000***	***8,000***	***8,000***	***10,000***
Rubber & Leather	***4,000***	***5,000***	***0***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***
Tires	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Rubber & Leather	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Textiles	***7,000***	***8,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***
Other MSW	***4,000***	***5,000***	***0***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***
MSW Subtotal	***129,000***	***154,000***	***6,000***	***7,000***	***14,000***	***16,000***	***33,000***	***40,000***	***66,000***	***79,000***	***97,000***	***117,000***	***129,000***	***154,000***

NON-MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
Non-MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
C&D	***78,000***	***82,000***	***4,000***	***4,000***	***8,000***	***8,000***	***20,000***	***21,000***	***39,000***	***41,000***	***59,000***	***62,000***	***78,000***	***82,000***
Aggregate	47,000	49,000	2,000	2,000	5,000	5,000	12,000	12,000	24,000	25,000	35,000	37,000	47,000	49,000
Wood	19,000	21,000	1,000	1,000	2,000	2,000	5,000	5,000	10,000	11,000	14,000	16,000	19,000	21,000
Misc C&D Waste	12,000	12,000	1,000	1,000	1,000	1,000	3,000	3,000	6,000	6,000	9,000	9,000	12,000	12,000
Other Non-MSW	***4,000***	***4,000***	***0***	***0***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***3,000***	***3,000***	***4,000***	***4,000***
Non-MSW Subtotal	***82,000***	***86,000***	***4,000***	***4,000***	***8,000***	***8,000***	***21,000***	***22,000***	***41,000***	***43,000***	***62,000***	***65,000***	***82,000***	***86,000***
TOTAL SOLID WASTE	***211,000***	***240,000***	***10,000***	***11,000***	***22,000***	***24,000***	***54,000***	***62,000***	***107,000***	***122,000***	***159,000***	***182,000***	***211,000***	***240,000***

Notes

Total quantities estimated in Total Generation Worksheet - see same for explanation of methodology

Inconsistencies in sums due to rounding errors

APPENDIX C - 2015 SOLID WASTE DIVERSION POTENTIAL PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

POPULATION	177,961		POTENTIAL DIVERSION LEVELS											
MUNICIPAL SOLID WASTE	Total		5%		10%		25%		50%		75%		100%	
MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***41,000***	***49,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***21,000***	***25,000***	***31,000***	***37,000***	***41,000***	***49,000***
Cardboard/Kraft Paper	17,000	20,000	1,000	1,000	2,000	2,000	4,000	5,000	9,000	10,000	13,000	15,000	17,000	20,000
Office/High Grade/Shreds	3,000	4,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	3,000	3,000	4,000
Newsprint	6,000	7,000	0	0	1,000	1,000	2,000	2,000	3,000	4,000	5,000	5,000	6,000	7,000
Magazines	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	15,000	17,000	1,000	1,000	2,000	2,000	4,000	4,000	8,000	9,000	11,000	13,000	15,000	17,000
Glass	***7,000***	***8,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***
Clear Glass Containers	5,000	6,000	0	0	1,000	1,000	1,000	2,000	3,000	3,000	4,000	5,000	5,000	6,000
Other Glass	1,000	2,000	0	0	0	0	0	1,000	1,000	1,000	1,000	2,000	1,000	2,000
Metals	***13,000***	***15,000***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***4,000***	***7,000***	***8,000***	***10,000***	***11,000***	***13,000***	***15,000***
Ferrous	10,000	12,000	1,000	1,000	1,000	1,000	3,000	3,000	5,000	6,000	8,000	9,000	10,000	12,000
Aluminum	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Non-Ferrous	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Plastic	***18,000***	***21,000***	***1,000***	***1,000***	***2,000***	***2,000***	***5,000***	***5,000***	***9,000***	***11,000***	***14,000***	***16,000***	***18,000***	***21,000***
PET #1 Bottles	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
HDPE #2 Bottles	0	1,000	0	0	0	0	0	0	0	1,000	0	1,000	0	1,000
Plastic Film/Wrap/Bags	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Other Plastics	14,000	16,000	1,000	1,000	1,000	2,000	4,000	4,000	7,000	8,000	11,000	12,000	14,000	16,000
Yard Trimmings/Food Waste	***39,000***	***47,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***20,000***	***24,000***	***29,000***	***35,000***	***39,000***	***47,000***
Food	20,000	24,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	15,000	18,000	20,000	24,000
Yard Waste	19,000	23,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	14,000	17,000	19,000	23,000
Wood	***9,000***	***11,000***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***	***11,000***
Rubber & Leather	***4,000***	***5,000***	***0***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***
Tires	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Rubber & Leather	3,000	3,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000
Textiles	***8,000***	***9,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***
Other MSW	***5,000***	***6,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***
MSW Subtotal	***144,000***	***171,000***	***6,000***	***7,000***	***15,000***	***19,000***	***36,000***	***43,000***	***75,000***	***89,000***	***109,000***	***129,000***	***144,000***	***171,000***

NON-MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
Non-MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
C&D	***86,000***	***92,000***	***4,000***	***5,000***	***9,000***	***9,000***	***22,000***	***23,000***	***43,000***	***46,000***	***65,000***	***69,000***	***86,000***	***92,000***
Aggregate	52,000	55,000	3,000	3,000	5,000	6,000	13,000	14,000	26,000	28,000	39,000	41,000	52,000	55,000
Wood	22,000	23,000	1,000	1,000	2,000	2,000	6,000	6,000	11,000	12,000	17,000	17,000	22,000	23,000
Misc C&D Waste	13,000	14,000	1,000	1,000	1,000	1,000	3,000	4,000	7,000	7,000	10,000	11,000	13,000	14,000
Other Non-MSW	***5,000***	***5,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***	***5,000***
Non-MSW Subtotal	***91,000***	***97,000***	***4,000***	***5,000***	***10,000***	***10,000***	***23,000***	***24,000***	***46,000***	***49,000***	***69,000***	***73,000***	***91,000***	***97,000***
TOTAL SOLID WASTE	***235,000***	***268,000***	***10,000***	***12,000***	***25,000***	***29,000***	***59,000***	***67,000***	***121,000***	***138,000***	***178,000***	***202,000***	***235,000***	***268,000***

Notes

Total quantities estimated in Total Generation Worksheet - see same for explanation of methodology

Inconsistencies in sums due to rounding errors

APPENDIX C - 2020 SOLID WASTE DIVERSION POTENTIAL PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

POPULATION	206,355		POTENTIAL DIVERSION LEVELS											
MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***48,000***	***57,000***	***2,000***	***3,000***	***5,000***	***6,000***	***12,000***	***14,000***	***24,000***	***29,000***	***36,000***	***43,000***	***48,000***	***57,000***
Cardboard/Kraft Paper	19,000	23,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	14,000	17,000	19,000	23,000
Office/High Grade/Shreds	4,000	4,000	0	0	0	0	1,000	1,000	2,000	2,000	3,000	3,000	4,000	4,000
Newsprint	7,000	8,000	0	0	1,000	1,000	2,000	2,000	4,000	4,000	5,000	6,000	7,000	8,000
Magazines	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	17,000	20,000	1,000	1,000	2,000	2,000	4,000	5,000	9,000	10,000	13,000	15,000	17,000	20,000
Glass	***8,000***	***9,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***
Clear Glass Containers	6,000	7,000	0	0	1,000	1,000	2,000	2,000	3,000	4,000	5,000	5,000	6,000	7,000
Other Glass	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Metals	***15,000***	***18,000***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***8,000***	***9,000***	***11,000***	***14,000***	***15,000***	***18,000***
Ferrous	11,000	14,000	1,000	1,000	1,000	1,000	3,000	4,000	6,000	7,000	8,000	11,000	11,000	14,000
Aluminum	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Other Non-Ferrous	1,000	2,000	0	0	0	0	0	1,000	1,000	1,000	1,000	2,000	1,000	2,000
Plastic	***21,000***	***25,000***	***1,000***	***1,000***	***2,000***	***3,000***	***5,000***	***6,000***	***11,000***	***13,000***	***16,000***	***19,000***	***21,000***	***25,000***
PET #1 Bottles	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
HDPE #2 Bottles	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Plastic Film/Wrap/Bags	3,000	3,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000
Other Plastics	16,000	19,000	1,000	1,000	2,000	2,000	4,000	5,000	8,000	10,000	12,000	14,000	16,000	19,000
Yard Trimmings/Food Waste	***46,000***	***54,000***	***2,000***	***3,000***	***5,000***	***5,000***	***12,000***	***14,000***	***23,000***	***27,000***	***35,000***	***41,000***	***46,000***	***54,000***
Food	23,000	28,000	1,000	1,000	2,000	3,000	6,000	7,000	12,000	14,000	17,000	21,000	23,000	28,000
Yard Waste	22,000	27,000	1,000	1,000	2,000	3,000	6,000	7,000	11,000	14,000	17,000	20,000	22,000	27,000
Wood	***11,000***	***13,000***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***3,000***	***6,000***	***7,000***	***8,000***	***10,000***	***11,000***	***13,000***
Rubber & Leather	***5,000***	***6,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***
Tires	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Other Rubber & Leather	3,000	4,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	3,000	3,000	4,000
Textiles	***9,000***	***11,000***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***	***11,000***
Other MSW	***6,000***	***7,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***	***7,000***
MSW Subtotal	***169,000***	***200,000***	***7,000***	***10,000***	***19,000***	***21,000***	***43,000***	***51,000***	***87,000***	***103,000***	***128,000***	***152,000***	***169,000***	***200,000***

NON-MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
Non-MSW Generation Range	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
C&D	***100,000***	***106,000***	***5,000***	***5,000***	***10,000***	***11,000***	***25,000***	***27,000***	***50,000***	***53,000***	***75,000***	***80,000***	***100,000***	***106,000***
Aggregate	60,000	64,000	3,000	3,000	6,000	6,000	15,000	16,000	30,000	32,000	45,000	48,000	60,000	64,000
Wood	25,000	27,000	1,000	1,000	3,000	3,000	6,000	7,000	13,000	14,000	19,000	20,000	25,000	27,000
Misc C&D Waste	15,000	16,000	1,000	1,000	2,000	2,000	4,000	4,000	8,000	8,000	11,000	12,000	15,000	16,000
Other Non-MSW	***5,000***	***6,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***
Non-MSW Subtotal	***105,000***	***112,000***	***5,000***	***5,000***	***11,000***	***12,000***	***26,000***	***29,000***	***53,000***	***56,000***	***79,000***	***85,000***	***105,000***	***112,000***
TOTAL SOLID WASTE	***274,000***	***312,000***	***12,000***	***15,000***	***30,000***	***33,000***	***69,000***	***80,000***	***140,000***	***159,000***	***207,000***	***237,000***	***274,000***	***312,000***

Notes

Total quantities estimated in Total Generation Worksheet - see same for explanation of methodology

Inconsistencies in sums due to rounding errors

APPENDIX C - 2025 SOLID WASTE DIVERSION POTENTIAL PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

POPULATION	177,017		POTENTIAL DIVERSION LEVELS											
MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***41,000***	***49,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***21,000***	***25,000***	***31,000***	***37,000***	***41,000***	***49,000***
Cardboard/Kraft Paper	17,000	20,000	1,000	1,000	2,000	2,000	4,000	5,000	9,000	10,000	13,000	15,000	17,000	20,000
Office/High Grade/Shreds	3,000	4,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	3,000	3,000	4,000
Newsprint	6,000	7,000	0	0	1,000	1,000	2,000	2,000	3,000	4,000	5,000	5,000	6,000	7,000
Magazines	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	15,000	17,000	1,000	1,000	2,000	2,000	4,000	4,000	8,000	9,000	11,000	13,000	15,000	17,000
Glass	***7,000***	***8,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***
Clear Glass Containers	5,000	6,000	0	0	1,000	1,000	1,000	2,000	3,000	3,000	4,000	5,000	5,000	6,000
Other Glass	1,000	2,000	0	0	0	0	0	1,000	1,000	1,000	1,000	2,000	1,000	2,000
Metals	***13,000***	***15,000***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***4,000***	***7,000***	***8,000***	***10,000***	***11,000***	***13,000***	***15,000***
Ferrous	10,000	12,000	1,000	1,000	1,000	1,000	3,000	3,000	5,000	6,000	8,000	9,000	10,000	12,000
Aluminum	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Non-Ferrous	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Plastic	***18,000***	***21,000***	***1,000***	***1,000***	***2,000***	***2,000***	***5,000***	***5,000***	***9,000***	***11,000***	***14,000***	***16,000***	***18,000***	***21,000***
PET #1 Bottles	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
HDPE #2 Bottles	0	1,000	0	0	0	0	0	0	0	1,000	0	1,000	0	1,000
Plastic Film/Wrap/Bags	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Other Plastics	13,000	16,000	1,000	1,000	1,000	2,000	3,000	4,000	7,000	8,000	10,000	12,000	13,000	16,000
Yard Trimmings/Food Waste	***39,000***	***47,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***20,000***	***24,000***	***29,000***	***35,000***	***39,000***	***47,000***
Food	20,000	24,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	15,000	18,000	20,000	24,000
Yard Waste	19,000	23,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	14,000	17,000	19,000	23,000
Wood	***9,000***	***11,000***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***	***11,000***
Rubber & Leather	***4,000***	***5,000***	***0***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***
Tires	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Rubber & Leather	3,000	3,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000
Textiles	***8,000***	***9,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***
Other MSW	***5,000***	***6,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***
MSW Subtotal	***144,000***	***171,000***	***6,000***	***7,000***	***15,000***	***19,000***	***36,000***	***43,000***	***75,000***	***89,000***	***109,000***	***129,000***	***144,000***	***171,000***

NON-MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
Non-MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
C&D	***86,000***	***91,000***	***4,000***	***5,000***	***9,000***	***9,000***	***22,000***	***23,000***	***43,000***	***46,000***	***65,000***	***68,000***	***86,000***	***91,000***
Aggregate	52,000	55,000	3,000	3,000	5,000	6,000	13,000	14,000	26,000	28,000	39,000	41,000	52,000	55,000
Wood	22,000	23,000	1,000	1,000	2,000	2,000	6,000	6,000	11,000	12,000	17,000	17,000	22,000	23,000
Misc C&D Waste	13,000	14,000	1,000	1,000	1,000	1,000	3,000	4,000	7,000	7,000	10,000	11,000	13,000	14,000
Other Non-MSW	***5,000***	***5,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***	***5,000***
Non-MSW Subtotal	***91,000***	***96,000***	***4,000***	***5,000***	***10,000***	***10,000***	***23,000***	***24,000***	***46,000***	***49,000***	***69,000***	***72,000***	***91,000***	***96,000***
TOTAL SOLID WASTE	***235,000***	***267,000***	***10,000***	***12,000***	***25,000***	***29,000***	***59,000***	***67,000***	***121,000***	***138,000***	***178,000***	***201,000***	***235,000***	***267,000***

Notes

Total quantities estimated in Total Generation Worksheet - see same for explanation of methodology

Inconsistencies in sums due to rounding errors

APPENDIX C - 2030 SOLID WASTE DIVERSION POTENTIAL PROJECTIONS (tons/year, rounded to nearest 1,000 tons)

POPULATION	179,602		POTENTIAL DIVERSION LEVELS											
MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Paper	***41,000***	***49,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***21,000***	***25,000***	***31,000***	***37,000***	***41,000***	***49,000***
Cardboard/Kraft Paper	17,000	20,000	1,000	1,000	2,000	2,000	4,000	5,000	9,000	10,000	13,000	15,000	17,000	20,000
Office/High Grade/Shreds	3,000	4,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	3,000	3,000	4,000
Newsprint	6,000	7,000	0	0	1,000	1,000	2,000	2,000	3,000	4,000	5,000	5,000	6,000	7,000
Magazines	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Other Paper	15,000	18,000	1,000	1,000	2,000	2,000	4,000	5,000	8,000	9,000	11,000	14,000	15,000	18,000
Glass	***7,000***	***8,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***
Clear Glass Containers	5,000	6,000	0	0	1,000	1,000	1,000	2,000	3,000	3,000	4,000	5,000	5,000	6,000
Other Glass	1,000	2,000	0	0	0	0	0	1,000	1,000	1,000	1,000	2,000	1,000	2,000
Metals	***13,000***	***16,000***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***4,000***	***7,000***	***8,000***	***10,000***	***12,000***	***13,000***	***16,000***
Ferrous	10,000	12,000	1,000	1,000	1,000	1,000	3,000	3,000	5,000	6,000	8,000	9,000	10,000	12,000
Aluminum	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Non-Ferrous	1,000	1,000	0	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000
Plastic	***18,000***	***21,000***	***1,000***	***1,000***	***2,000***	***2,000***	***5,000***	***5,000***	***9,000***	***11,000***	***14,000***	***16,000***	***18,000***	***21,000***
PET #1 Bottles	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
HDPE #2 Bottles	0	1,000	0	0	0	0	0	0	0	1,000	0	1,000	0	1,000
Plastic Film/Wrap/Bags	2,000	3,000	0	0	0	0	1,000	1,000	1,000	2,000	2,000	2,000	2,000	3,000
Other Plastics	14,000	16,000	1,000	1,000	1,000	2,000	4,000	4,000	7,000	8,000	11,000	12,000	14,000	16,000
Yard Trimmings/Food Waste	***40,000***	***47,000***	***2,000***	***2,000***	***4,000***	***5,000***	***10,000***	***12,000***	***20,000***	***24,000***	***30,000***	***35,000***	***40,000***	***47,000***
Food	20,000	24,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	15,000	18,000	20,000	24,000
Yard Waste	19,000	23,000	1,000	1,000	2,000	2,000	5,000	6,000	10,000	12,000	14,000	17,000	19,000	23,000
Wood	***9,000***	***11,000***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***	***11,000***
Rubber & Leather	***5,000***	***5,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***	***5,000***
Tires	2,000	2,000	0	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000
Other Rubber & Leather	3,000	3,000	0	0	0	0	1,000	1,000	2,000	2,000	2,000	2,000	3,000	3,000
Textiles	***8,000***	***9,000***	***0***	***0***	***1,000***	***1,000***	***2,000***	***2,000***	***4,000***	***5,000***	***6,000***	***7,000***	***8,000***	***9,000***
Other MSW	***5,000***	***6,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***2,000***	***3,000***	***3,000***	***4,000***	***5,000***	***5,000***	***6,000***
MSW Subtotal	***146,000***	***172,000***	***6,000***	***7,000***	***16,000***	***19,000***	***36,000***	***43,000***	***76,000***	***89,000***	***111,000***	***130,000***	***146,000***	***172,000***

NON-MUNICIPAL SOLID WASTE			5%		10%		25%		50%		75%		100%	
Non-MSW Generation Range	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
C&D	***87,000***	***92,000***	***4,000***	***5,000***	***9,000***	***9,000***	***22,000***	***23,000***	***44,000***	***46,000***	***65,000***	***69,000***	***87,000***	***92,000***
Aggregate	52,000	55,000	3,000	3,000	5,000	6,000	13,000	14,000	26,000	28,000	39,000	41,000	52,000	55,000
Wood	22,000	23,000	1,000	1,000	2,000	2,000	6,000	6,000	11,000	12,000	17,000	17,000	22,000	23,000
Misc C&D Waste	13,000	14,000	1,000	1,000	1,000	1,000	3,000	4,000	7,000	7,000	10,000	11,000	13,000	14,000
Other Non-MSW	***5,000***	***5,000***	***0***	***0***	***1,000***	***1,000***	***1,000***	***1,000***	***3,000***	***3,000***	***4,000***	***4,000***	***5,000***	***5,000***
Non-MSW Subtotal	***92,000***	***97,000***	***4,000***	***5,000***	***10,000***	***10,000***	***23,000***	***24,000***	***47,000***	***49,000***	***69,000***	***73,000***	***92,000***	***97,000***
TOTAL SOLID WASTE	***238,000***	***269,000***	***10,000***	***12,000***	***26,000***	***29,000***	***59,000***	***67,000***	***123,000***	***138,000***	***180,000***	***203,000***	***238,000***	***269,000***

Notes

Total quantities estimated in Total Generation Worksheet - see same for explanation of methodology

Inconsistencies in sums due to rounding errors

TECHNICAL MEMORANDUM 3

DATA COLLECTION AND MEASUREMENT RECOMMENDATIONS

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

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Memorandum

To: Mark Calvo, Guam Military Buildup Office
Carol Perez, Guam Military Buildup Office

From: Celeste Werner, Matrix Design Group, Inc.
Julie Carver, Matrix Design Group

Date: April 2013

Subject: Guam Zero Waste Plan: Data Collection and Measurement Recommendations

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The purpose of this memo is to partially fulfill the requirements of Task Order GR0706-08-03-10-01, Deliverable 4.1, by providing the Government of Guam (GovGuam) with an overview of why the collection of is so important and how the data used to shape the Zero Waste Plan was collected.

WHY COLLECT DATA AND MEASURE SOLID WASTE SYSTEMS?

A common adage in the waste industry is "you can't manage what you can't measure" (a twist on a quote by management guru, Peter Drucker). Sound data can be critical to successful waste diversion programs, and typically includes participation levels, material quantities, material quality, environmental impacts, job creation and program costs/revenues. This data allows:

- Planners to track solid waste trends, identify jobs potential and identify market development opportunities
- Managers to track the program progress, service gaps and funding needs
- Elected officials and legislators to justify new policies and programs and to tout successes
- Regulators to collect and aggregate data, potentially serving as a clearinghouse for that information, as well as verifying code compliance
- Citizens to see that their efforts make a difference
- Developers and investors to judge the feasibility of expanding or creating new infrastructure
- Economic development professionals to measure and report on job growth, tax revenues, capital investment, and other metrics showing economic growth

The collection and analysis of good databases are often an on-going process that begins with establishing a baseline scenario (such as in an initial year of implementation or a program change). The baseline data is then used as a basis of comparison for future program measurement. It can be argued that data does not in itself directly lead to waste diversion. Sound data collection, however, should be considered an essential starting point for any solid waste system because of its role in identifying obstacles, opportunities, efficiencies and progress.

Data Collection Challenges

Data collection is thought by many to be obvious and easy - so much so that most discount it as a solid waste program component that warrants focused strategizing and resource allocation. Other challenges include:

- Public programs may voluntarily collect and share data - private programs rarely do the same as they feel their data is proprietary and sharing it would create a competitive disadvantage (confidentiality guarantees can help mitigate this)
- Very few local or state programs require data collection - voluntary data collection programs struggle to provide data that is useful or accurate
- Lack of a detailed, standardized methodology between data collection programs - can lead to an inability to compare results and general confusion in what results really mean;
    - If methodology is not comprehensive and clear, reporting entities may not have enough information to report accurately
    - Where methodologies differ between communities, states and territories (i.e., different materials, different reporting entities, different diversion calculations) - results are not comparable
- No requirement for reporting disposal quantities (even when diversion data is collected) - without both disposal and diversion quantities, an estimate of waste generation and diversion progress cannot be made
- Limited staff and budget resources can impede the ability to conduct comprehensive data - collected data should be compiled in a user-friendly data base that can be easily updated, data needs to be verified and double-checked with reporting entities in some cases, and final results need to be shared with waste generators, diversion and disposal organizations, policy makers and the general public

Several USEPA Regions (4, 5, 8 and 9) are currently working to develop standardized reporting methodologies so that member states can compare data meaningful (ideally the organization will develop a national methodology in the future). Progress in two regions includes (Hood, 2013):

- Region 4 - has made progress with data reporting software (Hood, 2013)
- Region 8 - Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming worked together for over a year to develop a shared definition of diverted materials and a calculation methodology - implementation has generally been a voluntary survey of private recycling facilities (except Colorado which has mandatory date reporting requirements)
- Region 9 - work completed by Columbia University in California, Hawaii and Nevada a few years ago supported the need and future development of an MSW quantities database using USEPA's standard definition of what materials are considered MSW and data drawn from USEPA, state agencies and other sources

Although some states have reporting mandates, it is not expected that USEPA guidance will become mandatory in the near future. Unfortunately, some states are finding that voluntary reporting yields very mixed results due to spotty responses (especially from private recyclers) and lack of staff to follow through on double-counting and non-reporting organizations (McOmie, 2012). As a result, it is difficult to use collected data to reasonably describe the overall solid waste management system or calculate state-wide diversion levels - and the value of the collection effort is called into question.

Solid Waste Measurement on Guam

In addition to the general value of data collection identified in Section 1, specific benefits on Guam would include the ability to:

- Assess the impacts of the military buildup on recycling and disposal quantities
- Compare Guam's recycling rate to the recycling rates of military facilities in Guam
- Compare Guam's recycling rate to recycling rates on other islands or in other parts of the world

In 2012, Guam's MSW recycling rate was measured for the first time, and a rate of 17.85% by weight was calculated for calendar year 2011 (Hood, 2013). This work was completed by GEPA with support from USEPA Region 9.

Existing Guam Recycling Regulation and Policy

GEPA solid waste permit regulations require solid waste disposal facilities to collect and report quantities quarterly and annually under Guam Administrative Rules Title 22, Division 4, Chapters 20 and 23. There are no specific regulations that require the same of other types of solid waste management facilities on Guam.

Of significant note, the recent data collection effort on Guam spurred the development of new policy from the Governor's Office as well as GEPA:

- Governor Eddie Calvo has set a goal of increasing the recycling rate to 21% in 2013
- GEPA Administrator Eric Palacios has set a goal of increasing the recycling rate every year by 3% beginning in 2013

Baseline Data Collection Effort

In 2012, GEPA and USEPA Region 9 undertook a baseline data collection effort for MSW materials managed on Guam during 2011 calendar year. Although some reporting had occurred for previous years, this effort represented the first comprehensive measurement of solid waste quantities on Guam. This work was impressive both in terms of the work required (data collection is especially challenging in early years as the process is new for both surveyors and reporting entities) and the estimated recycling rate of 17.85%:

- This rate reflects primarily municipal solid waste
- This rate reflects primarily recycling - there is limited organics recovery or waste conversion on Guam at this time (source reduction and reuse are also largely ignored in most surveys due to the difficult of measurement)
- The national MSW diversion rate in 2010 was 34% (included recycling and composting - the report on 2011 quantities is not expected to be available until April of this year) - while Guam's recycling rate was lower than many coastal states (who typically have high the highest economic and environmental incentives for diversion), it was on par with states in the mid-west (i.e., Wyoming's 2010 MSW diversion rate was 15% and Colorado's 2010 rate was 20% while Hawaii was 40%, Vermont was 35% and Washington was 56% (these states all count different materials in their calculations - more information can be found through links in Section 5)

Key components of the 2011 baseline data collection undertaken by GEPA and EPA9 included:

- Developed a reporting methodology using EPA Municipal Solid Waste Recycling Measurement Guidance (USEPA, 1997) and materials provided as part of the early Guam Zero Waste Planning efforts (Matrix, 2011)
- Identified materials included in data collection and reporting - included diverted and disposed materials in general accordance with USEPA's suggested materials list (see Appendix 1) - adjustments made to best reflect baseline conditions on Guam are tabulated below (Hood, 2013)

TABLE 1. Data Collection Inclusions and Exclusions Specific to Guam

MATERIAL	ADJUSTMENTS MADE FOR 2011 BASELINE DATA COLLECTION EFFORT
Recycling	
Scrap Metal	Excluded vehicles (average estimated vehicle weight used was 3,018 pounds)
Wood	Excluded wood from construction and demolition and land clearing (not included in MSW recycling rate calculations)
	Excluded MSW wood hardfilled or used as landfill Alternative Daily Cover (counted as Disposal)
Green Materials	Included leaves, branches, and grass composted
	Excluded green materials hardfilled or used as Landfill Alternative Daily Cover
Food Scraps	Included limited composting (UOG pilot)
	Note: No Data Available in 2011 – Food scraps to animal feeding
Tires	Excluded tires exported for use in energy production/kilns (counted as Disposal)
Glass	Excluded glass used as landfill Alternative Daily Cover (counted as Disposal)
Disposal	
Landfill (Layon and DoD)	Included Alternative Daily Cover
	Excluded biosolids
Hardfill	Included MSW wood and green materials hardfilled as Disposal.
	Excluded construction and demolition materials and land clearing debris
Incineration	Included incineration of confiscated materials
	Included tires exported for energy recovery/use in kilns

- Developed reporting and database entry forms (see Appendices 2 and 3)
- Built awareness of the value of a recycling measurement system through Guam Recycling Team Meetings with interested stakeholders (hosted by GEPA)
- Collected data from 20 different recycling, composting and disposal programs/facilities
- Worked to avoiding double counting by limiting materials tracking to only those destined for final recycling markets, compost facilities or disposal - exclusions included;
    - Intermediated haulers, transfer stations and recyclers that ultimately move materials to "end of the line" facilities already county for final processing, sale, disposal (e.g., plastics are accepted by several haulers/recyclers, but are all being managed by one recycling company for final export and sale)
    - Military recyclables ultimately managed at Guam facilities already counted (though data that helps understand the military's impact on materials flows/recycling rates is important)
- Capture materials diverted through reuse programs and facilities
- Capture facilities not included in 2011 baseline year (e.g., the State Department of Agriculture composting facility)
- Track food waste diversion (including efforts by farmers using for animal feed)

- Add non-MSW materials (specifically C&D debris)
- Evaluate ways to utilize Guam export data to better refine Guam's recycling measurement (especially for tires, C&D and other materials often exported directly without processing)
- Consider ways to measure litter/illegal dumping (from GEPA beach cleanup events) and marine debris (USEPA, 2001)
- Final public reporting of results showing both quantities and percent diverted by weight for all materials from year to year (also report change in diversion quantities over time)

RECOMMENDATIONS FOR IMPROVING GUAM'S MEASUREMENT SYSTEM

Responsible Agency

It is expected that GEPA will continue to be the lead agency in collected, interpreting and publicly reporting data. It is recommended that GEPA continue to work with USEPA to the extent possible, however, to stay abreast of regional state and national efforts to standardize the process. It is also likely that the new or expanded zero waste association (also recommend by the Guam Zero Waste Plan) will provide assistance in terms of promoting reporting requirements and results. These activities will address an ever-changing group of reporting entities (and possibly even materials) every year. Barring any significant change in policy or procedure, however, they should become less time-consuming over time for GEPA and assisting organizations.

Objectives and Expectations

The objective of Guam's evolving data collection and measurement program should be to obtain a reasonable assessment of the overall waste quantities managed in a given calendar year. In keeping with USEPA guidance, these quantities to capture MSW generated on the island through typical disposal and diversion activities (reuse, recycling, composting and landfilling - activities like source reduction, backyard composting and grass-cycling are not generally measured as they are very difficult to track with accuracy). MSW sources are residential, commercial, institutional and office-based (not process) industrial wastes. It is probable, however, that Guam (like many other communities and states) will opt to include some industrial wastes in the future (such as C&D debris and biosolids).

The measurement results should provide the public, system stakeholders and policy makers with a good snapshot of the relative rates of disposal versus diversion on Guam and - through comparison with other data - an indication of opportunities for future diversion. Given how dynamic Guam's solid waste system is, however, it is not reasonable to expect this measurement to achieve 100% capture of data with 100% accuracy. The expectation instead should be that the methodology and results will gradually be refined each year over such that good, representative data is obtainable after three to four years of implementation.

Recommended Improvements to the 2011 Baseline Data Collection Effort

In addition to general recommendations to improve the current methodology used on Guam, the listing below includes observations made by GEPA and USEPA Region 9 after they completed the 2011 baseline data analysis.

1) Continue to Refine "Who" Should Report - In an effort to capture the greatest amount of materials managed on Guam and to avoid double counting, GEPA is targeting primarily "end of the line" material managers who either directly consume or disposal of the measured material, or sell the material for consumption by others. These include:

   - Permitted recyclers (private and military facilities)
   - Non-profit recyclers (shipping directly to recycling markets)
   - University of Guam (composting)
   - Permitted landfill operators (MSW - private and military facilities)
   - Permitted hardfill operators (construction and demolition, wood, green waste)

Short-term recommendations to improve this system include:

- Verify that stand-alone mulching operations are reporting diverted wood waste
- Continue collecting quantity data from haulers (especially GSWA's collection of residential single-stream recyclables) and large generators (such as the island's grocery stores, GovGuam government buildings and military recyclers) to use as a general check on quantities reported by processors
- Evaluate the need to enforce permitting on regulated facilities (anecdotal evidence suggests that some hardfills and passive composting facilities are not compliant with all regulations (and are probably not reporting quantities)
- Continue to identify and obtain data from facilities not captured in 2011 (such as the State Department of Agriculture mulching operation)
- Add data collection from Guam's donation and reuse facilities such as Habitat for Humanity of Guam, the Guam Corps/Salvation Army, Oasis, Rigalu, etc.

Long-term recommendations include:

- Work with the Port Authority of Guam, Guam Bureau of Statistics and Plans (prepare an annual Guam Export Report) and shipping lines (i.e., Matson Navigation Company and Mariana Express Lines) to review export data that will likely provide help evaluating materials that are exported directly to off-island markets without processing (such as whole tires and some C&D debris)

2) Continue to Refine "What" Should be Measured - Only MSW materials were measured for the 2011 baseline year. While a post-consumer MSW-only program is consistent with the USEPA guidance (1997), many states are currently measuring C&D debris if not the entire solid waste stream (i.e., all MSW and non-MSW materials) to best reflect actual disposal and diversion activities in their communities.

Short-term recommendations to improve this system include:

- Continue to consider best data sources for "challenging" materials - for example;
    - Measuring organic feedstock to a compost facility is more accurate than measuring product due to the high degree or volume reduction during processing
    - Measuring commingled streams - while mixed recyclables are currently separated for processing and marketing, it is possible (though not likely due to economics) that the single-stream materials in the future could be shipped off-island without sorting
- Continue to consider materials used as alternative daily cover and incineration (on- or off-island) as disposal - tires processed in a waste-to-energy facility may be considered as diverted
- Consider stating a preference for weight data but allow those entities that do not have access to scales (or have not developed their own conversion factors based on actual data) to submit volumetric data - even if GEPA provides standard conversion factors for most materials, this step invites inconsistencies and errors (it will likely improve overall data accuracy if GEPA calculates all conversions during the analysis phase)

Long-term recommendations include:

- Phase in the collection of C&D debris materials that are diverted
- Add reporting of food waste diversion including materials used by farmers as animal feed
- Measure litter/illegal dumping through GEPA beach clean-up programs

- Measure marine debris (USEPA, 2001)

3) Continue to Refine the "How" in the Survey Instrument - GEPA's survey instrument is fairly straight-forward and reflects the low number of recyclers, composters, landfill and hardfills on Guam. Keeping the data requests simple and short will encourage reporting and minimize the private sectors' concerns about sharing proprietary data.

   Short-term recommendations to improve this system include:

   - Requesting source information for diverted materials - this is a common tactic used by USEPA (1997) and will assist GEPA in both identifying possible double-counting and providing a general check on reported "end of the line" quantities
   - Provide a confidentiality guarantee - most governments have the ability to obtain an exemption from the Freedom of Information Act (USEPA 1997) and the use of a third-party (such as the new/expanded zero waste association) can help preserve confidentiality

4) Continue to Refine "What" the Data Means - GEPA is currently measuring total quantities disposed and diverted and the recycling rate (percent by weight) using standard USEPA (1997) calculations.

   Short-term recommendations to improve this system include:

   - Calculating total waste generation by adding disposal and diversion quantities
   - Calculating a per-capita generation rate (in terms of is pounds/capita-day, or ppcd) - this metric is being used more regularly throughout the U.S. and is a good indication of unit disposal patterns (is calculated by dividing the total generation, disposal and diversion quantities by the population base
   - Track annual results against historical results to illustrate changes over time (graphical results are especially helpful)

5) Develop Policy to Support Accurate Reporting - This could potentially include several components:

   - Island-wide disposal/diversion goals - that connects on-going efforts to better manage solid waste with tangible future goals
   - Enforce facility permitting - so that all facilities managing solid waste materials are known to GEPA, are compliant in their operations and are regularly reporting quantities managed (anecdotal evidence suggests that some hardfill and passive compost operations are not fully permitted)
   - Mandate quantity reporting - that incorporates the methodology discussed above and can range from warning to penalties and fines for non-compliance (mandatory reporting is typically less expensive to conduct and has a higher response rate than voluntary reporting, but would minimize GEPA's interaction with the regulated community)
   - Require GEPA to provide an annual diversion report to the Guam Legislature - Colorado has one helpful example (see Section 5)
   - Island-wide waste composition studies - data generated from these studies is an invaluable counter-part to data collection analysis as they indicate the potential for future diversion for each measured material (these studies could be conducted on waste materials by GSWA's contractor at the commercial transfer station or landfill every two to three years)

6) Continue to Publicize Results and Promote Successes - as noted by John E. Jones, "What gets measured gets done - what gets measured and fed back gets done well - what gets rewarded gets repeated"

7) On-Going Methodology Refinement – It is likely that the quality of data will evolve over the first few years as regulated entities begin pro-actively collecting data & increasingly comply with reporting requirements. As the survey pool increases, the data gaps will shrink and double-counting will be reduced. On-going efforts should include:

- Workshop/webinar training - reporting methodology can be confusing (e.g., MSW wood can be counted by stumps from land-clearing cannot) and the program will likely change over time
- Provide updated on conversion factors/calculators and methodology changes to island recyclers, non-profit organizations, reuser, villages, haulers and other stakeholders
- Provide education about related environmental benefits to encourage participation - e.g., greenhouse gas reductions, fuel reductions, etc.

SUMMARY OF BENEFITS AND IMPACTS

Estimated Costs and Revenues

It is expected that mandatory data collection and reporting will require legislation (Colorado successfully implemented this requirement in 2008). Once the policy is firmly in place, new WDEQ staff resources will be needed to enforce mandatory data collection and reporting - and to aggregate/report collected data on an on-going basis. Annual, on-going staff needs will be more significant in the first two to three years, but will taper off over time. Approximately 0.5 FTE will be required for the following annual tasks:

- Support any future policy adjustments (such as changing the regulated facilities over time)
- Develop & regularly revise a survey form that can be distributed & responded to on-line (the EPA Region 8 survey is a good starting point)
- Develop & maintain a database of landfill facilities & recycling operations
- Follow-up with regulated facilities during the reporting period
- Build & regularly populate data base of quantity information
- Analyze & interpret the data
- Follow-up on data gaps or faulty reporting
- Report & present the data throughout the state & on-line
- Necessary supervision by WDEQ management

GEPA already collected, analyzing and reporting data (completed for 2011, 2012 is in progress). As a result, it is not expected that additional staff or resources will be required in future years.

ADDITIONAL INFORMATION AND REFERENCES

- Colorado's mandatory data reporting requirements for recycling facilities. www.cdphe.state.co.us/regulations/solidwaste/100702part1SWRegs.pdf
- Colorado Recycling Facility Annual Reporting Form - www.cdphe.state.co.us/hm/forms/sw/recycling.pdf
- Columbia University Earth Engineering Center, "Detailed Examination of the Flows of Municipal Solid Waste Through Three EPA Region 9 States (CA, HI and NV)," data of publication not provided
- Environmental Paper Network Paper Calculator - www.papercalculator.org
- Guam Administrative Rules Title 22 - www.guamcourts.org/CompilerofLaws/GAR/22GAR
- Guam Environmental Protection Agency, "Recycling in Focus Fact Sheet." www.issuu.com/guamepa/docs/111512_factsheet_solidwaste_recyclingrate2

- Guam Environmental Protection Agency's Annual Recycling Rate Goal. http://mvguam.com/local/news/27690-gepa-increases-recycling-target.pdf
- Guam Governor Calvo's 2013 Recycling Goal. http://governor.guam.gov/wp-content/uploads/2013/01/HighlightsandGoals_GuamEPA.pdf and http://www.guampdn.com/article/20130112/NEWS01/301120305/Agencies-release-highlights-goals
- Hawaii Department of Health Office of Solid Waste Management, "Report to the Twenty-Sixth Legislature State of Hawaii 2011," December 2010.
- Hood, Timonie, US Environmental Protection Agency Region 9, March 5, 2013
- McOmie, Craig, Wyoming Department of Environmental Quality Recycling Coordinator, Wyoming Solid Waste and Recycling Association Conference commentary, August 2012
- University of Washington, "Recycling and Solid Waste Annual Report - Fiscal Year 2010," January 2011
- USEPA, iWARM for estimating energy conservation - www.epa.gov/epawaste/conserve/tools/iwarm/index.htm
- USEPA, "Measuring Recycling: A Guide for State and Local Governments," 1997
- For additional information on the materials covered in the MSW Recycling Rate calculation see: http://www.epa.gov/waste/conserve/tools/recmeas/docs/guide2.pdf
- USEPA, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010," published in November 2012
- USEPA Recycled Content Tool - www.epa.gov/climatechange/waste/calculators/ReCon_home.html
- USEPA Region 5, "Illegal Dumping Economic Assessment (IDEA) Model," January 2001 - www.epa.gov/region5/waste/illegal_dumping
- USEPA Volume-to-Weight Conversion Factors - www.epa.gov/osw/conserve/tools/recmeas/docs/guide_b.pdf
- USEPA Waste Reduction Model (WARM) for estimating greenhouse gas emission reductions - www.epa.gov/WARM
- Vermont Agency of Natural Resources, "Table 2 Solid Waste Diversion 2010" www.anr.state.vt.us
- Diversion Disposal Report Table 2 Wyoming Department of Environmental Quality, "Wyoming Solid Waste Diversion Study," prepared by LBA Associates, Inc., January 2013

Attachment 1

Sample Guam Municipal Solid Waste Recycling Rate Calculation Spreadsheet

Attachment 2

Waste Diversion Survey Form Used for 2011 Baseline Data Collection

Please see the next page.

Sample - Guam MSW Recycling Rate Calculation Spreadsheet

Background Information: U.S. EPA Recycling Measurement Guidance: http://www.epa.gov/epawaste/conserve/tools/recmeas/index.htm

GUAM RECYCLING RATE	XX.XX%

Formula: Tons Recycled/Tons Generated (Tons Recycled + Tons Disposed) * 100

Material Recycled	Company	Tons (fill in based on reports)	Notes
Cardboard			Note adjustments, conversion factors used, new companies/companies out of business, or any other
	Co. # 1		
Cardboard Subtotal			
Mixed Paper			
Mixed Paper Subtotal			
Metals			
Aluminum			
Subtotal Aluminum			
Ferrous (excluding Autos & including White Goods)			Adjust totals by subtracting vehicles sold (average vehicle weight estimate = 3018 lbs. metal/vehicle.)
	Co. #1		
Subtotal Ferrous			
Other Non-Ferrous Metals			
Other Non-Ferrous Metals Subtotal			
Mixed Metals			Note: Some recyclers sell mixed metals.
Mixed Metals Subotal			(Subtotal Aluminum + Subtotal Ferrous + Subtotal
Subtotal All Metals			Other Non-Ferrous + Subtotal Mixed Metals)
Plastics			Break out by resin type is data is available (e.g., PET,
Subtotal Plastics			HDPE, etc.)
Batteries - Car & Truck			
Subtotal Batteries			
Electronics			
	Co. #1		
	Co. #2		
Subtotal Electronics			
Composting			Break out materials composted by type if data is available.
Green Materials			
Wood			
Paper			
Subtotal Composted			
TOTAL MSW RECYCLED & COMPOSTED			Add all recycling and composting category subtotals
Material Discarded			
MSW Landfilled			
	Co. #1		Subtract biosolids data.
	DoD Landfill		
	ADC		Alternative Daily Cover (glass, green waste, etc.)
Subtotal Landfilled			
Wood Waste Hardfilled			
Subtotal Wood Waste Hardfilled			
Green Waste Hardfilled			
Subtotal Green Waste Hardfilled			
MSW Incinerated			NOTE: MSW incineration is banned in Guam; however items illegally seized are incinerated.
	Co. #1		
Subtotal MSW Incinerated			
Tires - Energy Recovery			Tires exported for Energy Recovery or use as Fuel in Cement Kilns is Disposal. If tires are recycled into
Subtotal Tires - Energy Recovery			
TOTAL MSW DISCARDED			Add subtotals landfilled, hardfilled, and incinerated.

Please see the next page.

WASTE DIVERSION SURVEY

The purpose of this study is to collect information about waste materials that are currently (or may in the future be) diverted from landfill disposal through various reuse or recycling options. We would like to collect information from organizations/facilities that generate, manage or use these materials which include recyclables, organics, tires, construction/demolition debris & wastewater treatment plant (WWTP) biosolids. We understand that many of these materials may currently be landfilled now - but as new programs may identify ways to divert them in the future, we need to understand programs that are currently in place at this time. Please complete BOTH pages of this survey - your cooperation will be invaluable to the development of future waste diversion programs. Thank you for your time.

Name & Title of Individual Completing Survey:

Best Contact for More Information *(phone preferred):*

Program/Facility Location *(provide physical location or general service area, as applicable):*

Owner:

Operator *(may be different from owner):*

Program Description *(such as waste management service or activity that generates the materials on page 2):*

Waste Management Activities/Services *(such as source reduction, collection sites, hauling, reuse, recycling, mulching/ composting, re-manufacturing, electronic waste processing, etc.):*

Waste-Generating Activities *(such as construction/renovation/demolition activities, car repair/tire facilities, wastewater treatment plants, landscaping & other industries):*

Does Program Provide Services for Profit or Not for Profit? *(Describe who services are provided to such as individuals, companies, cities, etc.):*

Does Program Generate/Process Materials for Use by Others? *(Describe what individuals or companies use these materials):*

What Changes Could be Made on Guam to Help You Divert More Materials in Future *(such as new/improved programs, changes in local or state rule-making, development of new markets for recycled materials, education, funding, etc.):*

Who Else Should We Contact *(to fully understand the programs and needs of waste generators & managers):*

WASTE DIVERSION MATERIALS REPORTING

Please provide quantities in <u>weights</u> wherever possible. Where individual materials quantities are not known, please provide the total quantity & describe the material mix. We understand that your program/facility may not currently divert these materials - however, the quantity of materials that are landfilled is also needed to support future waste diversion activities on Guam.

MATERIAL	QUANTITIES DIVERTED THROUGH REUSE, RECYCLING OR OTHER IN 2010 (tons)	QUANTITIES LANDFILLED IN 2010 (tons)	COMMENTS (i.e., Name of receiving facility or destination, broker, processor, remanufacturer/end market or other information)
Metal Containers & Scrap			
Aluminum Cans			
Steel/Tin/Bi-Metal Cans			
White Goods/Appliances			
Vehicles			
Other Aluminum (lawn chairs, tables, siding, gutters, etc.)			
Other Ferrous (empty aerosol cans, coat hangers, etc.)			
Non-Ferrous Scrap (copper, brass, etc.)			
Glass			
Clear Food/Beverage Bottles/Jars			
Brown Food/Beverage Bottles/Jars			
Green Food/Beverage Bottles/Jars			
Plastic			
PET Plastic Bottles (resin #1)			
HDPE Plastic Bottles (resin #2)			
Plastic Bottles (resin #3 - #7)			
Plastic Film Bags			
Expanded Polystyrene (resin #6)			
Paper			
Corrugated Cardboard (unwaxed, uncoated)			
Kraft Paper/Bags			
Newspaper			
Magazines/Catalogues			
Office/Computer Paper			
Low-Grade Paper (file folders, direct mail, books, etc.)			
Shredded Paper			
Telephone Directories			
Waxy/Coated Milk Cartons & Food Packaging			
Organics			
Food & Food-Contaminated Paper			
Green Waste (grass, leaves, small branches)			
Land Clearing (stumps, logs, trunks)			
Sod			
Clean Wood/Pallets (untreated, unpainted)			
Textiles (clothing, bedding, etc.)			
Construction/Demolition Debris			
Concrete			
Asphalt			
Metals			
Clean Wood/Pallets/Crates (untreated, unpainted)			
Sawdust			
Treated/Painted Wood			
Drywall			
Insulation			
Asphalt Shingles			
Carpet & Carpet Padding			
Other			
Special Waste			
Tires (car, truck)			
WWTP Biosolids			
Furniture			
Other			

TECHNICAL MEMORANDUM 4

MARKETS FOR RECOVERED MATERIAL

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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Memorandum

To: Mark Calvo, Office of the Governor of Guam, Director Military Buildup

From: Matrix Design Group, Inc.

Date: Originally issued in December 2012; Reissued in June 2013

Subject: Guam Zero Waste Plan: Markets for Recovered Material

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This technical memorandum is submitted to satisfy the requirements of Task Order GR0706-08-03-10-01, Deliverable 3c and presents a summary of available information on current market conditions and revenues (costs) for materials recovered from Guam's solid waste stream. Estimating material revenues is a key component for future diversion alternative analyses. A collateral benefit of researching markets is an accompanying understanding of how recovered materials are currently being recycled, reused, composted or repurposed on Guam to avoid landfill disposal, and what are the material processing requirements for selling recovered materials as commodities.

INTRODUCTION

Because Guam is an island, the natural division to understand markets for secondary materials is whether there are recovery opportunities on the island, or if materials must be prepared and shipped off the island.

On-Island Markets

Handling the materials on the island presents opportunities for better control in terms of regulating how business is conducted, and offering incentives and disincentives. Obviously, there are no overseas shipping costs, and the sale of material is not vulnerable to fluctuation of worldwide markets. On-island recovery provides more local jobs than shipping off the island along with potentially more tax revenues. Island markets at the current time include:

- Untreated wood - chipped for use as landscaping and soil erosion material (some composting)
- Green waste, wet cardboard, limited amount of mixed paper - some composting
- Food waste - diverted to pig farms
- Glass – Crushed glass is currently used as a landfill road base substitute for virgin aggregate and occasionally as alternative landfill cover and utility backfill material

Off-Island Markets

Shipping materials to markets off the island obviously introduces complexities including:

- Materials are generally baled to increase transportation efficiencies;
- Transport requirements/costs - include Port Authority of Guam charges port charges, shipping costs and port charges at the receiving port; and
- End-markets prices which are subject to global influences.

Markets for recyclable materials are commodity markets with daily price fluctuation and often significant price fluctuations over time. For example, it is not uncommon for prices to rise or fall by more than 50% within the course of a year. Some recycling companies enter into long-term contract with buyers to minimize the impacts of price fluctuations. Materials sent off-island for recycling include metals from Guam's successful metal recovery program (including aluminum beverage cans), old cardboard containers, limited quantities of other recovered paper, PET and HDPE plastic containers, car and truck batteries and electronics.

Research Methodologies for This Analysis

Material market research is typically based on one of two typical methodologies: Contacting local material brokers and people working within the industry for prices paid; and/or researching published price indices (both may represent total, gross revenues which require adjustment to consider transportation costs). Both methodologies were used in this analysis.

RESEARCH FINDINGS

Materials Identified in Guam Zero Waste Plan

The materials identified for this market analysis were driven by the waste diversion alternatives subsequently analyzed in the Guam Zero Waste Plan. This list includes:

- Residential (and some office) recyclables - paper in varying grades, cardboard, aluminum cans, glass, metal food cans and scrap metal, plastic bottles (PET-plastic #1, and HDPE-plastic #2)
- Tires
- Organics
- Construction and demolition debris (especially aggregate)
- Electronics waste

Survey Contacts

The research effort generated a list of contacts (see the memo appendix). These include relationships formed and information received during the February 2012 visioning meetings, members of the Recycling Association of Guam, listings in the Recycling Association of Guam's online recycling resources, listings in the University of Guam's online recycling directory and telephone directory listings. Telephone calls were placed to all the parties and businesses, but not all parties responded to provide information.

Summary of Responses and Disclaimer

The following table summarizes responses obtained from market research survey efforts. It is noted that these efforts (completed between October and November 2012) were hindered by several factors:

- GSWA is in the midst of a bidding process for processing/sales residential recyclables for a potential island-wide curbside program[1] - this has caused businesses to be less forth-coming about what they consider proprietary data
- GEPA recently surveyed local recyclers to collect baseline quantity information - many of these were not interested in providing additional information for the Guam Zero Waste Plan
- At least five of the recycling businesses researched are no longer in business
- With the exception of Matson, Inc. quotes, all information was provided anecdotally and verbally, thus making independent verification of most information impossible

[1] GSWA's Request for Expressions of Interest has been issued and responded to - the project may be out for formal bid by the end of 2012.

SUMMARY OF MATERIAL MARKET SURVEY RESPONSES

MATERIAL	LOCAL PRICES	MARKET DESTINATION	COMMENTS
Mixed Paper	Negative to $0	Asia or West Coast US	Baled and containerized. Trend is toward sufficient revenues to reinstate shipping out mixed paper; since price drop in ~2009, no positive flow. All paper classified mixed paper, as there is no separation into higher grades by any facility. Small volumes discourage separation into higher grades and baling. Some shredded material is given away as compost rather than shipped out at a loss (transportation greater than market revenues).
Cardboard	($20)/ton for collection	Asia or West Coast US	Revenue-positive material accepted by Mr. Rubbishman. Also accepted by DeWitt's, who declined to participate in survey and offer any information. Banned from Layon Landfill.
Aluminum Beverage Cans	$0.20-$0.32/pound paid to public	Various, West Coast US	Price paid based on cleanliness; baled and loaded in containers. Majority captured by iRecycle Program benefiting schools; iRecycle costs are subsidized by businesses. Bottle bill is not yet implemented and may enhance revenues.
Ferrous Metals	$0.03-$0.10/pound	Primarily China	Metals are actively recovered by multiple on-island brokers. Guam Port Authority reports that port charges are waived "for the good of the island" for non-containerized metals loaded on barges and on ships. Metals are banned from Layon Landfill.
PET & HDPE containers (Plastics #1 & #2)	($0.26-$0.52/pound)-$0	Not Disclosed (probably China)	Pyramid Recycling accepts, bales, and recycles. No revenues paid; no net income earned after processing and shipping. Service offered as courtesy. Bottle bill regulation may make plastic containers revenue positive.
Glass	$0	On-Island	Chenaga Operations Services, the contractor for Anderson AFB operates two glass crushers. Material is given to contractors at no charge. Bottle bill does not include glass.
Tires	($1.00-$12.00)/tire	Southeast Asia	Banned from Layon Landfill. Reports from industry that on-island brokers are not accepting tires, even for a fee, and there are tire stockpiles on the island because of market disputes. Guam Public Law 27-38 (now repealed) established a $3.00 per tire advanced disposal fee on tires. No reports from those surveyed on this fee's implication or whether adjusting fee would enhance market.
Computers & Electronics	$.11/pound	Asia	Banned from Layon Landfill. Excludes monitors; charges in place for monitors. Report from one scrap dealer that he no longer accepts material because not profitable.
Organics	($4.00-$9.00)/cy tipping fee (Eddie Cruz & Primos)	On-Island	Green waste and untreated wood banned from Layon Landfill. Eddie Cruz reports that chipped untreated wood and organic material is given away to community groups for projects, and that no revenue received. Similarly, no revenue received for shredded paper used on a limited basis for passive compost. Reports provided from multiple parties that there is little demand from landscapers.
Construction & Demolition Waste	($4.00-9.00)/cy tipping fee (Eddie Cruz & Primos)	On-Island	C&D landfills pull recyclable metals. Primo's Hardfill reports it has ceased composting and processing materials. Eddie Cruz reports he chips non-processed wood, mixes in dry and clean paper and cardboard for passive compost. Donates chipped wood and compost to non-profits for erosion control projects. Limited recovery at hardfills due in part to non-enforcement of illegal dumping and operation of unpermitted facilities.

MATERIAL	LOCAL PRICES	MARKET DESTINATION	COMMENTS
Aggregate Materials (asphalt, concrete, brick, soil, etc.)	($3.00-4.00)/ton	On-Island	Inert materials banned from Layon Landfill. Eddie Cruz sells aggregate for $2.00-3.00/ton; $6.00/ton covers his costs for preparing the material. Costs and handling paid through tipping fees. Inexpensive source of virgin materials available on island is disincentive for recycling aggregate.

Note: All prices are for loose material - paper recyclables baling cost reported to be $50/ton.

Discussion of Findings

The market survey indicates that there are:

- Revenue-positive off-island markets for metals
- Revenue-positive program for aluminum beverage (based on iRecycle and its subsidy partners for off-island marketing[2])
- Revenue-positive market off-island for cardboard
- Revenue-positive market off-island for computer components (excluding monitors)
- Revenue-negative market for mixed paper and plastics #1/#2 off-island that could potentially improve with greater quantities from an island-wide curbside program
- Glass crushing on-island (by AAFB and GSWA) for own use/give-away with no revenue generation
- Current market obstacles to off-island tire markets
- Limited to no revenues on-island for compost, wood chips or recycled aggregate

The researchers discussed these general findings with representatives of the AAFB, the Navy, Chenaga Operations Services, GSWA, the Recycling Association of Guam, USEPA Region 9 and the Guam Port Authority. The following information is ancillary to understanding market conditions for some of the materials not noted to be revenue-positive.

Paper - The paper being baled and shipped off the island is not sorted into separate and higher grades, but rather combined and baled as mixed paper (a relatively low-priced commodity). Chenaga Operations (Scott Reed) states two obstacles to sorting: Low quantities diverted and insufficient space at the processing center to store materials until there is enough material to sort and bale. The contract structure between the AAFB and Chenaga does not appear to include an incentive for developing or enhancing material markets.

Guam Transport and Warehouse (GTW) had previously provided drop-off paper recycling bins for public use, but discontinued this service. According to Bernie Gomez, the available market price the firm could obtain (from a Thailand the tissue-making plant) initially covered processing and shipping costs, but did not after the fall of market prices in 2009. Heavy contamination levels further exacerbated the problem. GTW also offers confidential shredding services, and markets this material through an off-island market using subsidies from its document destruction fees. In some cases, GTW offers shredded paper for mulch and composting on the island, but gains no income from doing so.

GSWA may initiate island-wide curbside collection of recyclables in 2013. If implemented, this program would greatly increase the quantity of recyclables, and would also support a new or expanded recyclables processing facility. The resulting ability to produce higher quality products in greater quantity is expected to generate higher revenues.

Plastic Beverage Bottles - It is also expected that increase diversion driven by implementation of Guam's bottle

[2] iRecycle is a non-profit organization that recycles aluminum cans to generate revenues for schools. Partners who donate/subsidize this program include Mr. Rubbishman, Pyramid, Ambros, Matson and Anheuser-Busch.

bill could make recycling plastics #1 and #2 revenue-positive. Further diversion incentives could be created if the iRecycle and other collection programs included plastic beverage bottles (also a common on-the-go packaging potentially well-captured by drop-sites). These options have not been explored as part of this research effort, however.

Glass Beverage Containers - The existing bottle bill legislation (Public law 30-221) does not cover glass beverage containers. Such a deposit system would increase the percentage of glass recovered on the island and limit litter.

Tires - The tire management system on Guam is decentralized and includes many tire retailers, automobile dismantlers and others. The current market disruption, which has resulted in tire stockpiling throughout the island, is likely to be repeated whenever future market demand is reduced. It may be advantageous to convene a tire task force to identify program barriers, centralized management and review the availability of vehicle registration dollars collected by GEPA to more broadly subsidize tire recycling.

Chipped Wood, Compost and Aggregate from Recovered Construction & Demolition Debris - The competition from unpermitted hardfills and unpermitted passive composting operations appears to be keeping tipping fees low at permitted facilities. While this (plus the Layon Landfill disposal ban) encourages separation of inert, green waste and woody material, the resulting low revenues earned by hardfill operators discourages recovery operations over hardfill disposal. The ability to level the playing field by requiring and enforcing operating permits (as well as illegal dumping restrictions) may allow legitimate facility owners to charge more reasonable tip fees and support on-site diversion activities.

NET REVENUE ANALYSIS

Due to the unavailability of specific and verifiable material pricing for Guam recyclables, the following alternative approach is used to more consistently estimate the approximated net revenue earnings from selling recyclables generated on the island:

- Gross revenue earnings from mill pricing indices - revenues paid for recyclables delivered to mill location
- Material preparation costs for shipping (baling)
- Transportation costs - including both export and import port charges, plus shipping costs

Gross Revenue Potential

Published Pricing Indices - Material pricing indices are posted by various publications on a regular basis, and typically reflect a reference point for multiple mills by region (these prices do not represent any guarantee and are subject to change). Some recyclers use indices for setting processing fees and selling materials to end markets. There is no clear, international pricing index that represents all material pricing potentials for Guam recyclables. However, there are reliable indices that provide fiber and container pricing sold to west coast U.S. mills. Those used for this estimation include:

- Official Board Markets (OBM) & PPI Pulp & Paper Week (PPW) - publish paper stock pricing in the first weekly issue of every month (these indices were merged in October, 2012 - Pacific Northwest prices were used)
- Mill Trade Journal Recycling Markets - publishes container pricing twice monthly (west coast prices were used)
- Recyclers World spot market checks where the above references did not provide information

These indices (like most published pricing sources) are subscription-based[3]. Unless otherwise noted, the following table includes average 2012 pricing averages from these indices. All pricing is exclusive of

[3] The OBM/PPW and Mill Trade index data provided has been obtained from subscriptions held by the City/County of Denver, Colorado.

transportation costs (discussed subsequently).

PRICING REFERENCE FOR GUAM RECYCLABLES (for baled materials unless otherwise noted)

MATERIAL	PRICING REFERENCE $/TON	SOURCE
Mixed Paper	$85	OBM/PPW Residential Mixed Paper (ISRI Mixed Paper #2)
Sorted Office Paper	$163	OBM/PPW (ISRI #37)
Sorted White Ledger	$240	OBM/PPW (ISRI #40)
Newspaper	$93	OBM/PPW Old News (ISRI ONP #8)
Corrugated Cardboard	$108	OBM/PPW Corrugated Containers (ISRI OCC #11)
Aluminum Cans (loose)	$1,523	Mill Trade
Steel Cans (loose)	$57	Mill Trade
Plastic #1	$564	Mill Trade clear PET
Plastic #2	$465	Mill Trade mixed HDPE

Note: OBM/PPW pricing reflects monthly average reported from January 2012 through November 2012
Institute of Scrap Recycling Industries paper grade specifications (ISRI Scrap Specifications Circular 2007)

Prices for Other Commodities - These indices do not address pricing for tires. Recyclers World spot markets (also a subscription-based pricing tool) identifies a cost of $1.13/whole passenger tire with revenues available for crumbed/granulated tires[4]. This supports the inability for sustainable off-island marketing without centralized management system to increase the economy of scale, as well as some type of subsidy (such as from the GEPA registration revenues).

Selling compost products off-island was not evaluated, as the shipping costs would be prohibitive, and managing clean soil, compost, ground wood chips and other compost products on-island is the reasonable course of action.

Material Preparation Costs - Baling and Loading

Baling of most materials is practiced to minimize shipping costs in intermodal containers. The cost of baling varies with equipment, material and labor requirements and was quoted to be as high as $50/ton. This value was used in the following table to represent baling as well as loading the containers.

Transportation Costs - Port Charges and Shipping

Port Charges - Port charges for loading and unloading materials are typically applied both at the export and import port. The shipping charge discussion (below) identifies these costs to range from $700 to $800 at each end.

As noted previously, the Port Authority of Guam may waive export port charges on non-containerized metal loads[5]. The statutory authority for this waiver (12 GCA 58147) technically applies to all recyclables materials. It also exempts shipping and recycling businesses from the Guam Use Tax Law on revenues earned from recycling. The waiver does not appear to be applied for all materials, however, and represents an economic incentive

[4] Recyclers World ScrapIndex.com (December 13, 2012) pricing - $0.20/lb. or $4.50 per tire revenue based on a 22.5 pounds average tire weight, excluding processing costs (required equipment is currently not available on Guam).

[5] Port Authority of Guam publishes naming rates, charges, rules and regulations (see Terminal Tariff #1 document).

(between $700 and $800 per load) for greater recycling on Guam.

Shipping Costs - The shipping lines bid transportation for containers on a case-by-case basis. These rates vary by current conditions, commodities, destinations and costs for fuel. Matson, Inc. is a sponsor of the iRecycle program and supports recycling on the island. Mariana Express Lines also provides container transport service between Guam and the mainland West Coast. Other lines serve Guam, including Chinese lines that serve the Chinese ports. Because the published pricing is based on markets (below) to the West Coast, quoted prices (provided by Matson) to the U.S. were used:

- Shipping cost for a 20-foot intermodal container - $4,775
- Shipping cost for a 40-foot intermodal container - $5,800
- These costs include port charges in the amount of $700 to $800 at each end

Research indicates that the Chinese shipping lines transport most recyclables to Chinese ports - anecdotal evidence suggests that these shipping costs may be lower than to the U.S. (one source indicated transportation charges as low as $2,000). Depending on Chinese market pricing, net revenues for materials sold to China may be higher than those tabulated below. Regardless, all charges are subject to numerous variables and should be thoroughly vetted before determining specific market revenues.

Net Revenue Estimations

In order to calculate the net cost or net revenue for recyclables sold off-island, the following table considers the cost of material preparation (baling and loading) and transportation (loading and shipping) costs. These total costs must be exceeded by gross material revenues to support sustainable marketing abroad. Note that high paper grades (sorted office and white ledger) have been included to show the revenue potential of sorting out these materials in future operations.

NET REVENUE ESTIMATION FOR OFF-ISLAND MARKETING

SHIPMENT IN A 20-FOOT INTERMODAL SEA CONTAINER (22 BALE MAXIMUM)										
Material	Baling & Loading Cost/Ton	Weight per Container (tons)	Baling & Loading per Container	Port Charges & Shipping to West Coast U.S.	Total Costs per Container	Gross Revenues/ Ton	Gross Revenues/ Container	Net Revenues (Gross Minus Total Costs)	Net Revenues (Cost)/Ton	Net Revenues (Cost)/Ton with Landfill Savings
Mixed Paper	$50	13.2	$660	$4,775	$5,435	$85	$1,122	$(4,313)	$(327)	$(156)
Sorted Office Paper	$50	13.2	$660	$4,775	$5,435	$163	$2,152	$(3,283)	$(249)	$(78)
Sorted White Ledger	$50	13.2	$660	$4,775	$5,435	$240	$3,168	$(2,267)	$(172)	$(1)
Newspaper	$50	13.2	$660	$4,775	$5,435	$93	$1,228	$(4,207)	$(319)	$(148)
Corrugated Cardboard	$50	13.2	$660	$4,775	$5,435	$108	$1,426	$(4,009)	$(304)	$(133)
Aluminum Cans	$50	5.5	$275	$4,775	$5,050	$1,523	$8,377	$3,327	$605	$776
Steel Cans	$50	11.0	$550	$4,775	$5,325	$57	$627	$(4,698)	$(427)	$(256)
Plastic #1	$50	6.6	$330	$4,775	$5,105	$564	$3,722	$(1,383)	$(209)	$(38)

SHIPMENT IN A 20-FOOT INTERMODAL SEA CONTAINER (22 BALE MAXIMUM)										
Material	Baling & Loading Cost/Ton	Weight per Container (tons)	Baling & Loading per Container	Port Charges & Shipping to West Coast U.S.	Total Costs per Container	Gross Revenues/ Ton	Gross Revenues/ Container	Net Revenues (Gross Minus Total Costs)	Net Revenues (Cost)/Ton	Net Revenues (Cost)/Ton with Landfill Savings
Plastic #2	$50	9.0	$450	$4,775	$5,225	$465	$4,185	$(1,040)	$(116)	$55
SHIPMENT IN A 40-FOOT INTERMODAL SEA CONTAINER (45 BALE MAXIMUM)										
Mixed Paper	$50	27.0	$1,350	$5,800	$7,150	$85	$2,295	$(4,855)	$(180)	$(9)
Sorted Office Paper	$50	27.0	$1,350	$5,800	$7,150	$163	$4,401	$(2,749)	$(102)	$69
Sorted White Ledger	$50	27.0	$1,350	$5,800	$7,150	$240	$6,480	$(670)	$(25)	$146
Newspaper	$50	27.0	$1,350	$5,800	$7,150	$93	$2,511	$(4,639)	$(172)	$(1)
Corrugated Cardboard	$50	27.0	$1,350	$5,800	$7,150	$108	$2,916	$(4,234)	$(157)	$14
Aluminum Cans	$50	11.3	$565	$5,800	$6,365	$1,523	$17,210	$10,845	$960	$1,131
Steel Cans	$50	22.5	$1,125	$5,800	$6,925	$57	$1,283	$(5,643)	$(251)	$(80)
Plastic #1	$50	13.5	$675	$5,800	$6,475	$564	$7,614	$1,139	$84	$255
Plastic #2	$50	18.7	$935	$5,800	$6,735	$465	$8,696	$1,961	$105	$276

Priced paid for baled materials by PNW mills, FOB - see Table on pages 3-4 (this prices are derived from standard indices and do not necessarily reflect local conditions).

Intermodal container capacities based on a standard size and capacity:

- Loading guidelines require 10 centimeters of space between the top of the load and the top of the container - area was backed out of the internal capacity of the containers
- Densities assumed from industry figures for an extra high-density economy 60-inch vertical baler (wastecare.com) - paper grades and corrugated 1200#/50-cf bale, PET 600#, HDPE 830#, aluminum cans 500#, steel cans 1,000#
- Containers are limited to a gross weight of 66,139# - net load of 20' container cannot exceed 61,289# (40' container cannot exceed 57,759#)
- Using an assumed 50-cf bale - maximum number of bales in a 20' intermodal container is 22 (40' is 45)
- Landfill disposal costs based on current $171/ton tip fee at commercial transfer station.

Net Revenue Estimate Observations

The market analysis reveals that under 2012 West Coast U.S. market conditions, recycling 40-foot container loads of nearly all materials exceeds the cost of landfill disposal on Guam (the exception is steel food cans). If the tip fee increases to $225/ton as predicted, high-grade paper, aluminum cans and both plastic grades could also be sustainably diverted in the smaller 20-foot loads. Other observations include:

- If market conditions (or location), materials preparation costs or transportation expenses change - so will the net revenue potentials tabulated above

- It was reported that many Guam recyclables are being marketed in Asia - while Asian market prices were not available, they are expected to be higher than in the U.S. (coupled with lower shipping costs, the net revenue picture may be notably stronger for materials marketed there)
- Key to observing economic sustainability is the consideration of avoided landfill tipping fees - as is the inclusion of this factor in future price or rate setting by Guam's recyclers (establishment of mandatory recycling programs such as GSWA's 2013 residential curbside program will help all stakeholders to take a broader view of the solid waste stream)
- Significant quantities of cardboard are being collected, baled and shipped by two private companies, indicating that actual net market prices in Guam for cardboard (and likely other materials) are higher than indicated in this analysis of mainland West Coast prices.

RECOMMENDATIONS

The overall market research efforts summarized in this memo lead to following recommendations:

- Conduct a detailed cost/benefit analysis for a central processing facility (or expansion of existing facility) for recyclables with space to store and sort paper into high grade grades and optimize markets through larger volumes
- Implement a residential curbside recycling program - this will be dependent on third-party processing costs that - when combined with collection costs - are less that current commercial transfer station tip fees
- Develop and implement bottle bill regulations - may also evaluate the inclusion of plastic bottles in the iRecycle program
- Evaluate future inclusion of glass beverage containers in the bottle bill deposit program - based on expansion of low-tech island end-uses (road fill, cover, art projects, etc.)
- Implement measures to prevent illegal dumping of waste and contamination of drop-site recycling bins
- Enforce prohibition of unpermitted hardfill and compost operations
- Convene a tire task force to review current obstacles to marketing tires and develop pro-active measures for down-market conditions - including use of GEPA registration revenues
- Implement regulations to consistently waive port charges for all recyclable materials
- Continue with GEPA data collection from recycling, the Port Authority of Guam and shipping lines (on an annual or bi-annual basis) - to develop reliable, comparable quantity, market and transportation cost data that recyclers can use to realistically evaluate diversion opportunities in the future

APPENDIX 1. CONTACTS

BUSINESS/ORGANIZATION	PHONE (AREA CODE 671) OR EMAIL CONTACT	CONTACT PERSON	COMMENT
Bali Steel, LLC	635-1123	David Bell	NC: No answer
Chenega Operations Services, LLC	366-1477	Scott Reed	Anderson AFB & Navy Base Housing
DeWitt's Moving & Storage; Recycling Center of Guam	488-5257	Ray Cruz	LC: Refused to cooperate. Cardboard
Eddie Cruz	989-7645	Eddie Cruz	C&D, metals, compost, aggregate
FSM Recycling	649-2400	Alec King	White goods, metals, batteries
Global Recycling Center	632-0789	Daniel Chu	LC: Unavailable for arranged times. Metals and tires. Provided copy of waste diversion survey. Recent fire.
Great Pacific Refuse Recycling	234-3387		NC: disconnected
Guahan Waste Control; Mr. Rubbishman	649-5183	Bob Perron	Cardboard, supermix
Guam Metal Development	688-5171		NC: disconnected
Guam Solid Waste Authority	898-5585	Chace Anderson	Discussion
Guam Transport Warehouse	647-7873	Bernie Gomez	Paper
Island Scrap Yard	737-1687		NC: Hung up
Island Waste Management	734-9279	John GF Christobel	Hauler
Mariana Express Lines	ed_cruz@mariana-express-guam.com	Ed Cruz	No quote
Matson	475-5963	Bernadette Valencia	Written quote
Port Authority of Guam	477-5931	Supervisor	
Primo's Hardfill	632-7114	Receptionist	LC: Would not call back
Pyramid Recycling; also Formosa Recycling	646-8130	Eric Hseuh	Metals, plastic bev., tires, e-waste
Steve Hiney	998-2127	Steve Hiney	Member RAG
Tomson LLC	688-9696		NC: May be out of business
Triple Star Recycling	648-2910		LC: Answered, could not reach "boss"
USAF	barbara.torres@us.af.mil	Barbara Torres	
USN	Troy.Imamura@fe.navy.mil	Troy Imamura	
Xiong's Family Recycling	649-4514		LC: Submitted info to GEPA

TECHNICAL MEMORANDUM 5

BASIS FOR JOB CREATION POTENTIAL ESTIMATES

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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Memorandum

To: Mark Calvo, Guam Military Buildup Office
Carol Perez, Guam Military Buildup Office

From: Matrix Design Group, Inc.

Date: June 2013

Subject: **Guam Zero Waste Plan: Basis for Job Creation Estimates**

The purpose of this technical memorandum is to partially fulfill the requirements of Task Order GR0706-08-03-10-01, Deliverable 4.1, by providing the Government of Guam (GovGuam) with a job creation estimate for implementing waste diversion policies, programs, and infrastructure and those associated with implementing the Zero Waste Initiatives detailed in the Guam Zero Waste Plan.

Jobs Estimate Basis

Job creation estimates for the Guam Zero Waste Plan have been developed using several sources (listed below), which currently represent the best data available. These sources vary in materials, geography and time periods analyzed. An average of applicable estimates from these sources has been compiled for use on Guam and is used to provide a general indication of potential new job creation associated with new or expanded waste diversion policies, programs, and infrastructure. As none of the sources specifically includes job creation data from Guam or any island community – therefore cultural differences, shipping constraints, on-island collection practices, lack of local markets, and other factors may alter results for Guam.

Data Used to Estimate Job Creation as Guam Implements Its Zero Waste Plan

TABLE 1. Data Used to Estimate Job Creation

Jobs Per 1,000 Tons					
RECYCLING ACTIVITY	TELLUS/SRM [a]	NERC [b]	CRI [c] (alum cans, glass bottles, PET bottles only)	ILSR [d]	Average
Collection					
General	1.67		2.30		
Public collection		2.01			
Private collection		1.18			
average					*1.80*
Paper/Container Processing					
General	2.00				
Materials recovery facility		0.62	0.64	1.00	
average					*1.07*
Organics Processing					
Composting		0.92		0.40	
Processing organics	0.50				
average					*0.61*
Retail Used Merchandise Sales		4.6 employees/business			
Pavement Mix Producers (asphalt & aggregate)		0.15			
average					*0.15*
Disposal					
trash collection	0.56		1.17		
average					*0.87*
landfilling	0.10		0.04	0.10	
average					*0.08*

a. Tell us Institute and Sound Resource Management's "More Jobs, Less Pollution: Growing the Recycling Economy in the U.S." (approx 2011) - based on 2008 data

b. DSM Environmental and MSW Consultants' "Recycling Economic Information Study Update: Delaware, Maine, Massachusetts, New York and Pennsylvania Final Report" (2009) - based on 2007 data for five New England states only

c. Container Recycling Institute's "Returning to Work - Understanding the Domestic Job Impacts from Different Methods of Recycling Beverage Containers" (2011) - pertains to container recycling only

d. Institute of Local Self-Reliance's " Recycling Means Business" (1997)

Results of Job Creation Estimate for Guam Zero Waste Plan

The average job creation rates identified above were applied to the projected quantities of diverted used building materials, recyclables, and organics to estimate the new processing positions likely generated as the Guam Zero Waste Plan is implemented (see Table 2 below). It should be noted that Table 2 does not consider increases needed in GovGuam staffing for the Zero Waste Initiatives.

Table 2 presented provides slight different numbers for job creation estimates that what is presented in the individual White Papers provided in Volume II of the Guam Zero Waste Plan. This is a direct result of implementing the Phasing Strategy presented in Section 5 of Volume I. Implementing the Zero Waste Initiatives in a phased manner will result in a job creation delay beyond that originally presented in the individual White Papers provided in Volume II. As part of the recommended Phasing Strategy, where initiatives overlapped, a reduction was made in Table 2 below to prevent over-estimating staffing needs and job creation estimates.

TABLE 2. Job Creation Estimate for Guam's Zero Waste Plan[a] (rounded to nearest 1 Full Time Equivalent [FTE]) Based on BluePrint Phasing Implementation Strategy Recommended in Volume I

Initiative		2015	2020	2025	2030
Upstream					
	Green/ Environmentally Preferable Purchasing Program	0	0	0	0
	Extended Producer Responsibility			13	27
	Plastic Bag Disposal Ban	0	0	0	0
	Pay-as-You-Throw Pricing (b)	2	10	13	15
Mid-Stream					
	Greening Roadway Paving			3	3
	Used Building Materials Facility		5	5	5
	3R Requirements for Buildings			1	1
	Illegal Dumping and Litter Control		2	2	2
Downstream					
	Organics Recovery Composting System		3	3	5
	Construction and Demolition Debris Processing Facility (25% service area only)		1	1	1
	Construction and Demolition Debris Diversion Policy			1	2
Global					
	Zero Waste Association	0	0	0	0
	Recycling Grant Program	6	8	15	15
	Education and Outreach	0	0	0	0
	Evaluation of Funding Sources	0	0	0	0
Total Jobs		***8***	***29***	***57***	***76***
Assumed on-island jobs[c]		***7***	***20***	***31***	***37***

a. Adjustments have been made in job estimates to address likely duplication between overlapping alternatives with the exception of the Guam Zero Waste Grant Program (which may overlap with the UBM, compost and C&D facilities)

b. The Bluepint Implementation Strategy presented in the Guam Zero Waste Plan, Volume 1 Section 5 expands PAYT implementation into Phases II and II, which is beyond that originally presented in the PAYT White Paper provided in Volume II.
[C] On-island job estimate based on assumption that only 50% of jobs associated with processing recyclables (i.e., PAYT and the Zero Waste Grant Program) will be created on Guam - only 10% of jobs associated with diverted e-waste will be created on Guam

Job creation observations include:

- Collection jobs - it was assumed for most alternatives that any new jobs associated with hauling diverted materials would be off-set by lost trash hauling jobs (the exception is the UBM facility, which will require additional transportation for the delivery of resold materials and includes these jobs is that estimate).
- Efficiencies may be expected to increase (and jobs decrease) as quantities grow - the sources used to determine job creation factors were generally based on much larger populations than Guam and likely include a higher efficiency (and possibly fewer jobs) than will ultimately be observed on Guam.

TECHNICAL MEMORANDUM 6

FINANCIAL MODEL

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Memorandum

Via Email

To: Mark Calvo, Government of Guam
Carol Perez, Government of Guam

From: Matrix Design Group, Inc.

Date: June 2013

Subject: Guam Zero Waste Plan: Financial Model

The purpose of this technical memorandum is to provide the Government of Guam (GovGuam) with an explanation of the methodology utilized to develop the Guam Zero Waste Plan Financial Model. A copy of the Microsoft Excel (MS Excel) file which contains the financial model is included on CD in the Final Zero Waste Plan.

METHODOLOGY

In order to consistently evaluate the financial costs and revenues of the fifteen Initiatives included in the Zero Waste Plan, a financial model was developed. In general, the model considers personnel costs, operational costs, indicted costs, and capital outlays, as well as direct revenues from material sales and avoided landfill costs. The basis for each of these costs is summarized below. The model presents cost estimates for the base year (start-up) as well as costs for 2015, 2020, 2025 and 2030. Since costs, revenues and avoided landfill costs are all presented in 2013 dollars, inflation calculations were not necessary. This is considered significant, given GSWA's potential to request substantial increases for residential and commercial disposal costs at the Layon Landfill.

Personnel – Direct costs for personnel were estimated based on the calculated average compensation for specific departments, using departmental staffing reports and budget reports. For GEPA, which accounts for the majority of positions evaluated in the Zero Waste initiatives, an average compensation of $59,236 is utilized. This includes salaries and benefits. An average compensation of $53,270 was calculated for Procurement (Department of Administration) staff, while an average of $42,070 was used for DPW staff.

Operational Costs – The section of the model incudes direct operational costs, either for startup or for ongoing activities. Startup costs include items such as outside consultants, printing, purchase of signs, and development promotional materials. Ongoing operational costs focus on utility costs for necessary facilities, operating and maintenance costs for vehicles and equipment, and ongoing contracted services.

Indirect Costs – Indirect costs focus primarily on departmental overhead and GovGuam overhead. Departmental overhead includes overhead costs associated with departmental operations, such as materials and supplies, printing, travel, etc. Departmental overhead was estimated to be 18.2%, based on costs identified in GEPA's financial reports. GovGuam overhead is calculated based on the total costs for the Department of Administration (DOA) as they relate to the overall cost for government operations. DOA provides a variety of support services to all departments within GovGuam, such as human resources, accounting, computer/technical support and other services. Based on a review of GovGuam financial statements, it is estimated that DOA accounts for approximately 7.0% of GovGuam's expenditures. As such, 7.0% is added to personnel costs to reflect these support services from DOA.

Capital Outlays – Capital outlays are described more specifically in the individual White Papers. In general, for those initiatives requiring capital outlays, they fall into two general categories – facilities and equipment. Equipment prices were researched on the Internet, based on requirements identified for specific initiatives. In those cases where facilities are required, land purchase is generally included at an average of $200,000 per acre, and facility development costs are included in the range of $80 to $100 per square foot.

Direct Revenues – Direct revenues are estimated based on the anticipated sales of recycled materials. As discussed in the 2012 Memorandum entitled *Markets for Recovered Materials*, some recycled materials can be bailed and shipped off-island. Though many of these products do not directly generate a profit, when the avoided landfill costs are also considered, most recycled materials generate positive economics. For other materials, particularly those that are normally shipped to hardfills, revenues are expected to be "local", as materials such as compost, aggregate and ground wood can be re-sold in the local marketplace. Revenues from these materials are generally included at a retail sales rate of $15 per ton.

Avoided Landfill Costs – Each White Paper provides an estimate of the tonnage which can be diverted from landfills, including Layon Landfill and the various hardfills on the island. These tonnage estimates were used to project avoided landfill costs, with municipal solid waste (MSW) tonnage estimated at the Layon rate and non-MSW tonnage estimated at the hardfill rate.

DESIGN

The Zero Waste Plan financial model was saved as a MS Excel workbook file. Within the workbook are a collection of worksheets. One worksheet is included for each of the fifteen initiatives evaluated in the Zero Waste Plan. Each zero waste initiative worksheet can be accessed by double-clicking the tab located at the bottom of the worksheet and labeled with the (abbreviated) name of the initiative (see Figure 1).

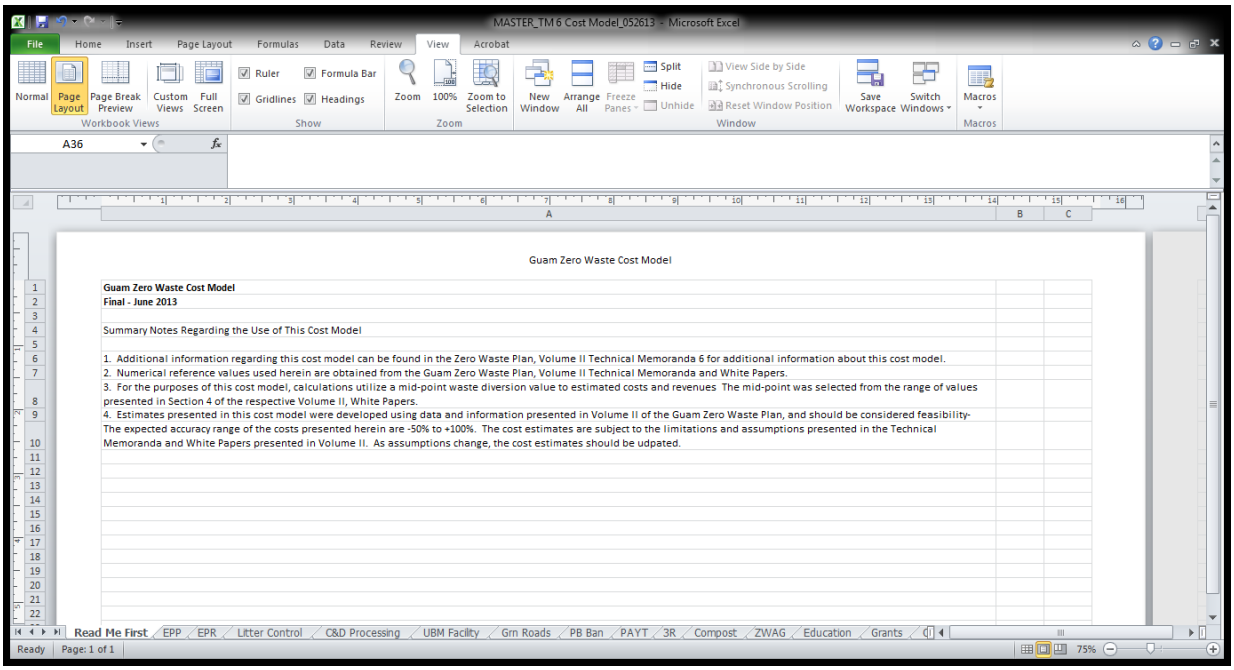
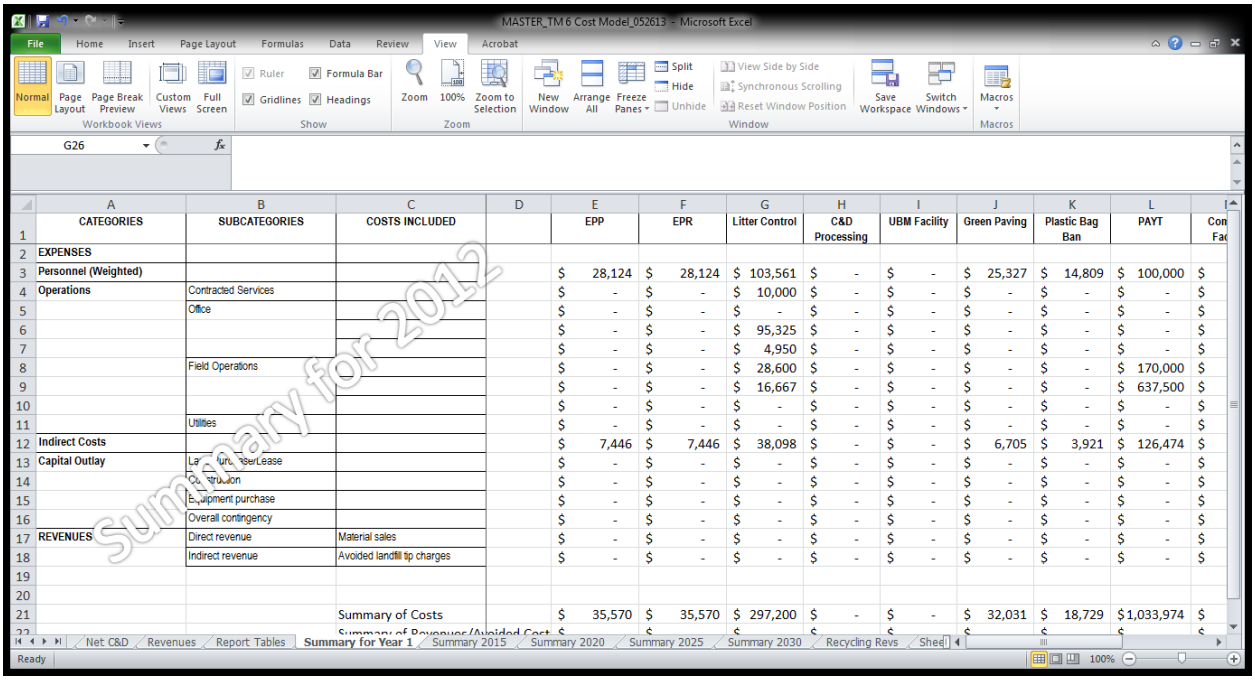


Figure 1.

Summary worksheets containing tables with numbers consolidated from the various initiative worksheets are also contained in the MS Excel workbook file (see Figure 2). The majority of these tables were used in Section 5 of the Zero Waste Plan.



	A	B	C	D	E	F	G	H	I	J	K	L	
1	CATEGORIES	SUBCATEGORIES	COSTS INCLUDED		EPP	EPR	Litter Control	C&D Processing	UBM Facility	Green Paving	Plastic Bag Ban	PAYT	Con Fac
2	EXPENSES												
3	Personnel (Weighted)				$ 28,124	$ 28,124	$ 103,561	$ -	$ -	$ 25,327	$ 14,809	$ 100,000	$
4	Operations	Contracted Services			$ -	$ -	$ 10,000	$ -	$ -	$ -	$ -	$ -	$
5		Office			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
6					$ -	$ -	$ 95,325	$ -	$ -	$ -	$ -	$ -	$
7					$ -	$ -	$ 4,950	$ -	$ -	$ -	$ -	$ -	$
8		Field Operations			$ -	$ -	$ 28,600	$ -	$ -	$ -	$ -	$ 170,000	$
9					$ -	$ -	$ 16,667	$ -	$ -	$ -	$ -	$ 637,500	$
10					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
11		Utilities			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
12	Indirect Costs				$ 7,446	$ 7,446	$ 38,098	$ -	$ -	$ 6,705	$ 3,921	$ 126,474	$
13	Capital Outlay	Land Purchase/Lease			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
14		Construction			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
15		Equipment purchase			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
16		Overall contingency			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
17	REVENUES	Direct revenue	Material sales		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
18		Indirect revenue	Avoided landfill tip charges		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
19													
20													
21			Summary of Costs		$ 35,570	$ 35,570	$ 297,200	$ -	$ -	$ 32,031	$ 18,729	$1,033,974	$

Figure 2.

Each worksheet (also known as a spreadsheet) is a collection of cells on a single "sheet" where data is stored and manipulated via the use of mathematical formulas. When any cell value is changed, the underlying mathematical formula will automatically recalculate to reflect the changed value (see Figure 3).

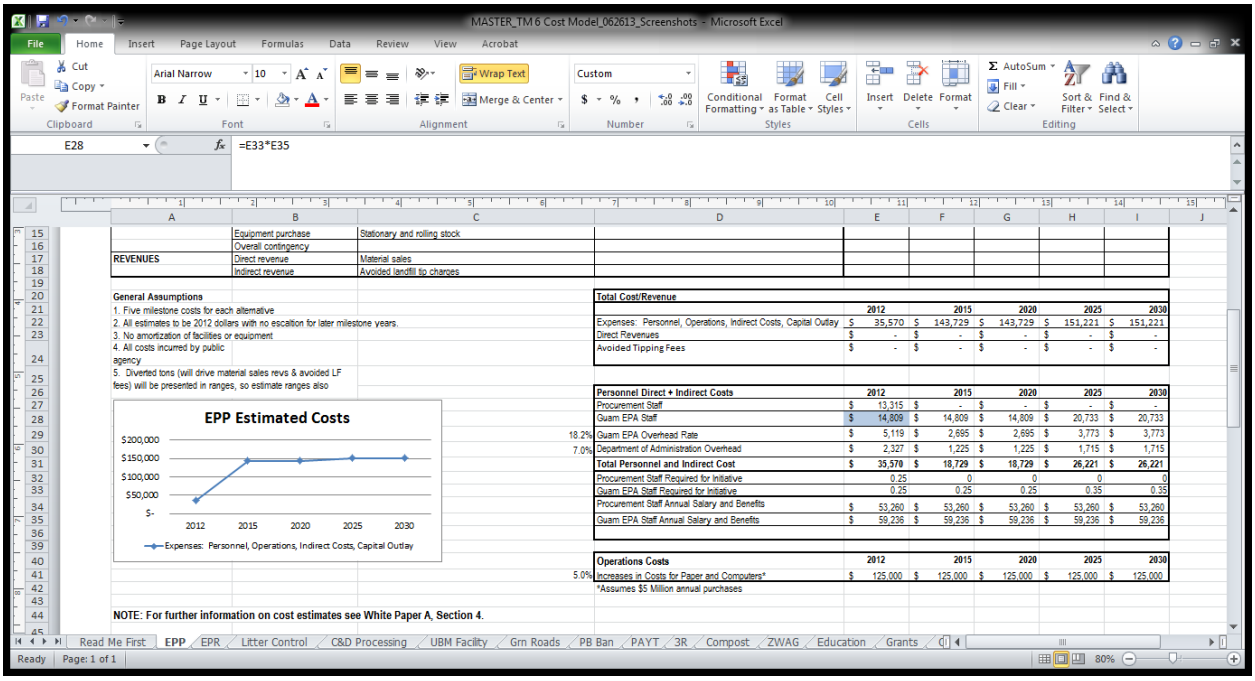


Figure 3.

Data tables which contain various reference values, such as landfill tipping fees in 2012, projected fees in 2015, material resale values, etc., are also contained within the workbook (see Figure 4) and are used in the embedded mathematical formulas. Any change to the data reference tables will also result in an automatic recalculation of values.

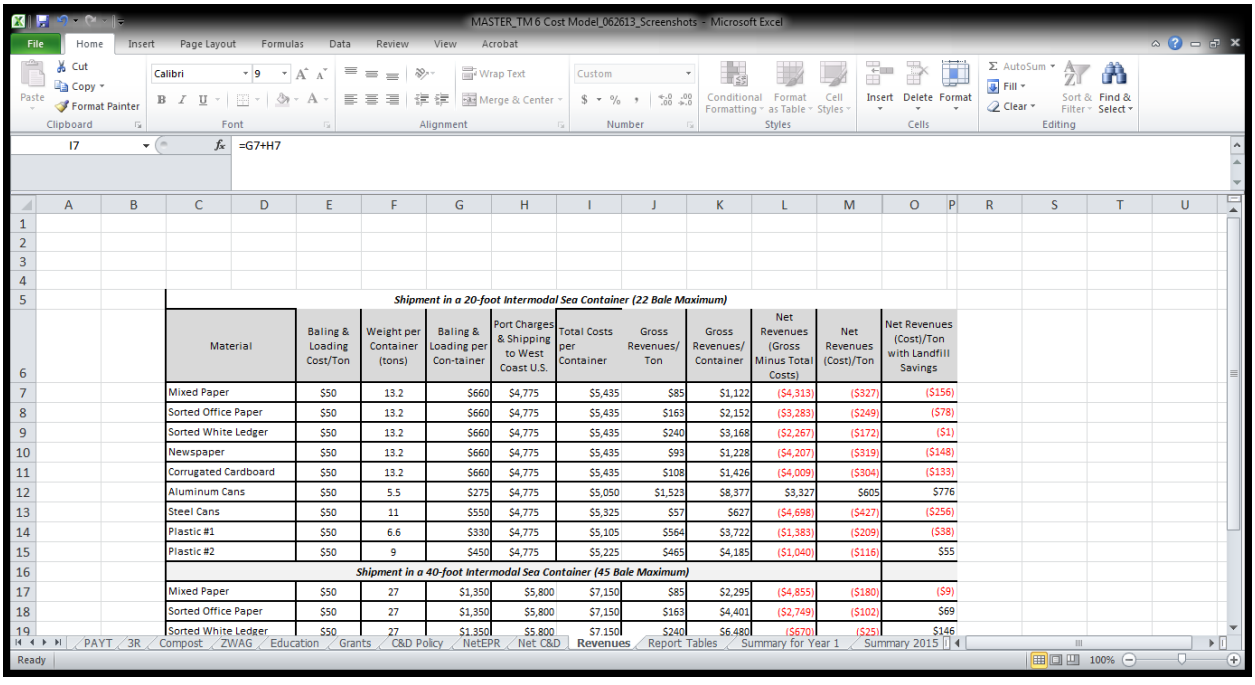


Figure 4.

Zero Waste Financial Model on CD

June 2013

Please see the next page.

TECHNICAL MEMORANDUM 7

LEGISLATION RECOMMENDATIONS AND PROCESS

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Memorandum

To: Mark Calvo, Guam Military Buildup Office

From: Matrix Design Group, Inc.

Date: June 2013

Subject: **Guam Zero Waste Plan: Legislation Recommendations and Process**

The purpose of this technical memorandum memo is to partially fulfill the requirements of Task Order GR0706-08-03-10-01, Deliverable 4.1, by providing the Government of Guam (GovGuam) with a summary of the Zero Waste Initiatives which will require legislation to enact. Several of the Guam Zero Waste Plan alternatives described in the White Papers involve the development of new policy (and ultimately, regulation). These include:

- Funding Sources (Guam Zero Waste Plan, White Paper O)
- Extended Producer Responsibility (Guam Zero Waste Plan, White Paper B)
- Plastic Bag Ban (Guam Zero Waste Plan, White Paper D)
- Pay-As-You-Throw Residential Trash Pricing (Guam Zero Waste Plan, White Paper C)
- 3R Requirements for Building Construction, Demolitions & Operation (Guam Zero Waste Plan, White Paper F)
- Litter Control/Illegal Dumping Enforcement (Guam Zero Waste Plan, White Paper H)
- Zero Waste Grant Program (Guam Zero Waste Plan, White Paper M)
- C&D Diversion Policy (Guam Zero Waste Plan, White Paper K)

Guam has a unicameral legislature (one chamber). There are 15 senators, led by the Senate Speaker. The session is two years long (the current 32nd Legislative Session extends from January 2013 through December 2014). The senators represent two primary parties (the Democrats hold the majority in the current legislature) and staff seven major committees. The committees most likely to hear solid waste bills are the Committee on Rules, Federal, Foreign & Micronesian Affairs, Human & Natural Resources, and Election Reform (environmental issues) and the Committee on Appropriations, Public Debt, Legal Affairs, Retirement, Public Parks, Recreation, Historic Preservation and land (fiscal issues).

As noted in Guam Zero Waste Plan White Papers, it is expected that GEPA will be instrumental in developing and implementing many new policies and programs that support Guam's future zero waste efforts. And while it is possible that the Governor's Office requests the input of GEPA on certain bills, GEPA staff will, in general, not be able to actively pursue legislation (the same will be true of other Guam governmental department staff such as DPW, GSWA, etc.). As a result, it will be critical for other public, private, non-profit and individual stakeholders to both introduce bills and take the lobbying lead - these efforts would ideally be coordinated by the new/expanded zero waste association (referred to elsewhere in this document as the zero waste association of Guam, or ZWAG).

A recommended general approach for developing and shepherding a waste-related bill through the Guam Legislature is described below.

1. Develop Legislative Bill Concept - This step represents initial efforts to develop legislative policy and should include:
   - Identify the initial policy components - such as the responsible parties, specific actions required, exemptions, consequences of non-compliance, fiscal impacts, funding sources, effective and sunset dates)
   - Identify the arguments for and against the policy that may arise from all potential stakeholders - the financial resource requirements will be especially important to estimate well
   - Build a coalition of supporters - also identify/address the viewpoints of potential opponents
   - Obtain considered stakeholder input (both pro and con) - and refine the bill concept

2. Find/Develop Senate Sponsor(s) - This may include one or more senators willing to champion the bill through the Legislature:
   - The sponsor(s) will likely require education about the benefits and impacts of the bill - consider "workshop-ing" the bill when the Legislature in not actively in session (i.e., not in the Session Hall considering/debating proposed legislation or in an official legislative function)
   - Work with Guam Legislature staff to formally write the bill - legislative declaration will be added and it will be assigned a bill number (prefaced by "LS" if the Legislature is in session or by "COR" if not)
   - Work with the sponsor(s) to predict which committee(s) the bill will be assigned to - as noted above, this is likely to be the committee that addresses natural resources unless this is a significant fiscal note, in which case it may initially be heard by the committee addressing appropriations (it is possible that many of the solid waste bills will be heard by both committees)

3. Lobby Bill Through Legislature - This effort will ideally be coordinated by individuals or an organization that understands the legislative process. It could potentially involve a professional lobbyist(s) who is familiar with the legislators, other lobbyists and bill-related sponsors (for example, ZWAG might hire a lobbyist to assist with the passage of one or more bills):
   - General lobbying could be conducted by any stakeholder in support of the bill - the coordinating organization should provide guidance on which legislatures should be targeted and when, and what key message should be conveyed
   - A one-page fact sheet that provides key bill concepts, key benefits, sponsors and contact(s) for more information is invaluable to the lobbying effort (can be used by stakeholders reaching out to legislators, can be provided directly to legislators, posted on websites, etc.)
   - Communications should include e-mail, phone, letter and face-to-face communication meetings - ancillary tools may include bill-specific websites, newsletters, brochures, workshops, public hearings, etc.

- Lobbying efforts should initially target assigned committee members and then the full Senate (once the bill passes through committee, it will be heard and voted on by the full Senate)
- Direct stakeholder testimony will also be necessary when the bill is heard in committee - the lobbying organizer should identify the best representative speakers from stakeholder groups supporting the bill and addressing anticipated opposition (while testimonies are generally short, speakers will likely be required to answer questions and defend their positions)

4. Develop Statute Into Regulation - Once the bill passes through the Legislature and becomes a law, it will likely require implementing regulation. The statutory language should specific what department (e.g., GEPA) must develop these rules and when they need to be in place (i.e., the effective date of the law). Once again, it is likely that ZWAG and other waste diversion stakeholders will be called upon to provide input on rule development and, eventually, implementation.

Please see the next page.

TECHNICAL MEMORANDUM 8

DATA AND DOCUMENT INDEX

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Memorandum

To: Mark Calvo, Guam Military Buildup Office
Carol Perez, Guam Military Buildup Office

From: Celeste Werner, Matrix Design Group, Inc.
Julie Carver, Matrix Design Group

Date: June 2013

Subject: **Guam Zero Waste Plan: Data and Document Index**

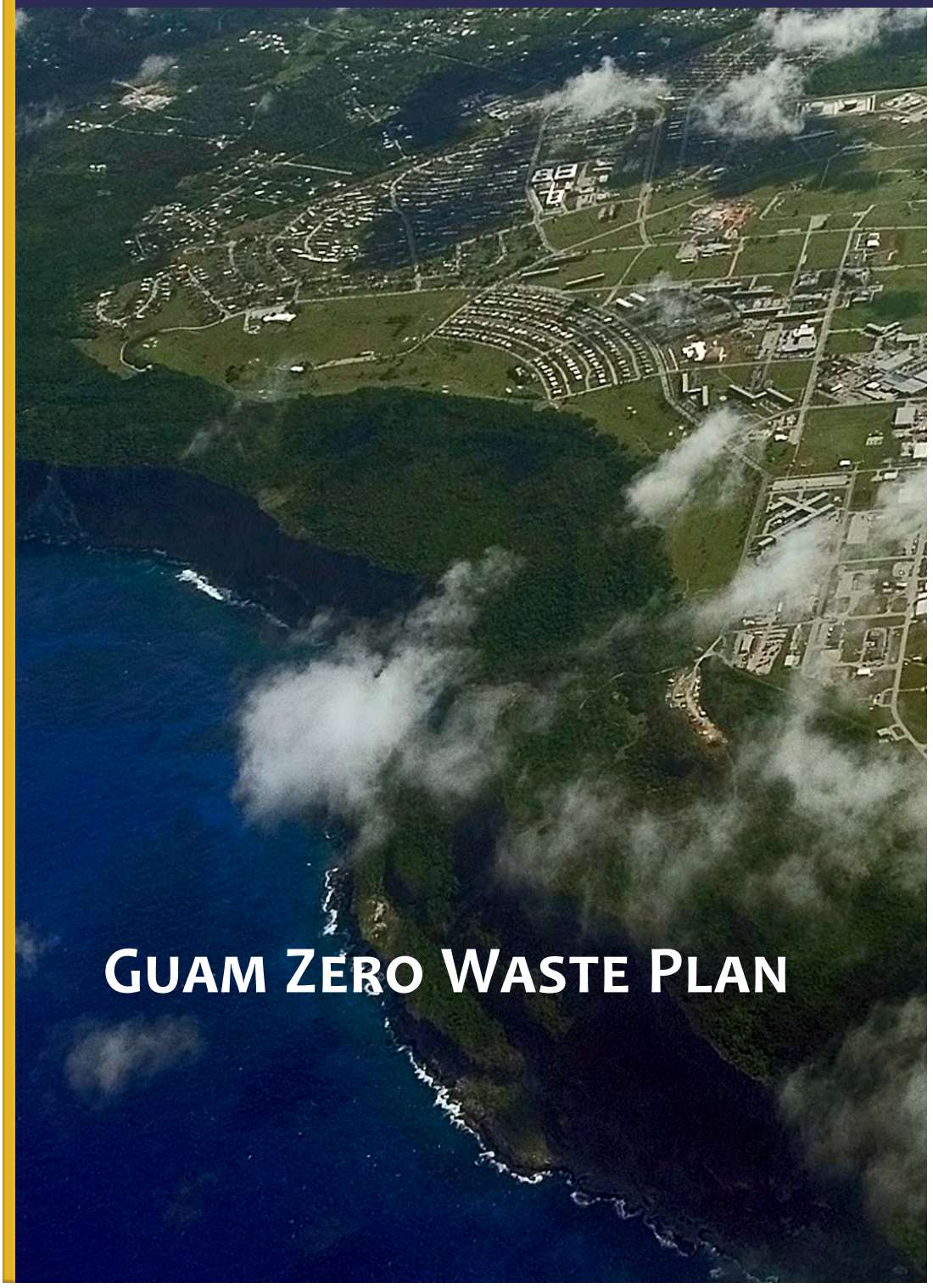
The purpose of this technical memorandum is to partially fulfill the requirements of Task Order GR0706-08-03-10-01, Deliverable 4.1, by providing the Government of Guam (GovGuam) with an electronic copy of the data and documents that were collected by Matrix Design Group, Inc. (Matrix) during research conducted for the Guam Zero Waste Plan. An electronic copy of the document index including all data and documents listed in the attached document index is included on CD in the Final Zero Waste Plan.

Data and Document Index on CD with Electronic Library of Information in Index

June 2013

ONEGUAM
ONE ISLAND. ONE VISION. ONE FUTURE.

White Papers



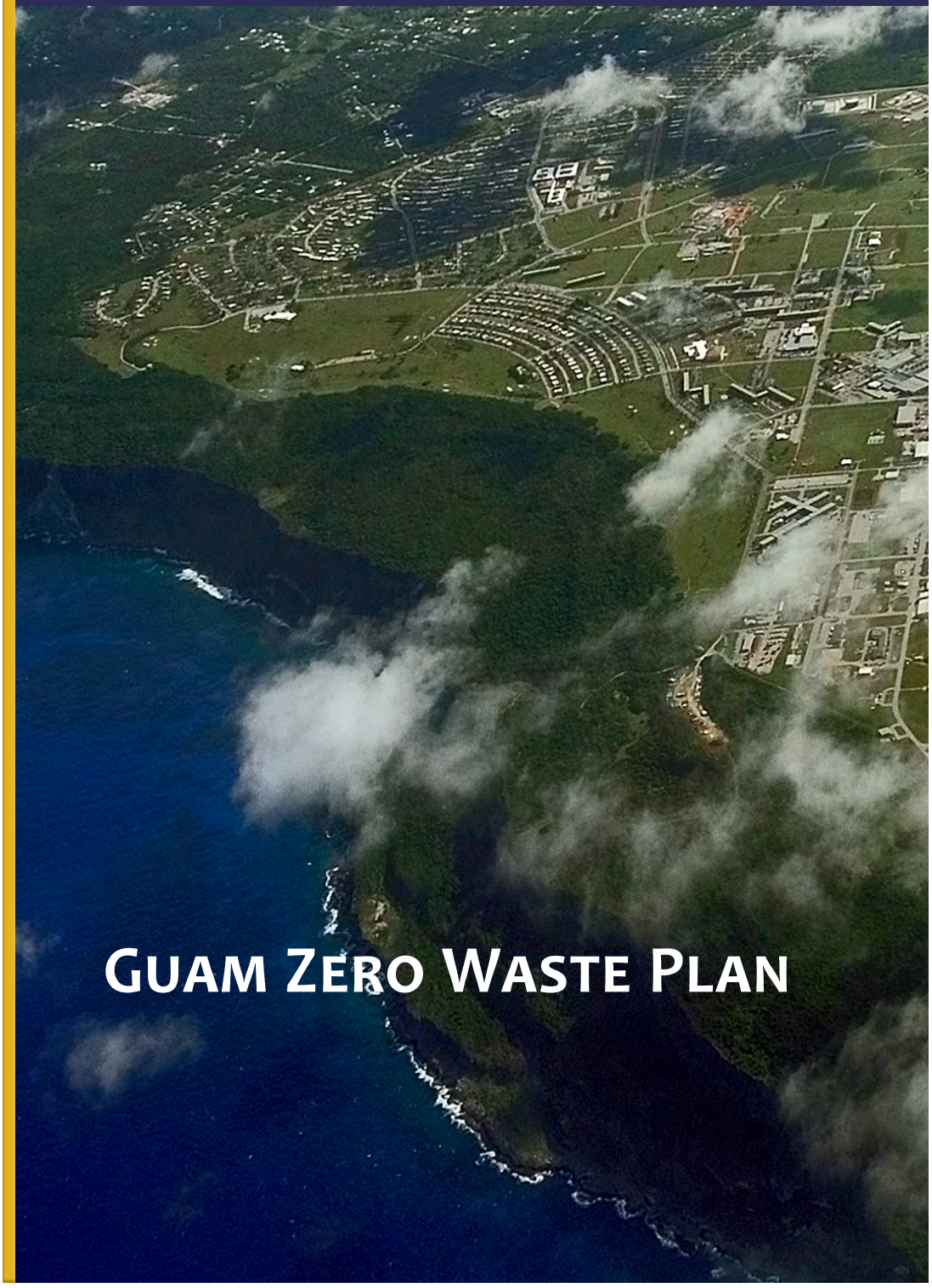
Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

Please see the next page.

ONEGUAM
ONE ISLAND. ONE VISION. ONE FUTURE.

White Paper A



Guam Zero Waste Plan

WP A

Please see the next page.

WHITE PAPER A

GREEN/ENVIRONMENTALLY-PREFERABLE PURCHASING PROGRAM

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Green/EPP Program*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Zero Waste Association*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving*

Purpose

This white paper, which is one of fifteen, presents an analysis of measures that can be implemented to create a new Green/Environmentally-Preferable Purchasing (EPP) Program to provide government leadership on Zero Waste by focusing on the initial acquisition of environmentally preferable office paper and electronic office equipment. In addition, to raise awareness of green purchasing and support Guam's green tourism leadership, a green meeting policy is recommended. As recycling and composting expand in Guam, focusing on additional environmentally preferable products should be prioritized.

White Paper Organization

This white paper is organized into the following primary sections:

- **Section 1** presents the purpose of this paper, provides a roadmap of the document and includes a snapshot of select key findings.
- **Section 2** provides an overview of the alternative.
- **Section 3** presents an implementation overview.
- **Section 4** summarizes benefits and impacts that may occur if/when the alternative is implemented.
- **Section 5** provides a list of resources and references that can be consulted for additional information.

Key Findings

Green purchasing is a purchasing policy that involves identifying, selecting and purchasing products (i.e. goods and services) with significantly fewer adverse environmental impacts than competing products. Guam does not currently have a Green Purchasing Policy. Green purchasing is typically implemented through a modification of existing purchasing practices, and it is assumed that this policy would initially apply for the procurement of products by GovGuam agencies only. It is expected that Guam Environmental Protection Agency (GEPA) and the General Services Administration (GSA) of the Guam Department of Administration would be the lead agencies for implementation and would coordinate with both the Governor's Office (Procurement Policy Office and Procurement Advisory Council) and other agencies as needed.

There are significant online guidance, training, and procurement specifications freely available for GovGuam to use in the development of this policy. Following are key implementation steps that will need to be taken to implement this policy:

- Create an inter-agency green purchasing team.
- Research Green Purchasing Program application and costs.
- Establish a policy.
- Evaluate existing vendor contracts and establish requirements for new bids.
- Provide staff training and promote a green recycling ethic.
- Conduct a pilot program implementing policy requirements (Recycled Copy Paper, Green Electronics, Green Conference Policy).
- Track and share results.
- Modify policy over time.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of green purchasing, including background information, examples of similar initiatives that have successfully been implemented worldwide, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What is Green Purchasing?

Green purchasing, also commonly referred to as green or environmentally preferable purchasing or EPP, is a purchasing policy that involves identifying, selecting and purchasing products (i.e. goods and services) with significantly fewer adverse environmental impacts than competing products. Green purchasing involves considering the costs, environmental characteristics and performance of a product in all stages of its life-cycle, from product design, development and production/provision, through product use, to the ultimate handling (i.e. recovery, recycling, re-use and/or waste disposal) of whatever remains of the product at the end of its useful lifespan.

Green procurement is rooted in the principle of pollution prevention, which strives to eliminate or to reduce risks to human health and the environment. It means evaluating purchases based on a variety of criteria, ranging from the necessity of the purchase in the first place to the options available for its eventual disposal.

Green products are generally produced in a manner that consumes fewer natural resources or uses them more sustainably, as with sustainable forestry. They may involve less energy in their manufacture and may consume less energy when being used, and they generally contain fewer hazardous or toxic materials. Green products are also generally designed with the intention of reducing the amount of waste created. In addition, green products generally require fewer resources to manufacture and operate, so savings can be made on energy, water, fuel and other natural resources (Green Council, 2013; International Institute for Sustainable Development, 2013).

Existing Programs on Guam

GovGuam does not currently have a green purchasing program in place. However, Guam law requires GEPA to identify "economically priced" recycled products that could be used in place of products made from virgin materials for government use (Title 10, Division 2, Chapter 51 of the Guam Code Annotated).

Federal agencies and state agencies that use federal funds are required to comply with Presidential Executive Order 13423 with respect to the use of federal funds for procurement to purchase green products and services. The United States Environmental Protection Agency (USEPA) has developed a Comprehensive Procurement Guideline (CPG) Program to provide purchasing and product selection guidance on recycled content products and a Green/EPP with a wide range of green purchasing guidance.

Successful Approaches Used in Other Locations

Green purchasing is becoming commonplace for many governments at both the city, county and state level, as well in businesses around the world. Most states have implemented some form of Green/ EPP policy through legislation or executive order. The federal government and Department of Defense (DOD) have become leaders

in environmentally preferable purchasing. In a recent study conducted by the Responsible Purchasing Network (RPN), the majority of 130 organizations surveyed emphasized their use of environmental and social criteria when purchasing (RPN, 2013). Each of these organizations spent between $3B and $10B in 2010 on these purchases, which indicates the growing trend on demand for green products. The most common green products targeted were office paper, paper products and computers.

Purchasing Environmentally-Preferable Office Paper

Green specifications available for paper purchasing and best practice recommendations are widely available and typically target both production and usage:

- Paper Use Reduction. Office best practices include increasing electronic versus hard-copy document transmission and procuring duplex printers and setting them to default duplex mode. It is noted that green paper procurement costs can be less than traditional paper purchasing practices when coupled with paper use reduction.
- Recycled Content. Typically, the primary specification is for some level of recycled content. For examples, 30-50% is the most common range for copy paper although up to 100% post-consumer content is available. Specifying 100% post-consumer recycled paper best advances Zero Waste (post-consumer waste is typically defined as waste produced by the end consumer of the material (e.g., waste scrap generated in the manufacturing process would not be considered post-consumer).
- Certifications. Green Seal, Forest Stewardship Council
- Other specifications may include acceptable forestry practices, chlorine-free certification, chain of custody certification for recycled content and vendor requirements for tree-free alternatives (see Additional Information section)

Purchasing Environmentally-Preferable Office Electronics

The global leader for green electronics is the Electronic Products Environmental Assessment Tool (EPEAT) eco-label. EPEAT is the procurement standard for the federal government as well as many state and local governments and businesses. Features of the EPEAT label include:

- A registry of over 2,300 certified computer models that meet various specification levels.
- Imaging equipment (printers, scanners, copiers) will be listed on the registry in 2013, as will televisions
- ENERGY STAR specifications are embedded in EPEAT so reduced energy usage is guaranteed.
- Human health, air quality, and ecological benefits from reduced toxic substances and pollution.

Environmentally Preferable Purchasing - Green Meeting and Conference Policy

GovGuam can show Zero Waste leadership by developing a Green Conference Policy appropriate for Guam. Green meeting policy examples and checklists are available (see Section 4). Common green meeting practices include:

- Limiting the use of paper handouts and binders.
- Turning off lights during breaks and at the end of the day.
- Requiring recycling bins.
- Reusable name tags.
- Refreshments/Meals
- Using pitchers and glasses instead of bottled water.
- Preference for reusable dishes and silverware if appropriate cleaning facilities are available.
- Requesting waste reduction in food service (e.g., recyclable/compostable containers/packaging, avoid polystyrene, donate excess food, and creamer bowls instead of individual containers, etc.).

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative can be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Opportunities include:

- Significant online guidance, training, and procurement specifications are freely available for use during the development of this policy.
- Green purchasing results can be converted directly into environmental impacts for outreach and education purposes (trees saved, energy and water conserved, greenhouse gases reduced, etc.).
- Resource conservation with the use of recycled content instead of virgin materials.
- Increased energy conservation by manufacturers of many green products.
- Increased recyclability of most products.
- More sustainable water conservation, greenhouse gas reduction, and fewer forestry and marine environmental impacts.
- Purchasing drives demand for recycled materials and supports design and manufacture of green products and services at competitive prices.
- A Green/ EPP program demonstrates leadership and commitment by local governments for the environmental and worker safety.
- Procurement process provides the ability to include ethical considerations (e.g., labor conventions, fair trade practices and workplace health and safety such as that included in Vancouver, British Columbia's purchasing policy).

- A state or territorial government Green/ EPP program can be a good model for other organizations.
- Green conferences expose attendees to green procurement leadership.

Constraints include:

- Potential for increased green product cost over traditional products.
- Some green products may have limited availability.
- Perceived issues with green product performance.
- Confusion in understanding what is “green”, what eco labels mean, and how to specify green products and services, though confusion is more often associated with building and cleaning products than office products.
- Purchasing organizations and procurement staff needs training to effectively identify, prioritize and purchase EPP products and services.

3. IMPLEMENTATION OVERVIEW

In a number of environmental fields, the implementation of environmental policy has led to significant achievements. The purchasing of goods, which is a direct responsibility of governments, can have significant positive environmental impacts. The following overview provides information on how to turn this notion into action.

Key Stakeholders

Green purchasing is typically implemented through a modification of existing purchasing practices. For the purposes of this white paper, it has been assumed that a green purchasing policy would be developed initially for the procurement of products by GovGuam agencies only. For some programs, government green purchasing efforts are supported by either legislation or executive orders. However, legislation or territorial rule-making is not required. It is expected that GEPA and the General Services Administration (GSA) of the Guam Department of Administration would be the lead agencies for implementation and would coordinate with both the Governor's Office (Procurement Policy Office and Procurement Advisory Council) and other agencies as needed. In addition to procurement agencies, GovGuam management and staff with procurement development and approval authority are also considered key stakeholders.

Another approach that could maximize the impact of green procurement efforts in Guam would be to include other local governments, academic organizations and the University of Guam. The team could also meet with DOD and federal green procurement leaders to learn from their experience.

Major Components

This policy can begin by developing a general green purchasing contract clause and targeting one or two products, and then be expanded over time to address additional products and services. The policy can be a simple modification of existing purchasing practices. There are numerous green purchasing resources available on the internet, and several of the more helpful ones are listed in Section 5. Examples of common green purchasing practices include:

- Cleaning Products.
- EnergyStar Products (e.g., appliances, lighting, windows, electronics, and heating and cooling products.
- Building Products.
- Fleets.
- Food Service.
- Integrated Pest Management (reduced use of pesticides).

Following are a number of implementation steps GovGuam can take to develop a Green Purchasing Program.

Create an Inter-Agency Green Purchasing Team

Include information technology, purchasing and environmental staff from GEPA and GSA, and consider expanding to include local government and University of Guam contacts. The Team should identify current purchasing practices and quantities of office paper products and office electronics purchased by GovGuam, and evaluate the environmental risks and potential adverse impacts of the various products.

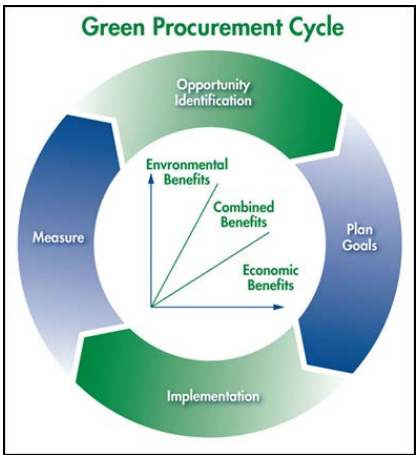
Research Green/EPP Options and Costs

To establish the program effectively, the team should use this information to do preliminary research on the availability and cost of purchasing the following products:

- Recycled Copy Paper: 30% postconsumer recycled content, 50% postconsumer content, and 100% postconsumer recycled content – process chlorine free.
- Computers: Assess current purchasing and which EPEAT equipment is currently being procured or could be substituted.
- Green Meeting and Conference Policy: Review checklists and meet with conference facility managers to discuss options and priorities for greening Guam meetings and conference.

Establish a Green Purchasing Policy

Evaluate potential changes to existing procurement policy practices to prioritize and specify purchasing requirements for computers and paper. Green purchasing criteria should include:



- Develop procurement language - this language should clearly communicate the priority for environmentally-preferable purchasing and ultimately influence the supply chain and contractor/vendor responses (see example language in the Zero Waste Visioning Stakeholder Meeting Conclusions Technical Memorandum);
- Certifications and eco-labels – Some products meet nationally-accepted environmental standards or have received eco-labels verifying environmental benefits such as recycled content, "green" packaging, durability, energy conservation, reduced toxicity, end-of-life management, producer take-back requirements and export standards as well as product information disclosure. Links for examples of these certifications are included in Section 4;
- Availability - should not be an issue for eco-labeled office computers, other office equipment, and paper (can be an obstacle for some cleaning and construction products);
- Performance - it is expected that GovGuam will require computer/office equipment and paper products to meet (or exceed) the performance of existing products (durability should be a key performance criteria to increase product life); and
- Price - most green purchasing policies allow a price premium for environmentally-preferable products (the RPN survey reported that survey organizations were willing to pay as much as 15% more for some green products). This will likely be a product-by-product decision (e.g., the electronic equipment price premium for EPEAT-registered products is typically 5%; the paper price premium for paper with at least 30-50% post-consumer recycled content is typically 5%).

Evaluate Existing Vendor Contracts

Identify the next bid opportunity when product specifications can be changed (where current vendors do not have desired certifications or ability to comply with other requirements, it will be necessary to identify alternative vendors).

Modify Vendor Bid Requirements/Product Specifications

Include green purchasing documents and required and/or preferred product specifications and certifications or eco-labels (see Additional Information sections for contract language examples).

Consider Cooperative Purchasing Contracts

These allow multiple purchasers to procure products and services under one regional or national contract to minimize administration (i.e., bidding efforts) and leverage collective purchasing power (i.e., better pricing, better vendor response). There are several links to cooperative contracting programs suitable for GovGuam in the Section 4. Contract pricing could potentially be made available to academic institutions and/or local government.

Provide Staff Training and Promote Conservation/Recycling Ethic

Target the IT and purchasing departments for procurement, and all workers for green meetings/conferences, product use and recycling. For example, a green purchasing myth that would require "debunking" by a good education program is the fear that recycled-content paper cannot be used in humid climates.

Consider Conducting a Pilot Project

One implementation alternative would be to "pilot" the green purchasing policy change in GEPA first, and then expand to other agencies. The GovGuam agencies should begin purchasing recycled paper, EPEAT electronics and piloting green meeting and conference practices. However, the greater the size of the green purchase orders, the better the pricing that can be obtained. Therefore, it is recommended instead that GovGuam agencies adopt green purchasing practices for one or two of the office products shown in Table A-D.1 (see below), plus one or two of the office electronics listed on the registry at www.epeat.net, then evaluate expansion to new products and/or services every two or three years. Future products could be expanded to include cleaning products, fleet operations chemicals and materials, carpet, etc.

TABLE WP-A.1 PAPER PRODUCTS AND USEPA'S RECOMMENDED RECYCLED-CONTENT LEVELS

PRODUCT	USE	POST-CONSUMER RECYCLED CONTENT (% by weight)	TOTAL RECYCLED CONTENT
Reprographic	Copy paper	30%	30%
Envelopes	Envelopes	30% (wove) 10-20% (Kraft, white, colored) 10% (Kraft, unbleached)	30% (wove) 10-20% (Kraft, white, colored) 10% (Kraft, unbleached)
Cover Stock	Document covers	30%	30%
Coated	Posters and brochures	10%	10%
Corrugated Containers	Packaging (boxes)	25-50% (<300 psi strength) 23-30% (300 psi strength)	25-50% (<300 psi strength) 23-30% (300 psi strength)
Industrial Paperboard	Packaging (tubes)	45-100%	100%
Padded Mailers	Mailers	5-15%	5-15%

Source: US EPA 2007 Comprehensive Procurement Guidelines - Paper, EPA530-F-07-039 (standards also available for checks, bathroom tissue, food tray liners and other paper products)

Post-consumer = paper product used as a consumer item or is waste from paper-making process

Track and Share Results

These should include product quality, environmental benefits (tons disposed versus diverted, greenhouse gas reductions, etc.) and cost changes over time (see the Additional Information section for links to the RPN, Environmental Paper Network, and USEPA benefit calculators).

Identify Future Product/Service Targets to Add to Green Purchasing Policy

Once the initial program is running smoothly, additional/new targets could be added over time (i.e., include computers, printer/copiers, toner cartridges, phones, servers, electronic equipment, fleet vehicles and tires, fluorescent and LED lighting, paint, building materials, cleaning products, etc.).

Promote GovGuam's Green Purchasing Policy as Model for Others

These can be a model for island municipalities, villages and schools (these organizations' ability to join in GovGuam's cooperative purchasing contracts will likely be a strong selling point). Island business may also utilize the GovGuam model.

Systematic Review

In order to establish whether the scheme is meeting its goals and objectives, it is important that a systematic review of the green purchasing program be carried out on a regular basis. The review should take into account changing environmental goals.

Major Milestones

To implement this alternative, the following milestones should be focused on initially.

- Green purchasing will require modification of existing GovGuam procurement policy. Legislation or an executive order could institutionalize green purchasing, but legislation is not essential. It is expected that green purchasing recommendations can be put into place through an administrative process that is led by GEPA and GSA staff with input from the Governor's Office. Modification of existing policies for one or two office paper and electronics products could be undertaken within 3 months of initiation of this alternative.
- The evaluation of existing vendor contracts, modification of bid requirements and product specifications, development of a green meeting/conference policy, and consideration of cooperative purchasing contracts could begin as soon as the initial green purchasing policy products are identified. It is expected that these activities could be completed within 6 to 12 months of initiation with existing staff resources.
- The initiation of staff training on the benefits of a green purchasing program should begin immediately upon finalization of the green purchasing policy.
- Once the initial program is running smoothly, additional/new targets should be evaluated and added over time (e.g., every 2 to 3 years).

Challenges

Key challenges to implementing a green purchasing program include:

- Availability – local distributors may not stock sustainable products, or only stock in small quantities. This challenge can be overcome by working with suppliers and distributors, as green products are now widely available.
- Cost – although many studies now show the long-term cost savings of buying "Green," there may be somewhat higher upfront costs for switching to these environmentally-friendly products.
- Insufficient knowledge – many organizations are unfamiliar with the concept of green procurement or with the options available to them. For an organization to participate, it must have an understanding of concepts, vocabulary and terms.
- Internal education and regulation – GovGuam will face the challenge of training employees that make purchasing decisions and ensure the newly preferred, sustainable products are being purchased.
- Purchasing habits: 'We've always done it this way' can be a difficult mentality to overcome. There may also be existing relationships between purchasers and suppliers that make it difficult to switch to alternatives.
- Supplier information – obtaining up-to-date product specifications, including environmental specifications, from suppliers can be difficult.
- Time to implementation – changes do not happen overnight. It takes time to research, negotiate and implement a successful green purchasing program.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

A Green/EPP Program is not expected to directly lead to significant diversion of more computer and office paper waste on Guam. However, both recycling programs influenced by this policy and a recycling ethic shared with GovGuam workers, and by extension their families, will have a ripple effect island-wide that will support increased resource management and waste diversion efforts over time.

Job Creation Potential and Small Business Opportunities

The cost and revenue information developed for the Green/EPP Program indicate limited opportunity for direct job creation outside of GovGuam agencies. The Green/EPP Program will, however, provide an opportunity for small businesses which can provide products that meet the Green/EPP Program goals with an opportunity to provide these products to GovGuam.

Estimated Revenue Generation

No direct revenue is expected as a result of the Green/EPP initiative, as no waste materials will be directly diverted from landfill disposal.

Avoided Landfill Disposal Costs

The Green/EPP initiative is not expected to result in any avoided landfill disposal costs, as no waste materials will be directly diverted from landfill disposal.

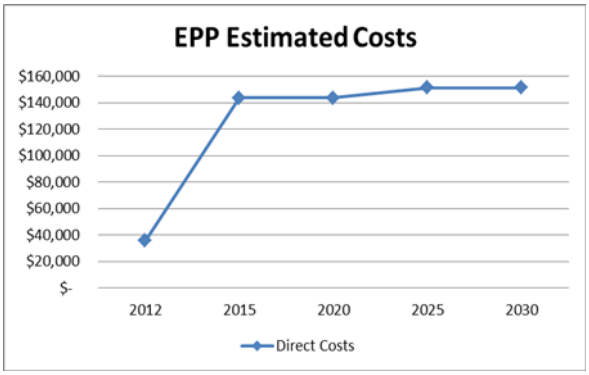
Human Health and Environmental Impacts

RPN reports that the average lifespan of an office computer is about three years, and most users replace - rather than upgrade - their equipment at end-of-life. Production of new computers and other office electronics requires significant natural resource, energy and water consumption. Disposal generates a waste stream with toxic metals and compounds (there is on-going work across the globe to minimize management of the e-waste stream in areas with inadequate environmental controls and by workers with minimal protection).

While end-of-life paper waste is easily recycled or composted, the lack of rigorous in-house recycling programs in many office environments means many million tons per year are disposed instead. Office paper production impacts human health and the environment negatively in many ways. Many of these impacts are exacerbated by the use of virgin materials. These negative impacts include:

- Deforestation;
- Increased energy and water consumption in paper-making;
- Water, air, and habitat pollution generation;
- Release of hazardous chemicals; and
- Waste production.
- However, recent research verifies that the production of every ton of 100% recycled-content paper:
  - Consumes 24 less trees;
  - Requires 33% less energy; and
  - Produces 37% less greenhouse gases, 49% less wastewater and 39% less waste than a comparable ton of paper made with virgin paper (Kinsella, 2012).

Economic Costs



Green purchasing will require modification of existing GovGuam procurement policy (i.e., no legislation should be required). It is expected that this will be researched and put into place through an administrative process that is led by GEPA and GSA staff with input from the Governor's Office.

Significant cost assumptions for the Green/EPP include:

- Policy development will occur in 2013-2014; development of policy will require the following professional staff with 0.25 FTE from GEPA and 0.25 FTE from the Department of Administration (Procurement) to establish this policy and develop a working program for all GovGuam agencies at the outset;
- Ongoing operations will extend from 2015 through the remainder of the planning period with 0.25 FTE from GEPA in the future to monitor, track and report enforce the provisions of the Green/EPP, increasing to 0.35 FTE in 2025;
- GovGuam overhead costs for Department of Administration included at 7% of salaries, and GEPA overhead of 18%;
- There will be no new equipment or other office requirements; and
- Incremental costs for purchasing paper and computer products under the Green/EPP, assumed at a 5% premium on 50% of the estimated average annual acquisition cost of $5 million.[1]

After first year costs of almost $36,000, total costs for the enactment of the Green/EPP initiative are estimated to range from $144,000 to $151,000 annually over the planning period, which will be primarily driven by the $125,000 pricing premium for paper and computer products. Without this premium, the initiative is expected to cost less than $27,000 annually once the program is implemented. No facilities or land acquisition are anticipated, and no additional expenses are included.

[1] Estimated assumes average annual spending for paper products and computer equipment of $5 million, 50% of which ($2.5 million) would be affected by the Green/EPP initiative. This assumption may be over-estimated, however, and should be verified to confirm actual program costs.

5. ADDITIONAL INFORMATION AND REFERENCES

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- City of San Diego green purchasing policy. www.sandiego.gov/environmental-services/recycling/ep3/pdf/sample_contr_lang.pdf
- Eco-labels – Listing of over 400 eco-labels. www.ecolabelindex.com/ecolabels/
- General Services Administration – Provides consolidated contracting opportunities for states and local governments. www.gsa.cov/content/141511
- National Association of State Procurement Officials (NASPO) and Western States Contracting Alliance (WSCA) - provides cooperative purchasing opportunities. www.naspo.org
- Northeast Recycling Council's Environmentally Preferable Purchasing Network (EPPNet) –A list-serv for public and private purchasers with example policies, specifications, vendors and performance metrics. www.nerc.org/eppnet/index.html
- Responsible Purchasing Network (RPN) – An international stakeholder network for socially responsible and environmentally sustainable green purchasing practices. www.responsiblepurchasing.org
  - Certified green products database, policy/contract language, consulting and other
  - Cost benefits calculator
  - Requires membership (nominal cost of $225/year for small states and cities)
- US Communities Green Purchasing Cooperative. www.uscommunities.org
- USEPA Comprehensive Procurement Guideline Program – Recommendations for minimum recycled-content products procured by federal agencies. www.epa.gov/cpg/products.htm
- USEPA Final Guidance on Environmentally Preferable Purchasing. http://www.epa.gov/epp. EPP guide for federal agencies with example policy language that could be utilized by GovGuam: www.epa.gov/epp/pubs/guidance/finaleppguidance.pdf
- Green Council, www.greencouncil.org, January 2013.
- International Institute for Sustainable Development, www.iisd.org, January 2013.
- Responsible Purchasing Network, www.responsiblepurchasing.org, November 2012.
- Kinsella, Susan, Calculating Recycled Paper, Resource Recycling, and November 2012.
- Vancouver, BC Sustainable Purchasing Policy. vancouver.ca/green-vancouver/sustainability-purchasing.aspx**.**

Paper Purchasing Resources

- Environmental Paper Network Paper Calculator. www.papercalculator.org
- Forest Stewardship Council – Certifies products made from sustainably harvested wood or harvesting practices. www.fscus.org

- Green Seal – A non-profit organizations providing procurement and product/service certification and technical assistance. www.greenseal.org

Electronic Equipment Purchasing Resources

- EPEAT – Provides product registry and certifications for computer, television, and imaging equipment purchases; example policy/contract language, training and other services. www.epeat.net
- ENERGY STAR – Joint USDOE and USEPA program for identifying energy-efficient products. www.energystar.gov
- E-Stewards Standards for Responsible Recycling and Reuse of Electronic Equipment – Certifies recyclers with focus on conformance with the Basel Convention. http://e-stwards.org/certificationoverview/
- Product Stewardship Institute – Includes purchasing guide for computers. www.productstewardship.us
- R2 Solutions – Non-profit organization with education and outreach services. www.r2solutions.org/version2/about-R2-solutions

Green Meeting and Conference Resources

- BlueGreen Meetings. www.bluegreenmeetings.org
- General Service Administration Sustainable Travel Bulletin. www.gsa.gov/graphics/ogp/FTRbulletin10-06.doc.
- National Recycling Coalition's Green Meetings Policy. www.fs.fed.us/sustainableoperations/greenteam-toolkit/documents/NationalRecyclingCollolitionGreenMeetingsReference.pdf.
- USEPA Region 9 Green Meeting and Conference Policy. www.epa.gov/region9/ems/pdf/EPA-R9-Grn-Mtgs-Policy.pdf
- USEPA Region 9 Green Meeting and Conference Policy. www.epa.gov/region9/ems/pdf/EPA-R9-Grn-Mtgs-Policy.pdf

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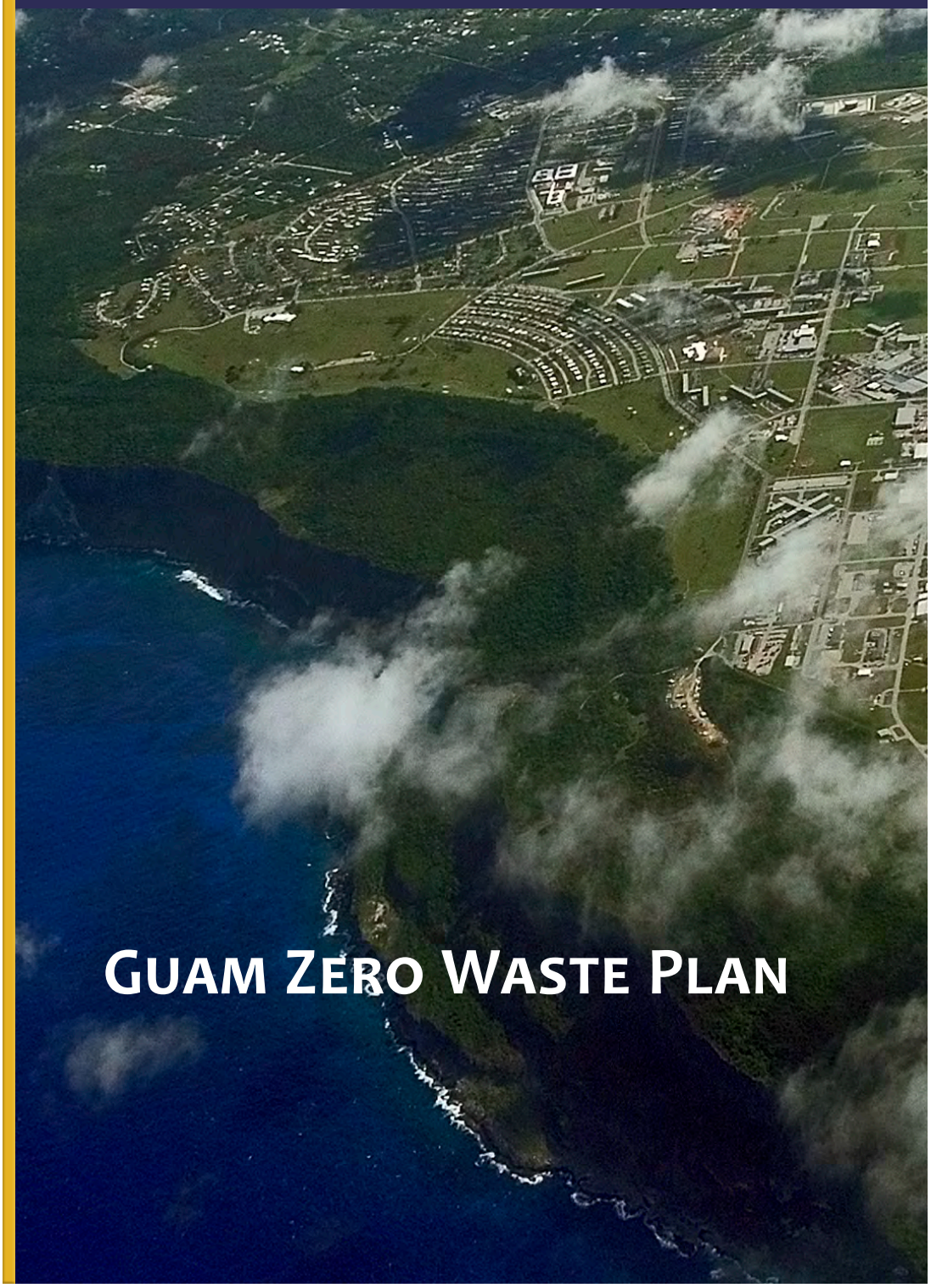
ONEGUAM
ONE ISLAND. ONE VISION. ONE FUTURE.

White Paper B



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP B

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WHITE PAPER B

EXTENDED PRODUCER RESPONSIBILITY

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100*% Recycled Post-Consumer Waste – Process Chlorine Free.*

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste, rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Extended Producer Responsibility*
- *Zero Waste Association*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Green/ Environmentally-Preferable Purchasing Program*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, one in a series of fifteen, presents an analysis of measures that can be implemented to develop an effective Extended Producer Responsibility (EPR) Program on Guam initially focused on electronics and packaging waste (including pallets and shipping containers). EPR is a strategy for incorporating all life-cycle costs of a product into its development and sales price. This strategy engages manufacturers to design to minimize end-of-life management requirements and includes consumers in payment for this management.

Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap of the document, and includes a snapshot of select key findings;
- Section 2 provides an overview of the initiative;
- Section 3 presents an implementation overview;
- Section 4 summarizes benefits and impacts that may occur if/when the initiative is implemented; and
- Section 5 provides a list of resources and references that can be consulted for additional information.

Key Findings

Because EPR is a regulatory mandate, legislation will be required for implementation. Successful legislation would be followed by the development of a territorial regulation that details how the law will be implemented, enforced, monitored and reported. Implementation would be island-wide. It is expected that Guam Environmental Protection Agency (GEPA) and the General Services Administration (GSA) of the Guam

Department of Administration will be the lead agencies for development and ongoing implementation of an EPR policy/program. The following lists key components for the program:

Government Responsibilities

- Identify to whom the regulations will apply and what products will be targeted.
- Identify producer responsibility and reuse/recycling opportunities.
- Identify education requirements.
- Identify diversion goals.
- Pass legislation.

Producer or Shipper Responsibilities

- Manage products in an environmentally and socially responsible manner, and in compliance with all pertinent regulations.
- Describe where products and packaging will be recovered.
- Make collection and management services available and reasonably accessible to consumers.
- Cover security, liability and costs.
- Offer zero-cost recycling, if appropriate - some EPR models include this requirement (can be achieved through mail-back programs or other).
- Label all products sold with brand name.
- Register and pay registration fees - fees can be set to cover the government's cost to manage the program.
- Report annual quantities of products sold and of pounds of product recovered.
- Use registered recyclers and/or reuse facilities to implement their program.

Reuse and Recycling Facility Responsibilities

- Report products processed by producers who comply with EPR regulation.
- Bill registered producers by brand ownership at least once per year.
- Comply with any applicable operational standards, laws and regulations.
- May also be required to register and pay fees.

Consumer Responsibilities

- Take consumed products to designated collection points or return via mail-in programs.

2. INITIATIVE OVERVIEW

This section presents an overview of EPR including background information, examples of EPR programs that have successfully been implemented in other locations, opportunities and constraints associated with implementing an EPR program, and a summary of what exists within GovGuam today with respect to an EPR programs.

What is Extended Producer Responsibility?

EPR is a mandate that requires producers or brand owners to be responsible for their products and packaging through end-of-life. The two key components of EPR are (1) a shift of financial responsibility for product end-of-life management from the local or state government to the producer with government oversight, and (2) the creation of incentives for producers to design products and packaging with lessened adverse environmental impacts (OECD, 2003).

EPR is related to several familiar environmental policies and trends—pollution prevention, design for the environment, "greening" the supply chain, product stewardship, eco-efficiency, and sustainable development. What distinguishes EPR from these concepts is its focus on product system sustainability (USEPA, 1998). EPR is often confused with product stewardship. Product stewardship refers to efforts to reduce any adverse health, safety, environmental, and social impacts of a product over its entire life cycle.

Products typically targeted by EPR programs are those that contain toxins, have low recovery rates, are costly to manage at end-of-life, and/or are problematic in the waste stream. Common products targeted for EPR legislation in the U.S. and Canada include household hazardous waste, electronics, paint, batteries, pharmaceuticals, tires, carpet, fluorescent lighting, gas cylinders, mattresses, pesticides, phone books, thermostats, auto switches, medical sharps, solar panels, textiles, packaging and ceiling tiles. EPR programs can operate effectively in tandem with voluntary product stewardship efforts to expand the materials and products covered. Concurrent landfill disposal bans of materials that are targeted by an EPR law have proven highly effective.

Existing Programs on Guam

GovGuam does not currently have an EPR policy or program in place. It should be noted that although Guam has implemented an advanced disposal fee for automobiles and tires, and efforts to develop implementing regulations for the Guam Beverage Container Recycling Act of 2010 (PL 30-221) are underway, these programs are not strictly considered an EPR strategy as they charge consumers instead of producers.

Although not specifically addressed in this white paper, federal agencies on Guam are required to comply with Presidential Executive Order (EO) 13423, which requires that federal agencies lead by example in advancing the nation's energy security and environmental performance. Requirements in EO 13423 include goals that deal with pollution prevention, electronics management and EPR concerns.

Successful Approaches Used in Other Locations

A wide range of EPR programs have been implemented in jurisdictions around the world (OECD, 2003). Government roles in EPR programs are typically limited to goal-setting, standardization to level the playing field for producers and general administration (i.e., tracking registered producers and recyclers, reporting, etc.). Despite the regulatory nature of these programs, EPR also has market-based features as it allows producers to devise their own approaches to meet the end-of-life product management and any goals set by governments. Product retailers and consumers also have a role in EPR. Retailers are only allowed to sell products made by producers complying with EPR regulation and must communicate end-of-life management options to consumers. Consumers, in turn, are responsible for using producer programs, which typically require returning consumed products to collection points. Section 3 of this analysis provides more detail on the various stakeholder roles and responsibilities.

Government-run EPR programs typically are based on one of the following four models:

- Fixed producer responsibilities tied to product recovery levels based on quantities of new products sold (typically by weight) - example states that use this model for electronic waste include IL, IN, MI, MN, NC, NY, NJ, SC and WI.
- Default collection program requirements that producers can opt-out of and run their own program - example states include OR, RI, VT and WA.
- Limited take-back program requirements that producers can decide how to meet (e.g., mail-back option for residents) - example states include MD, MI, MO, NC, OK, SC, TX, VA and WV.
- Register and approve recyclers - who in turn bill producers based on the product recycled - this model reduces overall program administration and levels the playing field for producers (example states include CT and ME).

EPR can be applied to individual materials, or can be regulated as an over-arching framework system, which provides one common policy with the ability to address multiple products. Each government-run EPR program has unique features depending on the needs of its jurisdiction and programs and therefore varies widely. While a framework approach is thought by many to be ideal for maximizing and standardizing stewardship policy while decreasing legislative and rule-making efforts, only Maine and California have taken this approach to date. In the United State, thirty-two states currently have single-material EPR laws in place (USEPA, 2012).

Extended Producer Responsibility for Electronic Devices

EPR programs addressing electronic devices have proven to be very successful. The USEPA (2012) reports that more than 2 million tons of computers become obsolete each year, and that less than 25% of these are recovered. These products may include toxic compounds that have the potential for adverse environmental and human health impacts if disposed of improperly (Compounds may include lead, mercury, cadmium, lithium, brominated flame retardants and phosphorus coatings). Other issues driving improved management of electronic scrap (e-scrap) include:

- Need for data destruction (to protect personal or business data).
- Resource conservation opportunities through reuse and recycling.

Electronics EPR laws have been passed in 25 states and cover 66% of the U.S. population. Hawaii's electronic waste (e-waste) law has required producer responsibility since 2010 and in initial years of operation diverted 2.4 pounds of e-waste per capita-year. This law requires both producers and recyclers to register and pay annual fees, recycle product and report quantities recovered (the state does not have a concurrent disposal ban). The Electronics Take-Back Coalition reports that states with mature electronics EPR regulations/programs (e.g., Maine, Minnesota, Oregon, Washington and Wisconsin) are recovering about 6.2 pounds of scrap e-waste per capita-year. By contrast, states like Colorado that have no EPR program recover less than 1 pound/capita-year.

Extended Producer Responsibility for Packaging

Packaging is typically defined as those materials used to contain, protect and allow the handling, delivery and presentation of product. Materials include cardboard; aluminum cans; steel cans; PET, LDPE and HDPE plastics; and glass - most of which are collected in curbside collection programs (LDPE plastics is the exception). In addition, pallets and shipping containers are of particular interest to islands.

Packaging in General

The Product Policy Institute reports that 30% (or 50M tons) of all materials disposed in the U.S. is packaging. While the paper, plastic and light-weight metals that make up most consumer packaging products typically don't include toxic materials, they do represent a significant waste of resources when virgin feedstock, energy, water and transportation fuels are taken into account. With the exception of the beverage industry in bottle-bill states, U.S. producers can currently package their products in any manner, with no responsibility for collecting, recycling or disposing of package waste.

EPR packaging regulations are not as common as EPR regulations for e-waste. Europe and Canada have the most advanced stewardship programs. European and Canadian programs require the producer or first importer to be the obligated party to pay the fees (as noted above, this addresses the problem of producers who might otherwise dodge EPR responsibility by not selling products in a low-population region such as Guam). Germany's Green Dot program charges manufacturers for packaging and uses revenues for recycling. This program has led to dramatic reductions in packaging waste - in 2007, the average recycling rate for packaging in the European Union countries was 57%. In Canada, Ontario levies fees on producers to fund 50% of municipal curbside recycling costs.

Also of note is New Zealand's voluntary product stewardship strategy for packaging operated by the Packaging Council of New Zealand (or PAC.NZ). Intended to assist producers in the design, manufacture and end-of-life management of new packaging products, PAC.NZ has developed a Code of Practice with key principles in the areas of packaging functionality, resource efficiency, use of low-impact material and end-of-life operations. In 2010, New Zealand recycled 56% of its total packaging (including glass).

In the U.S., EPR packaging is a fledgling effort and most are still in the voluntary, product stewardship phase. Eleven states currently have bottle bill laws, but these are operated as consumer, rather than producer-responsibility programs. Recent efforts by groups such as the Reusable Packaging Association, the Northwest Product Stewardship Council and others are working to encourage dialogue and develop best practices related to EPR policy for packaging with brand owners, retailers and other stakeholders.

Pallets and Shipping Container Packing Materials

Pallets (made of wood, plastic or metal) and metal shipping crates are the most common methods of transporting goods overseas. Earth 2017 estimates that there are 2 billion pallets in circulation in the U.S. that are used to transport 93% of all goods in this country. Despite their metal construction, shipping containers have a short 10-year lifespan due to their exposure to the elements (The Etsy Blog). Where there are not established requirements or market conditions to reuse, repair or recycle these materials at the end of shipments, however, they are discarded and become a bulky, voluminous waste stream. The drastic drop in the cost of manufacturing new containers exacerbates this practice (for example, The Etsy Blog reports that while a new shipping container cost $5,000 in the 1970s, the price is less than $1,000 today).

Wooden pallets can weigh as much as 80 pounds with general dimensions of 4' by 4' and a few inches high, and are stackable (Earth 2017) - aluminum and plastic pallets have the same dimensions and stackability but are obviously lighter. Shipping crates can be as small as 20' long (480 square feet floor space) but can be twice that size (many can be dismantled and folded when empty).

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how an EPR program could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Opportunities associated with the implementation of an EPR Program include:

- Provides environmental protection as products in the waste stream become more complex and/or contain more toxic materials.
- Shifts burden of cost of responsible recycling and end-of-life management away from local governments and ratepayers to producers.
- Increases recycling of designated products.
- Creates jobs very quickly as local businesses step up to meet demands for recycling.
- Avoids costs related to contamination from improper disposal.
- Improves cost equity as cost for end-of-life management are borne by consumers of the targeted products only and not by all ratepayers.

- Appeals to both political parties as EPR lowers government's costs while providing strong environmental benefits.
- Increases sales and revenues as businesses figure out how to offer take-back to enhance their current business model.

Constraints associated with the implementation of an EPR Program include:

- Local governments that don't already pay for collection and disposal systems may not see themselves as stakeholders or beneficiaries from an EPR law.
- Businesses may oppose any and all government regulation, preferring market-based initiatives to achieve similar ends.
- Producers prefer to have government and consumers share end-of-life costs.
- Recycling targeted EPR products can still have net costs even though these are typically less than managing through landfills.
- Specific controls are required to protect worker health and environment.
- Producers often oppose EPR programs because costs that were previously external to their business model must be internalized.
- Producers may bring significant resources to a lobbying effort against EPR legislation.

Requiring overseas transporters to take back pallets and shipping containers will likely be challenging due to the layers of service providers and regulators between the buyer and the supplier.

3. IMPLEMENTATION OVERVIEW

In a number of environmental fields, the implementation of environmental policy has led to significant achievements. Implementation of a legislated EPR program can have significant positive environmental impacts. The following overview provides information on how to turn this initiative into action.

Key Stakeholders

It is expected that GEPA and the GSA of the Guam Department of Administration will be the lead agencies for development and ongoing implementation of an EPR policy/program. Non-regulatory staff and volunteer professionals will also be needed to champion this policy through the legislative process. Key implementation steps, based on the recycler-based model described above and broken out by stakeholder responsibilities, are described below.

Major Components

Government roles in EPR programs are typically limited to goal-setting, standardization to "level the playing field" for producers and general administration (i.e., tracking registered producers and recyclers, reporting, etc.). Despite the regulatory nature of these programs, EPR also has market-based features as it allows producers to devise their own approaches to meet the end-of-life product management and any goals set by government. Most commonly, producers establish and operate take-back or other types of collection programs. These may be operated by individual producers (e.g., Apple or Dell) or by an association of like producers (e.g., the Brewers Distributors and the Manufacturers Recycling Management groups in British Columbia and the U.S., respectively).

Product retailers and consumers also have a role in EPR. Retailers are only allowed to sell products made by producers complying with EPR regulation and must communicate end-of-life management options to consumers. Consumers, in turn, are responsible for using producer programs, which may include returning consumed products to collection points.

Because EPR is a regulatory mandate, legislation will be required for implementation. Successful legislation would be followed by the development of a territorial regulation that details how the law will be implemented, enforced, monitored and reported. Implementation would be island-wide affecting any targeted products imported to Guam with the exception of the U.S. federal government operations on Guam, which separately deal with EPR issues through EO 13423.

Government Responsibilities

- Define products to be covered by an EPR policy/program. Any exemptions and exclusions must be spelled out.
- Define who the EPR policy/program applies to. It is expected that GovGuam will choose to develop EPR policy that will cover products sold to residents and small businesses (e.g., up to 100 employees), local governments, school districts or other public entities, although scrap electronics coming out of large businesses should be managed by those businesses as RCRA-covered hazardous wastes and thus do not need to be addressed.

- Identify producer responsibility and reuse/recycling opportunities associated with shipping targeted products (i.e., where pallet and shipping container constraints can potentially be included in supplier selection and contracting)
- Identify education requirements. GovGuam may want to consider spreading this responsibility across several stakeholders (e.g., retailers, producers, government).
- Establish diversion goals. Annual goals should be established, including methodologies addressing how producers will determine if they have achieved compliance.

Identify provisions for bearing the cost of managing "orphan" products. These provisions would specifically apply to products manufactured by producers who have since gone out of business.

- Establish monitoring and reporting requirements.
- Establish penalties for non-compliance. Penalties could include lower civil administrative penalties, higher penalties for intentional, knowing or negligent violations, and/or restricting market access for a product that is not in compliance with the EPR policy/program requirements.
- Report program results to the public and legislature on a regular basis. The Product Stewardship Institute provides a calculator for estimating direct cost savings and avoided costs (see the Additional Information section).

Producer or Shipper Responsibilities

- Manage products in an environmentally and socially responsible manner, and in compliance with all pertinent regulations.
- Describe where products and packaging will be recovered.
- Make collection and management services available and reasonably accessible to consumers.
- Cover security, liability and costs.
- Offer zero-cost recycling, if appropriate - some EPR models include this requirement (can be achieved through mail-back programs or other).
- Label all products sold with brand name.
- Register and pay registration fees - fees can be set to cover the government's cost to manage the program.
- Report annual quantities of products sold and of pounds of product recovered.
- Use registered recyclers and/or reuse facilities to implement their program.

Reuse and Recycling Facility Responsibilities

- Report products processed by producers who comply with EPR regulation.
- Bill registered producers by brand ownership at least once per year.
- Comply with any applicable operational standards, laws and regulations.
- May also be required to register and pay fees.

Consumer Responsibilities

- Take consumed products to designated collection points or return via mail-in programs.

Based on a review of the 26 state e-waste laws currently in effect, the following list is a refinement of the implementation guidelines provided above for general EPR programming:

- Develop a comprehensive list of obligated electronic devices. Possibilities include TVs, monitors, both newer flat-panel displays and older CRTs and portable DVD players; computers (including laptop, desktops (CPU), and all-in-one computers); imaging equipment (including printers, faxes, and scanners); peripherals including keyboards/mouse, zip drives, external hard drives, portable electronic music devices (MP3 players/portable music players); consumer electronics (including VCRs and DVD players); e-book players/readers; digital picture frames; game consoles; portable digital assistants (PDAs); cell phones; converter boxes; cable/satellite receivers; small servers; and electronic keyboards.
- Develop a list of packaging materials to target. Packaging is typically defined as those materials used to contain, protect and allow the handling, delivery and presentation of product. Materials include pallets; shipping crates; cardboard; aluminum cans; steel cans; PET, LDPE and HDPE plastics; and glass. Options for better managing this packaging on Guam which could be implemented by public, private and non-profit buyers alike include (only the first three bullets are truly EPR or EPP strategies - the remaining reuse and recycling options are included here to consolidate overall opportunities associated with managing this problem packaging):
  - Requiring supply vendors to use shippers who will take pallets once shipments are unloaded - may require coordination with the Guam Port Authority.
  - Evaluating the ability to require light-weight, more durable pallets made of aluminum or plastic in vendor contracts.
  - Evaluating shipping opportunities that replace pallets with slip sheets, rolling carts or other reusable containers for some purchases that can be easily cleaned and reuses - modify vendor contracts as needed.
  - Encouraging Guam businesses that reuse pallet wood for furniture, outdoor sheds, etc. (many pallets are made from durable hard wood) - note that kiln-dried wood has been chemically treated to make them resistant to pests and rot (Mother Nature Network website).
  - Encouraging businesses and individuals to reuse shipping containers for storage and living space - there are several examples of homes, offices, storage sheds, swimming pools and other uses found on links provided in Section 5 (The Etsy Blog warns that "shipping container architecture" requires treatments to remove hazardous wastes applied for oceanic hauls).
  - Supporting new Guam businesses to repair broken pallets for resale to vendors and transporters.
  - Recycling wood pallets into mulch, compost feedstock, animal bedding, particle board manufacture - will likely require nail removal.
- Obligate the producer or “first importer” so the party that imports the product into the territory will be obligated if the producer does not take responsibility. This approach is especially useful in island environments where distributors might otherwise be tempted to forego sales rather than comply with EPR regulation.

- Require producers or first importers to register with GEPA and pay annual fees. Fees should be set to cover administrative costs and adjusted regularly to ensure producers are not over-charged or under-charged.
- Require recyclers to register with Guam EPA and require recyclers to be either R2 or e-Stewards certified. The R2 and e-Stewards certification systems address potentially improper export of hazardous e-waste to developing countries. The e-Stewards system certifies e-recyclers to the highest standards including compliance with the Basel Convention. The R2 certification system is not quite as rigorous as e-Steward system, although it is currently under revision. See the Additional Information section for program links.
- Require producers to ensure there is at least one permanent drop-off site for electronics on Guam with maximum accessibility to residents and small businesses.
- Require retailers and first importers to share responsibility for education.
- Alternative approaches to support an initial EPR program for the island could include:
  - Implement an EPR program for e-waste as described previously.
  - Encourage voluntary replacement of single-use, disposable bags plastic and paper bags with reusable bags to reduce consumption and therefore end-of-life management.
  - Can be accomplished through a fee system or disposal ban.
  - Several local governments in the United States (including Maui and Kauai) and territories (American Samoa) have banned the use of plastic shopping bags - at least one Guam grocer has begun a limited "green bags" programs.
  - On-going education will be needed to encourage consumers to shift to reusable bags.

Major Milestones

To implement this alternative, the following key milestones should be focused on.

- Enact legislation to implement an EPR policy/program on Guam. It is expected that EPR legislation will be pursued by GovGuam staff and volunteer island recyclers, organizations and citizens. As GovGuam staff will have limited ability to actively lobby a bill through the Guam Legislature, business and volunteers will likely need to champion this policy. It is recommended that the EPR policy/program legislation be developed as framework legislation with the flexibility to start with one category of products as a priority initially, and then be modified to address other products in the future without new legislation each time. Legislation is expected to take a minimum of 6 to 12 months to enact, possibly longer.
- Develop a territorial regulation that details how the law will be implemented, enforced, monitored and reported. It is expected that these activities could be completed within 12 to 24 months of the enactment of EPR legislation with existing staff resources.
- Finalize implementing regulations for the Guam Beverage Container Recycling Act of 2010. This will increase consumer awareness, retailer involvement and container diversion over current levels (note, this law currently excludes glass containers). Actions necessary to accomplish this should be undertaken immediately with existing staff resources.

- Implement the EPR program. Implementation would be island-wide affecting any targeted products imported to Guam with the exception of the U.S. federal government operations on Guam. Implementation would begin as soon as regulations are finalized and phased in over a to-be-determined period of time.
- Report results. Reporting of results, including financial and operational performance audits, including the final disposition of the secondary materials collected is recommended. Audits should begin within 12 months of the initial implementation of the regulation.
- Add new products. Once the EPR program is running smoothly, additional/new targets should be evaluated and added over time (e.g., every 2 to 3 years). Over time, products that could be evaluated and added include printed materials, mercury-containing lamps and other products, automotive products, household hazardous waste and special wastes.

Challenges

Major challenges to implementing an island-wide EPR program include:

- Guam's relatively undeveloped overall waste diversion strategy makes it unlikely that full packaging-based EPR legislation would be successful in the short-term. Alternative approaches to support an initial, hybrid EPR/product stewardship for the island could instead initially include the implementation of an EPR program for e-waste, followed next by packaging materials, and later by other materials.
- Cost – although many studies now show the long-term advantages of implementing an EPR program there are often high upfront costs for getting the program initiated and implemented.
- Efficiency – Executing legislative objectives using practical and efficient methods will require coordination and cooperation.
- Time to implementation – Changes do not happen overnight. It takes time to enact and implement an effective and successful EPR program.
- The following challenges to packaging recycling hinder the implementation of effective EPR programs:
  - Multi-material packaging is expensive to recover. Wastes often included mixed paper and metal; so-called "biodegradable" paper than cannot be composted; composite materials with paper, metal and plastic fused together.
  - Lack of ability at processing facilities to separate different plastics.
  - Glass breakage (especially in single-stream collection programs) makes recovery difficult and degrades other materials.
  - Difficulty capturing "away from home" packaging (such as plastic bottles).
- Lack of resources - government programs that target residential generators rarely have the ability to expand their services or target additional materials.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

Table WP-B.1 presents landfill diversion potential over a period of fifteen years if an EPR policy is enacted through legislative action, assuming a 2015 implementation date for this policy. Assumptions for estimating future diversion resulting from EPR programming on Guam include:

- Policy development will take at least two years and diversion associated with new policy will not be measurable until 2015.
- E-waste is included in Table WP-B.1 under Other Waste with other materials. While e-waste diversion will likely increase to levels exceeding 50% over the planning period, the impact on the overall Other MSW Waste category is assumed to increase at a slower rate.
- Packaging is limited at this time to plastic bags only with assumed implementation of a voluntary ban on, or replacement of single-use bags with reusable bags (this would potentially be expanded in the future to include a ban on single-use, disposal bags at checkout locations with increased diversion potential) - it is assumed that 70% of the Plastic Film/Wrap/Bags waste materials would be single-use, disposable bags that would be targeted by this policy.
- Both e-waste and packaging materials are assessed for the MSW waste stream only.

TABLE WP-B.1 LANDFILL DIVERSION POTENTIAL[1]
NEW EXTENDED PRODUCER RESPONSIBILITY (Implementation Expected 2015)

YEAR	E-WASTE (OTHER WASTE)		PLASTIC BAGS		COMBINED	
	Assumed Range of Diversion Potential through Recycling		Assumed Range of Diversion Potential through Avoided Generation		Assumed Range of Diversion Potential	
	% by Weight	Tons	% by Weight	Tons	% by Weight	Tons
2015	5-10%	0-1,000	5-10%	0	0-5%	0-1,000
2020	10-25%	1,000-2,000	10-25%	0-1,000	0-5%	1,000-3,000
2025	10-25%	1,000-2,000	10-25%	0-1,000	0-5%	1,000-3,000
2030	25-50%	2,000-3,000	25-50%	0-1,000	0-5%	2,000-4,000

Notes:

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted; however, mid-point diversion quantities are used for estimates described in subsequent sections. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

Job Creation Potential and Small Business Opportunities

To estimate the potential job creation associated with new Guam EPR policy targeting e-waste and plastic bags, it is assumed that e-waste recycling will generate 13 jobs for every 1,000 tons (Peters, 2006) in addition to any GEPA or GSA staffing increases. Based on these assumptions and on the diversion tonnages described above, the potential for job creation associated with a new Guam EPR program (specifically e-waste recycling, which has high labor requirements) may range from an initial 5 FTEs in 2015 to 27 FTEs by 2030. No new jobs are anticipated for the voluntary replacement of disposable plastic bags with reusable bags as this effort would reduce generation and therefore eliminate the need for post-consumer management

The job creation potential estimates presented herein are for private sector jobs associated with materials processing and re-manufacturing, most of which will occur off-island. It is noted that most other materials potentially targeted by the EPR program in the future have lower labor requirements and will not generate as many jobs.

Guam currently has limited e-waste processing capability and this initiative represents an ideal small business opportunity. E-waste recycling is especially well-suited to employing special-needs work forces, and could represent a new local, specialized employment opportunity on Guam in the future. Until e-processing businesses are established on Guam, these jobs will likely occur off-island.

Estimated Revenue Generation

The diversion of electronic waste and packaging is not expected to generate revenues (banned plastic bags will not generate revenue as generation itself will be reduced). It will instead cost to sell diverted e-waste to local processors, due to the required downstream investment in overseas shipping and materials management. Reportedly, a local service provider charges $0.11 per pound to accept e-waste products, which equates to a "negative revenue" of $220 per ton. Given estimated diversion rates in Table WP-B.1, negative revenues could range from $91,000 in 2015 to almost $454,000 in 2030. Despite this "negative revenue", the savings achieved by avoiding landfill disposal costs will off-set most costs (discussed subsequently).

Avoided Landfill Disposal Costs

Based on diverted quantities described in Table WP-B.1 and assuming an average tipping fee of $175 per ton at GSWA's commercial transfer station throughout the planning period, avoided tipping fees would range from $95,000 in 2015 to $475,000 in 2030.

Human Health and Environmental Impacts

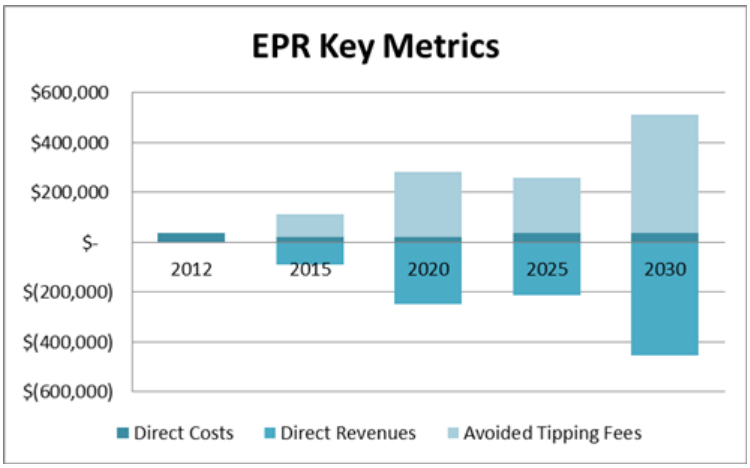
New EPR legislation will have an island-wide impact in terms of reducing adverse environmental and public health impacts by recycling instead of disposing of products and their packaging. Despite the fact that safely recycling some materials can be difficult, the positive environmental impacts far outweigh any negatives, and include:

- The safe disposal of potentially toxic materials (especially in e-waste).
- Diversion of materials previously disposed of via landfilling, which also helps to preserve habitat that might otherwise be used for new or expanded landfills.

- With the burden of recycling products after use, producers may be incentivized to design more sustainable, less toxic, and easily recyclable electronics.
- Using fewer materials and designing products that last longer can help to keep these materials out of landfills.

Economic Costs

It is expected that EPR legislation will be pursued by GovGuam staff and volunteer island recyclers, organizations and citizens. As GovGuam staff will have limited ability to actively lobby a bill through the Guam Legislature, business and volunteers will likely need to champion this policy. Significant cost assumptions for an EPR initiative that targets electronic waste in the municipal solid waste steam, as well as the voluntary banning of plastic bag bans include:



- 0.25 FTE from GEPA and 0.25 FTE from the Department of Administration (Procurement) to implement successful legislation and regulation at the outset;
- 0.25 FTE from GEPA through 2020 to provide consumer education, enforcement, monitoring, tracking, reporting and management of registration funds, potentially increasing to 0.5 FTE thereafter as new materials are researched and added to the program;
- Departmental overhead equal to 18% of compensation;
- GovGuam overhead costs for Department of Administration included at 7% of departmental costs;
- Total costs for the EPR initiative are expected to be almost $36,000 in the base year in order to establish the program. Subsequently, costs are expected to range from $19,000 to $38,000 annually; and
- Development and ongoing costs donated by volunteer businesses, organizations and citizens are not included.

5. ADDITIONAL INFORMATION AND REFERENCES

The following resources and references can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Association of State and Tribal Solid Waste Management Officials (ASTSWMO). www.astswmo.org/
- Northwest Product Stewardship Council. www.productpolicy.org
- Product Stewardship Institute (includes financial benefits calculator). www.productstewardship.us
- Product Policy Institute. www.productpolicy.org
- California Product Stewardship Council. www.calpsc.org
- USEPA Region 10 Product Stewardship. www.epa.gov/osw/conserve/tools/stewardship/basic.htm Anne Peters, "Study of Economic Impacts of Growth in Electronics Recycling," for Computer Tack-Back Campaign, April 2006.
- OECD (Organization for Economic Cooperation and Development). Proceedings of OECD Seminar on Extended Producer Responsibility: EPR Programme Implementation and Assessment. Part 1: Taking Stock of Operating EPR Programmes. December 2003.

Office Electronics

- E-Stewards. http://e-stwards.org/certificationoverview/
- Electronics Take-Back Coalition. www.electronicstakeback.com
- National Center for Electronics recycling. www.electronicsrecycling.org and www.ecycleclearinghouse.org
- R2. www.r2solutions.org

Packaging

- Container Recycling Institute. www.container-recycling.org
- Packaging Council of New Zealand. www.packaging.org.nz
- Reusable Packaging Association. http://reusables.org/

Pallets and Shipping Containers

- Earth 2017, "Green Innovation: Recycled Aluminum Pallets." www.earth2017.com/best-practices/green-innovation-recycled-aluminum-pallets/
- Ellison, Chappell, "Recycling the Shipping Container," on The Etsy Blog website. www.etsy.com/blog/en/2011/recycling-the-shipping-container
- Mother Nature Network Shipping Crate Architecture Examples. www.mnn.com/your-home/remodeling-design/stories/crate-expectations-11-shipping-container-housing-ideas
- South Carolina Smart Business Recycling, "Managing and Recycling Pallets," 2011

- Starbucks Drive-Through Shipping Container (Northglenn, CO). http://inhabit.com/starbucks-opens-modular-drive-thru-made-from-shipping-containers-near-denver/

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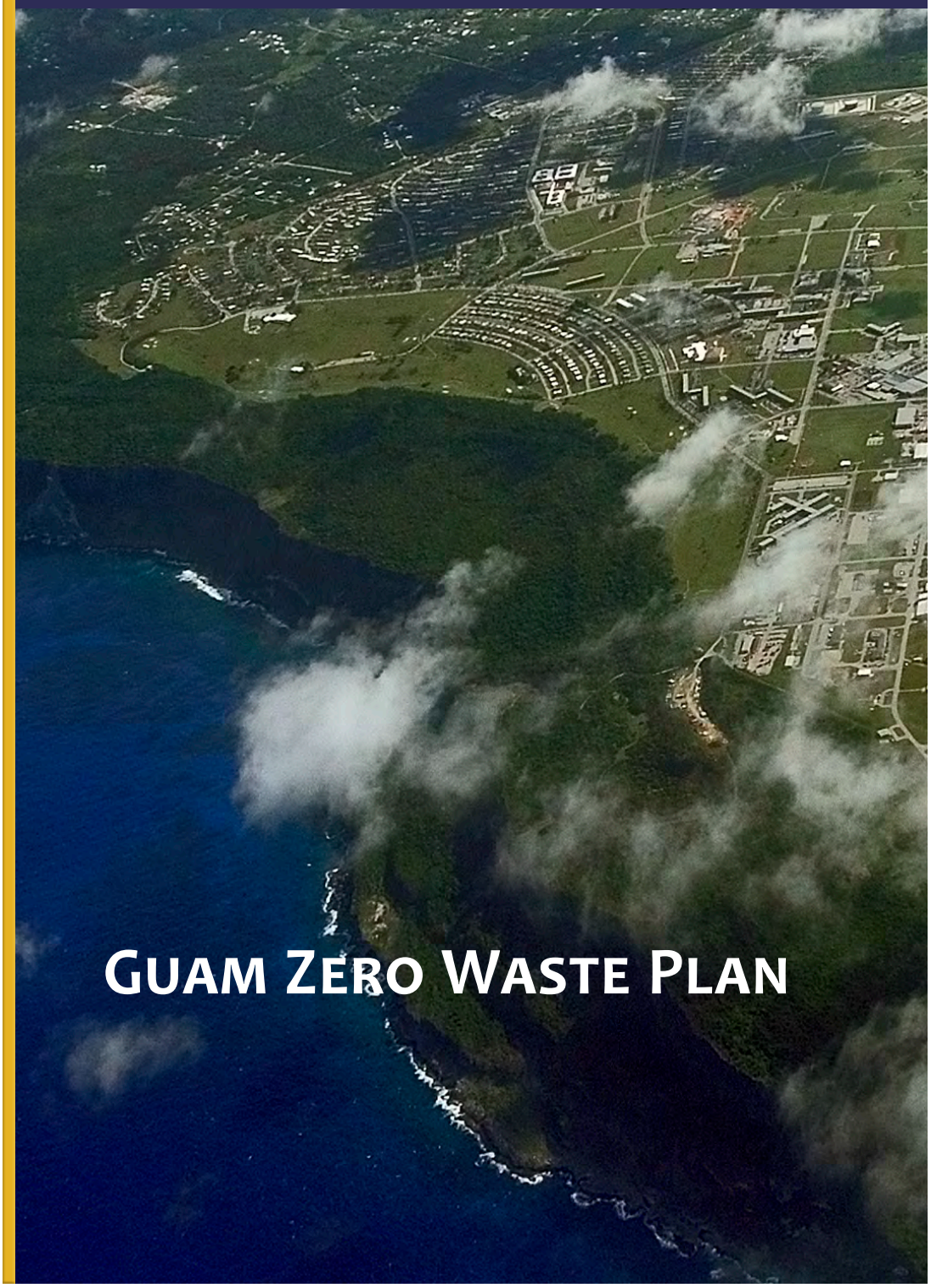
White Paper C



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP C

Please see the next page.

WHITE PAPER C

PAY-AS-YOU-THROW TRASH PRICING POLICY

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste, rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Pay-As-You-Throw Pricing Policy*
- *Greening Roadway Paving Systems*
- *Zero Waste Association*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Green/Environmentally-Preferable Purchasing Program*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, one in a series of fifteen, presents an analysis of measures to implement an effective Pay-As-You-Throw (PAYT) policy to introduce a financial incentive for trash reduction.

The focus of this analysis is the potential implementation of a PAYT pricing policy for bundled trash and recycling curbside collection service to Guam residents. This policy depends upon the successful addition of curbside recycling (currently being evaluated by Guam Solid Waste Authority). Convenient curbside recycling and composting opportunities are proven, successful Zero Waste practices. This initiative proposes the implementation of variable rate trash service levels by expanding the current 96-gal service to offer at least two smaller trash volume choices. Homeowners' ability to choose to reduce their trash service will be an incentive to more aggressively buy environmentally preferable products and products with less packaging, practice source reduction and reuse, and utilize Guam's recycling and anticipated composting programs. Monthly residential solid waste fees will be adjusted to reflect these service choices.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap of the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

PAYT is a trash collection pricing alternative to flat fees. Also called variable rate or unit pricing, PAYT is an approach that charges less to those who generate less trash than those who generate more. PAYT establishes an equitable fee structure in a user-pay system. It produces an incentive for waste generators to create less trash through source reduction, reuse, recycling and composting.

Key implementation steps are:

1) Determine residential applicability.
2) Implement a full-scale curbside recycling program.
3) Design a PAYT System that includes:
   - Provisions for smaller containers;
   - Continued weekly collection;
   - An allowance for extra trash (as currently done) by providing a second cart for an additional $15 fee or by allowing residents to use bags with program-approved, $4 stickers, or require homeowners to increase their level of service; and
   - Determine a pricing mechanism.
4) Develop other program components including:
   - Discounted pricing for low-income families;
   - Strategy for on-going services - such as changing service levels/swapping carts (may be free in first six months but a fee afterwards), cleaning carts, replacing carts, etc.;
   - Data collection and reporting to track program performance - including trash service level selection, trash and recycling set-outs, trash and recyclables quantities collected and managed; and
   - Program enforcement - including prohibition of illegal dumping, trash in unauthorized containers or non-containerized, inclusion of recyclables in trash carts and trash in recyclable carts.
5) Increase public outreach and education efforts.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of the Zero Waste initiative including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What is a Pay-As-You-Throw Trash Pricing Policy?

Pay-As-You-Throw: People who throw more away will pay more

PAYT is a trash collection pricing alternative to flat fees. Also called variable rate or unit pricing, PAYT is an approach that charges less to those who generate less trash than those who generate more. Similar to water, electrical and other common municipal pricing, PAYT establishes an equitable fee structure in a user-pay system. It produces an incentive for waste generators to create less trash through source reduction, reuse, recycling and composting. PAYT therefore not only provides service choices, but provides a mechanism for controlling fees. Many PAYT systems also "bundle" collection costs for diverted materials in PAYT trash pricing - i.e., provide trash and recycling, trash and yard waste (or all three) for one price. This provides an additional incentive to recycle and/or compost.

PAYT is widely recognized as the most effective incentive for waste diversion practiced in the U.S. today (Lombardi, 2012). Examples of successful PAYT programs include:

- San Jose, California - recycling rates increased from 28% to 43% in the first year (Brown, 2011)
- Worcester, Massachusetts - recycling rates increased from 3% to 36% in the first year (Brown, 2011)
- New Hampshire community study - observed that recycling rates increased from between 30% and 50% (Hallas-Burt, et al. Al., 2004)
- Falmouth, Maine - recycling rate increased by more than 50% (Clean Air - Cool Planet website)

Research indicates that U.S. curbside PAYT programs have resulted in an average 49% decrease in waste disposal. This research was completed in New England where relatively high landfill tip fees approach those charged at the Layon Landfill. The study found that 25% to 30% of quantities diverted through PAYT programming were recycled, while 70% to 75% were source-reduced and composted (Green Waste Solutions, 2010). It is noted, however, that directly attributing diversion successes to PAYT is difficult as multiple program changes are typically implemented in tandem with new PAYT policies (i.e., new recycling service, new recyclables accepted, new containers, new public outreach efforts, etc.).

As a municipal, county or state policy, PAYT can be applied to any collection system including city-operated collection, contract hauler collection or an open-market hauling system (in an open system, policy typically establishes a pricing structure but leaves actual rate-setting to haulers). PAYT policy is routinely applied only to homeowners, as business collection service is commonly based on variable pricing; however, PAYT can be

applied toward discounted business recycling and composting collection. PAYT is most often used for curbside collections, although some communities have applied to drop-site collections as well (e.g., Fremont County, Wyoming).

Key to PAYT is the ability to have discrete collection units with differential pricing. In other words, for PAYT to be fully effective, it needs to be applied to homeowners who have their own trash containers. This can make PAYT in larger multi-family and other areas served by dumpsters challenging. Pricing differentials between the number/sizes of container options available to residents also has to be great enough to encourage diversion over disposal. Where the differential is negligible, changes in wasting patterns are not typically as great.

PAYT Container Options

PAYT can be implemented with any type or combination of trash containers that allow variable rate pricing. Examples include:

- Can/cart programs - residents choose a service level based on the number containers (e.g., one, two or three 32-gallon size) OR the size of container (e.g., 32-, 64- or 96-gallon unit in a variable system) that meets their trash collection needs (fees are tied to the selection and vary with volume)
- Bag programs - residents buy program-specific bags (about 30-gallon size) and use as many as needed for each collection (discount prices are sometimes available when purchased in bulk)
- Tag or sticker programs - similar to bag programs, residents use their own bags but purchase program-specific tags or stickers that must be attached to any bag for collection
- Hybrid programs combine both flat and variable rate pricing - by charging residents a flat, base service fee for a small can or cart volume but collect extra garbage if placed at the curb in program-specific bags or bags with specified tags or stickers
- Weight-based program – collection trucks have scales and weigh each tagged bin.

Similarly, recycling and yard waste containers also vary widely in most programs. As more recyclables are collected together in single-stream recycling programs, larger 64- and 96-gallon carts are prevalent. Grass and leaf yard waste (and sometimes food waste) is often containerized (cans, carts or bags), while larger materials (limbs, branches, etc.) are often placed at the curb loose. Lastly, it should be noted that, depending on the program, containers can be provided by residents, by governments, by haulers or by a combination - although residents ultimately pay the cost.

PAYT Pricing Options

If cans or carts are selected, the unit-based pricing mechanism must also be determined. While there are many pricing structure possibilities, the most common options include:

- Proportional (also called incremental) pricing where each volume unit costs the same and is additive as the volume increases - this option is the most common and creates the greatest recycling incentive, is easiest for the public to understand and for billing departments to implement, but can generate revenues in excess of actual program costs (which is not acceptable to some program managers)
- For illustrative purposes with a variable cart system
    - Assume a base trash volume unit of 32 gallons, a corresponding price of $15/household-month and a pricing differential of 100%
    - If the resident selected 32-, 64- or 96-gallon service, the cost would be $15, $30 or $45/household-month, respectively
- There is some evidence that increasing pricing for additional volumes by 80% (i.e., 32 gallons would be $15, 64 gallons would be $27, and 96 gallons would be $39) instead of 100% provides the same diversion success (Skumatz, 2006)
- This option can include pricing in excess of actual cost for higher volumes as fixed collection costs are generally covered once the vehicle arrives at the curb - some communities find this acceptable as the price signal/diversion incentive is greater while others choose to use much lower differentials (e.g., Sacramento, CA uses a range of 20% to 30%)
- Two-tiered (also called fixed plus incremental) pricing where each trash volume unit price includes a flat fee to cover fixed collection costs plus an incremental fee to create a pricing differential and diversion incentive;
- For illustrative purposes with a variable cart system
    - Assume a base trash volume unit of 32 gallons, a flat fee of $10/household-month, an incremental fee of $10 for every 32-gallon unit and a pricing differential of 100%
    - If the resident selected 32-gallon service, the cost would be $20 ($10 flat plus $10 incremental) - similarly, the 64- and 96-gallon service would be $30 and $40/household-month, respectively
- This option brings pricing slightly more in line with actual costs by elevating the lower volume service price and reducing the higher volume price (as compared to the proportional example above)

Pricing choices can be confusing. The USEPA (among others) have developed resources and examples that can be helpful (USEPA, 1999 and the SMART BET Calculator - see the Additional Information and References section).

Existing Programs on Guam

Currently there is no policy requiring variable rates for residential trash collection on Guam. However, the Guam Solid Waste Authority (GSWA) currently operates facilities and programs that would be important precursors to a successful PAYT program on Guam. Variable rate pricing is in place for other residential utility services provided on Guam including electricity and water (Guam Power Authority, Guam Water Works).

Pertinent GSWA Services/Operations

There are approximately 44,000 civilian residents in Guam. GSWA began providing residential trash collection services for a fee in 2008, and currently provides weekly curbside trash collection to approximately 17,000 single-family homes (the remaining 61% of multi-family, residential as well as commercial and military trash is collected by private haulers). Curbside trash collection service is not mandatory, and many residents have delayed paying for the service provided (although GSWA has minimized this in past months). Other residents drop off trash at island convenience centers for fees that begin at $7.50 for three cubic yards and are limited to 6 cy/day (recyclables are accepted for free). The following program components form an existing foundation for a new PAYT system (Anderson, 2012):

- Comprehensive database of residential accounts throughout the island
- Weekly curbside collection - including collection vehicles and 96-gallon trash carts (GSWA's existing cart vendor contract can be extended to include new carts for a PAYT program)
- Private sector processing of pilot and convenience center recyclables
- Trash collection/disposal based on a monthly per-household fee of $30
    - Additional carts are available for $15 (although few residents require) or extra trash can be bagged and tagged with a $4 sticker - making this a quasi-hybrid PAYT system, except that trash volume unit choices are not available to residents and the waste diversion potential is not maximized (and recycling service is not yet provided)
    - Fees cover the cost of collection, disposal and construction/debt service of the Layon Landfill

GSWA also provides services and conducts operations not directly related to a future PAYT program (bulky/metal waste collections, special waste management, commercial transfer station and municipal solid waste landfill operations). Commercial trash collection service on Guam is provided by private haulers, who are required to deliver all materials to the commercial transfer station in Harmon.

GSWA Curbside Recycling Program

GSWA conducted a pilot curbside recycling study with 1,000 households in 2010/2011, using 96-gallon carts identical to those used for trash collection only with green instead of brown lids. Results from households with twice-monthly collection included a 16% diversion rate by weight and projected capture of nearly 2,000 tons/year of recyclables from their current 17,000 single-family residential accounts (GBB, 2012). GSWA is currently evaluating the feasibility of collecting single-stream recyclables from residences that also receive trash collection service.

As of March 2013, a procurement process is underway to determine the economic sustainability of collection, processing and marketing recyclables as compared to the net cost of existing trash collection and landfill operation (GBB, 2013). If the economics are favorable, GSWA intends to implement island-wide curbside recycling in less than one year (Anderson, 2012). At this time, GSWA is not planning to incorporate PAYT with this implementation.

Successful Approaches Used Worldwide

More than 7,100 U.S. communities now have PAYT systems (Skumatz, 2006). In addition, Iowa, Minnesota, Washington and Wisconsin all require PAYT on a state level for some residents. Outside the U.S., countries like Denmark, France, Italy and the Netherlands have national PAYT policy. A partial list of U.S. governmental entities that have implemented various PAYT options include:

- Can/cart-based programs - Austin, TX; Fort Worth, TX; Lakeland, FL; Loveland, CO; Oakland, CA; Portland, OR; Sacramento, CA; San Jose, CA; Thornton, CO; Vancouver, WA; San Francisco, CA
- Bag /tag/sticker programs - Bath, ME; Concord, NH; Falmouth, ME; Grand Rapids, MI; Mount Vernon, IA; Portland, ME; Worcester, MA
- Hybrid cart/bag programs - Attleboro, MA; Cedar Rapids, IA; Middletown, RI; Minneapolis, MI

Example residential PAYT programs for cities that provide their own public collection services (similar to Guam) are detailed below. These programs are provided to demonstrate how different program types have been designed as potential examples for Guam.

Lakeland, Florida (quasi-proportional pricing for bundled trash/yard waste)

Lakeland's PAYT program was implemented in 2011/2012 and serves 42,000 residential accounts (all single- and multi-family). The city provides bundled weekly trash and yard waste collection. Weekly recycling is available for an extra fee. The city's trash/yard waste service is based on a quasi-proportional pricing structure with very low fee differentials established to more closely represent actual program costs:

- Trash cart options include 35-, 65- and 95-gallons
- Corresponding pricing (trash/yard waste) of $13.50, $14.50 and $15.50/household-month cost
- Quarterly collection of non-containerized, bulky yard waste (pricing included in trash fee)
- Single-stream recyclables collection in 18-gallon bins (transitioning to 65-gallon carts) - fee is an additional $2/month

Metrics are currently being analyzed for this program. Anecdotal evidence is that increased diversion levels have notably increased with PAYT (Wood, 2013).

Loveland, Colorado (proportional pricing for bundled trash/recycling)

Loveland's PAYT program has been in place since 1993 and serves nearly 24,000 single-family and townhome/condo units. The city provides bundled weekly trash/every-other-week recyclables collection - weekly yard waste (seasonal) collection is available for an extra fee. The City's trash/recycling service is based on a proportional pricing structure that increases fees by approximately 100% with the addition of each 17-gallon unit:

- Trash cart options include 17-, 35-, 65- and 95-gallons
- Corresponding pricing (trash/recycling) of $2.75, $5.50, $11.00 and $16.50/household-month - extra trash must be bagged and tagged with a $1.50 sticker
- Single-stream recycling carts are 35-, 65- and 95-gallons (pricing included in trash fee)
- Yard waste collection in 95-gallon carts - fee is an extra $7.50/month between April and November

Loveland's waste diversion rate is over 60%, including both recycling and organics recovery.

Minneapolis, Minnesota (two-tiered pricing for bundled trash/recycling/seasonal yard waste)

Minneapolis' PAYT program has been in place since the 1990s and serves 104,000 accounts of up to four residential units. The city provides bundled weekly trash/every-other-week recycling/weekly yard waste (seasonal) collection. City staff acknowledges that the City's system probably does not create a strong diversion incentive especially as the two-tier pricing structure includes very low fee differentials for the various level of service (Jenks, 2013):

- Trash cart options include 22- and 96-gallons but residents can additionally dispose of two large, burnable items (city is served by a waste-to-energy facility) and are provided vouchers for free transfer station use for bulky item and tire disposal
- Corresponding pricing (trash/recycling/yard waste) of $2 and $5/household-month, respectively on top of $19 base fee (includes a state tax)
- Multi-sort recycling (pricing included in trash fee) - residents sort recyclables into more than two streams using small bins

The city does not track its waste diversion rigorously, but estimates a recycling rate of about 18% (without organics). To increase these results, the city is currently moving its recycling program to single-stream, planning a residential food waste pilot study, may consider adding an intermediate trash cart size and adjusting PAYT rates to create a greater diversion incentive by residents.

Portland, Maine (proportional PAYT pricing for trash/recycling/seasonal yard waste)

Portland's PAYT program has been in place since 1999 and serves approximately 23,000 accounts of up to nine residential units (some larger multi-family units also opt in for city service). The city provides bundled weekly trash/weekly recycling/seasonal yard waste collection. The City's trash/recycling service is based on proportional pricing:

- Trash bag options include 15- and 30-gallons

- Corresponding pricing (trash/recycling) of $1 and $2/bag
- Single-stream recycling containers are 18-gallon bins (pricing included in trash fee, transition to carts in progress)
- Curbside collection of ten small bulky items/year (price included in trash fee) - large bulky items require a $40 sticker
- Curbside yard waste collection (November only) and 10 one-cubic yard tips at transfer station (pricing included in trash fee)

Portland's diversion success was measurable and directly attributable to implementation of curbside PAYT. Pre PAYT rates were less than 10% but jumped to 30% nearly immediately after implementation (Moon, 2013). Current rates are about 38% by weight (without organics). In an effort to improve waste diversion at larger multi-family units, Portland is currently working on a new policy requiring property managers/ homeowners association to provide recycling equal to what the city would provide and to include space for recycling in new multi-family and commercial construction.

Sacramento, California (quasi-proportional PAYT pricing for trash)

Sacramento's PAYT program has been in place for more than 13 years and serves over 124,000 household accounts of up to four residential units.

The city's system is based on variable rates for weekly trash collection only - weekly recyclables and yard waste service is available for an extra fee. The city's trash service is based on a proportional pricing structure (the State of California limits pricing to program costs - Thoma, 2013):

- Trash cart options include 32-, 64- and 96-gallons
- Corresponding pricing (trash only) of $13.40, $17.66 and $21.49/household-month - special pricing also available for manual bags, special services and residential units of five or more
- Single-stream recycling cart options include 32-, 64- and 96-gallons - fee is an extra $5/month regardless of cart size
- Yard waste collection - extra fee ranges from $10.35 (single-family service/resident-provided containers) to $45.74/month (large multi-family complexes/non-containerized)

Diversion success is measured in terms of waste disposed on a per-person basis. While Sacramento has observed significant decreases over the life of its PAYT program, reductions continue today (disposal rates have decreased from 6 pounds/capita-day in 2008 to 5 pounds/capita-day in 2011).

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an alternative and also take into consideration constraints or limitations that could make the alternative less than optimally effective.

Opportunities include:

- Increased diversion by providing a financial incentive reduces solid waste management system costs by decreasing tip fees and increasing recyclables revenues.
- This program is flexible enough to be implemented in communities with public collection, contract collection, or open market private hauling systems.
- Can be implemented quickly and at low cost to government. Price changes are implemented by haulers and paid by users.
- Revenue streams are relatively stable and avoid highs and lows of tax revenue.
- Increased hauler opportunities for new/expanded accounts.
- Better customer recycling service levels and more equitable user-pay pricing – similar to utilities.
- Provides both customer choice and some control over fees charged.
- Cost-effective way to decrease greenhouse gas emissions.
- Creates more green jobs through increased diversion of recyclables and compost feedstocks.
- Provides direct economic incentives and decreases costs for participants reducing waste.

Constraints Include:

- Public opposition if PAYT pricing is perceived as a tax (especially where previous program costs such as property taxes or flat fees are not visibly reduced to make change to PAYT revenue neutral).
- Opposition by residents who generate high volumes of trash and have higher PAYT bills.
- Obtaining payment for any level of service - GSWA has struggled with non-payment since 2008.
- Increased pricing impacts on low-income families.
- Challenge for haulers to initially estimate service levels and set prices.
- Fees in excess of actual costs can create hauler incentive to encourage large service volume levels.
- With variable trash cart sizes, haulers need to increase inventory of containers, change billing system, and buy new billing software.
- Illegal dumping may increase initially.
- Bundled, single price for collection of trash and diverted materials can give the mistaken impression that recycling, and/or composting, is free.

3. IMPLEMENTATION OVERVIEW

The key to PAYT is the ability to have discrete collection units with differential pricing. In other words, for PAYT to be fully effective, it needs to be applied to homeowners who have their own trash containers. This can make PAYT in larger multi-family and other areas served by dumpsters challenging. Pricing differentials between the number/sizes of container options available to residents also has to be great enough to encourage diversion over disposal - where the differential is negligible; changes in wasting patterns are not typically as great.

It is assumed that a new PAYT program on Guam would utilize automated carts only (bag containers would not be appropriate given the animal population and wind). These carts would be the same containers currently used by GSWA for trash and pilot recyclables collection.

Major Components

The policy described below includes the provision of new, smaller curbside trash service (unit) levels to all residents, in addition to a new pricing structure that reflects a bundled trash and recycling service in one fee. This effectively means that recycling will be mandatory for all homeowners - they will, however, have the ability to reduce their total monthly solid waste bill by reducing their trash service through increased source reduction, reuse and recycling activities (yard waste diversion may also be an option in the future).

GSWA's final decision related to island-wide curbside collection of recyclables will depend on the receipt of favorable bids for processing (in response to the March 2013 Request for Bids). Assuming GSWA proceeds with this new service, it is recommended that implementation of PAYT pricing be incorporated at the same time to allow residents to adjust to both changes at the same time.

Key implementation steps are described below.

1. Determine Residential Applicability

Currently, GSWA provides curbside trash collection to single-family residents. It is expected that curbside recycling service will be provided to the same residents.

It should be noted that implementing PAYT in larger multi-family units can be challenging when trash dumpsters are shared and/or service is managed by property/association managers such that individual homeowners are not directly incentivized to divert waste. Space for adding recycling containers can also be limited. While PAYT can still be implemented at multi-family locations, the program's effectiveness may be more restricted. Options can include building-wide diversion incentives that can be passed on to homeowners, requirements that managers implement their own systems making recycling at least as convenient for residents as trash collection (e.g., Portland, Maine's new proposal) and requirements that new/renovated building plans include space for recycling and right-sized trash containers.

2. Design PAYT System

This will include several components:

- Containers - as GSWA's current curbside trash service is based on 96-gallon carts, it is expected that the new policy will;
  - Provide two smaller trash carts to provide residents with reasonable options for trash reduction - GSWA has identified the preliminary intent to make these sizes 32 and 64 gallons, respectively (48-gallon carts may also be made available)
  - Continue to provide weekly collection
- Extra trash - GSWA will need to continue managing extra trash as they do currently (by providing a second cart (for an additional $15 fee) or allowing residents to use bags with program-approved, $4 stickers) or to require homeowners to increase their level of service
- Pricing mechanism - this choice will depend upon the level of diversion incentive GSWA chooses to create and fees that best represent actual collection and materials management costs, and is likely to include;
  - Two-tiered or fixed plus incremental - to best balance these two objectives (and is most similar to the existing pricing structure used by GSWA)
  - A flat fee that covers fixed collection and management costs
  - An incremental fee for the base trash volume (e.g., 32 gallons) that covers variable costs and creates a diversion incentive;
- Some programs (Boulder and Fort Collins, CO) require that the flat fee be no greater than the incremental fee for the base volume (e.g., a flat fee of $10 and an incremental fee of $10 for a total of $20 for that unit)
- To provide the strongest diversion incentive, the incremental will increase by 80% to 100% for each increase in base volume
- Container tracking - GSWA currently uses radio-frequency identification (RFID) tags on its trash carts to simplify and improve maintaining/tracking account information (address and service levels), collection performance, trash and recycling set-out levels and billing (it is expected that RFID will also be used on new recycling and trash carts - will not be effective on extra trash bags)

3. Develop Other Program Components

These should include:

- Discounted pricing for low-income families
- Strategy for on-going services - such as changing service levels/swapping carts (may be free in first six months but a fee afterwards), cleaning carts, replacing carts, etc.
- Data collection and reporting to track program performance - including trash service level selection, trash and recycling set-outs, trash and recyclables quantities collected and managed
- Program enforcement - including prohibition of illegal dumping, trash in unauthorized containers or non-containerized, inclusion of recyclables in trash carts and trash in recyclable carts

4. Public Outreach and Education

Outreach and education will be required at key steps during the development and implementation of PAYT policy and should be paired with strong customer service activity during program roll-out. Key outreach/education and customer service action points include:

- Well in advance of policy implementation to explain policy benefits and objectives, to gain input to program design and to educate residents about their trash service choices;
  - This may take six to nine months and will likely mimic the outreach effort GSWA conducted in advance of the pilot recycling study in 2011/2012
  - Could also benefit from University of Guam Green Team assistance
  - Should target village mayors, community groups, individual homeowners and multi-family/homeowner managers/representatives
- Immediately prior to trash cart delivery to solicit homeowners service level choice - cart delivery should be conducted by GSWA customer service representatives and be accompanied by a program description (cart deliveries will only apply to residents who want to reduce current 96-gallon service, and will include swapping old carts with new, smaller carts - ideally the old, larger carts will serve as back-up recycling containers)
- During roll-out and during first six to nine months of program implementation - customer service needed to answer questions and make adjustments to service levels (i.e., facilitate cart change-outs)
- On-going public outreach and customer service after the first year of implementation - as needed

Future Policy and Program Considerations - It is likely that GSWA will conduct regular evaluation of the pricing structure, especially after the first one to two years when service levels have stabilized. It is possible that the pricing mechanism and structure will be adjusted over time. If island-wide composting opportunities are eventually developed that support diversion of residential organics, the curbside collection system and pricing would also require adjustment.

Finally, GSWA may consider program modifications in the future such as accepting additional recyclables (e.g., glass if local markets improve) and also collecting yard and food waste when composting services are available. Some of the most successful PAYT programs involve three-bin collection of trash, recyclables and organics (yard waste food waste, and food-contaminated paper), and a trash bin (generally smaller because so much material can be handled by recycling and composting.

Major Milestones

A suggested timeline for developing a PAYT policy is as follows:

- 2014 - depending on the outcome of the March 2013 curbside recyclables processing procurement effort, GSWA may be implementing island-wide curbside recycling before the end of 2014 (PAYT should be implemented at the same time)
- 2013 through 2014 - design PAYT program components as well as U.S. District Court and Public Utilities Commission approval for pricing (introduce as part of public outreach associated with new curbside collection of recyclables)

- 2014-2015 - assist resident in making trash service level choices, obtain and deliver/swap trash carts

Challenges

It is important to take into account constraints that the PAYT policy could face to make this alternative less than optimally effective.

- Ability to implement PAYT and the new recycling service simultaneously to maximize savings associated with using replaced trash carts as recycling carts.
- Potential initial public opposition - research shows that the public prefers the PAYT system once it is implemented (e.g., San Francisco, California has a 90% program approval rating, USEPA, 2009).
- Difficulty setting initial rates as projected program costs will be based on "guesstimates" of residential service levels that are likely stabilize as program matures - many programs show that, while service level selection of 32-, 64- and 96-gallon trash service may start out with distributions in the range of 25%, 35% and 40%, respectively (i.e., more residents with mid- and large-sized carts) - within two or three years, the distribution changes to a range of 50% (32-gallon), 35% (64-gallon) and 15% (96-gallon) (examples include Boulder, Edgewater and Fort Collins, Colorado).
- Increased pricing for large families - can be addressed through education about homeowners' options to reduce trash and prices through source-reduction, reuse and recycling.
- Increased pricing for low-income families - discounted prices can be developed for qualifying low-income residents (e.g., Dubuque, Iowa offers 50% discount to low-income families of five or more, low-income elderly, etc.).
- Illegal dumping - research shows that while spikes may be observed during initial implementation, but is not more prevalent in PAYT communities after first few months (USEPA, 2010), creative options exist for enlisting citizen support (e.g., Sacramento, California offers a $500 reward for information leading to an arrest and conviction).
- Impacts to curbside trash and recyclables collection (and recyclables processing contracts) when the GSWA receivership expires - needs to be anticipated by GovGuam and GEPA.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that there were approximately 31,000 to 37,000 tons of recyclables generated by municipal solid waste stream (MSW) generators in 2012 (only a fraction of these materials were actually recycled). Assumptions for estimating the feasibility for a PAYT policy on Guam include:

- Implementation will be tied to GSWA's implementation of residential curbside recycling services and will be in place by the end of 2014 - diversion associated with a new PAYT policy will not be measurable until 2015.
- Targeted materials include the following MSW materials currently collected in GSWA's pilot recycling program - cardboard; mixed office/newspaper/magazines (assume future sustainable market); aluminum and plastic #1/#2 containers (in future years, these materials may be expanded to include glass, yard and food waste collection).
- Only 30% of the MSW recyclables are generated by the residences served by GSWA - this is based on the assumptions that only 50% of MSW is residential and just under 40% of residences currently have curbside service (this could be expected to increase to 60% as new recycling service is added and additional public outreach for GSWA services is provided).
- Of residential recyclables, diversion ranges from 10% to 80% over the planning period
    - These levels are generally consistent with the 2,000 tpy estimate from GSWA's pilot recycling study without PAYT (GBB, July 2012) but would grow over time under the combined effects of PAYT's diversion incentives and bundled pricing.
    - These rates consider material-specific diversion only - they do not directly reflect recycling rates (which would be lower when convenience center and commercial tonnages are considered).
    - These projections may change if additional diversion incentives or policies are established and enforced on Guam - and when new materials are added.

Table WP-C.1. LANDFILL DIVERSION POTENTIAL [1]

NEW RESIDENTIAL PAYT POLICY (implementation expected 2015)

YEAR	PAPER (cardboard, office paper, newsprint, magazines)		CONTAINERS [2] (aluminum, plastic #1/#2)		MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/Year
2015	10%-20%	1,000-2,000	10%-20%	0	1%	1,000-2,000
2020	40%-60%	4,000-6,000	40%-60%	1,000	3%-4%	5,000-7,000
2025	50%-70%	4,000-7,000	50%-70%	1,000	3%-5%	5,000-8,000
2030	60%-80%	5,000-8,000	60%-80%	1,000	4%-5%	6,000-9,000

Notes:

1: Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

2: Aluminum and plastic container quantities are expected to decrease when the Bottle Bill (Guam Public Law #30-221) is implemented because many containers will be recycled at bottle bill redemption facilities instead of via curbside recycling.

Job Creation Potential and Small Business Opportunities

There is expected to be measurable creation of new jobs associated with a new residential PAYT trash pricing policy on Guam. These recyclables processing jobs are expected to range from 2 new FTEs in 2015 and up to 15 in 2030 (based on the generation of slightly more than one new job for every 1,000 tons of materials diverted, as shown in the Basis for Job Creation Potential Estimates Technical Memorandum.

These employment estimates are associated with initial materials processing (i.e., sorting and baling for shipment to secondary processing facilities and end-markets) and are therefore expected to be developed in the private sector (GSWA will continue to contract for processing). Jobs associated with secondary materials processing or manufacturing are likely to occur off-island and have not been estimated here, but would increase the total job creation potential.

Estimated Revenue Generation

The implementation of the recycling component of the PAYT program is expected to generate significant quantities of materials which can be sold to local processors. However, as detailed in the 2012 Technical Memorandum entitled Markets for Recovered Materials, the majority of recycled materials do not a net revenue due to the cost of overseas shipping. Key valuation metrics from the Markets for Recovered Materials Technical Memorandum are presented in Table WP-C.2 below. As shown, only Aluminum Cans, Plastic # 1 and Plastic #2 have positive net revenues per ton. In those cases where recycled materials do not generate net revenues (a net cost), the numbers are highlighted in red in Table WP-C.2 below.

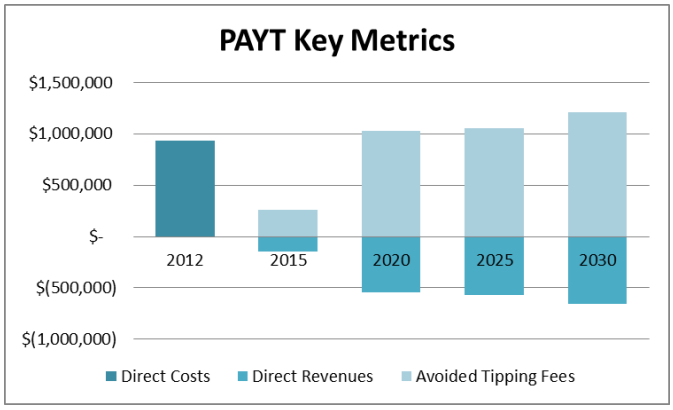
Table WP-C.2. Pricing Values for Traditional Recyclables (2012) [1]

Shipment in a 40-foot Intermodal Sea Container (45 Bale Maximum)										
Material	Baling & Loading Cost/Ton	Weight per Container (tons)	Baling & Loading per Con-tainer	Port Charges & Shipping to West Coast U.S.	Total Costs per Container	Gross Revenues/ Ton	Gross Revenues/ Container	Net Revenues (Gross Minus Total Costs)	Net Revenues (Cost)/Ton	Net Revenues (Cost)/Ton with Landfill Savings
Mixed Paper	$50	27	$1,350	$5,800	$7,150	$85	$2,295	($4,855)	($180)	($9)
Sorted Office Paper	$50	27	$1,350	$5,800	$7,150	$163	$4,401	($2,749)	($102)	$69
Sorted White Ledger	$50	27	$1,350	$5,800	$7,150	$240	$6,480	($670)	($25)	$146
Newspaper	$50	27	$1,350	$5,800	$7,150	$93	$2,511	($4,639)	($172)	($1)
Corrugated Cardboard	$50	27	$1,350	$5,800	$7,150	$108	$2,916	($4,234)	($157)	$14
Aluminum Cans	$50	11.3	$565	$5,800	$6,365	$1,523	$17,210	$10,845	$960	$1,131
Steel Cans	$50	22.5	$1,125	$5,800	$6,925	$57	$1,283	($5,643)	($251)	($80)
Plastic #1	$50	13.5	$675	$5,800	$6,475	$564	$7,614	$1,139	$84	$255
Plastic #2	$50	18.7	$935	$5,800	$6,735	$465	$8,696	$1,961	$105	$276

Notes:

1: Aluminum and plastic container quantities are expected to decreases when the Bottle Bill (Guam Public Law #30-221) is implemented because many containers will be recycled at bottle bill redemption facilities instead of via curbside recycling.

Based on the diverted quantities described in Table WP-C.1, , the "sale" of recyclables collected as part of the PAYT initiative will have a net cost of more than $144,000 in 2015, increasing to more than $652,000 by 2030. It is important to note, however, that these negative revenues will be more than offset by avoided landfill costs.



Avoided Landfill Disposal Costs

Based on the diverted quantities described in Table WP-C.1 and an average tipping fee of $175 per ton at GSWA's commercial transfer station throughout the planning period, avoided tipping fees would be $263,000 in 2015, increasing to more than $1.2 million by 2030.

Human Health and Environmental Impacts

PAYT policies can have significant beneficial impacts on human health and the environment.

- PAYT raises source reduction, recycling, and composting rates resulting in reduced pollution and associated health benefits. This decrease in waste

disposal helps to prolong the lifetime of the landfills, and helps to preserve habitat that may otherwise be used for new or expanded landfills.

- Due to increased diversion rates, PAYT is also attributed with significant greenhouse gas reductions.
- Research has shown that PAYT is significantly less expensive than most energy strategies in reducing greenhouse gas emissions - specifically strategies involving wind, solar and residential weatherization (Skumatz, 2008).

Economic Costs

With respect to economic benefits, governments and/or haulers realize PAYT cost savings associated with the need to dispose of less trash. These savings vary as a function of landfill tip fees, but reported savings appear to be universal (Brown, 2011). Fort Worth, Texas reduced its tip fees by $7M (and increased recyclables revenues by more than $0.5M) the first year after implementing PAYT. Dover, New Hampshire and Worcester, Massachusetts reduced their waste management costs by $320K and $1.2M, respectively, with PAYT.

Although the PAYT initiative represents a significant shift in how waste collection and disposal are viewed, the implementation of this initiative represents more of a shift in accounting than a distinct change in the service provided. GSWA currently provides trash pickup for approximately 17,000 single-family homes on Guam in 96 gallon containers, for a monthly fee of $30. Under the PAYT initiative, customers would continue to receive curbside pickup. However, customers would have a choice of 32-, 64- or 96-gallon containers, with varying fees for each size of container - and a new fee schedule would be implemented (those residents who retain their 96-gal trash cart may/may not still have a $30/month fee). If GSWA implements curbside recycling in tandem with PAYT pricing, GSWA customers would be provided with a second container for recyclables and monthly fees would be adjusted to include the bundled cost of trash and recycling (in this case, monthly fees would likely increase even if the same 96-gal trash service is retained).

Significant cost assumptions for the PAYT initiative include:

- Acquisition costs for 32- and 64-gallon receptacles for customers;
- Public outreach to explain PAYT options and allow residents to choose their service level;
- Legal and staff costs to have rates and terms approved by the Public Utilities Commission and the Federal Court;
- Delivery costs for new trash receptacles; and
- Collection of larger receptacles and storage of the outdated receptacles.

Total costs for the PAYT initiative are expected to be incurred prior to actual implementation only, and be about $933,000 in 2015. This total includes an allowance of $100,000 to complete the process of getting the necessary approvals from the Public Utilities Commission[1] and the court system; $638,000 for the acquisition of 8,500 new automated carts; $170,000 for delivery of new carts; and $25,000 for administrative overhead of staff salaries. Beyond this pre-implementation investment, additional on-going costs for PAYT initiative will be negligible.

[1] Assumes one direct FTE and additional funding for legal support

Costs for implementing PAYT on Guam will focus primarily around the public outreach needed to prepare residents for a new pricing system and assist them in evaluating new trash cart sizes - and the purchase/delivery of new trash carts. Assumptions used for this analysis include:

- PAYT trash pricing will be implemented simultaneously with GSWA's new residential curbside recycling service to existing trash customers;
- No new collection costs will be incurred - trash fleet and drivers will be reallocated to recyclables collection as trash quantities drop and recyclables quantities increase;
- 50% of current trash customers will choose to change their service to a smaller trash cart size; and
- GSWA's outreach effort for PAYT will likely be conducted in tandem with outreach for the new recycling service.

On the cost savings side, it is probable that the 96-gallon trash carts replaced by smaller carts will be used for recycling by GSWA (GSWA uses 96-gallon recycling carts in its pilot currently). While GSWA will need to modify the trash carts with different color lids (to indicate recycling instead of trash), there will be some cost savings for the curbside recycling program (expected to be a savings of more than half the price of each cart, as shipping costs will also be avoided). As a result of this overlap, it will be important for GSWA to be able to implement PAYT at the same time as its new recycling service.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Anderson, Chace (Gershman, Brickner and Bratton, Inc. Project Manager), e-mail communication, November 29, 2012
- Anderson, Chace (Gershman, Brickner and Bratton, Inc. Project Manager), e-mail communication, February 1, 2013
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- Clean Air-Cool Planet (Falmouth, ME PAYT example) - www.cleanair-coolplanet.org/for_communities/payasyouthrow.php
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- Skumatz, Lisa "Pay As You Throw (PAYT) in the US: 2006 Update and Analyses," prepared for the USEPA Office of Solid Waste, December 2006
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- USEPA, "Pay-As-You-Throw Summer 2010 Bulletin," EPA530-N-09-001, 2010
- USEPA, "Pay-As-You-Throw Summer 2009 Bulletin," EPA530-N-09-001, 2009
- USEPA, "Rate Structure Design - Setting Rates for a Pay-As-You-Throw Program," EPA530-R-99-006, January 1999

- USEPA SMART BET Calculator - Saving Money and Reducing Trash Benefit Evaluation Tool (to help communities evaluate unit-based pricing), www.epa.gov/epawaste/conserve/tools/payt/tools/smart-bet/index.htm
- Wood, Jeff (Lakeland Solid Waste Manager), personal communication February 1, 2013

Other Resources

- Guam Power Authority: http://guampowerauthority.com/home/home_electricity_bill.php
- Guam Water Works: http://www.guamwaterworks.org/understanding_bill.html
- U.S. EPA Pay As You Throw Website, http://www.epa.gov/epawaste/conserve/tools/payt/index.htm
- U.S. EPA , Pay As You Throw Rate Setting Design
- http://www.epa.gov/epawaste/conserve/tools/payt/tools/rsd.htm
- Econservation Institute, Pay As You Throw West http://paytwest.org/
- SERA, Increasing Recycling Now! Guidebook for Community Adoption of Recycling And Pay As You Throw Ordinances, 2008, http://www.paytnow.org/PAYT_OrdinancesReportSERA_v4.pdf

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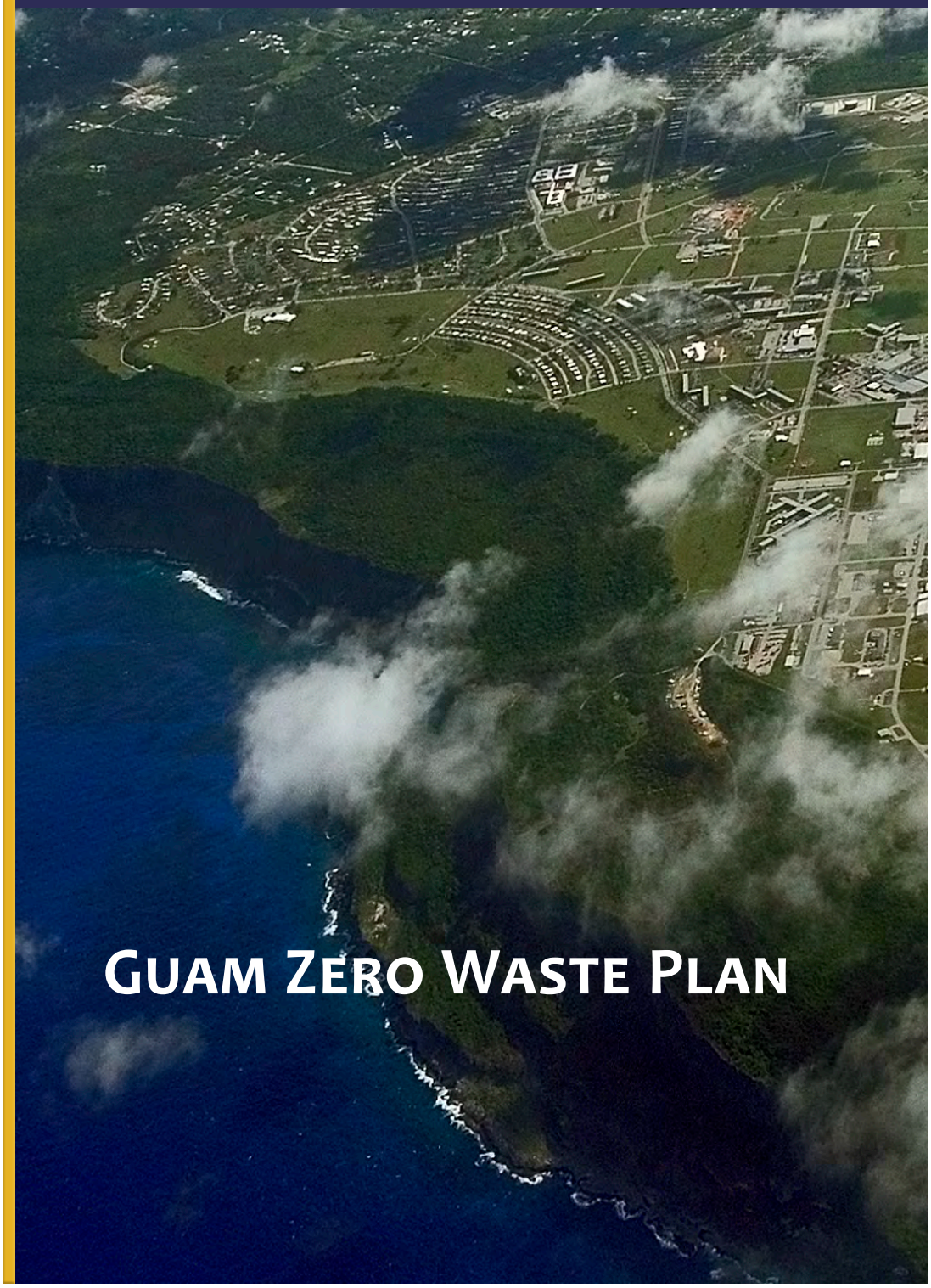
White Paper D



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP D

Please see the next page.

WHITE PAPER D

PLASTIC BAG DISPOSAL BAN

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste, rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Plastic Bag Disposal Ban*
- *Green Purchasing Program*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Zero Waste Association*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be implemented to make a plastic bag ban effective. This type of ban is different from the landfill disposal bans used to force diversion of other materials once they are consumed (e.g., yard waste, appliances, etc.) because it is implemented at the point of consumption.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap to the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

This section presents the key findings in the document. Plastic bag bans prohibit the provision of single-use, disposable bags for carry-out by targeted businesses such as supermarkets, big box stores, restaurants, fast food/convenience stores and other retailers (as well as wholesalers). Key steps that will need to be undertaken to implement a plastic bag disposal ban are as follows:

- Establish credible basis for policy.
- Determine which single use bags to target.

- Determine what businesses to target.
- Determine timeline.
- Consider exemptions.
- Determine enforcement and penalties.
- Track progress and consider modifications.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of the Plastic Bag Disposal Ban initiative including background information, a summary of what exists on Guam today, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and with respect to the initiative.

Between 500 billion and 1 trillion plastic bags are used worldwide each year (Mercola, 2012). Many of these are used only once before being discarded. While the demand for recycled plastic bags by landscaping and composite lumber markets is growing, the vast majority of recycling programs do not yet accept this material. Plastic bags also cause recycling equipment processing and the contamination of compost and mulch. Plastic bags do not contribute significantly to the solid waste stream in terms of weight, but they can be a very visible contributor to the litter and marine debris that degrade community aesthetics, pollute waterways and increase clean-up costs.

In recent years, plastic bags have become a popular target of local recycling programs and environmental organizations. By the end of 2011, more than 80 communities in the U.S. and Canada had mandatory bag policies (The Brendle Group, 2012). American Samoa, Hawaii counties and many cities in the Philippines have banned plastic bags. Other countries that have banned free plastic bags include Bangladesh, Australia, Italy, South Africa, Ireland, Bhutan, Pakistan, Haiti, Uganda and Taiwan.

What is a Plastic Bag Ban?

Plastic bag bans prohibit the provision of single-use, disposable bags for carry-out by targeted businesses such as supermarkets, big box stores, restaurants, fast food/convenience stores and other retailers (as well as wholesalers). These businesses must either provide an alternative bag (e.g., paper or reusable) - for free or for a fee - or encourage customers to provide their own bags. In some cases customers using their own bags are given refunds against purchases (e.g., 5-10 cents off). Plastic bag ban programs seek to achieve a number of goals including:

- Controlling litter - and subsequent impacts to utilities, waterways and wildlife.
- Reducing solid waste management costs - including facility site clean-up and equipment repair associated with recyclables and organics contaminated with plastic bags.
- Reducing life-cycle costs and conserving resources.

- Raising public awareness and involvement - plastic bags cause very visible pollution and are a tangible example of consumption and waste.

Enforcing Organizations

Governments are the primary organizations that establish these plastic bag bans. In the U.S., implementing governments are limited, to date, to cities and counties, although some states have introduced bag ban legislation. In Canada, several provinces have developed related policies. Globally, there are numerous country-wide programs (e.g., Denmark, Ireland, Taiwan, Italy, Bangladesh, Rwanda), and many more local government bans. To a much lesser extent, some individual retailers have also adopted bag reduction policies without government involvement.

Implementation by Businesses

Regardless of who initiates a plastic bag ban policy, businesses are targeted for actual implementation. As a result, they eliminate the cost of purchasing plastic bags but may face new costs associated with changing their bag inventory, training staff, educating the public, purchasing/selling alternative bags, providing refunds for use of reusable bags or reconfiguring sales systems to accommodate bags fees (explained below). These costs may be off-set by reduced purchase of single-use plastic bags (most of which are exported from off-island).

Types of Policies

Single-use bag policies in general include the following primary components:

- Materials targeted - may be plastic bags only or in combination with other single-use, disposal bags (paper bags).
- Mechanism - can be a bag ban, fee or hybrid.

Many ban/fee programs target both plastic and paper bags. Reasons for this approach include the assumption that banning or adding fees for one type of bag would only increase the use of the other type of disposable bag. Life cycle environmental analysis of paper and various types of plastic bags has found that there are significant impacts associated with all types of disposable bags (Boustead Consulting, 2007).

Bag bans have some advantages over fee programs in that they make greater progress toward meeting diversion and litter goals, easier to enforce, expand public awareness, and reduce retailers' costs. They do not, however, generate any revenues that governments and retailers can use to off-set education and implementation, can garner public opposition (perceived as eliminating public choice), are often opposed by plastic bag

manufacturers (such as those represented by the American Chemistry Council and the American Bag Alliance), and require purchase of reusable bags.

Some governments have chosen fees instead of bans, which sends a direct economic signal to consumers, retains customer choice, and generates revenue for programs implementation. However, these programs are typically harder to implement, increase retailers costs and can be difficult for low-income populations.

Opposition

Not surprisingly, proponents and opponents to the ban/fee issue disagree on several issues that have not been satisfactorily addressed for all policy makers (Kettl, 2012; Russo and Meyers, 2012; American Plastic Bag Alliance website). The points of disagreement include:

- Plastic bag construction and ultimate resource conservation impacts.
- Environmental impacts of compostable, biodegradable and photodegradable bags.
- Health and environmental impacts of reusable bag manufacture and recyclability.
- Job creation/loss associated with plastic versus reusable bags.

Existing Programs on Guam

The Recycling Association of Guam has estimated that 40 million plastic bags are given by retailer to consumers in Guam each year. Currently, the only known plastic bag reduction program on Guam is the Mission Zero Bags program implemented by the Pay-Less Supermarkets in early 2012 (www.facebook.com/MissionZeroBags). Pay-Less is the largest supermarket chain in Guam and Pay-Less estimates that it contributes 28% of the plastic bags used in Guam. Every Wednesday, the stores do not provide plastic check-out bags. Customers can either purchase paper bags at 5 cents each or use their own bags for a 5-cent/bag refund. All revenues earned from the paper bag sales support a grant program (grantees include public and non-profit organizations with green programs). Pay-Less has done significant outreach on Mission Zero Bags in Guam through television, radio, billboards, store events and signage, and social media.

Pay-Less held a celebration to report that they achieved the 1.1 million bag reduction goal in September, three months prior to the deadline Payless also established a new goal of eliminating 5 million plastic bags. Pay-Less data indicates that the grocer's sales events on Wednesdays and outreach efforts have successfully encouraged public participation and support (see Section 5 for links to this data).

Successful Approaches Used Worldwide

Some governments initially worked to reduce single-use, disposal carry-out bags through education and outreach but found virtually no measurable decrease in plastic bag consumption (City of Aspen, 2012). While voluntary retailer programs have been effective in Canada, most U.S. programs now include a regulated ban, fee or ban/fee hybrid approach. A partial list of governments that have established the various options are listed below (example plastic bag ban programs are provided subsequently in greater detail):

- Plastic bag bans - American Samoa; Australia; Hawaii Counties; Portland, OR (Washington D.C. also bans plastic bags that are not 100% recyclable)
- Fee on both paper and plastic - Washington, D.C. and Montgomery County, MD (5-cent fees on both bags); Boulder, CO (10-cent fees on both bags)
- Hybrid (e.g., fee on paper and plastic bag ban) - Seattle, WA (5-cent fee on paper bags); San Francisco, San Jose, and Los Angeles County, CA; Telluride, CO (10-cent fees on paper bags); Aspen, Basalt and Carbondale, CO (20-cent fees on paper bags)

American Samoa

This program became effective in 2012 and targets all wholesale and retail businesses (including farmers markets and road-sale food sales). The American Samoa Environmental Protection Agency endorses non-petroleum-based, biodegradable, compostable bags; paper bags; reusable cloth bags and woven baskets. Non-compliance penalties range from $50 for a single infraction to $1,000 for multiple infractions. The USEPA recognized the importance of American Samoa's plastic bag ban for decreasing plastic waste and directly protecting marine and bird life in the Pacific (USEPA, 2010).

Hawaii

Each county is Hawaii has now individually banned plastic bags and has effectively established a state-wide ban although specific rules vary by county:

- Hawaii's ban becomes effective in 2014 (rule-making still in progress) - targets non-recyclable bags provided by retailers with penalties ranging from $250 to $1,000/day (retailers have one year to prepare by charging for plastic bags distributed), KTA supermarket is working to eliminate all single-use bags by 2014 (West Hawaii Today, 2012).
- Honolulu's ban becomes effective in 2015 - prohibits any commercial business from providing non-biodegradable plastic or non-recyclable paper bags with penalties ranging from $100 to $1,000/day.

- Kauai's ban became effective in 2011 - targets non-recyclable, non-biodegradable and non-reusable bags provided by all commercial businesses with penalties of $250 to $1,000/day.
- Maui's ban became effective in 2011 - targets non-biodegradable bags provided by all businesses with penalties of $500 to $1,000/day.

Portland, Oregon

Portland's initial plastic bag ban became effective in 2011 and reported that 50M less plastic bags were consumed and 300% more reusable bags were used in the first six months (Resource Recycling, 2012). In 2012, Portland expanded its ban to now apply to about 5,000 retail and food providers with buildings greater than 10,000 square feet.

On the flip side, it should be noted that not all plastic bag policy efforts have been successful. The State of Illinois failed in 2012 to pass a state-wide extended producer responsibility effort that would have required plastic bag manufacturers to provide collection and recycling for plastic bags. Several states (Oregon and California) have failed to pass a state-wide ban. Toronto, Canada was unable to pass a plastic bag ban in 2012 and Taiwan repealed its bag ban as early as 2006 (Cemansky, 2012).

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste alternative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an alternative and also take into consideration constraints or limitations that could make the alternative less than optimally effective.

Opportunities include:

- Involves consumers and retailers in front-end Zero Waste program.
- Addresses a major component of litter - especially in sewers/drains, river and marine environments.
- Increases operational costs at solid waste facilities such as landfills, transfer stations, MRFs, compost sites.
- Until recently, there were only limited programs that accepted plastic bags for recycling.
- Very visible part of the waste stream – even though low component by weight.
- Policy issues help public identify with the need to shift away from disposable culture.
- Retailer purchase and inventory costs may be reduced if reusable bags replace single-use plastic bags.
- Collection of fees for violators provides government with revenues to administer/enforce the program, clean up litter, or cover other Zero Waste program costs.

Constraints Include:

- Public may oppose as it represents change from status quo and reduces choice.
- Retailers may oppose as it requires staff training, public education, and change in bag inventory.
- Targeting only plastic bags can create confusion for public and retailers.
- Bans do not provide government with revenues to administer/enforce the program, clean up litter, or cover other Zero Waste program costs.

3. IMPLEMENTATION OVERVIEW

In a number of communities, the implementation of a plastic bag disposal ban has led to significant achievements. Implementation of a disposal ban can have significant positive environmental impacts, as long as there is a plan on how to implement the ban. The following overview provides information on how to turn this initiative into action.

Key Stakeholders

Because a material use ban is a regulatory mandate, legislation will be required for implementation. Successful legislation would be followed by the development of territorial regulation that details how the law will be implemented, enforced, monitored and reported. Implementation would be island-wide, affecting targeted businesses. It is expected that GEPA will be the lead agency for development and on-going implementation, although non-regulatory staff will be needed to champion this policy through the legislative process. Leadership by GSWA was also explored but GBB determined that regulation and enforcement of this policy was outside the receivership's responsibilities (Manning, 2013).

Major Components

Key steps that will need to be undertaken to implement a plastic bag disposal ban are as follows.

Establish Credible Basis for Policy

To establish solid policy, some communities have developed language establishing the basis of legislation. This can include the specific policy goals, research findings that support the policy need and information that makes the policy relevant locally. Two good examples are the findings in the Boulder County ordinance (October 2012) and the Anacostia River trash reduction plan that identifies quantifiable need (i.e., >20% and nearly 50% plastic bags in river and tributary trash, respectively - Anacostia Watershed Society, 2008). Islands such as American Samoa, Hawaii and Taiwan also provide relevant examples.

Determine Which Single-Use Bags to Target

While this analysis has focused only on a ban associated with plastic bags provided at check-out, decisions will still be required concerning the types of banned bags, such as:

- Bags provided by one or more type/size of businesses (see below)
- Only single-use bags - Austin and Washington D.C. exempt thick plastic bags with handles that can function as reusable bags (Hawaii is currently considering the same)

- Only non-recyclable bags - this distinction only makes sense when collection and processing infrastructure exists for these materials (does not on Guam at this time)
- Only non-biodegradable bags - the definition of biodegradable can engender some debate (the Biodegradable Plastics Institute provides applicable testing standards at www.bpiworld.coms)
- In concept, GEPA supports the banning of single-use, biodegradable bags from restaurants and retail facilities on Guam.

Determine Which Businesses to Target

As noted in the examples provided above, all businesses of any size that provide plastic bags can be targeted. It is important that the targeted businesses be selected fairly and defensibly, and that all businesses in the target category are subject to the same policy requirements. Alternatively, those businesses to which the ban applies may be limited to only:

- For-profit businesses - versus non-profit organizations (Hawaii utilizes this exemption)
- Retailers - versus both retailers and wholesalers (American Samoa targets both)
- Certain types of retailers - such as grocers only (the Aspen, CO program)
- Businesses of a certain size (e.g., Portland's policy applies only to those businesses with more than 10,000 square feet of retail space)
- Vendors at events and markets
- Targeted businesses can expand over time with a "phased" policy (see below) or if the initial policy is expanded in the future

Determine Time Line

In many cases, legislated policy is more successful if a phased approach is used that allows the policy to be implemented in steps. This may allow the government, retailers and public time to adjust and prepare for change. Examples include:

- Initial lag between law passage and effective date (ideally at least six months) - to provide government time to develop implementing regulation and conduct stakeholder outreach, businesses time to adjust their inventory and the public adequate warning
- Optional phasing - between consecutive program expansion such as;
  - Hawaii's program which allows retailers an initial year to adapt by allowing them to provide bags for a fee before the actual ban becomes effective.
  - Portland's initial program targeted only big box stores and supermarkets for one year (approximately 200 businesses), but subsequently expanded its targets through new policy to also target restaurants and other retailers (about 5,000 total businesses).
- Sunset date (when the policy will expire without further action) - can improve the likelihood of initial approval - this date should be set far enough into the future that results can be measured and interpreted to either support the sunset provision or argue for a policy extension.

Consider Exemptions

Any policy should consider those materials, stakeholders and/or instances when implementation will likely cause a hardship or be infeasible. Common exemptions associated with plastic bag bans include (examples primarily from Hawaii, Honolulu and Seattle programs unless otherwise noted):

- Those used for sanitary purposes, for bulk items on when moisture is an issue - such as vegetables, meat, fish, poultry, frozen foods, flowers, deli foods, etc.
- Special uses such as those bags used for prescription drugs, food take-out orders, pet waste, dry cleaning, newspapers, door-hangers.
- Bags sold in packages (e.g., garbage bags), approved compostable and yard waste bags.
- Miscellaneous - Washington D.C. exempts bags used to transport partially consumed bottles of wine and food taken away from restaurants with seating.

Establish Enforcement and Penalties

While some ban programs allow an initial warning for businesses prohibited from providing plastic bags, many include financial penalties that increase with multiple violations. Funds collected can be used to cover administrative and outreach costs.

Track Progress

Collect data to measure the success of the program and report to legislators, businesses and public (should include metrics such as number of plastic bags distributed, number of single-use paper and reusable bags used, litter impacts, etc.).

Future Program Options

These may include adding fees on paper bags and/or also banning paper bags and expanding consumer-targeted bans to cover other difficult-to-recycle or potentially toxic items such as polystyrene, lead fishing and wheel weights, or mercury thermometers.

Major Milestones

- By 2014 - conduct litter/waste research specific to Guam, convene stakeholders and enact legislation;
- By 2015 - reach effective date of plastic bag ban; and
- 2017 and beyond - consider adding a paper bag ban.

Challenges

While implementation of a plastic bag on Guam may be easier than in some large cities because there will likely be fewer targeted businesses and lower enforcement needs, there will still be policy challenges:

- New policy with mandates that affect business as well as public choice often encounter initial opposition;
- Those who have adopted the practice of using single-use bags for pet litter, trash, recyclables, yard waste, etc., may oppose a plastic bag ban;
- Plastic bag manufacturing industry opposition;
- Banning only one type of single-use bag (plastic) will likely drive increased use of alternative disposable bags (paper) ;
- Reusable bags can be expensive to purchase and difficult for low-income consumers; and
- Limited on-island manufacture of reusable bags (but may eventually create new business opportunities).

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that approximately 2,000 tons of plastic film, wrap and bags were generated on Guam in 2012 (single-use, disposable carry-out bags comprise only a portion of this quantity). GEPA did not observe measurable quantities of diversion in its survey for 2011. A new plastic bag ban will have an island-wide impact in terms of reducing litter, consumption of disposal materials and reduced solid waste facility costs - as well as creating a highly visible way for both the public and commercial sectors to change their consumption behavior. However, as this policy focuses on a material ban, the generation and use of plastic bags will be decreased as will the need for post-consumer management.

Assumptions for estimating future diversion resulting from a potential ban on Guam include:

- Policy development will take at least two years - diversion associated with new policy will not be measurable until 2015;
- Plastic bag waste is negligible in Guam's total waste stream - it is estimated that only 2,000 tons/year of plastic film/wrap/bags were generated in 2012 (as these materials are so light-weight, however, their weight does not adequately describe their potential environmental impact) - as much as 70% of this stream may be single-use, disposable carry-out plastic bags that would be eliminated from use (not specifically recycled) by this policy; and
- Single-use plastic bags are assessed for the MSW waste stream only.

Table WP-D.1. LANDFILL DIVERSION POTENTIAL[1]
NEW GUAM PLASTIC BAG BAN (Implementation expected 2015)

YEAR	PLASTIC BAGS		MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential through Reduced Generation		Combined Range of Diversion Potential	
	% by Weight	Tons	% by Weight	Tons
2015	5-10%	0	0%	0
2020	55-65%	1,000	0%	1,000
2025	65-75%	1,000-2,000	0%	1,000-2,000
2030	75-85%	1,000-2,000	0%	1,000-2,000

Notes:
1. *Diversion ranges and tonnages estimated as detailed in Technical Memoranda: 2010 Baseline Measurement Data And 20-Year Waste Quantity Projections. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).*

Job Creation Potential and Small Business Opportunities

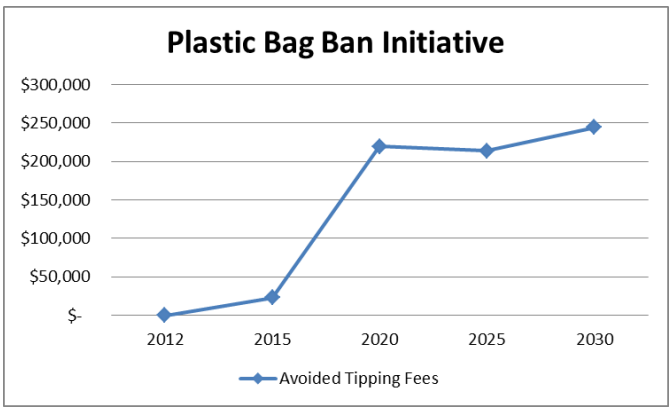
It is anticipated that there will be no notable job creation and/or small business opportunities created as a result of the Plastic Bag Ban initiative. However, limited opportunities may be created within the market to provide alternatives to plastic bags for retailers and consumers.

Estimated Revenue Generation

No direct revenues are expected as a result of the Plastic Bag Ban initiative. While many tons of plastic bags will be diverted from landfill disposal as a result of this program, there will be reduced generation at the source (included of recycling materials once they are used and wasted).

Avoided Landfill Disposal Costs

Based on diverted quantities described in Table WP-D.1 and assuming an average tipping fee of $175 per ton at GSWA's commercial transfer station throughout the planning period, avoided tipping fees would be $24,000 in 2015, increasing to $244,000 by 2030.



It is also anticipated that several types of solid waste management costs on Guam will be lowered as plastic bag contamination is reduced including:

- Daily clean-up costs at the Layon Landfill, GSWA/private convenience centers, transfer stations;
- Equipment down time at local recycling and composting operations; and
- Litter clean-up.

While these cost savings have not been estimated for Guam, Boulder (population 299,000) and Larimer (population 306,000) Counties in Colorado estimated that MRF equipment repair and landfill litter clean-up,

respectively, has been over $200,000 and $21,000/year (The Brendle Group, 2012). In addition, legislation in some places includes monetary penalties for repeat violators.

Human Health and Environmental Impacts

Though the use of reusable bags can lead to some sanitary concerns that have the potential to make people ill if they are not regularly washed, the benefits to human health and the environment from banning plastic bags far outweigh the negative. Benefits include:

- Reducing our dependence on fossil fuels.
- Conserving resources.
- Helping to preserve the integrity of our local ecosystems, especially marine ecosystems
- Reducing the burden on landfills, extending their lifetimes, and helping to protect habitat that otherwise could potentially be appropriated for a new or expanded landfill.
- Helping to cut back on litter in the community.

Economic Costs

It is expected that a plastic bag ban will be pursued by GEPA staff and volunteer island recyclers, organizations and citizens. As GEPA staff will have limited ability to actively lobby a bill through the Guam Legislature, business and volunteers will likely need to champion this policy. Significant cost assumptions for the Plastic Bag Ban initiative that targets single-use, disposal bags in the municipal solid waste stream include:

- Policy development will occur in 2013-2014
- 0.25 FTEs from GEPA beginning in the base year to implement successful legislation and regulation, and continuing at that level using GEPA and/or DPW staff throughout the forecast period for the provision of education, enforcement, monitoring, tracking, reporting and managing penalty collections;
- Total costs for the Plastic Bag Ban initiative are expected to be less than $19,000 annually for 0.25 FTE to support the program; and
- GovGuam overhead costs for Department of Administration are included at 7% of departmental costs, and departmental overhead is included at 18% of salaries;
- Development and on-going costs donated by volunteer businesses, organizations and citizens - are not tabulated; and
- There will be no new equipment or other office requirements.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- American Chemistry Council - www.americanchemistry.com/
- American Progress Bag Alliance - http://plasticsindustry.org/apba/
- Anacostia Watershed Society, "Anacostia Watershed Trash Reduction Plan," prepared for the District of Columbia Department of the Environment, December 2008
- Biodegradable Plastics Institute - www.bpiworld.com
- Boustead Consulting & Associates, "Life Cycle Assessment for Three Types of Grocery Bags – Recyclable Plastic; Compostable, Biodegradable Plastic; and Recycled, Recyclable Paper," 2007
- The Brendle Group, "Triple Bottom Line Evaluation - Plastic Bag Policy Options," prepared for the City of Fort Collins, October 2012
- Cemansky, "How Many Cities Have a Ban on Plastic Bags?", http://people.howstuffworks.com/has-many-cities-have-a-ban-on-plastic-bags.com
- City of Aspen, Colorado, "Addressing Single Use Items in a World of Convenience," prepared by Ashley Cantrell Perl, June 2012
- City of Boulder, "Bag Use in Boulder," Public Meeting, April 2012
- City of Boulder Ordinance No. 7870 (October 2012)
- Guam Payless Supermarkets (community grant program) - www.paylessmarkets.com/
- Hawaii Tribune Herald, "Plastic Bag Ban Nears," by Nancy Cook Lauer, October 2012
- Kettl, "The Plastic Bag Ban: A Battle of Socio-Economic Policy," February 2012 - www.governing.com/templates/gov_print_article?id=138135358
- KUAM News, "Pay-Less Launches 'MOB' Mini-Grant Project," July 2012
- KUAM News, "Mission Accomplished at Pay-Less," September 2012 http://www.kuam.com/story/19579746/2012/09/19/mission-accomplished-at-pay-less
- Manning, David (Gershman, Brickner and Bratton, Inc. - Receiver Representative), e-mail communication, March 18, 2013
- National Grocers Association - www.nationalgrocers.org
- Pacific News Center - www.pacificnewscenter.com/index.php?option=com_content&view=article&id=27283:payless-reaches-goal-of-eliminating-11m-bags&catid=56:community-events
- Plasticbagrecycling.org (on-line resource for plastic bag/film recycling) - www.plasticbagrecycling.org/plasticbag/index.html
- Plastic Bag Ban Map - www.mnn.com/lifestyle/responsible-living/blogs/interactive-map-shows-plastic-bag-bans-around-the-world
- Plastic Pollution Coalition - http://plasticpollutioncoalition.org/

- Resource Recycling, "State & Province Watch - Portland Moves Forward On Bag Ban," December 2012
- Russo and Meyers, "Should Cities Ban Plastic Bags?", October 2012 - http://online.wsj.com/article/SB10000872396390444165804578006832478712400.html
- TischlerBise, "Disposable Bag Fee Nexus Study," prepared for the City of Boulder, 2012
- USEPA, “USEPA Applauds American Samoa’s Decision to Ban Plastic Shopping Bags’; September 30, 2010, http://yosemite.epa.gov/opa/admpress.nsf/0/921A87D72D9AAFC1852577AE007394F1
- West Hawaii Today, "Bag Ban Begins," by Nancy Cook Lauer, January 2013

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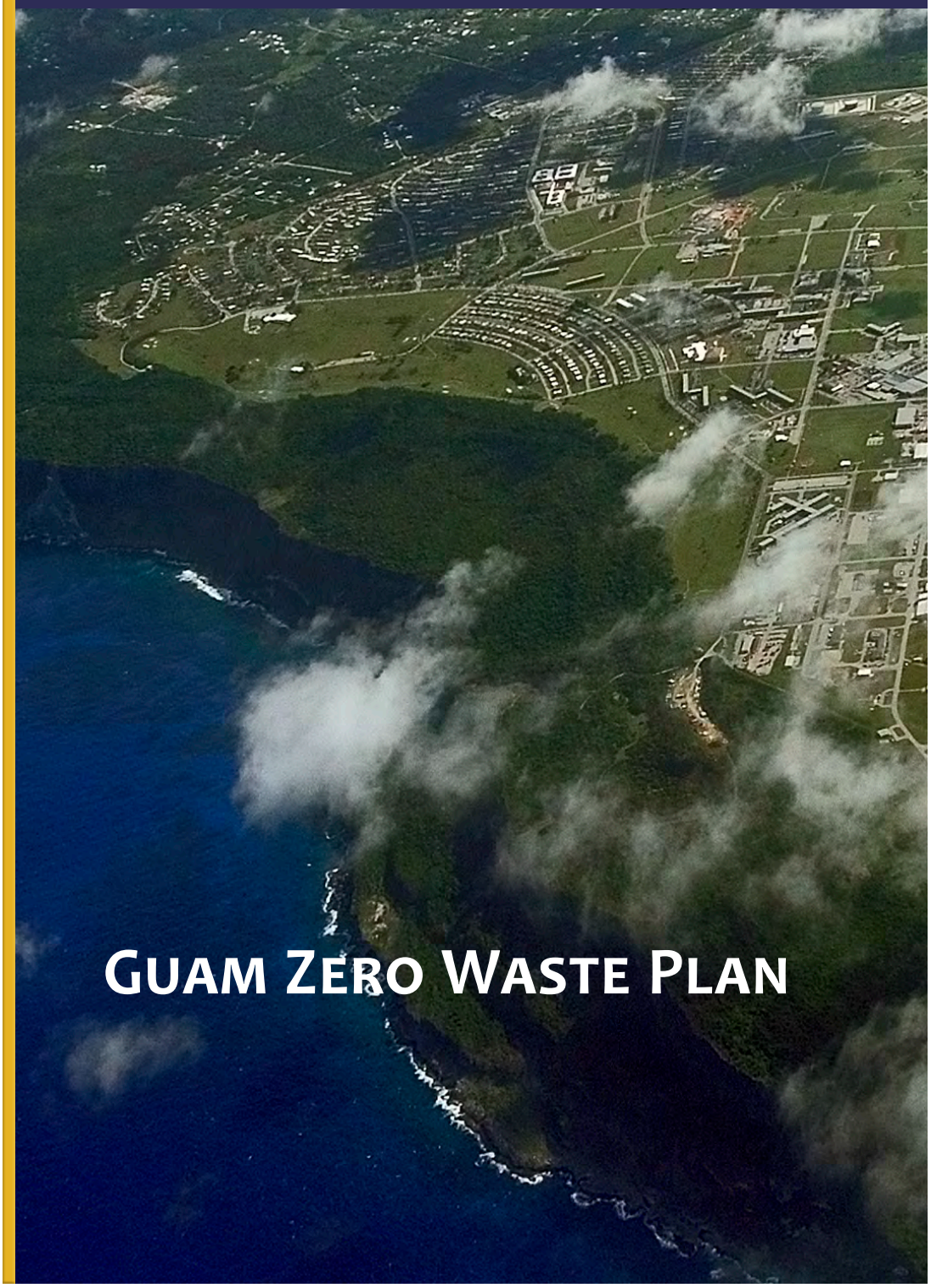
White Paper E



Guam Zero Waste Plan

GOVERNOR'S SEAL ISLAND OF GUAM

WP E

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WHITE PAPER E

USED BUILDING MATERIALS FACILITY

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies programs, and facilities needed to implement a Zero Waste plan. No single initiative, alternative, or strategy can be put in place to achieve a Zero Waste plan. Multiple layered strategies and initiatives will be needed to develop an effective Zero Waste program for Guam. The Guam Zero Waste Plan includes a detailed analysis of fifteen Zero Waste initiatives selected by GovGuam with input from key solid waste stakeholders as improvements most likely to advance a Zero Waste initiative on Guam.

ZERO WASTE INITIATIVES

- *Used Building Materials Facility*
- *Green/Environmentally Preferential Purchasing Program*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Zero Waste Association*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be implemented to develop a new Used Building Material Facility to advance Zero Waste on Guam. Building materials can represent a significant part of the waste stream, and significant construction is anticipated with the military build-up.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap of the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the initiative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

Policy Options

- Incentivize reuse and deconstruction - potentially require Reuse Plan as a building permit condition; require deconstruction GovGuam and local government buildings, schools, etc.;
- Implement a green building program; and
- Implement disposal bans on materials typically managed by used building material programs (e.g., appliances).

Implementation Options

- Establish and construct designated Used Building Materials/Reuse Facility
- Develop Reuse Areas at transfer stations
- Develop Reuse Education and Outreach Program
  - Promote online reuse and transfer of used building materials
  - Develop Reuse Information to support buildup contractors
- Develop Reuse Measurement/Tracking System.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of Used Building Material facilities including background information, a summary of what exists on Guam today with respect to this initiative, examples of similar initiatives that have successfully been implemented, and opportunities and constraints associated with establishing a Used Building Material facility.

What is a Used Building Materials Facility?

Building projects (especially demolition and renovation) can generate notable quantities of materials with the potential for salvage and reuse by others. In the last decade, environmental and home-building organizations throughout the United States (U.S.) have begun to address this potential with increasingly sophisticated and successful used building materials programs. These programs can not only accomplish significant landfill diversion, but also provide low-cost household and building materials to homeowners and contractors, and support organizations that build homes for low income families (e.g., Habitat for Humanity Programs).

Used building material facilities are not typically large revenue-generators and are most often operated as break-even operations by non-profit organizations whose missions focus on environmental conservation and/or low-income housing. Most programs accept donated materials from individuals and contractors for direct resale to other contractors and homeowners. Some programs may pay or charge a small amount for some items. Resale prices are typically 50% to 70% lower than comparable products by traditional retailers. Revenues are used to operate the program, provide related public services, and support other community organizations.

Existing Programs on Guam

There are currently no dedicated Used Building Material facilities on Guam. The most similar program is Habitat for Humanity of Guam, whose mission is home-building for those in need. To that end, this program accepts virtually any donated materials which are:

- Mostly sold at rummage sales or Craig's list to generate cash for home-building construction and furnishing.
- Kept in inventory for use in new home construction (only a few items).
- Donated to the other programs listed (Guam Habitat for Humanity does not include a ReStore for direct resale at their office location.).

Other donation programs such as the Guam Corps/Salvation Army, Oasis and Rigalu accept "gently used" non-building materials (i.e. furniture, household goods, clothing, etc.) for resale. Several building material companies sell small quantities of surplus or reused building materials to these organizations. Proceeds are used for other program services such as food banks, tutoring, counseling and similar.

Finally, Guam residents promote building materials reuse through online platforms including Craig's list and FreeCycle (Yigo and Santa Rita Groups).

Successful Approaches Used in Other Locations

Many programs provide ancillary services that support or are supported by the reuse and resale of used building materials. These services are often fee-based and may include material pick-up and delivery service, deconstruction training or assistance, and consulting. Deconstruction services are especially relevant to Zero Waste planning, as they focus on strategic methodologies for dismantling structures to maximize the salvage of reusable materials. Depending on materials used in the original construction, some residential deconstruction projects have salvaged more than 90% (by weight) of total project waste. It should also be noted that deconstruction practices encourage building design and construction that ultimately facilitates deconstruction and salvage at the end of life (and as such can be considered a green building policy) (Boulder County, 2007).

Another critical service offered by used building programs is job creation (such as retail and customer service) and job training associated with deconstruction and construction. For example, Boulder County, Colorado's ReSource program provides both wood-working and tools training using materials in their inventory. Brattleboro, Vermont's ReNew program, on the other hand, provides employment development skills through multiple levels of job training. Notable Used Building Material facilities in operation throughout the U.S. are described below.

Habitat for Humanity ReStores (825 locations in the U.S. and Canada)

Habitat for Humanity, a non-profit organization that builds homes for people in need, operates 825 ReStores in the U.S. and Canada. Six ReStores are in operation in on the major Hawaiian islands - Oahu (Kapolei and Honolulu), Kauai, Maui and Hawaii (Kailua Kona and Hilo). ReStores sell new and gently-used home improvement goods, furniture, home accessories, building materials and appliances to the public at a fraction of the retail price. Tax deductible donations of used building materials are made by individuals, contractors, and businesses. The proceeds, and in some cases the donated building materials, are used by local Habitat for Humanity affiliates to help build and renovate more homes and communities. Ancillary services offered by Habitat for Humanity ReStores include:

- ReStore development and operation plans and training.
- Extensive network of ReStores with expertise on building material reuse.
- Community Suppor -local Habitat for Humanity low income housing construction.
- Pick-up and delivery services vary.
- http://www.habitat .org/restores.
- Habitat ReStore Honolulu Craigslist: http://honolulu.craigslist.org/search/sss?query=Honolulu+Habitat+for+Humanity+ReStore&srchType=A&minAsk=&maxAsk=

ReSource (Boulder/Fort Collins, CO)

ReSource is an architectural salvage and reclaimed building materials facility that is operated by a non-profit organization. The Used Building Material facility in Boulder includes 6,800 square feet of indoor showroom,

retail and office space; 4,400 square feet of outdoor retail area; and is operated by 15 full-time staff. Annual sales are roughly $0.7M, which is approximately twice the expenses budgeted for operation. As of 2013, ReSource will be co-located with the county's hard-to-recycle facility and is adjacent to the county's material recovery facility, county household hazardous waste facility and private compost facility. Ancillary services offered at the Used Building Material facility include:

- Deconstruction - training, project assessment, planning, contractor references and tax deduction estimates.
- Woodworks - led by a furniture-maker/designer and using donated and reclaimed materials.
- Tool Library - over 3,500 hand, electric and gas-powered tools available for members at fees between 75% and 90% less than other rental businesses.
- Tool School - training for do-it-yourself, tool-based projects.
- Provides a pick-up and delivery service.
- http://resourceyard.org/

Urban Ore (Berkeley, CA)

Urban Ore is a for-profit enterprise that diverts as much as 20 tons of materials daily. Urban Ore's 30-year old operations include a 30,000-square foot warehouse for household items and 100,000 square feet outdoor used building materials and "last chance" that will be reused or recycled if not sold sales area. Urban Ore conducts salvage operations at Berkeley's disposal facility under contract to the city to supplement its inventory of donated materials. In addition to its sales operations, the program provides:

- Recovery of materials from the local transfer station.
- Pick-up and delivery services - by appointment, fee based on distance, number of items, etc.
- Zero waste planning and consulting services through the Urban Ore Development Associates - including conceptual, interactive Zero Waste resource parks (their average schematic-based project costs range from $15k to $30k).
- Rental of materials for theater and community groups, teachers, etc.
- http://urbanore.com/

ReNew Building Materials and Salvage, Inc. (Brattleboro, VT)

Also a non-profit organization serving low- to moderate-income homeowners, the cornerstones of ReNew's used building materials program is a retail store and deconstruction service center. Specific services include:

- Deconstruction - estimating, planning and actual deconstruction.
- Job skills readiness training - for individuals with disabilities or other barriers to employment (three levels for youth, those transitioning from corrections and others).
- Voucher system for families in need of building materials to build, remodel or repair their homes.
- Public education - through brochures, presentation and event displays.

- Community support - at least 10% of all net revenues are donated to local non-profits including housing, building, education, hospice, art and other organizations.

Reuse Centers at Transfer Stations (Hawaii County, HI and El Cerrito, CA)

To promote the reuse of building and household items, the County of Hawaii developed model rural transfer station reuse drop-off and pick up areas at transfer stations across the island. El Cerrito recently opened a model transfer station that includes drop off trailers provided by building material reuse organizations and an Exchange Zone. Services include:

Puhoa Transfer Station Reuse Area, Hawaii

- Reuse drop-off opportunity - the programs vary by location, with some being staffed and others being unstaffed with designated drop off areas.
- Staff to track items transferred for reuse and sometimes sell more valuable items dropped off (some sites operated by non-profit organizations)
- Locally-built bamboo shelters to cover the reusable items have been built at some transfer stations.
- Ability to incorporate trailers/trucks to collect and transport reusable items to reuse facilities.

The Arc of Hilo (Hilo, HI)

The Arc of Hilo is a non-profit organization providing educational, vocational training and adult day health services for individuals with disabilities on the Big Island for over 50 years and is the largest employer of people with disabilities in Hawaii County. Arc of Hilo worked to establish a building material reuse warehouse in Hilo, under a (expired) grant program from the U.S. Environmental Protection Agency. Arc provides:

- An online, interim alternative - siting and obtaining funding for a suitable warehouse was difficult, and the team began using Craigslist to sell used building materials and furniture from businesses and contractors.
- Relationships with island contractors and building materials suppliers.
- Item pick-up by buyers directly from the business location, so the operation grew and developed significant building material reuse activity without warehouse construction.
- Several 40 yard containers for low-turnover items.
- Provision of donation receipts.

Other examples include:

- Habitat for Humanity's Honolulu ReStore (Honolulu, HI) - uses Craigslist to post items available and support the physical store.
- FreeCycle (on-line reuse website) - The Freecycle Network™ is made up of 5,085 groups with over nine million members around the world. It's a grassroots, nonprofit movement of people who are giving (and getting) stuff for free in their own towns to keep reusable materials out of landfills. Each local group is

moderated by local volunteers. Membership is free. There are currently two FreeCycle groups in Guam, in Yigo and Santa Rita, with about 175.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this initiative could be developed and managed. To implement a successful Used Building Material facility, the opportunities associated with this initiative must be taken advantage of and the constraints or limitations that could make the initiative less than optimally effective must be considered.

Opportunities include:

- Promotes the highest and best use of materials for their intended purpose.
- Reduces the volume of waste going to landfills and saves on disposal fees.
- Reduces the consumption of virgin materials and saves the energy required to manufacture new items.
- Supports homeowners by reducing costs of materials and supplies – some programs target low-to moderate-income families.
- Provides green building rating systems credits.
- Encourages green building – especially for residences.
- Provides opportunity to leverage green building practices typically practiced only in commercial or government buildings.
- Supports other community service organizations with overlapping missions.
- Supports a local economy and a local business.
- Allows use of architectural treasures and vintage items, often of higher quality, that are no longer produced.
- The ability to expand the infrastructure and services of an existing Used Building Material facility.
- The ability to use volunteers to bolster paid staff in initial years.

Constraints Include:

- Construction and operation of Used Building Material facility - as part of its support GovGuam should consider incentives to encourage non-profit development of this facility.
- Requires segregation and transportation of reusable building materials.
- Deconstruction, which is an ideal source for used building materials, can be more expensive and more time consuming than demolition, though tax deductions for donated materials can balance up-front costs.
- Competition for landfill tons which can be an important factor in some communities.
- Donors don't always understand why some materials cannot be accepted.
- Determining tax donation value can be difficult for some donations.

3. IMPLEMENTATION OVERVIEW

As noted previously, building projects, especially demolition and renovation projects, can generate notable quantities of materials with the potential for salvage and reuse by others. The establishment of a Used Building Material facility can provide positive environmental impacts on Guam. The following overview provides information on how to turn this initiative into action.

Major Components

Any number of companies or non-profit organizations could ultimately operate a Used Building Material facility on Guam. For the purpose of this analysis, it is assumed that a non-profit or for-profit business would likely develop and operate a new Guam used building material facility (instead of GovGuam or a local governmental entity). Verifying need and supporting policy would likely be developed by Guam Environmental Protection Agency (GEPA), with some other waste diversion, housing- or building-related organization ultimately developing and operating a new facility. It is likely that an organizational Board of Directors or advisory group would provide policy, budget and administrative guidance for the operation.

The military build-up is expected to being significant new construction activity, both through direct DoD facility contracts and construction associated with induced growth. Both on and off-island contractors are working to support the build-up and many temporary construction workers are expected. This is anticipated to result in significant reuse and donation opportunities for surplus building materials.

While waste stream quantities and composition vary with changes in regulation, consumer activities, consumptive practices and even weather, it is possible that upwards of 10% of Guam's total solid waste stream could be building-related debris from demolition and renovation projects. While there is no hard data to support exact material quantities on Guam, this estimate is based on assumptions that 35% of the total solid waste stream is C&D debris, 35% of the C&D stream is building-related waste (versus roadway and bridge waste), and 75% of the building waste is household items, salvageable building material and miscellaneous waste suitable for managing in a used building material program. As noted in Section 4, these quantities could reach 6,000 tons/year over the planning period even if conservative diversion rates are assumed.

Major steps to implementing a new Used Building Material facility are identified below.

Identify Opportunities to Expand Existing Programming or New Used Building Material Facility Developer/Operator

Interim/Short-Term Options - The existing Habitat for Humanity of Guam has some building space and a basic used building material operation currently in place. While space is limited and there is minimal focus on material re-sale, there may be an opportunity for expansion if external resources were made available. Alternatively, if this program/site is not available for expansion, in the interim it may be able to support a new facility by:

- Expanding their current on-line reuse efforts to reuse suitable materials and help build an initial inventory for a new facility.
- More broadly promoting the reuse of household items and used building materials.

Long-Term Infrastructure - Any number of non-profit organizations or private-sector businesses could ultimately develop and operate a Used Building Material facility (or facilities) on Guam - others (such as Habitat for Humanity of Guam) may be interested in a partnership or operational collaboration. While it is not expected that this facility would be publicly financed, the GEPA or Guam Economic Development Agency could put out a Request for Interest/Qualifications solicitation to stimulate interest and identify what organizations would have in ultimately developing and operating a new facility. It is likely that an organizational Board of Directors or advisory group would provide policy, budget and administrative guidance for the operation.

Evaluate Regulatory/Building/Zoning Compliance Issues

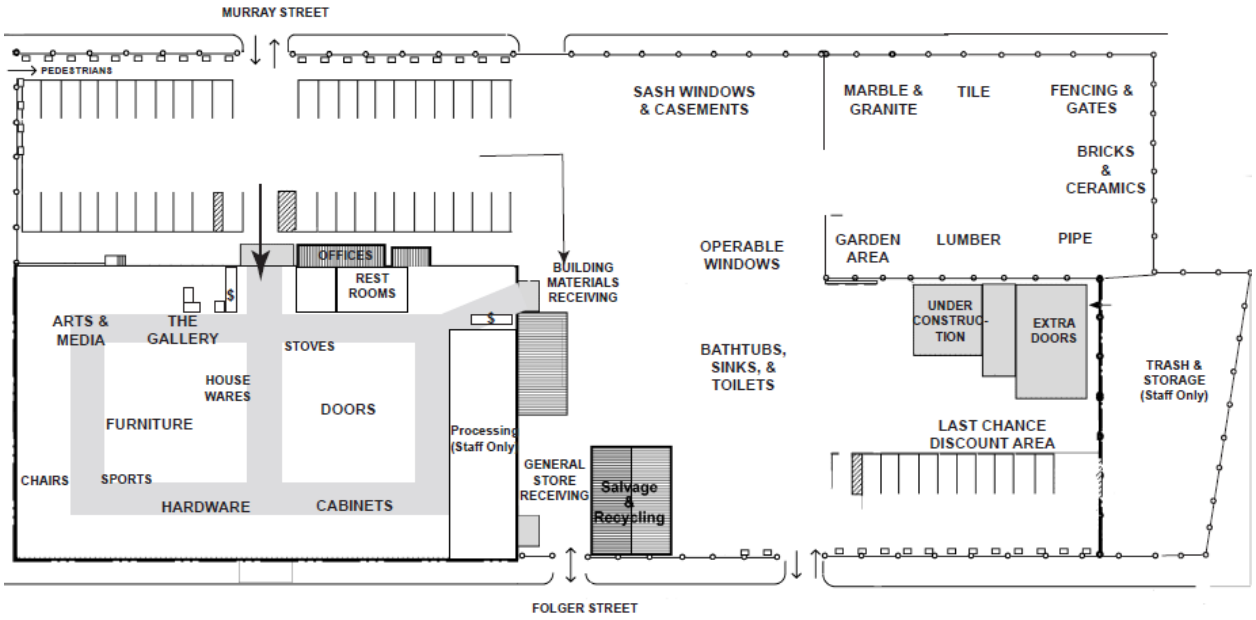
Applicable Guam regulations (22 GAR) do not include regulations specifically applicable to reuse operations. GEPA's position is that items salvaged for reuse are not waste materials and are therefore not regulated by the agency. Facility drawings, an operations plan and compliance with local planning rules will be required at a minimum.

Find a Location and Develop the Facility

Optimally, a Used Building Material facility would be located near active construction sites or the commercial transfer station in Harmon to make diversion more convenient for donors. The facility could be a remodel of an existing transfer station or similar facility. If a new facility is required, property can be purchased, donated, rented or leased (existing warehouse and/or office space would be ideal). A great public/non-profit partnering opportunity may be local government provision (at no or low cost) of suitable property. Facility development needs will vary but may include:

- Security fencing and lighting;
- Building construction or renovation for indoor sales, office and employee areas;
- Site set-up for parking, in-take and outdoor sales areas;
- Utilities (lighting and heat) and employee break areas as needed; and
- Specialty areas can be phased in as time and resources allow - such as a showroom to display high-value items, wood-work projects, trainee projects, etc.; dedicated hardware space; and loading/unloading docks.

Facility layout can vary. The layout for Urban Ore's facility in Berkeley, California, which is typical of Used Building Material facilities, is shown below.



Source: http://urbanore.com 1

Determine What Materials the Facility Will Accept

A donations policy should include acceptable conditions guidelines and consider:

- Acceptable materials for donation may include:
  - Used building materials: architectural items, doors, fixtures, flooring, glass, hardware, heating, lighting, lumber and sheet goods, paint, plumbing, roofing, shelving and racking, shutters, siding, stairs, tools, windows and more;
  - Household goods: appliances, cabinets, furniture, appliances and more; and
  - Miscellaneous materials: fencing, gardening items, landscaping and more.

- Unacceptable materials typically include:
  - Materials not consistent with the organization's mission;
  - Regulated materials (e.g., fluorescent lighting fixtures, refrigerators) and items that local health codes may prohibit the reuse of (e.g., duct work, gas fixtures);
  - Materials that require excessive sorting, cleaning or repair;
  - Materials that are not reusable as donated and/or cannot survive in the retail environment long enough to be sold (e.g., upholstered or leather furniture that have to be stored outside); and
  - Materials that won't sell and can be costly to recycle or dispose in some communities (e.g., old appliances, jet tubs, self-assembled furniture, bedding)

Develop Sales Plan

Key components include necessary for the sales plan include:

- Pricing procedure for standard items using clear metrics (length, square feet, etc.) - this will improve consistency and establish reasonable customer expectations;
- Work towards computerized sales to increase efficiency and data tracking;
- Determine if "credits" in lieu of payment to minimize cash flow and extend value to donors (the Urban Ore program offers trade credits to its donors);
- Proof of identification and signed declaration of ownership before accepting materials; and
- If the Used Building Material facility is operated by an IRS approved non-profit, then a system should be developed to provide donors with an acknowledgement of donation to support tax deductions, although most programs do not estimate donation value or deductions.

Determine Range of Services

Initially, it is likely that a new Used Building Material facility would limit services to the acceptance and resale of donated items. Over time, however, the addition of ancillary services would be considered/evaluated including:

- Material pick-up and delivery - most donors and buyers will be homeowners without the ability to transport large items (these services could be provided through one or more third parties at cost);
- Repair services for common household items and/or repair training skills (to extend the life of consumer goods) - consideration for such a program on Guam should consider:
  - Hiring professional repair technicians or contracting repair businesses for specific items (appliances, computers, etc.) - but this will require payment that may not be sustainable during the first years of facility operation;
  - A Repair Cafe program could be an ideal alternative by establishing repair sessions in which those with repair skills (e.g., technicians, seamstresses, upholsterers, wood-workers, etc.) voluntarily assist those with broken items (the used building facility may be able to supply tools and materials in inventory). The Repair Cafe is popular in parts of Europe and Scandinavia, typically include free gatherings where items are repaired, homeowners gain some new skills and all parties socialize as they extend the life of consumer goods; and
  - Professional repair training will likely require access to a certification program and testing (there are a number of programs available on-line). There may also be an opportunity for supplemental on-the-job training at the used building material facility.

Determine Staffing

Some programs rely exclusively on volunteer labor (i.e., most Habitat for Humanity programs), while others pay all staff. It is expected that a volunteer program would have a paid, part-time volunteer coordinator as well as a part-time employee for data entry, inventory management and accounting. This staffing plan would grow as the quantity and variety of materials increased, and services are added.

Collaborate with Others to Obtain Materials, Generate Sales and Operate Sustainably

These organizations are likely to include:

- Regulatory agencies - GEPA, village governments and GSWA;
- Navy and Air Force - to encourage/require their demolition contracts to salvage materials accepted by the used building material facility;
- Building contractors - to both donate and buy items;
- Retailers of like materials - who may donate non-salable items to fill out the facility's inventory; and
- Other reclaimed material organizations that might donate/buy materials and promote the facility - Habitat for Humanity of Guam, Salvation Army, etc.

Supporting Policy

The implementation of new Guam policy or regulation that encourages (or mandates) diversion would make development and operation of a new facility more feasible by a third party. Developing a greening building policy, minimum diversion standards for construction projects, and pay as you throw (PAYT) programs which provide residents with diversion incentives would all ultimately support a Used Building Material facility. Other helpful policies include those that would:

- Incentivize reuse and deconstruction over demolition - potentially require a reuse plan for construction permits or require for GovGuam and local government buildings, schools, etc.;
- Implement a green building program; and
- Implement disposal bans on materials typically managed by used building material programs (e.g., appliances).

Future Growth

Guam may find that there is future value in operating additional used building materials facilities throughout the island to minimize hauling distances, reduce space requirements and better serve developing areas.

Major Milestones

To establish a Used Building Material facility on Guam, several milestones should be focused on.

- Identify who/what organization will develop and operate the Used Building Material facility - and or partner/collaborate - this may include the use of existing building(s) or programming in the short-term as more permanent infrastructure and long-term operations are developed. This activity, which is the first priority, could take up to 12 months to complete.
- Find a new or expanded location and complete the facility design and operations plan. This activity should address any local regulatory/building/zoning compliance activities and is expected to take approximately 6 to 12 months to complete.

- Develop a business plan for the facility and finance development. This activity is expected to take 3 to 6 months to complete.
- Build and begin operating the facility. Depending on the size of the facility, this activity could take 6 to 12 months to complete.

Challenges

This initiative will face several challenges. Deconstruction, which is an ideal source of used building materials, has been slow to catch on because contractors are doubtful of its time and cost effectiveness. It becomes more attractive when you take into account the savings in disposal costs and the resale value of the building materials. However, build-up related surplus materials should provide ample opportunities for building material reuse. Other challenges include:

- Encouraging non-profit sector development and operation;
- Educating donors regarding the acceptability of materials;
- Determining an equitable valuation system for tax donations;
- Coordinating volunteer efforts.
- Determining tax values are difficult for some donations.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that between 78,000 and 82,000 tons of total C&D were generated on Guam in 2012 (approximately 35% of the total waste stream). Assumptions for estimating the feasibility for a new Used Building Material facility located in the general vicinity of the existing commercial transfer station in the future include:

- Evaluation will take at least two years – diversion associated with a new facility will not be measureable until 2015;
- Targeted materials include building-related C&D materials in the non-municipal waste stream – in the general categories of reclaimed household goods, used building materials and miscellaneous items;
- All used building materials generated on Guam were considered in the tabulations (see Table WP-E.1) as both military and civilian waste are expected to be managed at a new Guam used building materials facility ;
- Roughly 35% by weight of all C&D debris is generated from building construction versus roadway and bridge construction (USEPA, 2011);
- Approximately 30% of the building-related waste being will be available for reuse; and
- Diversion levels ranging from 10% to 50% over the planning period – these levels may change if island-wide C&D diversion policy (especially pertaining to deconstruction) is legislated and enforced.

TABLE WP-E.1. LANDFILL DIVERSION POTENTIAL[1]
USED BUILDING MATERIAL FACILITY
(Implementation expected 2015)

YEAR	Assumed Range of Diversion Potential for Used Building Materials		Non-Municipal Solid Waste Diverted	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year
2015	10-20%	1,000-2,000	1-2%	1,000-2,000
2020	20-30%	2,000-3,000	2-3%	2,000-3,000
2025	30-40%	3,000-4,000	3-4%	3,000-4,000
2030	40-50%	4,000-5,000	4-5%	4,000-5,000

Notes

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

Job Creation Potential and Small Business Opportunities

The estimate of job creation potential for a Used Building Material facility is based upon the assumption that this operation will likely be an expansion of an existing program (like Habitat for Humanity of Guam) and that the addition of paid staff would happen slowly. It was assumed that one FTE (0.5 FTE manager, 0.5 FTE repairman) and volunteers (for data entry/inventory/accounting) would be added by 2015 and that up to four FTE would be in place by 2030 (adding staff for accounting and for material pick-up/delivery). This assumption is supported by the Financial Model Technical Memorandum findings in New England for mature Used Building Material operations averaging about five FTEs.

As noted previously, it is most likely that these jobs will be created by non-profit or for-profit organizations. Ultimate job creation from this programming will depend on the quantity of appropriate material is diverted, the amount of repair work, job training and other activities are undertaken, and how many used building material operations are ultimately established on the island.

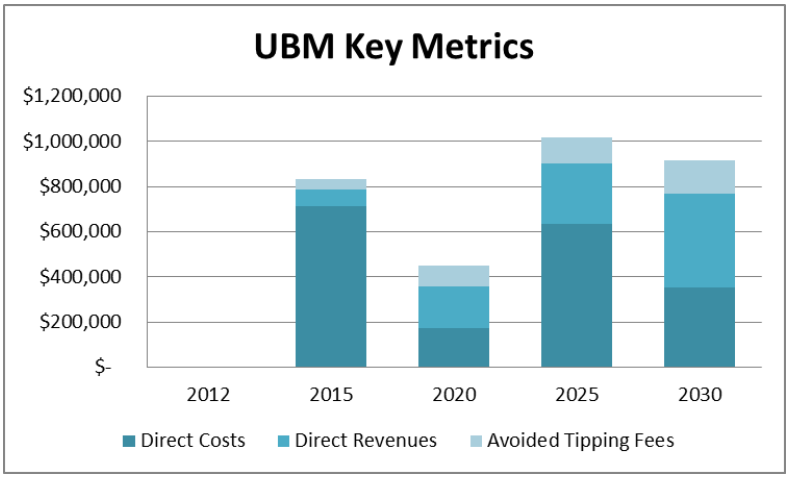
Estimated Revenue Generation

Used Building Material revenue generation was based on Table WP-E.1 diverted quantities and the assumptions that salvaged Used Building Material materials have an average retail sale value of $150 per ton and that approximately 35% of inventory would be resold in 2015 (45% in 2020, 55% in 2025 and 65% in 2030). The estimated revenue potential was found to range from $74,000 in 2015 to $412,000 in 2030.

Avoided Landfill Disposal Costs

Based on Table WP-E.1 diverted quantities and an assumed average tipping fee of $35 per ton for hardfill sites, avoided tipping fees would range from $49,000 in 2015, increasing to $148,000 by 2030.

It should be noted that these hardfill landfill tipping fees are generally paid to private sector firms, such that the avoided fees could actually be considered a detriment to private operators.



Human Health and Environmental Impacts

Significant quantities of materials that could potentially be salvaged and reused by others are generated by building projects, especially demolition and renovation projects. The establishment of a Used Building Material facility can provide various positive environmental impacts on Guam (Mother Earth News, 1998), including:

- Improved air quality from not having to burn waste materials.
- Reuse of these materials offsets the need to extract and consume virgin resources, which also reduces greenhouse gas emissions, water and air pollution.
- Extends the life expectancy of regional landfills thereby helping to prevent the loss of habitat associated with new or expanding landfills.
- The degradation of some used building debris can produce harmful substances. Reuse of these materials helps to prevent the air, and water quality from potentially being impacted by these harmful substances.
- Reuse of building materials helps to conserve the energy that would have been required to manufacture new items.

Economic Costs

Significant cost assumptions for the Used Building Material include:

- Expansion of existing infrastructure, staff and operations - with 1.0 FTE beginning in 2015, increasing by 1 FTE every five years, to a maximum of 4.0 FTEs in 2030;
- Non-profit staffing costs at GEPA-equivalent rates - which is expected to be an over-estimation and may reduce initial costs staffing
- Land acquisition (an acre) and facility (3,500 square feet) development costs budgeted at $615,000 in 2015, with a $100,000 upgrade in 2025.
- Utility costs included at $6 per SF of building area; and
- GovGuam overhead costs for the Department of Administration are included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.

Total costs for the Used Building Material facility are expected to be about $713,000 in 2015, which includes $615,000 for land acquisition and infrastructure expansion (if existing operations does not require this much expansion or already has use of adequate land, these cost could be significantly reduced). These initial development costs may be capitalized in part with grant funding (from Guam's new Zero Waste Grant program or other sources). Future costs include $100,000 facility expansion to accommodate increasing material quantities in 2025 and an increase in 2030 to $325,000 due to staff additions. These costs are expected to be largely off-set by material sales revenues (and fully off-set when avoided landfill costs are considered).

5. ADDITIONAL INFORMATION AND REFERENCES

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Building Materials Reuse Association (www.bmra.org)
- Habitat for Humanity ReStores (http://www.habitat.org/restores/)
- WasteCap Resource Solutions (www.wastecaplorg/services/deconstruction).
- Repair Café See http://repaircafe.org for more information.
- Renew Building Materials and Salvage, Inc. - http://renewsalvage.org/
- Puhoa Transfer Station, HI - http://media.saic.com/project/developing-county-hawaii%E2%80%99s-next-generation-recycling-and-waste-transfer-station
- El Cerritio Transfer Station - http://ca-elcerrito.civicplus.com/index.aspx?NID=336
- DSM Environmental and MSW Consultants, "Recycling Economic Information Study Update: Delaware, Maine, Massachusetts, New York and Pennsylvania Final Report," prepared for the Northeast Recycling Council, 2009

Other Resources

- Freecycle http://www.freecycle.org
- Craigslist http://craigslist.org
- Habitat for Humanity's Honolulu ReStore (Honolulu, HI) - http://honolulu.craigslist.org/search/sss?query=Honolulu+Habitat+for+Humanity+ReStore&srchType=A&minAsk=&maxAsk=

References

- Boulder County, Colorado "An Overview of Building Deconstruction - A National Glance with Local Focus," prepared about 2007
- USEPA, "Estimating 2003 - Building-Related Construction and Demolition Material Amounts"

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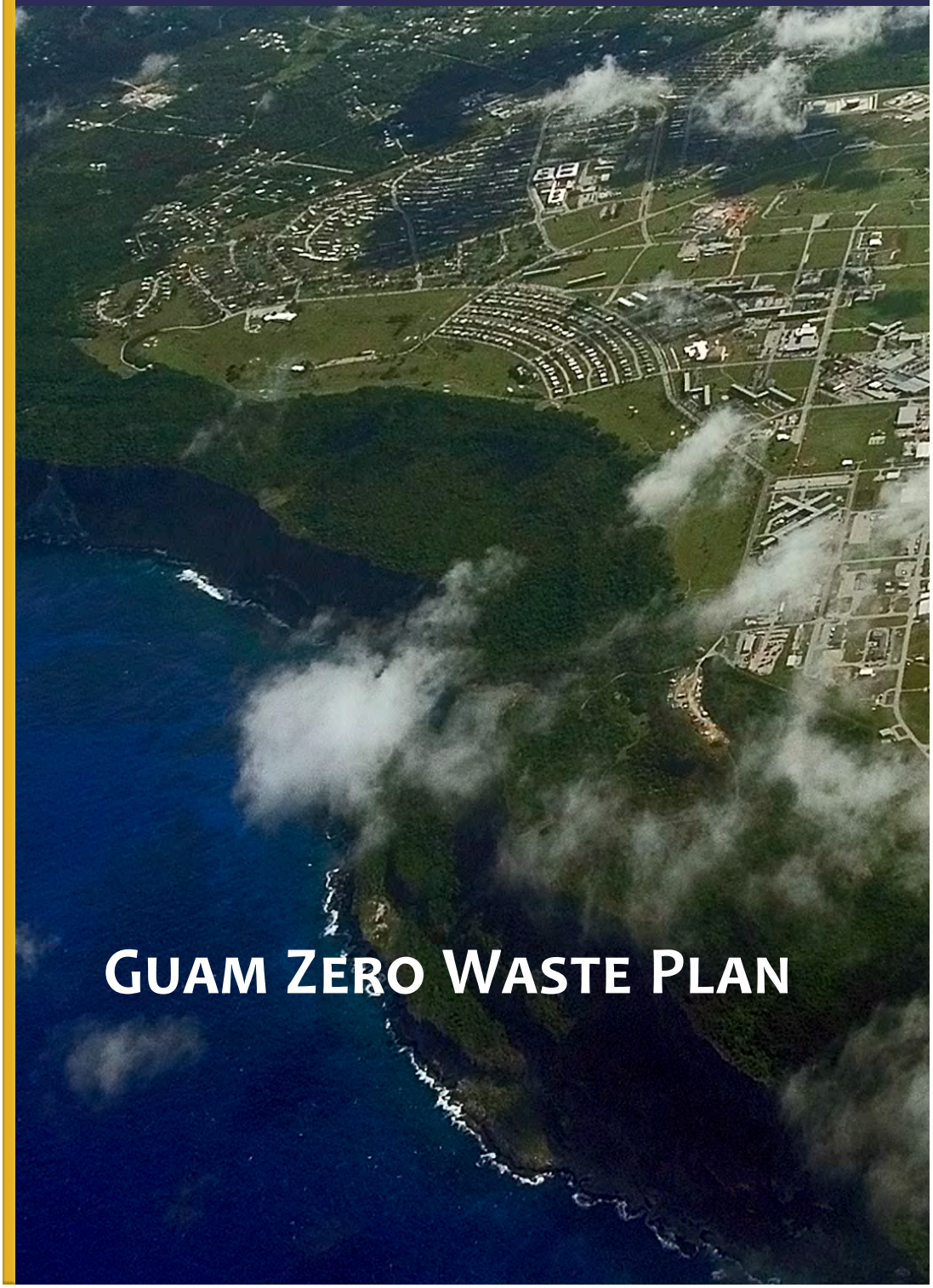
White Paper F

WP F



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

Please see the next page.

WHITE PAPER F

REDUCE, REUSE, RECYCLE REQUREMENTS

FOR BUILDING DEMOLITION, RENOVATION, AND OPERATION

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100**%** *Recycled Post-Consumer Waste – Process Chlorine Free.*

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***3R Requirements for Buildings***
- Extended Producer Responsibility
- Zero Waste Association
- Public Education and Outreach
- Illegal Dumping and Litter Control
- Evaluation of Funding Sources
- Green/ Environmentally-Preferable Purchasing Program
- Construction and Demolition Debris Diversion Policy
- Recycling Grant Program
- Pay-As-You-Throw Pricing Policy
- Plastic Bag Disposal Ban
- Used Building Materials Facility
- Greening Roadway Paving Systems
- Organics Recovery Composting System
- Construction and Demolition Debris Processing Facility

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of reduce, reuse, recycle (3R) requirements that can be implemented to minimize waste generated from building demolition and renovation as well as from the building's operation and maintenance activities.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap to the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the initiative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the initiative is implemented.
- Section 5 provides a list of resources and references that can be consulted for additional information.

Key Findings

Healthier buildings have positive impacts on worker productivity, school test scores and energy cost savings. In terms of increased productivity and reduced sick time research indicates a net present value range of benefits from $37 to $55 per square foot (Kats, 2003). A national review conducted in 2006 indicates that green schools cost less than 2% more than conventional schools to construct, but provide financial benefits that are 20 times as large through enhanced student learning, reduced health and operational costs and ultimately, increased school quality and competitiveness (Kats, 2006).

Given the environmental impacts of buildings, the adoption of a 3R building standard on the island of Guam would greatly impact resource consumption, energy efficiency and waste generation. In addition to the resource and energy benefits, there is proven health, environmental, and economic value in government green building

leadership. Numerous green building studies indicate that sustainable buildings reduce operational costs, increase worker productivity and improve occupant health.

- Adopt a **3R building rating system** that can be either voluntarily used or alternatively required for new building construction and/or major renovations on all public-sector buildings including buildings constructed in part with public funds. See the Appendix A for additional information.
- Develop a **3R building code** that applies to all new building (both public and private-sector) construction and major renovations. As opposed to the rating systems described in Appendix A, which could be voluntary or mandatory for specific building sectors, a 3R building code would require all builders to incorporate more sustainable practices and materials into the design and construction of their buildings and would be monitored and enforced by a building inspection department. See Appendix B for additional information.
- Develop **3R building incentives** that encourage the reduction of MSW and C&D debris waste from building construction, renovation, demolition and operation activities. According to the United States Green Building Council (USGBC), a variety of incentives can be offered to encourage 3R building practices and materials. These incentives can be grouped into (1) structural, (2) financial and (3) outreach and are discussed in greater detail in Appendix C.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of this proposed Zero Waste initiative including background information, examples of similar initiatives that have successfully been implemented in other locations, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What Are 3R Requirements?

Reduce, Reuse, Recycle (3R) requirements for building demolition, renovation, and operation of buildings are a key part of green building. The term "green building," also referred to as "sustainable construction" or "high performance building" is defined by the USEPA as "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout the a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction." Buildings account for a significant amount of resource consumption and waste generation in the U.S. and thus the adoption of a green building standard would minimize these impacts. According to EPA performance statistics, buildings in the U.S. accounted for the following:

Energy:

- 39% of total U.S. energy consumption in 2005.
- 72% of total U.S. electricity consumption in 2006.

Air and Atmosphere:

- 39% of total U.S. carbon dioxide emissions in 2008 (21% residential, 18% commercial).

Water Use:

- 13% of the total water consumed in the U.S. per day (26% commercial, 74% residential).

Materials and Waste:

- 26% (approximately 160 million tons) of non-industrial waste generated in the U.S. is from building-related construction and demolition (C & D) debris.
- Building-related C & D debris combined with municipal solid waste (MSW) is estimated to account for two-thirds of all non-industrial solid waste generation in the U.S.
- 20-30% of building-related construction debris is recovered for processing and recycling including concrete, asphalt, metals and wood.
- Sources of building-related C & D debris include demolition (48%), renovation (44%) and new construction (8%).

Healthier buildings have positive impacts on worker productivity, school test scores and energy cost savings. In terms of increased productivity and reduced sick time research indicates a net present value range of benefits from $37 to $55 per square foot (Kats, 2003). A national review conducted in 2006 indicates that green schools cost less than 2% more than conventional schools to construct, but provide financial benefits that are 20 times

as large through enhanced student learning, reduced health and operational costs and ultimately, increased school quality and competitiveness (Kats, 2006).

Given the environmental impacts of buildings, the adoption of a 3R building standard on the island of Guam would greatly impact resource consumption, energy efficiency and waste generation. In addition to the resource and energy benefits, there is proven health, environmental, and economic value in government green building leadership. Numerous green building studies indicate that sustainable buildings reduce operational costs, increase worker productivity and improve occupant health.

In terms of waste management, 3R building requirements would reduce solid waste generated from renovation and demolition projects as well as from the operations and maintenance of existing buildings. Several national and international rating systems could be utilized to implement 3R building requirements on Guam. Additionally, modifications to the existing building code can be made to encourage or require the use of sustainable building materials and operations.

How Can Green Building Measures be implemented to Minimize Waste?

Several existing national and international green building rating systems could be utilized by GovGuam to increase the number of high performance buildings that minimize municipal solid waste (MSW) and construction and demolition (C&D) debris waste generation. These rating systems could be implemented in their entirety or specific sections that focus on waste management could be developed into regulatory policies. Listed below is a summary of the various national and international 3R building rating systems, including descriptions of the components that address waste generation from construction and demolition to operations and maintenance.

3R building practices can be implemented using a variety of regulatory and market-based strategies. Following are three different strategies that could be utilized to implement green building measures to minimize waste on the Island of Guam:

- Adopt a **3R building rating system** that can be either voluntarily used or alternatively required for new building construction and/or major renovations on all public-sector buildings including buildings constructed in part with public funds. See Appendix A for additional information.
- Develop a **3R building code** that applies to all new building (both public and private-sector) construction and major renovations. As opposed to the rating systems described in Appendix A, which could be voluntary or mandatory for specific building sectors, a 3R building code would require all builders to incorporate more sustainable practices and materials into the design and construction of their buildings and would be monitored and enforced by a building inspection department. See Appendix B for additional information.
- Develop **3R building incentives** that encourage the reduction of MSW and C&D debris waste from building construction, renovation, demolition and operation activities. According to the United States Green Building Council (USGBC), a variety of incentives can be offered to encourage 3R building practices and materials. These incentives can be grouped into (1) structural, (2) financial and (3) outreach and are discussed in greater detail in Appendix C.

Examples of Governments with Adopted Green Building Standards

Within the U.S., the USGBC reports that 14 federal agencies, 45 state governments, 58 counties, 384 cities and towns and several school districts across the U.S. have acknowledged the long-term benefits of green building and have implemented minimum green building standards for their buildings. In 2006, 16 Federal agencies signed a Memorandum of Understanding entitled "Federal Leadership in High Performance and Sustainable Buildings" which focused on the five green building components listed below:

- Employ integrated design principles (new construction)/Employ integrated assessment, operation, and management principles (existing buildings).
- Optimize energy performance.
- Protect and conserve water.
- Enhance indoor environmental quality.
- Reduce environmental impact of materials.

In 2007, Executive Order 13514 was signed which requires that starting in 2020 federal buildings be designed to achieve "net zero energy" by 2030 and addresses greenhouse gas emissions requirements, building performance, water conservation, strategic planning, stormwater management, fleet management, waste diversion, procurement and environmental management. In terms of waste reduction and landfill diversion, EO 13514 requires federal buildings to achieve a 50% solid waste diversion rate by 2015.

The Department of Defense (DOD)

In 2010, the Department of Defense (DOD) prepared the "Strategic Sustainability Performance Plan – FY 2010" which included the following requirements related to green building standards:

- It is DOD policy is to build, operate, maintain, reuse, demolish or deconstruct DOD buildings in a sustainable manner, as outlined by DoD 4170.11 and Unified Facilities Criteria 4-030-01.
- DoD Components will design and build, and certify as appropriate, all new construction projects, at a minimum, to the Silver level" of LEED (or equal).
- Beginning in FY 12 for projects in the planning stage, the sum of energy and water efficiency credits shall equal or exceed 40% of the points required for a LEED-Silver (or equal) rating…"
- The DoD Components will design, execute and certify major repair/renovation projects to be LEED Silver, at a minimum, where appropriate."

The Navy

The Navy was the first federal agency to certify a LEED project in the United States. The Bachelor Enlisted Quarters at the Great Lakes Naval Training Center achieved Bronze certification under LEED-NC v1.0. This facility was awarded the White House Closing the Circle Award, Category/title: Model Demonstration Facility in 2000 for its LEED certification. The Navy continues to aggressively pursue sustainable development; in May 2011, the

Secretary of the Navy announced that all Navy Military Construction (MILCON) projects will be built to LEED Gold standards. For FY11 and FY12, applicable MILCON projects shall achieve sustainable design and construction equivalent to or above LEED Gold, with certain exceptions. For FY 13 and later, applicable MILCON projects will be required to achieve sustainable design and construction equivalent to, or above, LEED Gold. The Navy currently has more than 90 LEED certified buildings, including the first Child Development Center (LEED-NC v2.1 Silver) in the Department of Defense, approximately 500 projects registered for LEED certification, and over 115 LEED Accredited Professionals, including active duty Military and civilians.

State of Hawaii

On June 26, 2006, Governor Lingle signed HB #2175, thus requiring each state agency to design and construct buildings to achieve LEED Silver certification or equivalent. The law applies to all new state-owned or state-funded construction of 5,000 sq ft or greater, including K-12 public schools. The Hawaii state legislature amended its provisions to Hawaiian counties with HRS 46 19.6, requiring priority processing for all construction or development permits for projects that achieve LEED Silver or equivalent.

In 2004, the City and County of Honolulu passed Bill #69 (2004), providing an exemption from real property taxes on the building improvements for a period of one year on all new commercial, resort, hotel and industrial construction that achieves LEED Certification. On February 27, 2006, the City and County of Honolulu passed Ordinance #06-06 requiring new city facilities over 5,000 square feet to achieve LEED Silver. To date, over 60 buildings have been constructed which achieved a minimum LEED silver rating, and another 200 buildings with a minimum LEED silver rating are scheduled to be built in the near future (Hood, 2013).

Photo courtesy of Hawaii Research Academy

Commonwealth of Puerto Rico

On October 24, 2007, Governor Acevedo Vilá signed Executive Order OE-2007-41, requiring that all new construction or major renovations of government-owned or substantially-funded buildings earn LEED certification, including buildings built for the use of the Commonwealth, including schools. Applicable buildings of 10,000 sq ft or greater are required to earn LEED Certified, and 30,000 sq ft or greater to earn LEED Silver certification. The EO further requires all such buildings to certify at least every 5 years through LEED for Existing Buildings, or the most appropriate USGBC-sponsored rating system. The certification thresholds for existing buildings are also LEED Certified for 10,000 sq ft or greater, and LEED Silver for 30,000 sq ft or greater.

Republic of the Philippines

The Republic of the Philippines and its Department of Energy initiated the Philippine Energy Efficiency Project (PEEP) which includes four major green building components:

- Efficient Lighting Initiative
- Efficiency Initiatives In Buildings And Industry
- Communication And Social Mobilization
- Project Implementation Support

A subcomponent under the "Efficiency Initiative in Buildings and Industry" category of PEEP is the Efficient Building Initiative (EBI) which is intended to accelerate the implementation of a Philippines green building rating system. The Philippine DOE selected the BERDE (Building for Ecologically Responsive Design Excellence) to implement the EBI. The BERDE was developed by the Philippine Green Building Council (PHILGBC) as a rating system for green buildings.

The BERDE includes a waste management component to "identify waste management practices covering reduction and segregation, materials recovery facilities, and proper waste collection, handling, and disposal for consumable and durable goods, ongoing consumables, batteries, and building materials used in renovations and additions to existing structure. Develop policies for demolition and construction waste for future refurbishments."

The Philippine GBI may serve as a model for the development of partnerships between public (Philippine Department of Energy) and non-profit organizations (Philippine Green Building Council) that advance green building standards on the island of Guam.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Table WP-F.1. Opportunities and Constraints Associated with Strategies That Can Be Used to Implement Green Building Requirements

STRATEGY	OPPORTUNITIES	CONSTRAINTS
Develop a Green Building/ "3R" Rating System	■ Existing rating systems are in-place and can be adopted without the addition of new public agencies to administer the program (i.e. the certification is handled through a third-party agency such as the USGBC administering LEED certification). ■ A minimum rating system achievement level could be required for public buildings and applied to private sector buildings through voluntary incentives or mandatory regulations. ■ Existing rating systems could be adapted into new "Guam 3R Building Requirements" that reflects he issues and needs on the island and could initially focus on waste management and resource efficiency. ■ Opportunities may exist to partner with non-profit green building organizations such as a Guam 3R Building Council to develop a rating system. ■ Adopting a Green Building/"3R" Building Rating System would potentially offer significant health, productivity and environmental benefits beyond Zero Waste. ■ Significant resources and training exist to support adopting a Green Building Rating System in Guam.	■ If an existing rating system is not utilized, GovGuam and/or partner organizations must develop, administer and maintain a 3R building rating agency such as a Guam 3R Building Council. ■ If new 3R building requirements are only applied to public buildings, the impact would be less significant due to the minimal amount of public building construction in relation to the private sector. ■ If mandated for the private sector, the rating system may face resistance from the private development community due to perceived increases in building costs. ■ Training required for building and construction industry professionals/staff to implement and administer rating system practices. ■ Building material reuse and recycling facilities and equipment are necessary to achieve high building materials reuse and recycling rates. For additional information regarding reuse and recycling facilities evaluated in the Guam Zero Waste Plan, see the Construction & Demolition Debris Processing Facility and Used Building Materials White Papers in Volume II.
Develop a Green Building/"3R" Code	■ Creates a unified building code that requires sustainable building practices and materials for all new building construction and renovation projects. ■ "Greening" the building code would create mandatory 3R building requirements that would apply to all	■ Requires the implementation of a building inspection department that is trained in 3R building design and construction and can review and enforce code-required 3R building standards. ■ A mandatory 3R building code may face resistance from the private development

STRATEGY	OPPORTUNITIES	CONSTRAINTS
	new construction or major renovations in both the public and private sectors. ■ Provides clear direction for required 3R building standards as opposed to optional "credits" offered in the voluntary rating systems. ■ The International Green Construction Code (IgCC) could be used as a model adopted in its entirety or incrementally as priorities demand. ■ The State of California's CalGreen building code, which went into effect statewide on January 1, 2011 could also be used as a model.	community due to perceived increases in building costs.
Develop Green Building/"3R" Incentives	■ Provides optional incentives such as tax credits, expedited permitting and technical assistance to encourage private sector 3R building practices. ■ Provides a voluntary, market-based approach to encourage 3R building practices in the private sector.	■ Requires the implementation of a diverse range of incentive programs developed and maintained by a variety of government agencies. ■ Incentives must be well balanced to encourage a broad range of 3R building practices.

Existing Programs on Guam

GovGuam currently does not have any formal "3R Building" policies in place. However, it should be noted that Department of Defense operations on military bases on Guam utilize green building procedures in compliance with Executive Order 13514, which requires federal agencies to divert at least 50% of all construction and demolition debris by the end of FY2015.

3. IMPLEMENTATION OVERVIEW

Section 3.0 presents an overview of the strategies for implementing 3R building requirements that reduce MSW and C&D debris waste from building renovation, demolition, and operation activities. It should be noted that implementing a 3R building rating system, greening the building code, or enacting 3R building incentives as a stand-alone initiative or a combination or initiatives could be utilized to varying degrees to encourage or require 3R building strategies that directly or indirectly impact the generation of waste from building renovation, demolition and operation activities. Depending on the on the initiative or combination of initiatives chosen, enabling legislation and the subsequent development of regulations may be required.

Major Components

Create a 3R Building Stakeholder Advisory Committee

This group should include representatives from GSA, EPA, DOD, DPW, GEPA, the Governor's Office, Guam Contractors Association, the Guam Hotel and Restaurant Association, architects, engineers, recyclers and representative building tenants. The purpose of the Stakeholder Advisory Committee would be to establish goals and objectives for the 3R building initiative and provide guidance in determining the preferred combination of 3R building implementation strategies.

Identify and Evaluate Potential 3R Building Criteria to Minimize Waste

These should consider salvage and reuse practices, sustainable procurement and effective waste management activities with the goals of reducing environmental impacts and minimizing landfill disposal requirements (the LEED and Green Globes programs provide guidelines for developing these in details):

- Environmentally-preferable purchasing of building materials and equipment.
- Reuse of existing buildings, structural (floors, roof, weight-bearing walls) or non-structural building (interior walls, doors, ceiling systems, etc.) components.
- Used, salvaged or refurbished building materials (may also include furniture).
- Recycled-content building materials (emphasis should be on post-consumer content).
- Materials extracted or produced on Guam (versus import).
- Materials from rapidly renewable sources and only wood certified by Forest Stewardship Council as having an abundant, reliable and rapidly renewable supply.
- Materials and components that have increased durability and low-maintenance.
- Materials and components that will allow easy disassembly.
- Waste management plan for construction, renovation and deconstruction as appropriate including;

- Identify all potential materials for diversion (may include soil and land-clearing debris).
- Contractor training for on-site sorting.
- Adequate job-site containers for re-useable, recyclable and compostable waste.
- Adequate access to reuse, recycling and composting facilities (may include contracts).

Evaluate Costs as Needed on Criteria-Specific Basis

An evaluation of life-cycle costs may be needed to justify initial cost hikes through off-setting performance improvements and long-term cost savings. A cost recovery assessment should also be completed to identify return on investment time-frames. This information can be used to determine whether to make criteria mandatory or preferred. Both Green Globes and LEED have cost-estimating guidance (both are subscription-based programs).

Develop 3R Building Policy

The proposed 3R building requirements policy may utilize a combination of voluntary and mandatory implementation strategies that are focused on the reduction of municipal solid waste from building renovation, demolition and operation. Depending on what initiative or combination or initiatives is chosen, enabling legislation may be required and the subsequent development of regulations may be required.

Initiate 3R Building Pilot Projects

Prior to full-scale adoption of the proposed 3R building requirements policy, a series of pilot project should be developed that encompass a broad range of building types (office, retail, industrial, etc.) to allow for adequate review of the 3R building implementation strategies.

Develop Project Tracking System to Monitor Process and Record Results

The tracking system should identify all required or preferred 3R building criteria and provide method for documentation. Waste management activities should include material weights and estimates of landfill diversion.

Promote and Share 3R Building Experiences

It will be important for GovGuam to publicize the long-term benefits realized by each 3R building project (especially energy savings, reduce water consumption and decreased greenhouse gases). Promotion will emphasis how GovGuam is leading by example will give credence to 3R building practices and will encourage other building owners to follow suit.

Use GovGuam 3R Building Requirements Policy as a Model for Municipalities

Village buildings, schools and other institutions could ultimately adopt material resource standards developed by GovGuam for their own construction and renovation.

Major Milestones

The implementation of a successful 3R building requirements initiative on the Island of Guam has several major milestones which are as follows:

Create a 3R Building Stakeholder Advisory Committee

The formation of a diverse range of professionals involved in the design, construction and operation of buildings is a critical first step in the development of a 3R building standard on Guam. The stakeholder advisory committee will ensure that all aspects of the building industry are represented and will provide direction throughout the development of the 3R building requirements standard.

Develop a 3R Building Policy

Based on a thorough evaluation of the various 3R building implementation alternatives, the stakeholder advisory committee with develop a 3R building requirements policy best suited for the Island of Guam. The policy may include a range of voluntary and mandatory 3R building practices that focus on the reduction of municipal solid waste.

Monitor and Report 3R Building Initiatives

A 3R building evaluation program should be developed to monitor and report the degree of success of the various 3R building policies. The 3R building program reports can be used to modify or enhance the programs to ensure they are effective and efficient.

Challenges

Several challenges exist to the implementation of a 3R building requirements standard which are as follows:

Achieving Consensus

3R building encompasses a diverse range of professionals who affect how a building is designed, constructed and operated. This includes developers, architects, engineers, contractors, public officials, building managers and tenants. Many of these groups have different goals and objectives when considering their role in the building industry. Therefore, it is critical that adequate representation of these groups is considered when developing the 3R Building Stakeholder Advisory Committee.

Degree of 3R Building Policy Complexity and Scope

3R building can be influenced using a variety of strategies that were discussed in Section 1.0 including mandated government regulations, optional financial incentives and outreach programs. Given the scope of these strategies, a number of public agencies may be affected by the implementation and enforcement of a 3R building policy including planning/building departments, environmental agencies and city officials.

Voluntary vs. Mandatory 3R Building Practices

Careful consideration should be given to the balance of voluntary vs. mandatory 3R building practices. Prioritization of strategies that reduce municipal solid will assist in the evaluation of optional incentives and required regulations that most support those waste management priorities.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

Estimated landfill diversion potential for this initiative follows. Assumptions for estimating the feasibility for a 3R building program on Guam include:

- Program development will occur in 2013 and 2014 - diversion will not be measurable until 2015.
- Targeted materials include clean wood and lead-free aggregate (in the non-MSW stream) generated by non-military, building projects:
  - 35% of the total C&D stream is building debris.
  - 40% of the total C&D stream comes from civilian projects.
  - Wood is 20-30% of the C&D stream - only 50% is clean.
  - Aggregate is 40-50% of the C&D stream - only 95% is lead-free.
- These projections may change as the 3R building program evolves.

TABLE WP-F.2. LANDFILL DIVERSION POTENTIAL[1]
(Assumes implementation in 2015)

YEAR	CLEAN WOOD		LEAD-FREE AGGREGATE		NON-MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year
2015	0-5%	0-100	5-10%	200-600	0-5%	200-700
2020	10-20%	100-200	20-25%	1100-1800	0%	1,200-2,000
2025	20-30%	200-400	30-35%	1400-2100	0%	1,600-2,500
2030	30-40%	400-500	40-45%	1900-2800	0%	2,200-3,300

Notes:

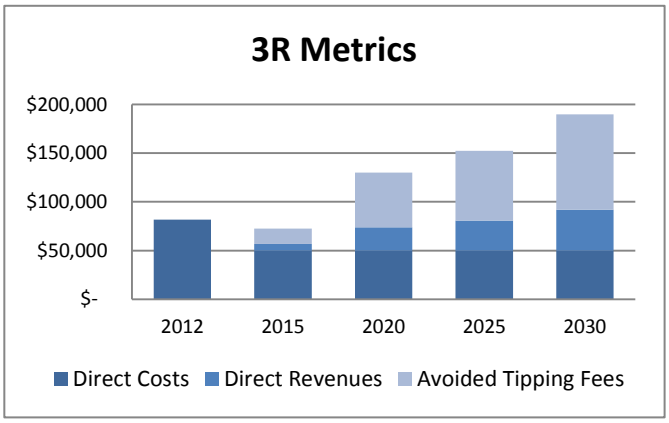
1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measure Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted quantities are rounded to the nearest 100 tons (i.e., value of "0" tons means less than 100 tons)

Job Creation Potential and Small Business Opportunities

The 3R Building initiative is not expected to provide significant direct job creation or small business opportunities.

Estimated Revenue Generation

Based on the diverted quantities described in Table WP-F.2 and an assumed sales potential of $15 per ton, direct revenues from this program are expected to increase from $7,000 in 2015 to more than $42,000 in 2030.



Avoided Landfill Disposal Costs

Based on the diverted quantities described in Table WP-F.2 and an assumed tipping fee of $35 per ton for hardfills, avoided landfill costs will increase from $16,000 in 2015 to almost $98,000 in 2030.

Human Health and Environmental Impacts

3R building practices can have significant positive impacts on human health and the environment. Studies have indicated that healthier buildings have positive impacts on worker productivity, school test scores, and a reduction of energy consumption. Further impacts include:

- Studies indicate that sustainable buildings improve occupant health.
- Reduces resource consumption, increases energy efficiency, and reduces waste generation. With this reduction of virgin material consumption, there is also a reduction of greenhouse gas emissions from both avoided landfill disposal and from virgin material production.
- Reduces air and water pollution.
- With the use of fewer resources, this will help to extend landfill lifetime, and help to preserve habitat that may otherwise be appropriated for landfill expansion.

Economic Costs

Significant cost assumptions for the 3R Requirements Building initiative include:

- The need for 0.25 FTEs from GEPA and 0.25 FTEs from DOA in the base year, in order to establish the program.
- An annual allowance of $50,000 for interaction with the U.S. Green Building Council (USGBC).
- GovGuam overhead costs for Department of Administration are included at 7% of departmental costs, and department overhead is included at 18% of salaries.

Total costs for the 3R Requirements Building initiative are expected to be almost $82,000 in the base year. No new facilities or supplies are expected to be required. Costs are expected to decrease to only the USGBC costs ($50,000) beyond the base year (if the USGBC cost is over-estimated, these on-going costs could be notably reduced).

5. ADDITIONAL INFORMATION AND REFERENCES

The following resources can be consulted to obtain additional information regarding this Zero Waste initiative.

Additional Resources

- Green Building Resources (from www.usepa.org, February 2013)
- Department of Energy (DOE) Federal Energy Management Program (FEMP). FEMP provides services, tools, and expertise to federal agencies for implementing sustainable design practices within federal buildings and communities. www1.eere.energy.gov/femp/program/sustainable_buildings.html
- DOE Building Technologies Program. DOE leads networks of research and industry partners to continually develop innovative, cost-effective energy saving solutions and better products for residential and commercial buildings. www1.eere.energy.gov/buildings/
- ENERGY STAR®. ENERGY STAR provides businesses and organizations with tools and resources to reduce energy consumption and provides a method for benchmarking facilities nationwide. www.energystar.gov
- Environmental Building News. A monthly newsletter on environmentally responsible design and construction, featuring comprehensive, practical information on a wide range of topics related to sustainable building—from renewable energy and recycled-content materials to land-use planning and indoor air quality. www.buildinggreen.com
- Environmental Management Systems (EMS) Office of Policy, Economics and Innovation (OPEI). This website provides information about EPA's efforts to develop policies and related materials about EMS. www.epa.gov/ems
- Green Building Certification Institute (GBCI). GBCI is a third-party organization that provides independent oversight of professional credentialing and administers the LEED certification program. www.thegbi.org
- Green Building Initiative. The Green Building Initiative is a non-profit organization whose mission is to accelerate the adoption of building practices that result in energy-efficient, healthier, and environmentally sustainable buildings by promoting credible and practical green building approaches for residential and commercial construction. GBI oversees and administers Green Globes®, a green management tool that includes an assessment protocol, a rating system, and a guide for integrating environmentally friendly design into both new and existing commercial buildings. www.thegbi.org/green-globes
- Green Buildings. EPA's Green Building website is a "portal" site designed to give users one convenient gateway from which to access numerous EPA programs and topics related to environmentally friendly building. www.epa.gov/greenbuilding
- Laboratories for the 21st Century (Labs21®). Labs21 is a voluntary partnership program dedicated to improving the environmental performance of U.S. laboratories. www.labs21century.gov/
- National Institute of Building Sciences (NIBS). NIBS is a nonprofit, non-governmental organization focused on identifying and resolving the problems and potential problems hampering the construction

of safe, affordable structures for housing, commerce, and industry throughout the United States. www.nibs.org

- Sustainable Buildings Industry Council (SBIC.) SBIC is a nonprofit organization dedicated to advancing the design, affordability, energy performance, and environmental soundness of residential, institutional, and commercial buildings nationwide. www.nibs.org/?page=sbic
- U.S. General Services Administration (GSA) Public Buildings Services - Sustainable Design. GSA is committed to incorporating sustainable principles into the design, construction, and renovation of its buildings. The site outlines the basic principles for sustainable development and explains that sustainable development will become an integral part of every business. www.gsa.gov/portal/content/104462
- U.S. Green Building Council (USGBC). The USGBC is the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work. www.usgbc.org
- U.S. Green Building Council (USGBC) Northern California. Green Building Codes Resource Center (CalGreen). Effective January 1, 2011, commercial and residential buildings being constructed or renovated in California must meet certain baseline efficiency, sustainability and ecological standards. http://www.bsc.ca.gov/Home/CALGreen.aspx
- Whole Building Design Guide. The Whole Building Design Guide is a complete Internet resource offered by NIBC to a wide range of building-related design guidance, criteria, and technology for all federal and private-sector building criteria. www.wbdg.org
- New Buildings Institute (NBI). NBI is a nonprofit organization working to improve the energy performance of commercial buildings. We work collaboratively with commercial building market players—governments, utilities, energy efficiency advocates and building professionals—to remove barriers to energy efficiency, including promoting advanced design practices, improved technologies, public policies and programs that improve energy efficiency. www.newbuildings.org
- More information on the positive impacts of green buildings can be found at www.usgbc.org.

References

- Hood, 2013. Timonie Hood (USEPA, Region 9) telephone conversation with Gale Suzuki-Jones (Hawaii Dept of Business, Economics and Tourism). January 24.
- Kats, 2003. Green Building Costs and Financial Benefits.
- Kats, 2006. Greening America's Schools Costs and Benefits.

APPENDIX A. GREEN BUILDING RATING SYSTEMS

A number of organizations have developed green building **rating systems** that are in use worldwide. Information regarding the following predominant green building rating systems is presented in this appendix:

- Leadership in Energy and Environmental Design (LEED)
- Green Globes
- Building Research Establishment Environmental Assessment Method (BREEM)
- ICC 700 National Green Building Standard (NGBS).

Leadership in Energy and Environmental Design (LEED)

LEED is a voluntary green building rating system developed by the United States Green Building Council (USGBC) to evaluate the design, construction and operation of high performance buildings and neighborhoods. The LEED program provides third-party verification of green buildings and includes a suite of nine rating systems described below.

- LEED for New Construction and Major Renovations
  - Addresses the design and construction of new buildings and major renovations
  - Building types include offices, libraries, churches, hotels and government buildings
- LEED for Existing Buildings Operations and Maintenance
  - Addresses the sustainable practices of building operations and maintenance
  - Includes the following major aspects of ongoing building operations:
    - Exterior building site maintenance programs
    - Water and energy use
    - Environmentally preferred products (EPP) and practices for cleaning and alterations
    - Sustainable purchasing policies
    - Waste stream management
    - Ongoing indoor environmental quality

LEED for Existing Buildings Operations and Maintenance is highly applicable to the development of green building standards focused on waste stream management and landfill diversion.

- LEED for Commercial Interiors
  - Addresses the tenant improvement market in commercial and institutional buildings for tenants who lease space or don't occupy the entire building.
  - Developed to work in conjunction with the LEED for Core and Shell Development rating system
- LEED for Core and Shell Development

  - Addresses buildings projects where the developer controls the design and construction of the entire core and shell base building but has no control over the tenant fit-out.
  - Building types include commercial or medical office buildings, retail centers, warehouses or lab facilities.
- LEED for Retail
  - Addresses the design and construction of a broad range of retail buildings including banks, restaurants, apparel, electronics, big box, etc.
  - Provides two options for certification:
    - New Construction and Major Renovations
    - Commercial Interiors
- LEED for Schools
  - Addresses the design and construction of K-12 schools.
  - All projects involving a full building dedicated to K-12 instruction must use either LEED for Schools or LEED for Existing Buildings Operations and Maintenance
- LEED for Homes
  - Addresses single-family, multifamily, affordable and market rate housing projects.
- LEED for Neighborhood Development
  - Addresses principles of smart growth, urbanism and green building in neighborhood design
- LEED for Healthcare
  - Addresses inpatient and outpatient care facilities, licensed long term care facilities, medical offices, assisted living facilities and medical education and research centers.

Each LEED rating system is divided into five main credit categories which are as follows:

- Sustainable Sites (SS): Encourages strategies that minimize the impact on ecosystems and water resources.
- Water Efficiency (WE): Promotes smarter use of water, inside and out, to reduce potable water consumption.
- Energy and Atmosphere (EA): Promotes better building energy performance through innovative strategies.
- Materials and Resources (MR): Encourages using sustainable building materials and ***reducing waste.***
- Indoor Environmental Quality (IEQ): Promotes better indoor air quality and access to daylight and views.

Additionally, two bonus credit categories are available for *Innovation in Design* and for *Regional Priority Credits* that address environmental priorities for buildings in different geographic regions. LEED for Neighborhood Development and LEED for Homes offer additional credit categories specific to the two rating systems.

The rating system categories offer a range of prerequisite requirements which must be completed for the certification as well as optional credits which can be selected to achieve points that count toward a total rating system scale of 110 points (LEED for Homes utilizes a 136-point scale). Based on the number of points received, a LEED project is scored as either LEED Certified, LEED Silver, LEED Gold or LEED Platinum. Additionally, individuals can become LEED accredited professionals (AP) and earn credentials such as LEED Green Associates (denotes a basic knowledge of green design, construction and operations) or LEED Accredited Professionals (AP) with specializations in the various LEED rating systems.

The implementation of the LEED rating system for public and/or private building projects would reduce waste generation from building construction and demolition as well as ongoing building operations and maintenance. Specifically, the Materials and Resources credit category addresses the following design and construction practices that affect waste generation:

- **LEED for New Construction** - Materials and Resources (MR) credits
  - Prerequisite 1 - Storage and Collection of Recyclables
  - Credit 1.1 - Building Reuse - Maintain existing walls, floors and roof
  - Credit 1.2 - Building Reuse - Maintain existing interior nonstructural elements
  - Credit 2 - Construction Waste Management
  - Credit 3 - Materials reuse
  - Credit 4 - Recycled content
  - Credit 5 - Regional materials
  - Credit 6 - Rapidly renewable materials
  - Credit 7 - Certified wood
- **LEED for Existing Buildings** - Materials and Resources (MR) credits
  - Prerequisite 1 - Sustainable purchasing policy
  - Prerequisite 2 - Solid waste management policy
  - Credit 1 - Sustainable Purchasing - Ongoing consumables
  - Credit 2 - Sustainable Purchasing - Electric-powered equipment
  - Credit 3 - Sustainable Purchasing - Furniture
  - Credit 4 - Sustainable Purchasing - Facility alterations and additions
  - Credit 5 - Sustainable Purchasing - Food
  - Credit 6 - Solid Waste Management - Waste stream audit
  - Credit 7 - Solid Waste Management - Ongoing consumables
  - Credit 8 - Solid Waste Management - Durable goods
  - Credit 9 - Solid Waste Management - Facility alterations and additions

Green Globes

Green Globes is a green building assessment and rating system for new and existing building that evolved from the BREEAM international standard (also discussed in this section) and is utilized in the United States and Canada. Within the U.S., it is developed and administered by the Green building Initiative (GBI) who also develops standards for the American National Standards Institute (ANSI). Within Canada, Green Globes for existing buildings is administered by BOMA (Building Operations and Maintenance) Canada as "BOMA BEST" and all other Green Globes projects are administered by ECD Energy and Environment Canada Ltd.

The Green Globes rating system is divided into the three primary programs and their respective "environmental assessment areas" listed below:

- Green Globes for New Construction (NC)
  - Energy: performance, efficiency, demand reduction, energy efficient features, use of renewable energy, transportation
  - Water: Performance, conservation, treatment
  - Resources: Low-impact materials (LCA), re-use, demolition, durability, recycling
  - Emissions: Air emission (boilers), ozone depletion, water and sewer protection, pollution controls
  - Indoor Environment: Ventilation, lighting, thermal and acoustical comfort, ventilation system
  - Project Management: Design process, environmental purchasing, commissioning
  - Site: ecological impact, development area, watershed features, enhancement
- Green Globes for Continual Improvement of Existing Buildings (CIEB)
  - Energy: performance, efficiency, management, CO2, transportation
  - Water: Performance, conservation, treatment
  - Resources: Waste reduction, recycling
  - Emissions: Boilers, water effluent, hazardous materials
  - Indoor Environment: Air quality, lighting, noise
  - Environmental Management: EMS documentation, purchasing, environmental awareness
- Green Globes for CIEB for Healthcare
  - (same rating environmental assessment areas as CIEB)

Within the Green Globes rating system, waste management is directly addressed in the "Materials" environmental assessment area. The materials assessment within the "New Construction" and "Existing Buildings" rating systems address the following building materials and processes that affect waste management:

- Green Globes New Construction (NC)
  - Systems and materials with low environmental impact
  - Materials that minimize consumption of resources

  - Reuse of existing buildings
  - Building durability, adaptability and disassembly
  - Reuse and recycling of construction waste
  - Facilities for recycling and composting
- Green Globes Continual Improvement of Existing Buildings (CEIB)
  - Facilities for storing and handling recyclable materials
  - Waste reduction work plan
  - Site pollution
  - Environmental purchasing
  - Tenant awareness including waste reduction and recycling

Building Research Establishment Environmental Assessment Method (BREEM)

BREEAM is a voluntary, international environmental assessment method and rating system for non-domestic buildings design, construction and operation. It was established in the United Kingdom and is developed and administered by the Building Research Establishment (BRE) as well as other National Scheme Operators (NSOs) in countries such as the Netherlands, Germany, Norway, Spain and Sweden. Similar to LEED and Green Globes, the BREEAM rating system addresses the following types of building construction:

- BREEAM for New Construction
- BREEAM for Communities
- BREEAM In-Use
- EcoHomes
- BREEAM Refurbishment
- Code for Sustainable Homes

BREEAM awards points or 'credits' and groups the environmental impacts as follows:

- Energy: operational energy and carbon dioxide (CO2)
- Management: management policy, commissioning, site management and procurement
- Health and Wellbeing: indoor and external issues (noise, light, air, quality, etc.)
- Transport: transport-related CO2 and location related factors
- Water consumption and efficiency
- Materials: embodied impacts of building materials, including lifecycle impacts like embodied carbon dioxide
- Waste: construction resource efficiency and operational waste management and minimization
- Pollution: external air and water pollution

- Land Use: type of site and building footprint
- Ecology: ecological value, conservation and enhancement of the site

The "Waste" section of the BREEAM rating system directly addresses building impacts on waste generation and include construction site waste management, recycled aggregates, recycled waste storage, compactor/bailers, composting and floor finishes.

ICC 700 National Green Building Standard (NGBS)

The ICC 700 Green Building Standard is developed and administered by the National Association of Home Builders (NAHB) as a green rating system for residential buildings. Four different NGBS rating systems exist for the following types of development:

- Multifamily certification
- Single-family certification
- Remodeling certification
- Land development certification

The NGBS rating scale is divided into five chapters and includes the following:

- Chapter 5 - Lot Design, Preparation and Development
- Chapter 6 - Resource Efficiency
- Chapter 7 - Energy Efficiency
- Chapter 8 - Water Efficiency
- Chapter 9 - Indoor Environmental Quality
- Chapter 10 - Operation, Maintenance and Building Owner Education

Both Chapter 6 and Chapter 10 include credits for waste generated from building construction and operation including Construction Waste and Materials, Enhanced Durability and Reduced Maintenance, Reused or Salvaged Materials, Recycled-Content Building Materials, Recycled Construction Waste, Renewable Materials, Resource-Efficient Materials, Indigenous Materials, Life-cycle Cost Analysis and the development of operation training manuals for building owners.

APPENDIX B. GREEN BUILDING CODES

Another option for implementing green building standards that reduce MSW and C&D debris waste generation on Guam is the "greening" of the existing building code. As opposed to the rating systems described in Appendix A, which could be voluntary or mandatory for specific building sectors, a green building code would require all builders to incorporate more sustainable practices and materials into the design and construction of their buildings and would be monitored and enforced by a building inspection department. The International Code Council (ICC) created the International Green Construction Code which is the first model green building code to be developed for municipalities and building code agencies.

International Green Construction Code (IgCC)

The IgCC creates a regulatory framework for new and existing buildings and establishes minimum green requirements for buildings and is developed in association with ASTM (American Society for Testing and Materials) and AIA (American Institute of Architects). The IgCC includes the following areas of focus:

- Chapter 3 - Jurisdictional Requirements and Life Cycle Cost Assessment
- Chapter 4 - Site Development and Land Use
- Chapter 5 - Material Resource Conservation and Efficiency
- Chapter 6 - Energy Conservation, Efficiency and CO2 Emission Reduction
- Chapter 7 - Water Conservation and Efficiency
- Chapter 8 - Indoor Environmental Air Quality and Comfort
- Chapter 9 - Commissioning, Operations and Maintenance
- Chapter 10 - Existing Buildings

The IgCC is currently adopted in Rhode Island; Maryland; Oregon; Richland, WA; Keene, NH; Ft. Collins, CO; Kayenta Township, AZ; Boynton, Beach, FL; Phoenix, AZ; and Scottsdale, AZ. California was the first U.S. state to adopt a green building code which is known as CALGreen and focuses on the following aspects of the building code:

- Planning and Design
  - Site Development
- Energy Efficiency
- Water Efficiency and Conservation
  - Indoor Water Use
  - Outdoor Water Use
- Material Conservation and Resource Efficiency
  - Weather Resistance and Moisture Management
  - Construction and Waste Reduction, Disposal and Recycling
  - Building Maintenance and Operation

- Environmental Quality
  - Pollutant Control

APPENDIX C. GREEN BUILDING INCENTIVES

The information contained in this appendix was taken from the USGBC's website at www.usgbc.org. State and local governments across the country have found that one of the most effective strategies to encourage green building is through targeted financial and structural incentives. Rewarding developers and homeowners who choose to build green is an effective way to encourage the adoption of best-practices in design, construction and operations while simultaneously improving the health, prosperity, and quality of life for all.

According to the USGBC, a variety of incentives can be offered to encourage green building practices and materials. These incentives include:

- **Structural Incentives for Green Building.** These incentives encourage developers to utilize green building practices that reduce municipal solid waste through rewards such as expedited development reviews or permitting processes and/or increased development density and building height bonuses. These incentives make green building more attractive to builders with little or no cost to the jurisdiction that utilizes them.
- **Financial Incentives for Green Building.** Financial incentives such as tax credits, fee reduction/waivers, guaranteed loans and grants can be given to developers who utilize green building practices that reduce municipal solid waste. The perceived impact to municipal revenue from implementing these financial incentives may be offset by the increase in the assessed property values from the development of these projects.
- **Outreach Incentives for Green Building.** In addition to structural and financial incentives that provide direct benefits to building developers, outreach opportunities such as technical assistance programs can encourage green building practices that reduce municipal solid waste. Free planning or certification training programs can be offered by jurisdictions to assist developers unfamiliar with green building practices.

Additional information regarding each of these incentives follows.

Structural Incentives

Simple modifications in zoning permissions and review processes can yield impressive dividends for developers and building owners alike. Structural incentives such as density bonuses and expedited permitting are implemented at low or no cost to government authorities and encourage developers to build green by making healthy, efficient and high-performance buildings an even more attractive option.

Expedited Review/Permitting Processes: Review and permitting processes can vary greatly in length from one jurisdiction to another. In some cases these processes can take months or even years, resulting in increased project costs and delays on returns. Reducing the duration of the review and permitting process for verifiable green building projects can result in major cost savings for the developer. Expedited permitting allows a municipality to offer a significant incentive with little or no financial investment, since it only requires a shift in permitting priority.

Density Bonuses: Density bonuses provide an opportunity for municipalities to tie incentives to specific local public policy priorities. Many municipalities allow for percentage increases in Floor Area Ratio (FAR) or other measures of density contingent upon certification or proof of building green. Even municipalities with height restrictions are providing height bonuses (another form of a density bonus) for green buildings, particularly for

urban infill projects. These additional bonuses in density yield both short-and long-term dividends for developers and building owners through the rent or sale of additional units allowed by the bonus incentive.

Financial Incentives: Financial incentives are a highly successful means of encouraging developers to follow green building practices. And while financial incentives necessarily require a financial investment in cleaner, healthier buildings, state and local governments are finding that these investments pay dividends to the community's Triple Bottom Line: ecology, economy, and equity.

Tax Credits and Abatements: Many municipalities already offer tax credits and abatements as a means of advancing specific policy agendas. Abatements work by exempting property owners from paying taxes for a period of time. Credits work by crediting specific tax liabilities back to owners of these properties. These same principles are being applied to homes and developments that achieve measurable, verifiable green building goals. And while this incentive has an up-front cost to the municipality, the increased assessed property value from an energy-efficient, greener building frequently offsets any reduction in tax revenue over time.

Fee Reductions or Waivers: Some municipalities that charge fees for permit review or other permitting processes are offering reductions or waivers for developers or contractors who commit to verifiable green building practices. While this incentive comes at a marginal cost to government authorities, the benefits of a healthier and more efficient building stock pay dividends the entire community. In many cases, this incentive can be paired with a structural incentive such as expedited permitting.

Grants: Grants for green building developers and homeowners are being established by state and local governments to entice construction and renovation project teams to go green in markets that may otherwise be resistant. These programs can be funded through taxes or fees, or through federal and state funds. Such grants are usually awarded to homeowners or developers to subsidize or render more profitable the design and construction of high-performance buildings. Grant programs often require homeowners and developers to submit a proposal for the grant funding, or meet specific program goals.

Revolving Loan Funds: While the long-term benefits of building smart, efficient and healthy buildings are well documented, so too are the concerns over the up-front costs of a green building retrofit. Revolving loan funds allocate low interest loans from a large fund to those seeking to build or renovate to verifiable green building standards. These loans are then repaid to the fund at a rate lower than the operational cost savings from the improvements so that both the building owner and the fund, collects on cost-savings in the first month. The result is the removal of a major financial barrier to green building and a constantly-replenished fund that can continue to provide additional loans to the community.

Other Incentives

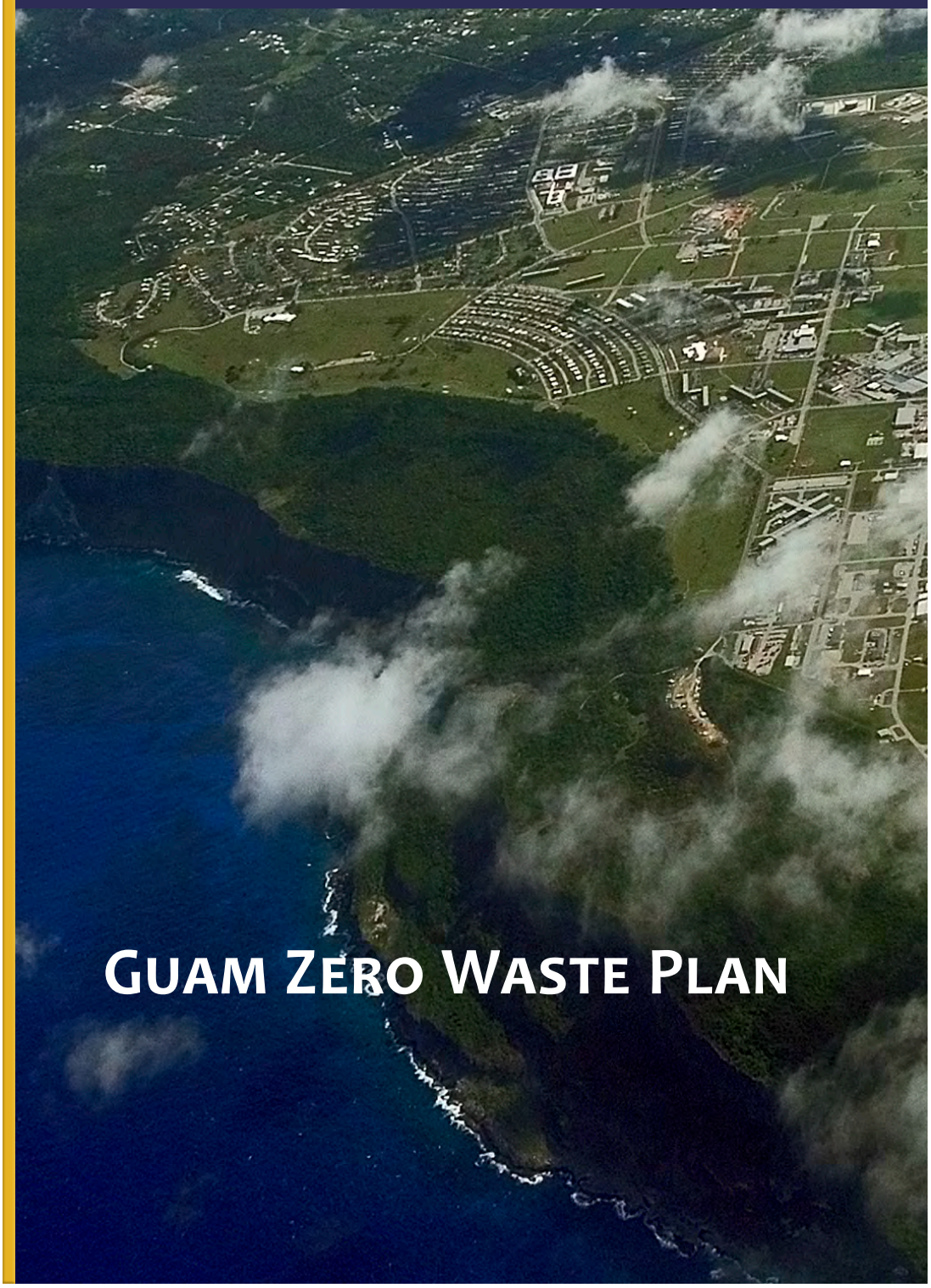
Technical Assistance: Another low cost incentive that is gaining in popularity is the offering of technical expertise and assistance through a government authority for green building projects. As consumer demand surrounding green building continues to grow exponentially, residential and commercials builders can greatly benefit from technical expertise to keep pace with the innovation of this developing market. Free technical assistance provides this familiarization and realizes the potential created by a locality or state that is flush with green building expertise and innovation. Technical assistance is commonly offered by building department staff with a professional credential of a green building expert.

Marketing Assistance: Developers and owners of green buildings have much to gain from the increased marketability of third-party certified, high-performance green real estate. In recognition of the unique marketability of green buildings, some municipalities are offering free marketing assistance which includes signage, awards, websites, press releases, and other means to help green builders rent and sell their properties more effectively. In addition to incentivizing new construction and green retrofits of existing buildings, the community at large benefits from this increased recognition of sustainability through public education and awareness of the built environment that surrounds them.

Please see the next page.

ONEGUAM
ONE ISLAND. ONE VISION. ONE FUTURE.

White Paper G



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

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Please see the next page.

WHITE PAPER G

GREENING ROADWAY PAVEMENT SYSTEMS

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste, rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Greening Roadway Paving Systems***
- Zero Waste Association
- Public Education and Outreach
- Illegal Dumping and Litter Control
- Evaluation of Funding Sources
- Green/ Environmentally Preferential Purchasing Program
- Extended Producer Responsibility
- Construction and Demolition Debris Diversion Policy
- Recycling Grant Program
- Pay-As-You-Throw Pricing Policy
- Plastic Bag Disposal Ban
- "3R" Requirements for Public Buildings
- Used Building Materials Facility
- Organics Recovery Composting System
- Construction and Demolition Debris Processing Facility

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be implemented to green Guam's roadway infrastructure by using recycled materials in roadway pavement systems as an alternative to the use of conventional materials produced directly from quarried sources. The analysis presented in this white paper focuses on three recycled materials: scrap tires, glass and mulch/compost processed from yard waste, wood waste and land-clearing debris.

White Paper Organization

This white paper is organized in the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap of the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the initiative.
- Section 3 presents and implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 provides a list of resources and references that can be consulted for additional information.

Key Findings

This section presents key findings. Roadways are a central component of infrastructure throughout the world and present a wide array of opportunities for using recycled materials. Pavement materials have traditionally consisted predominantly of crushed rock and aggregate. In the last decade, there have been significant advances in the use of recycled materials as an alternative to conventional materials in many roadway pavement system applications.

There are four primary steps which will need to be taken to start greening the roadway pavement system in Guam:

- Convene stakeholders.
- Identify potentially feasibility use of recycled materials (e.g., tires, glass and compost/mulch).
- Quantify benefits and drawback of using recycled materials.
- Evaluate the economics of using recycled materials.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of green roadway pavement initiatives including background information, examples of where recycled materials have been successfully used in roadway pavement systems in other locations, opportunities and constraints associated with using recycled materials in roadway pavement applications, and a summary of what exists within GovGuam today with respect to this initiative.

What is a Green Roadway Pavement System?

Roadways are a central component of infrastructure throughout the world and present a wide array of opportunities for using recycled materials. Pavement materials have traditionally consisted predominantly of crushed rock and aggregate. In the last decade, there have been significant advances in the use of recycled materials as an alternative to conventional materials in many roadway pavement system applications.

Recycled materials that can be used in roadway pavement system applications include waste tire products, glass, compost/mulch, recycled asphalt pavement, recycled concrete/concrete pavement, coal fly ash, blast furnace slags, coal bottom ash, municipal solid waste incineration bottom ash, construction debris, foundry sands, mining wastes, and contaminated soils.

Asphalt and concrete pavement recycling has been practiced for many years; in fact, recycled asphalt pavement is one of the most recycled materials with rates of 80% diversion nation-wide (Recycled Materials Resource Center website). However, it is only recently that other materials have been addressed in state highway materials standards. Over the last few years, some standards have been modified to allow less traditional recycled materials to replace or supplement virgin materials.

Guam's lack of local markets and geographic isolation makes diversion of many waste materials particularly challenging. In some cases, the logistics and cost of diversion to off-island markets makes recycling unsustainable. However, the development of local recycling markets through recycled material use in highway construction and maintenance can provide multiple benefits.

Existing Programs on Guam

For the implementation of the 2030 Guam Transportation Plan, Guam has a partnership with the Federal Highway Administration (FHWA) to utilize federal funds on the improvement and maintenance of the territorial highway system which also addresses village streets. In honoring this partnership, Guam is required to adhere

to FHWA's Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-03 US Customary Units, 2003). As noted below, existing standards are supplemented by FHWA's Recycled Materials Policy.

Existing procurement law on Guam (Title 5 Guam Code Annotated, Chapter 5, Article 3) also requires that bidders on paving, highway construction or maintenance projects on secondary or tertiary roads consider the use of processed glass. Additionally, although not specifically addressed in this white paper, military construction contracts involving roadway infrastructure adhere to the United Facilities Guide Specifications which also allow for the use of recycled materials in pavement systems.

Guam has a $3/tire advanced disposal fee that is paid by consumer to tire sellers. Tires are not accepted at the commercial transfer station or public convenience centers and are not managed by GSWA.

Successful Approaches Used in Other Locations

Recycled materials are being used in roadway pavement system applications around the globe from Australia to the United States and China to Europe. In the United States, the FHWA of the U.S. Department of Transportation maintains the primary highway standards used in federally-funded projects. FHWA standards often reference American Association of State Highway and Transportation Officials (AASHTO) specifications. Both organizations are industry leaders in terms of existing policy as well as new material research and updates. Both organizations use American Society of Testing and Materials (ASTM) testing procedures for some material classifications. FHWA's FP-03 standards address some use of recycled pavement materials.

In 2002, FHWA issued a Recycled Materials Policy stating that recycled materials:

- Should be evaluated to assess economic, engineering and environmental benefits.
- Should be given first consideration in materials section based on assessment outcomes.
- Should not be prohibited without technical basis.

The FHWA's Recycled Materials Resource Center (RMRC) and AASHTO have been working to implement this policy. See Section 5 for further information on RMRC's research on scrap tires, glass cullet and other information.

Most state transportation departments have standards for the design and construction of state highways. In some instances, state and territorial governments adopt or modify the federal highway standards that are maintained by the U.S. Department of Transportation through the FHWA. This is the case in Guam, where the FHWA highway standards have been adopted by the GDPW. Local and regional governments, in turn, often adopt state standards. These standards address material selection for highway projects by establishing required characteristics and minimum performance criteria – in many standards the types of acceptable highway materials are specified.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this initiative could be developed and managed. To successfully green roadway pavement systems on Guam, GovGuam must take advantage of the opportunities associated with the use of recycled materials in roadway pavement systems and also take into consideration constraints or limitations that could make this initiative less than optimally effective.

Opportunities include:

- Conserves existing natural resources/virgin material sources and conserves energy.
- Alleviates demand for scarce resources, e.g., aggregate.
- Provides market for materials that might not otherwise be diverted, especially from an island environment, and especially competitive where recycled produce is available at low price.
- Can reduce cost of processing some recycled materials, e.g., color-sorting furnace-ready glass.
- Reduces disposal needs for materials that are recycled instead of wasted.
- Can be implemented by private sector, requiring limited government resources for oversight.

Constraints include:

- Use of recycled waste materials requires evaluation for long-term performance, future environmental impacts, economics, recyclability and safety.
- Material processors may not be available to shred/crumb rubber, crush glass or produce quality compost products on Guam – processing costs can make recycled materials less competitive.
- Lack of information (for some materials) to fully evaluate risk to human health and the environment.
- Lack of universal framework for materials evaluation so that regulators and users have consistent approach for making decisions.
- If generation rates are low, materials may not be available in adequate quantities.
- Location specific issues, such as the rhinoceros beetle infestation in Guam, could impact opportunities to spread mulch to certain parts of Guam.

3. IMPLEMENTATION OVERVIEW

The use of scrap tires, glass and mulch/compost processed from yard waste, wood waste and land-clearing debris as a substitute for conventional materials in roadway pavement systems can provide significant positive environmental impacts. The following overview provides information on how to turn this initiative into action.

Major Components

Roadway design and construction standards are often expanded or modified by supplemental specifications that address project- or location-specific needs and opportunities. To allow the use of recycled waste materials, GovGuam will need to develop specifications for each material. It is expected that Guam Department of Public Works (GDPW) will be the lead agency for or evaluating and developing roadway pavement system specifications that allow the use of recycled materials (i.e., tires, glass and/or compost/mulch) with assistance from the Guam Environmental Protection Agency (GEPA).

Consideration may also be given to supporting supplemental material specifications by GovGuam procurement policy that requires the GDPW and its contractors to use recycled materials when performance criteria and life cycle cost constraints are met. Additionally, given Guam's partnership with FHWA, it is likely that the federal agency will be involved in approving these specifications as well.

There are four primary steps which will need to be taken to start greening the roadway pavement system in Guam:

- Convene stakeholders
- Identify potentially feasibility use of recycled materials (e.g., tires, glass and compost/mulch)
- Quantify benefits and drawback of using recycled materials
- Evaluate the economics of using recycled materials.

The activities that should be accomplished in each of these steps are presented below. This information is followed by more detailed information regarding the potential use of scrap tires, glass and compost/mulch in roadway pavement systems on Guam.

Convene Stakeholders

Stakeholders may include local construction companies; construction material suppliers (i.e., aggregate plants, gravel quarries, etc.); recyclers/composters; regulators (FHWA, GDPW, GEPA); and local village transportation staff to discuss the stakeholders ideas and concerns regarding this initiative. As appropriate, communicate with experts who are familiar with green roadway pavement systems.

Identify Potentially Feasible Use of Recycled Materials

This should include a consideration of potential recyclables without sustainable local markets, or recycled materials that could be more economically diverted with a stronger local market. Tires, glass and compost/mulch have been focused on for the analysis presented in this white paper.

Quantify Benefits and Drawbacks of Using Recycled Materials

This evaluation should assess the long-term performance, environmental impacts, recyclability and worker health of each material in each application. Some state highway departments accomplish this through a beneficial use process that allows diversion activities to be exempt from permitting regulations, which encourages recycling by streamlining the regulatory process. See Section 5 – Additional Information for links to state policies such as the State of Montana's approved beneficial use policy for the use of post-consumer glass in roadway base.

FHWA has developed a framework for evaluating the feasibility of using recycled waste materials in highway applications (FHWA, Publication RD-00-14):

- Define and evaluate feasibility by providing historical data including research and data conducted and compiled by others (i.e., engineering and material properties, environmental, health and safety data, implementation constraints, recyclability, etc.).
- Evaluate usage - this may include one or more of the following steps:
- Screening of collected data - if regulatory agencies find that potential impacts have been address and are acceptable, use will likely be approved at this stage
- If screening is not successful a laboratory evaluation may be needed with testing focused on engineering, material, environmental, health and safety properties
- If laboratory test results are inconclusive field testing may be required. This may be conducted over a short-term period to see how the recycled material affects the end-product production process, during/immediately after construction and over the long-term to evaluate impacts during the post-construction period.

Evaluate Economics

An economic analysis is necessary to determine whether recycled waste materials are cost-competitive with their virgin counterparts (cost-competitiveness may vary over time). Cost implications include consideration of the following:

- Cost of material purchase - including raw material price, processing, stockpiling, loading and hauling to the construction site
- It is expected that GovGuam will rely on private sector contractors to process recycled materials to meet the specification requirements for highway construction
- Estimate will need to consider the private sector's existing or potential ability to produce baled tires, glass cullet, mulch, compost or other material products
- Cost of installation - including design, construction, testing and inspection
- Life-cycle cost - including the annual effective cost, the capital recovery and annual maintenance cost (the FHWA framework document provides cost estimate calculations).

Scrap Tires

The Rubber Manufacturers Association estimates that one scrap tire is generated for every U.S. citizen each year, which equates to approximately 159,000 tires/year in Guam (or nearly 2,000 tons) in 2012. According to GEPA, no tires were recycled in 2011 although more than 1,000 tons of tires were shipped off island to waste to energy facilities or cement kilns (GEPA, 2012). Tires are difficult to manage in stockpiles and landfills, and take up critical disposal facility space. Historically, tires have been marketed by the island's recyclers (e.g., Pyramid and Global Recycling) to China, Taiwan and Vietnam for producing retreads and as fuel in tire-to-energy plants. Global market conditions are currently depressed, however, and limited off-island tire recycling is happening at this time. However, markets are dynamic and conditions are likely to change. Additionally, tires are not accepted at the commercial transfer station or public convenience centers and are not managed by GSWA. As a result there is a strong incentive to find economical diversion opportunities.

GovGuam also manages some junk vehicles and automotive waste including tires, appliances and recyclables using revenues obtained through annual motor vehicle registrations (until 2012, Article 5/Government Operations allowed the collection of fees on each vehicle, tire ($3/tire), white goods, batteries and piece of heavy equipment (fees are currently levied on vehicles and heavy equipment only). These revenues, maintained in Guam's Recycling Revolving Fund are meant to support one full-time person working at GEPA. Additionally, annual vehicle registration dollars are collected in GEPA's Recycling Revolving Fund to support tire management costs.

More than two dozen states either ban tires from disposal in landfills or require that they be slit to minimize environment impacts. Recycling opportunities in highway applications can include:

- Construction fill material (shredded or chipped) - shredding/chipping equipment is not known to be currently available on Guam. Photo at left shows tire shredding equipment.
- Aggregate substitute in base layers or hot mix asphalt (ground) - required equipment includes granulators, hammer mills or fine grinders; magnet/air separator to remove steel/fabric belt fragments; screen to recover various size fractions
- Asphalt modifier in hot mix asphalt (crumbed) - required equipment includes cracker mill, granulator or micro-mill processes
- Miscellaneous use for noise reduction, retaining walls, shoulder stabilization and slope protection - typically use baled whole or slit tires, required equipment includes a tire cutting machine to slit tires and/or a baler to compact bales.

The first three applications all require specific equipment to process whole tires. Existing standards and specifications from FHWA and state transportation departments (see Section 5 for links to material specifications) establish acceptable size ranges and contamination levels for each application. For example, crumbed rubber needs size reduction in the range of 0.187 to 0.0029 inches. Laboratory test results will be required to verify that sizing is acceptable.

Based on potentially unsustainable processing needs, the use of baled tires may be the least expensive and most feasible option for use in roadway pavement systems. One existing recycler (Pyramid) operates a shredder and baler (an evaluation of existing equipment capabilities and possible private sector partnerships would be a necessary part of evaluating a supplement specification for this application). In most mainland communities, crumb rubber meeting the precise specifications for rubberized asphalt pavement applications is not processed locally. The benefits of using recycled rubber in roadways could be significant in promoting broad Zero Waste goals even if recycled rubber is imported and local processing capacity is not developed, although the economics of this strategy should be carefully considered.

The use of whole tires for roadway retaining walls may provide reasonably simple and effective diversion opportunity. For example, all 2,000 tons of tires estimated to be generated in Guam each year could be recycled in less than a one-mile stretch of highway that is rehabilitated with a short, two-bale high wall. Each bale is about 5 feet long and is comprised of about 100 tires. Many retaining walls are at least three bales high and two or even three bales deep. Care would need to be taken to ensure that fire risks are minimized through best management practices. While Guam has about 540 miles of highway, building a mile of retaining wall every year may be optimistic (these walls would most likely be constructed on new or expanded highways where adequate right-of-way access could not be obtained to build traditional slopes).

Glass

The estimated waste composition analysis identified as much as 7,000 tons/year of container glass in Guam's 2012 solid waste stream. According to GEPA's recent *Recycling In Focus Fact Sheet*, negligible quantities of glass were recycled in 2011. Glass is considered one of the most recyclable materials, but it is also expensive to haul, requires color-sorting for most manufacturing uses and is a prevalent contaminant in mixed recyclables streams. Glass is especially unsustainable to recycle where there are no local markets, and there are no glass bottling production in Guam. Utilizing glass cullet in roadway pavement systems, which eliminates the need for color-sorting, can save energy and reduces costs over its virgin aggregate counter-parts. When used as an aggregate substitute where aggregate sources are limited, it can be especially valuable (see photo at right of recycled glass pavement).

Glass has been approved as an aggregate substitute in many highway applications:

- Sub-base and base layers

- Asphalt or concrete pavement
- Embankment fill
- Utility bedding
- Fiberglass and sandblasting
- Gravel substitute
- Glass beading in highway striping and other reflective surfaces.

If future highway projects use 15% glass cullet in their sub-base layer, nearly 1,300 tons of glass could be recycled/mile based on AASHTO M318-02, which assumes 28' road width, sub-base layer thickness of 12" and glass density 3,100 lbs/cy. This equates to 18% of the total glass generated in Guam each year. Depending on the level of new road construction during the military build-up and the amount of on-going highway reconstruction, the potential to divert glass and reduce reliance on aggregate may make processing feasible.

An evaluation of permanent or mobile glass processing and screening equipment (such as that currently owned by Andersen AFB and operated by Chenega Operations Services) would be a necessary part of evaluating a supplemental specification for this recycled material. Crushed glass is reportedly donated for contractor, artisan and landfill daily cover use at this time. Anecdotal information indicates that the Andersen AFB crushers cannot produce aggregate that meets most roadway pavement specifications (subbase size requirements typically range from 3/8 to 0.0029 inches and laboratory test results would be necessary to verify that the size produced by the existing equipment is acceptable). Some mainland U.S. processors report operating costs of at least $12/ton and throughput of 2 tons/hour.

Compost/Mulch

The estimated waste composition analysis completed for the Guam Zero Waste Plan identifies as much as 21,000 tons/year of yard waste in Guam's 2012 municipal solid waste stream (or 14% of the total waste stream). The non-municipal waste stream also includes 21,000 tons per year of wood waste, although only a portion of this sub-stream is likely to be clean wood suitable for processing as mulch. This number would be further increased by the land-clearing and pallet waste generated during construction through land-clearing activities, pallet use and other non-municipal solid waste debris. According to GEPA's recent *Recycling In Focus Fact Sheet,* less than 23 tons of wood waste was diverted in 2011 (GEPA, 2012).

Although full-scale composting has not matured on Guam to a point that capital or operating costs are known, the composting process can be a relatively cost-intensive process (requiring debagging, grinding, turning, hydration, screening, hauling and monitoring equipment). However, it is expected to be less expensive than disposal via landfill even when all regulatory requirements are established and allows the materials to be used to enrich the land rather than paying to bury them in hardfills. Further, the development of local markets for these materials will improve operating costs. Chipping or grinding brush, pruning waste and landscaping debris for mulch is generally a low-cost

operation using mobile equipment and can be especially cost-effective when debris generated from clearing and grubbing operations is generated on-site.

More than 30 state transportation departments currently have specifications that address the use of compost product materials in roadway applications. Roadway applications for compost and mulch typically occur at the end of the rehabilitation or reconstruction process and include both soil amendments (especially where organic content in the natural soil is low) and erosion control (see photo below). These benefits are both temporary (helping establish vegetation and mitigate storm impacts immediately post-construction) and permanent (supporting long-term plant health). Compost, which is often applied as filter berms, socks or compost blankets improves sandy soils by increasing water retention and improve clay soils by adding porosity. It also adds microbes to the soil which extract nutrients and improves plant health. Mulch also increases waste retention, reduces soil temperature extremes and minimizes erosion.

Mulch application is fairly straight-forward and typically requires only grinding equipment. The Eddie Cruz Hardfill, South Pacific Environmental, the University of Guam, and the Coconut Rhinoceros Beetle Eradication Project all operate mobile grinders. The ability of this equipment to meet specification requirements and the potential for a private partnership are considerations that should be further evaluated. For example, Texas Department of Transportation's draft Special Specification 5080/Shredded Brush as Erosion and Sedimentation Control requires maximum 3-inch shredded brush. It is likely that new heavy duty mobile grinding equipment will be needed on the island if this recycled material is utilized in roadway applications. This equipment would ideally be able to process brush, logs, whole trees, stumps, bark, chunk wood, pallets, C&D wood debris, treated wood and other materials.

If compost/mulch can be used for vegetation and erosion control on Guam roadway right-of-ways, a reasonable amount of this waste could be diverted from disposal. If only 5% of Guam total highways (about 27 miles) underwent rehabilitation or reconstruction each year, approximately 1,000 tons of compost and 200 tons of wood mulch would be diverted. This equates to more than 10% of the yard/green wastes generated by Guam's businesses and residents annually. Compost typically reduces feedstock volume by 50% - therefore 2,000 tons of yard waste is needed to produce 1,000 tons of compost. This diversion estimate assumes 30-foot right-of-way on each road side and applications rates for compost and mulch of 5 tons/acre and 1 ton/acre, respectively.

Major Milestones

In order for this alternative to be implemented, the following milestones should be focused on.

- Convene stakeholders and identify targeted materials. Tires, glass and compost/mulch are recommended for initial consideration. Additional materials could be added for consideration based on stakeholder input. It is expected that this activity with existing GovGuam staff resources and could be completed within 3 months of reaching a decision to implement this alternative.
- Coordinate with the Department of Defense (DOD) to assess existing and planned recycled roadbuilding practices being used in Guam.
- Quantify benefits and drawback of using recycled materials. Compile existing research and economic data, conduct a screening evaluation (laboratory and field testing will not be required for these

materials). It is expected that this activity could be completed within 3 months of initiation with existing GovGuam staff resources and assistance from USEPA and FHWA.

- Evaluate the economics of using recycled materials. This activity could be completed within 6 months of initiation by procuring an independent economic analysis and with existing GovGuam staff resources.
- Develop supplemental requirements allowing the use of recycled materials in current roadway pavement system component specifications. It is expected that this activity could be completed within 12 months of initiation with existing Gov. Guam staff resources and assistance from FHWA.

Challenges

This initiative will face a variety of general and specific challenges.

- The cost of procurement and importing the required equipment (where it does not already exist on the island) may make on-island processing infeasible, even if the GDPW relies on highway and recycling contractors for material processing.
- Equipment procurement costs – the glass applications described above require that glass be crushed and screened to meet specific size requirements. Currently, Andersen Air Force Base (Andersen AFB) owns glass crusher equipment (producing minus 1/4") and glass pulverizing equipment (producing sand) but it is unlikely that this equipment would meet roadway specifications. For highly contaminated material, magnetic separation and air classification equipment may also be needed to remove contaminants before the crushing and screening.

Additional potential challenges to using compost/mulch on Guam roadway pavement system applications in the short term include:

- Mature compost operations do not exist on Guam and new operations may not produce consistent, quality, high-nutrient value product when needed by contractors in the short-term. Establishing product testing for erosion/sediment control applications - typically include pH; salt, moisture, organics matter content; particle size; carbon dioxide evolution rate; and contamination levels. AASHTO R51-10 and R52-10 for filter berms, filter socks and compost blankets references USEPA Test Methods for the Examination of Composting and Compost. Other standards will apply for specific applications.
- The spread of the Coconut Rhinoceros Beetle infestation has been exacerbated by illegal dumping and stockpiling of green waste - existing quarantine regulations prohibit the transfer of host material from the western coast but are not consistently enforced (the Guam Department of Agriculture, USDA and University of Guam are working to improve enforceable policy at both the territory and village level.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

Development of supplemental specifications for using recycled material in roadway pavement systems has the potential to not only reduce landfilled materials, but to create local markets for materials that do not currently have sustainable diversion options. Assumptions for estimating future diversion resulting from the implementation of this alternative on Guam include:

- Policy development will take at least two years - diversion associated with new policy will not be measurable until 2015;
- Targeted materials (tires, glass and yard waste) are primarily in the municipal solid waste stream - diversion of clearing and grubbing debris at non-municipal, construction sites would increase the tonnages estimated in the table below; and
- Diversion levels of 10-25% for tires, 0-10% for glass and 0-25% for yard waste (processed into mulch or compost) - these levels may increase depending on the additional policy or voluntary incentives are implements on Guam and if mulch-compost from land-clearing debris is included in these applications.

TABLE WP-G.1. LANDFILL DIVERSION POTENTIAL[1]
GREENING ROADWAY PAVEMENT SYSTEMS
(Implementation expected 2015)

YEAR	TIRES		GLASS		YARD WASTE		MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons	% by Weight	Tons	% by Weight	Tons	% by Weight	Tons
2015	10-25%	0-1,000	0-5%	0	0-5%	0-1,000	0-5%	0-2,000
2020	10-25%	0-1,000	0-5%	0	5-10%	1,000-3,000	0-5%	1,000-4,000
2025	10-25%	0-1,000	5-10%	0-1,000	10-25%	2,000-6,000	0-5%	2,000-8,000
2030	10-25%	0-1,000	5-10%	0-1,000	10-25%	2,000-6,000	0-5%	2,000-8,000

Notes:

1. *Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).*

Job Creation Potential and Small Business Opportunities

To estimate the potential job creation associated with utilized recycled municipal solid wastes on Guam's roadways, the following assumptions have been made:

- Traditional recyclables processing may generate slightly more than one job/1,000 tons managed (see The Basis for Job Creation Potential Estimates Technical Memorandum) - although data specific to tires is limited; and
- Organics processing may generate less than one job/1,000 tons (see the Basis for Job Creation Potential Estimates Technical Memorandum).

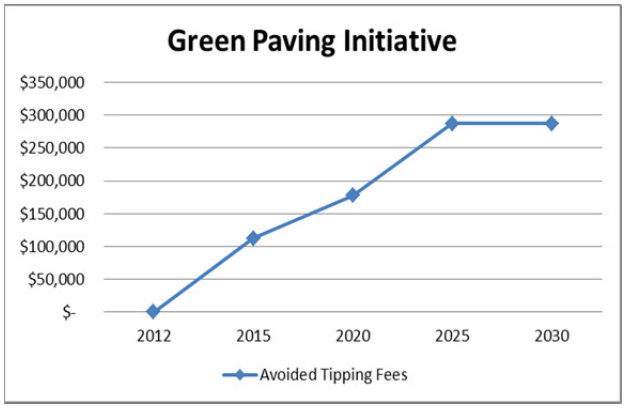
Based on the projection of quantities diverted, it is possible that up to one new FTE could be created on Guam in 2015 up to three new FTEs through 2030. As processing would most likely be accomplished by roadway contractors or local recyclers, these would likely represent small business opportunities on Guam in the private-sector. This job creation potential also has the potential to increase by any GDPW staffing increases that occur as a result of implementing this initiative.

Estimated Revenue Generation

The diversion of tires, glass, compost or mulch to greening roadway pavement systems is not expected to generate net revenues. Instead of landfilling these materials, they will be processed as a highway material at a cost close to or less than that of virgin materials and this cost will be estimated as part of the specification development process. As noted previously, the value of using rubberized asphalt on Guam to extend pavement life may be an additional option for reducing highway maintenance costs. However, the technical and economic suitability of this option requires further study.

Avoided Landfill Disposal Costs

Based on the diverted quantities presented in Table 1, an average tipping fee for tires and glass of $175 per ton at GSWA's commercial transfer station and yard waste tipping fee of $35 per ton for hardfill sites, the avoided landfill costs would range from 112,000 in 2015, increasing to almost $288,000 by 2030.



Human Health and Environmental Impacts

The use of tires, glass and compost/mulch as a substitute for conventional materials in roadway pavement systems can provide significant positive environmental impacts, including:

- Provides an opportunity to use recycled materials in roadway pavement and reduce the impact of these materials on landfills, extending the landfill's lifetime and helping to preserve habitat that might otherwise be appropriated for a new landfill or a landfill expansion.

- Reduces greenhouse gas emissions from both avoided landfill disposal and virgin aggregate production.
- Reduces air and water pollution.
- Conserves existing natural resources and virgin material sources.
- Recycled materials are often used in permeable pavement, which is cooler than traditional pavement in the summer and improves air quality by radiating less heat (howstuffworks.com).

Economic Costs

The Greening Roadway Pavement Systems initiative is essentially a policy issue that does not require legislative action. It is expected that new highway policy will be developed by the GDPW and GEPA staff. Cost estimate assumptions include:

- Policy development will occur in 2013-2014 - and will require the equivalent of a combined 0.25 FTE technical staff from both agencies to identify targeted materials, conduct research and develop policy language;
    - Target areas are expected to be limited to tire retaining walls, glass cullet, highway subbase and mulch/compost for vegetation and erosion control
    - If additional material use options (such as recycled asphalt pavement) are evaluated by GDPW and GEPA staff in the future, higher policy development costs would be incurred
- No on-going operational costs are expected once the Highway Department's supplemental specifications are in place; and
- There will be no new equipment or other office requirements.

Total costs for implementing the greening roadway pavement systems requirements are estimated to be $32,000 in year 2015 only. This includes direct salary costs, departmental overhead of 18% and Department of Administration overhead of 7% of departmental costs.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- American Association of State Highway and Transportation Officials (AASHTO) - includes state recycling coordinators and solid waste management regulators, http://www.transportation.org
- American Society for Testing and Materials - www.astm.org
- Construction Materials Recycling Association - www.cdrecycling.org
- Green Highways Partnership (GHP) – provides technical information on beneficial uses, operates a Recycling and Beneficial Use Group, http://www.greenhighwayspartnership.org/
- 2030 Guam Transportation Plan - http://www.guamtransportationprogram.com/guam-transportation-plan-2030
- Hawaii Department of Transportation, Solid and Hazardous Waste Branch - John Valera, jvalera@eha.health.state.hi.us
- PennDOT Benchmark Study: Current Practices and Future Trends for the Use of Recycled Materials in Highway Construction, prepared by PennDOT Environmental Quality Assurance Division, May 2011
- Recycled Materials Resource Center (RMRC) – funded by FHWA and USEPA, http://rmrc.wisc.edu/ (also see tires and glass research)
- Transportation Research Board (TRB) - www.trb.org
- U.S. Department of Transportation/Federal Highway Administration – provides highway design and construction services and research for federally-funded highway projects, www.fhwa.org
    - "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects" – FP-03 US Customary Units (2003)
    - "Framework for Evaluating Use of Recycled Materials in the Highway Environment," Publication No. FHWA - RD-00-140
    - Mechanical Properties of Tire Bales for Highway Applications, FHWA/TX-10/0-5517-1 (2009) http://www.utexas.edu/research/ctr/pdf_reports/0_5517_1.pdf
- USEPA Roadway Construction resources – www.epa.gov/wastes/conserve/lmr/road.htm

Tires

- Leonard Jones, P.E., "Building with Tire Bales - Addressing Some Engineering Concerns", 2005
- Rubber Manufacturers Association - www.rma.org/
- Rubberized Pavements Association – http://rubberpavements.org
- Texas Department of Transportation, "Using Scrap Tire and Crumb Rubber," 2007 Annual Progress Report

Glass

- AASHTO M318-02 "Standard Specification for Glass Cullet Use for Soil-Aggregate Base Course", 2010
- State of Montana - beneficial use determination, http://deq.mt.gov/Recycle/

Compost/Mulch

- Industrial Resources Council - www.industrialresourcescouncil.org
- AASHTO R51-10 "Standard Practice for Compost for Erosion/Sediment Control (Filter Berms and Filter Socks), 2010
- AASHTO R52-10, "Standard Practice for Compost for Erosion/Sediment Control (Compost Blankets), 2010
- Aubrey Moore, "Update on the Guam Coconut Rhinoceros Beetle Eradication Project," University of Guam, February 2012

References

FHWA's "Framework for Evaluating Use of Recycled Materials in the Highway Environment", Publication No. FHWA-RD-00-140.

Guam EPA, Recycling In Focus Fact Sheet, November 2012.

Please see the next page.

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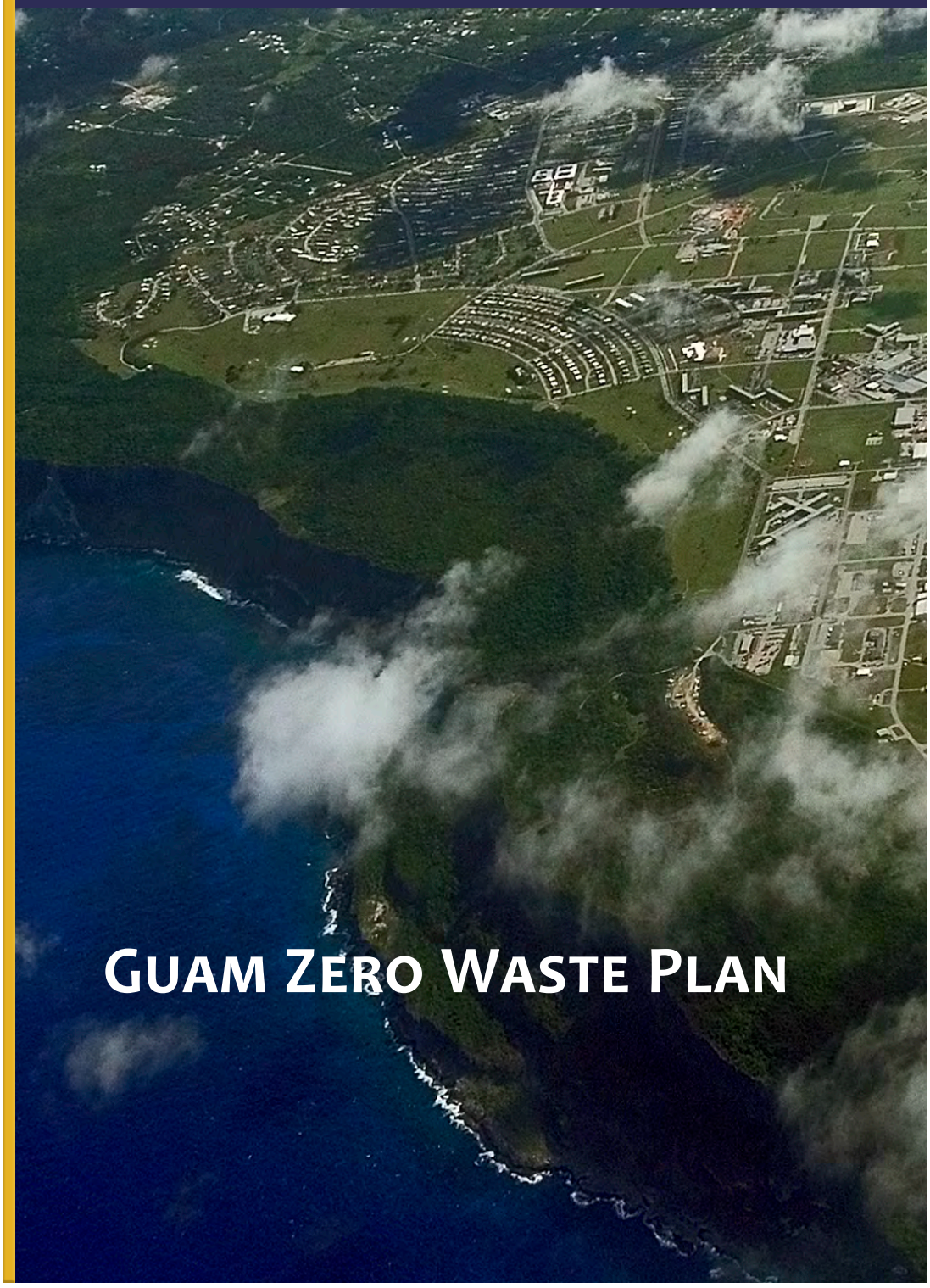
White Paper H



Guam Zero Waste Plan

WP H

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WHITE PAPER H

ILLEGAL DUMPING AND LITTER CONTROL

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste, rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Illegal Dumping and Litter Control***
- Evaluation of Funding Sources
- Green/Environmentally Preferential Purchasing Program
- Extended Producer Responsibility
- Zero Waste Association
- Recycling Grant Program
- Pay-As-You-Throw Pricing Policy
- Plastic Bag Disposal Ban
- Education and Outreach
- "3R" Requirements for Public Buildings
- Used Building Materials Facility
- Greening Roadway Paving Systems
- Construction and Demolition Diversion Policy
- Organics Recovery Composting System
- Construction and Demolition Debris Processing Facility

Purpose

This white paper, which is one in a series of fifteen, presents a summary of one initiative of that can be implemented to help GovGuam achieve the goal of Zero Waste. This initiative is the control of illegal dumping and litter.

White Paper Organization

This white paper is divided into five sections:

- Section 1 presents the purpose of this white paper, provides a roadmap of the document and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presets an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 provides a list of resources for additional information and references.

Key Findings

There are existing regulations, regulatory programs and volunteer programs on Guam to fight illegal dumping and provide assistance with litter control. GovGuam has several existing regulations in place that prohibit littering and allow for enforcement actions to be undertaken against such activities. However, from a practical perspective, these existing regulations are reportedly only marginally effective. For GovGuam's illegal dumping and litter control program to be optimally successful, the following key actions that both augment the existing regulations and present new implementation strategies (described in more detail in Section 3) are recommended:

Policy Actions

- Enact a tougher Anti-Litter and/or Illegal Dumping Law and increase fines/penalties for littering and illegal dumping.
- Provide funding to adequately staff an illegal dumping and litter control program.

Implementation Actions

- Re-establish a cross-functional Illegal Dumping and Litter Control Team.
- Work more closely with the Council of Mayors to provide additional enforcement and cleanup.
- Focus on higher conviction rate for violations taken to court.
- Develop, implement and publicize the program; and expand community outreach efforts.
- Initiate more volunteer cleanup activities throughout the year.
- Develop an Adopt-a-(Road, Beach, etc.) Zero Waste Zone (Cleanup Program) for groups/businesses.
- Track/Measure Progress.

2. INITIATIVE OVERVIEW

This section presents an overview of illegal dumping and litter control including background information, examples of programs that have successfully been implemented in various locations, opportunities and constraints associated with this initiative, and a summary of what exists on Guam today with respect to an illegal dumping and litter control program.

What is Littering and Illegal Dumping?

The information presented in this section is largely excerpted from EPA's *Illegal Dumping Prevention Guidebook* (EPA, 1998). Littering and illegal dumping are acts of improper disposal of trash. However, there are subtle differences between the two. Litter is primarily small items that are scattered about – items such as paper, food containers, beverage containers, convenience products, newspapers, vehicle debris and cardboard. Littering can be an intentional act or it can be accidental. Some of the trash found along roadways is the result of unintentional consequences such as items blown from yards and vehicles, lost items, or debris leftover from accidents. While litter is often easy to remove, keeping an area litter-free can be costly and time consuming.

Illegal dumping is intentional disposal of waste in an unpermitted area. Illegal dumping is also referred to as "open dumping" and "midnight dumping" because materials are often dumped in open areas from vehicles along roadsides and most commonly late at night. Illegally dumped wastes are primarily materials that are dumped to avoid either disposal fees or the time and effort required for proper disposal. Illegally dumped materials often include:

- Household garbage
- Construction and demolition debris
- Yard waste
- Appliances or "white goods"
- Furniture
- Scrap tires
- Medical waste

Illegal dumping and littering is also a problem along shorelines, and in coastal waters, estuaries, and oceans in/adjacent to Guam and throughout the world. Any man-made, solid material or object which is discarded, disposed of, or abandoned that enters the coastal or marine environment is referred to as marine debris. Marine debris may enter waterways either directly from a ship, or indirectly when washed out to sea via rivers, streams and storm drains. The majority of marine debris enters our oceans and coasts from a number of land based sources, and often from illegal dumping.

Existing Programs on Guam

There are regulations/regulatory programs and volunteer programs which exist on Guam to fight illegal dumping and provide assistance with litter control. Following is a brief description of each.

EXISTING PROGRAMS TO REDUCE LITTERING AND DUMPING

- *GovGuam Regulations*
- *Volunteer Programs:*
  - *Community Assisted Policing Program*
  - *Islandwide Beautification Task Force*
  - *Guam Coastal Management Program*

Regulations/Regulatory Programs

GovGuam has several regulations in place which prohibit littering and allow for enforcement actions to be undertaken against such activities. Regulations relevant to litter control can be found in:

- Title 10 of the Guam Code Annotated: Health and Safety (10 GCA Health and Safety)
  - Chapter 51: Solid Waste Management and Litter Control
    - Article 1: Solid Waste Management, Sections 51110 and 51115
    - Article 2: Litter Control, Sections 51201 through 51208.

The purpose of Article 2 is to define and prescribe procedures pertaining to littering and to provide authority for the regulation of littering in order to enhance the environment for the people of Guam. Provisions included under Article 2 include the:

- Designation of apprehending officers from various GovGuam agencies including the Guam Environmental Protection Agency (GEPA), Department of Parks and Recreation, the Department of Agriculture, the Department of Public Works, all village mayors and assistant mayors, any peace officer in the Guam Police Department, including the community police volunteers, the A.B. Won Pat International Airport Authority Police, the Port Authority of Guam Police, and the Guam Fire Department's uniformed personnel.
- Establishment of a Litter Control Revolving Fund administered by the Administrator of GEPA.
- Definition of littering and prohibited activities, including willful or negligent dumping or abandonment of litter.
- Provisions for enforcement, including the power to issue citations for violations, and penalties.

Litter control regulations are also located within Title 22 of the Guam Administrative Requirements, Chapter 20 (22 GAR 20), Sections 20107 through 20119. These regulations include the:

- Definition of "public nuisance" as anything determined by the Director of the Department of Public Health and Social Services to be dangerous to life; injurious to health; or renders soil, air, water or food impure or unwholesome.
- Definition of responsibilities for the abatement of conditions that are considered to be public nuisances.
- Establishment of the failure of responsible parties to abate conditions that are considered to be public nuisances as illegal.

- Establishment that the owner is financially responsible for abatement of public nuisances.
- Creating a time restraint during which abatement measures must be implemented.
- Establishment that the Director of the Department of Public Health and Social Services and any personnel acting on his behalf has the authority to give notice and enforce the rules and regulations of 22 GAR 20.

Provisions for litter enforcement can also be found within Title 5 of the Guam Code Annotated, Chapter 40 (5 GCA 40), Sections 40113, 40115 and 40131. These provisions include the:

- Authority of Mayors and Vice Mayors to fine violators of sanitary and health laws and to cite violators of litter and defacement laws and regulations.
- Fines for these violations are imposed by the Traffic Court through monetary penalties in an amount not less than $100.000 and not more than $1,000.00, or through the requirement to perform community service including the cleaning of roadsides, public grounds and facilities within the municipality in which the violation took place not to exceed 100 hours, or both.

From a practical perspective, although there are legal regulations in place to prohibit illegal dumping and littering, these regulations are reportedly only marginally effective. During the Zero Waste Visioning Session held in February 2012, meeting participants identified several reasons that the existing litter control regulations were ineffective including insufficient staffing and training of staff to adequately address the problem, inconsistent enforcement of the existing regulations, dismissal of violations in court, and a general lack of public awareness of the issues and problems created by littering and illegal dumping.

Volunteer Programs

The Guam Police Department (www.gpd.guam.gov) operates a volunteer program, known as the Community Assisted Policing Effort (CAPE), which among other activities, provides volunteers to enforce Guam's littering laws through a partnership with the Islandwide Beautification Task Force (www.guamibtf.com). The Islandwide Beautification Task Force provides a "litter-bug" service which is used to report anyone littering or illegal dumping by taking down a violator's license plate number, a brief description of the violator's vehicle and items you see them dumping, and reporting the activity to CAPE. Littering and illegal dumping events can be reported by sending an email to gpdlitterbug@gmail.com or gpdvsc@gmail.com; or by calling CAPE at 647-8923. Beginning in November 2012, the Islandwide Beautification Task Force established a new program to encourage nonprofit organizations to help keep Guam beautiful. Through the program, a $500 grant will be provided to chosen organizations after their participation in a local clean-up effort.

The Guam Coastal Management Program, which is overseen by the Bureau of Statistics and Plans (www.bsp.guam.gov) and the Coastal Cleanup Committee also organize marine debris cleanup events. The most recent event was the annual Guam International Coastal Cleanup Day on September 15, 2013, in which more than 3,000

volunteers participated. During this event, more than 26 miles of shoreline was cleaned up and approximately 23,500 pounds of trash were collected (Bureau of Statistics and Plans, 2012). Internationally, Coastal Cleanup week is the third wend of September every year.

Successful Approaches Used Worldwide

Examples of successful illegal dumping and litter control programs exist across the globe. The problem of illegal dumping and litter control is typically legislated at a country or state level, with enforcement of the legislation delegated to local authorities. Typically, the legislation defines actions which can result in the assessment of fines and/or penalties. Examples of successful legislation and programs related to illegal dumping and litter control exists in the:

- United States - punishable with a fine, community service, or both, as set out by state statutes and city ordinances. All 50 states and most U.S. territories have anti-litter laws.
- Saipan – An Anti-Litter Act enacted in 1999 authorizes penalties for littering. The Anti-Litter program run by the Division of Environmental Quality successfully collected over 18,500 pounds of litter in 2012.
- Australia - no national legislation, although state based environmental protection authorities have laws and fines to discourage littering.
- The Philippines – Environmental Enforcement personnel administer an anti-litter law which prohibits littering and illegal dumping, with penalties consisting of fines or optional community services.

A number of non-profit organizations exist with the aim of raising awareness and running campaigns including clean up events. Clean Up the World is a worldwide campaign. In the United States there are a number of organizations running anti-litter campaigns. Keep America Beautiful was founded in 1953. At least 38 states have high profile, government-recognized slogan campaigns, including "*Don't Mess with Texas*"; "*Let's Pick It Up New York*"; "*Don't Trash California*"; "*Take Pride in Florida*"; and "*Keep Iowa Beautiful*". In Australia, Clean Up Australia Day is supported by many major Australian companies, firms, and volunteers alike. Anti-litter organizations include Keep Australia Beautiful founded in 1963 that created the popular "*Do the Right Thing*" campaign and its Tidy Towns competition became well known being a very competitive expression of civic pride. "*Keep Britain Tidy*" is a British campaign run by the Keep Britain Tidy environmental charity, which is part funded by the U.K. government (Wikipedia, 2013).

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative could be developed and managed. To implement a successful illegal dumping and litter control program, GovGuam must take advantage of the opportunities associated with this initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Opportunities include:

- Educates the public about the impacts of and discourages improper disposal of waste.
- Recovery of costs associated with cleanup if those responsible are identified and prosecuted, as well as assignment of community service, is allowed under existing laws.
- Reduces pollution and potentially contaminated run-off by removing illegally dumped materials.
- Creates volunteer and community recognition opportunities.
- Increases community worth, self-esteem and restores the natural beauty of the land.
- Increases the value of the property that contains the trash and adjacent properties.

Constraints include:

- Cost of cleanup and proper disposal of litter and illegal dumped materials is assumed by the local government.
- Requires commitment of dedicated staff and resources to enforce regulations to ensure that littering and illegal dumping activities are minimized.
- Requires specific controls to protect worker health and environment.
- Fines/penalties assessed under existing regulations may be inadequate to deter littering and illegal dumping.
- Requires specific controls to protect worker health and environment.

3. IMPLEMENTATION OVERVIEW

Successful illegal dumping and litter control programs focus on increased public awareness of the problem and its implications, community involvement, and targeted enforcement to eliminate or reduce illegal dumping and littering practices. Based on the experience of many communities, prevention of illegal dumping and littering before it happens in the first place and minimizing its reoccurrence is the best strategy to reduce the problem.

Major Components

Successful illegal dumping and litter control programs use a combination of public education, citizen participation, and authorized enforcement measures to reduce illegal dumping and littering. Illegal dumping and litter control programs must address the contributing factors in the area where they are implemented to be effective. It is expected that GEPA would continue leading the implementation of this program with assistance from the Mayor's Council and volunteer community groups.

Following are a number of implementation steps recommended to make Guam's existing illegal dumping and litter control program more effective. Information presented herein is adapted from USEPA publications (USEPA 1998, 2001), the City and County of Honolulu, Department of Environmental Services website (2013) and the Pennsylvania CleanWays Program Guidelines (2008).

Create/Re-establish a Cross-Functional Illegal Dumping/Litter Control Team

Coordination among authorities, communities and industry to create/re-establish an Illegal Dumping/Litter Control Team made up of stakeholders with the authority and resources to address the problem is essential for success. Key stakeholders, including representatives from the Police Department, GEPA, the Mayor's Council, GSWA, GDPW, Islandwide Beautification Task Force, schools and community groups must work together to make Guam's existing Illegal Dumping/Litter Control Program more effective. Such coordination allows sharing/leveraging of limited resources, presents a unified voice to the program, and helps avoid duplication of effort. A committee of appointed representatives from each stakeholder group should be established and meet on a regular basis to discuss progress, plan events, and establish procedures and responsibilities.

IMPLEMENTATION STEPS

- *Create Team of Stakeholders*
- *Develop Effective Program*
- *Obtain Local Leadership Support*
- *Utilize and Integrated Approach*
- *Publicize Successes*
- *Expand Focus on Marine Debris*
- *Go Beyond Enforcement*

Develop an Effective Program

Creating and effective illegal dumping/litter control will require GEPA to evaluate the existing program, determine what is/is not working within the program, identify and troubleshoot existing difficulties, establish metrics for improvement and set a schedule for implementation. Some of the issues that must be evaluated with respect to increasing the effectiveness of the existing litter control program on Guam include determining:

- The locations of persistent illegal dumping and littering activities;
- Types of wastes dumped and the profile of dumpers;
- Possible driving forces behind illegal dumping (i.e., excessive disposal fees or limited disposal options);
- Potential mitigation measures;
- Previous education, conservation, and cleanup efforts;
- Training of enforcement (both GovGuam and volunteer) and judicial personnel; and
- Current control programs and local laws or ordinances addressing the problem.

Obtain Leadership Support from Local Officials

Local politicians and high-level officials must make prevention programs a priority and support them with adequate funding, access to equipment and labor resources. In addition, department staff must work with available resources to carry out the program and report accomplishments back to high-level authorities. Territory laws already exist to discourage illegal dumping. However, ordinances and laws are ineffective without a commitment from high-level authorities for enforcement. For example, enforcement officers must have the support of their administration, and GEPA, the Police Department and the Mayor's Council must have the support of the court system. In addition, if illegal dumping is not viewed as a priority and little action is taken, residents become frustrated and stop contacting enforcement officers or local officials to report problems. Residents must be encouraged to persist in contacting different local and state agencies until they find an individual who is responsive to their concerns.

Utilize an Integrated Approach

An effective illegal dumping and littering control program requires the integration of several approaches that complement each other, including:

- Site maintenance and controls. Many illegal dumping areas continue to experience problems after being cleaned up. Signs, lighting, and barriers can reduce or eliminate continued dumping in a given area. In addition, a plan needs to be in place to maintain the area and to promptly remove any materials that are dumped.
- Coordination of Efforts. Coordination of cleanup efforts to the extent possible should be implemented to leverage labor from sources such as community and youth groups and correctional programs; equipment from public works or highway agencies and private companies; and funding from sources such as governmental agencies or through corporate donations.
- Community outreach and involvement. Community programs established to organize special waste cleanup events and support community-oriented policing have proven effective in addressing illegal dumping and littering problems. The focus of any community involvement effort should be to teach residents what can be done to prevent illegal dumping and littering, how and why they should get

involved, and who to contact for assistance or to report an incident. In some areas, organized community groups serve as the main catalyst for information exchange and involvement among residents.

- Public education. Many argue that the most important component of a successful illegal dumping and litter control program is public education. However, outreach and education programs are only effective when the behavior of a target audience changes or is sustained. Designing and implementing an effective outreach and education programs for illegal dumping and litter control with a clear, simple message to which the target audience can relate must be developed.
- Targeted enforcement. The framework of effective enforcement consists of laws, regulations, and ordinances that regulate waste management and prohibit illegal dumping and littering. However, this framework is only effective to the extent that it is enforced and offenders are prosecuted. Laws, regulations and ordinances require sufficient resources, trained enforcement, clear lines of authority, timely prosecution, and support of the judicial system. Communities with repeat dumping problems have worked with law enforcement to use hidden video cameras to apprehend illegal dumpers, recover cleanup costs, and raise awareness that illegal dumpers will be prosecuted (USEPA, 1998).
- Program measurement. Tracking and evaluation methods should be used to measure the impact of illegal dumping prevention efforts and determine whether goals are being met. Baseline figures should be established for indicators such as annual cleanup costs, facility compliance, arrests, convictions, fine collection, complaints and number of problem sites. Evaluation of information being tracked allows for identification of needed adjustment and allocation of resources to improve the effort.

Integration of these strategies and cooperation of partners from government, communities and industry are needed to plan, implement and sustain a successful illegal dumping and litter control program.

Publicize Successes

Publicizing program results is necessary to obtain continued support from high-level authorities and to maintain cooperation between authorities and community groups. Prevention programs must be recognized as cooperative efforts, and successes need to be shared with all parties involved to validate their participation, gain additional support, and allow others to benefit from lessons learned.

Over time, tracking program impacts such as arrests, fines, vehicle impoundments, cleaned-up sites, and avoided costs are integral to the continuation of illegal dumping and littering control prevention efforts. Evaluating program efforts provides data for cost-benefit analysis, publicity efforts, budget hearing and grant program accountability.

Expand Focus on Marine Debris

GovGuam agencies have been leaders on Beach Cleanup, and should continue to focus resources on reducing, tracking, and cleaning up marine debris. Specifically, GEPA and the Guam Bureau of Statistics and Plans should join U.S. EPA Region 9, Navy, Air Force, and Coast Guard contacts to partner on measuring marine debris and identifying types, brand names, sources, and country of origin of marine debris on Guam and in the surrounding waters.

Go Beyond Enforcement

Enforcement is only one aspect in the fight against littering and illegal dumping. Beyond enforcement, there is a need to educate on the benefits of:

- Disposing of trash properly and reduce/reuse/recycle whenever possible.
- Hiring only licensed and reputable haulers for special services. Many people assume that anyone paid to collect trash is legitimate.
- Provide funding for each Village to sponsor/adequately staff a cleanup day twice each year.
- Volunteer in other local or regional cleanups (such as the Great American Cleanup) or organize a cleanup.
- Develop an Adopt-a-(Road, Beach, etc.) Zero Waste Zone (Cleanup Program) for groups/businesses.
- Work with other individuals, groups, and agencies to increase everyone's sense of stewardship and community.

Major Milestones

In order for this alternative to be implemented, focus should be placed on several milestones, including:

- Immediately re-establish a cross-functional Illegal Dumping/Litter Control Team. While GEPA is the logical agency to lead the team, responsibility for this position should be shared with the Department of Public Health and Social Services. Representatives of agencies that have enforcement authority and that could contribute to the illegal dumping and litter control program should be invited to participate on the team including representatives from the Police Department, Department of Public Works, Solid Waste Authority, Department of Agriculture, and the Department of Parks and Recreation. Additional key stakeholders that should be invited to participate include representatives of the Mayor's Council and the Department of Education.
- The next priority would be to work with the Illegal Dumping and Litter Control Team to evaluate the existing program and determine what actions are necessary to make the illegal dumping and litter control program more effective, including defining the problem and giving direction to government efforts. Assignments to evaluate separate aspects of the program could be given to various members of the team to report back on. This action should be completed within 90 days of the re-establishment of the Illegal Dumping and Litter Control Team.
- Concurrently, GEPA and DPHSS should begin working with the Guam Police Department and Mayor's Council to obtain support from local officials for a stepped-up enforcement program. The Mayor's Council can also provide support from a community involvement and volunteer effort perspective.
- Once additional funding and resources have been secured to cover the costs of administering the program, GEPA can begin a process to add additional full-time resources to the program. It is anticipated that the overall process of recruiting, screening and pre-qualifying the pool of applicants will require an additional sixty days to complete.

Challenges

This initiative will face a variety of challenges. First and foremost will be the ability to obtain resources to adequately implement an effective illegal dumping and litter control program. Initially, agencies may need to assist by providing underutilized resources, whether it be personnel or equipment, from within their own resource pool.

Other challenges include:

- Maintaining a positive momentum to keep the initiative effective;
- Coordinating volunteer efforts;
- Finding a cost-effective solution for disposal of litter and illegally dumped materials;
- Fines may need to be increased in existing regulations and local laws to discourage littering and illegal dumping; and
- Care will need to be taken to ensure that enforcement officers and judges administer penalties and fines in a standardized and equitable manner.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation.

Landfill Diversion Potential

Assumptions for estimating future diversion resulting from a potential ban on Guam include:

- Diversion is measurable in the first year this initiative is implemented.
- Plastic (#1 and #2) and glass are anticipated to be most significant components of materials diverted.

TABLE WP-H. 1. LANDFILL DIVERSION POTENTIAL[1]
(Implementation expected 2015)

YEAR	PLASTIC (#1 AND #2)		GLASS		MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year
2015	0-15%	0	5-10%	0-1000	0-10%	0-1000
2020	20-30%	0-1000	10-20%	1000-2000	10-20%	1000-3000
2025	30-40%	1000 -2000	20-25%	1000-2000	20-30%	2000-4000
2030	40-50%	1000-2000	30-35%	2000-3000	30-40%	3000-5000

Notes:
1. *Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Quantities are rounded to the nearest 1000 tons (i.e., value of "0" tons means less than 500 tons)*

Job Creation Potential and Small Business Opportunities

The cost and revenue information developed for the litter control initiative anticipates that the program will be developed and operated by GovGuam. Direct job creation is expected to be 2.0 FTE. However, this initiative also anticipates acquisition of a number of outside products and services, including purchase of trash receptacles, purchase of signage, development of a media campaign, annual printing, purchase (or leasing) of vehicles. All of these activities offer opportunities for Guam-based small businesses.

Estimated Revenue Generation

The implementation of the Litter Control initiative is expected to generate quantities of recyclable materials, which can be sold to generate direct revenues. Based on these quantities, it is anticipated that this initiative will generate revenues ranging from $24,000 in 2015 to $109,000 in 2030.

The litter control initiative may also generate some direct revenues as a result of fines. However, anecdotal information suggests that actual revenues from fines will be limited unless the Guam court system is more aggressive in requiring payment of fines. As such, no direct revenue is assumed.

Avoided Landfill Disposal Costs

As discussed above, this initiative is expected to divert 850 tons from landfills in 2015, increasing to 3,600 tons by 2030. This will result in avoided tipping fees of $148,000 in 2015, to as much as $628,000 in 2030.

Human Health and Environmental Impacts

Littering and illegal dumping are both major problems that raise significant concern with regard to safety, property values, and quality of life. Littering and illegal dumping pose significant threats to the human health and the environment by:

- Polluting ground and surface water resulting in marine debris.
- Illegal dumping and marine debris harm tourism and fishing.
- Decreasing the value of the property than contains the trash and adjacent properties.
- Attracting additional dumping.
- Discouraging new residents and businesses from entering the area.
- Decreasing community worth.
- Spoiling the natural beauty of the land and sea.
- Damaging equipment or causing accidents on land and at sea.

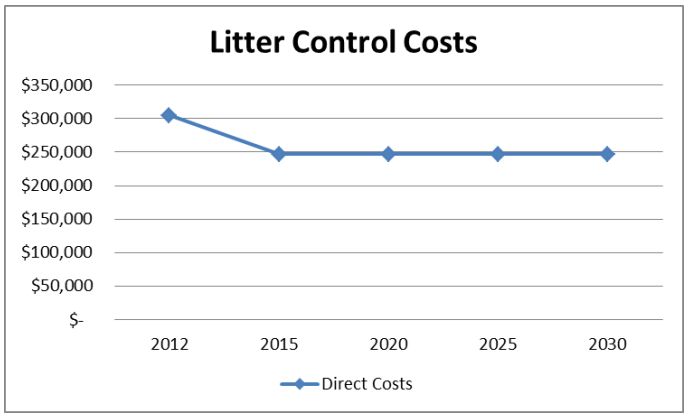
In addition, the cleanup of litter and illegal dump sites is a major economic burden on local government, which is typically responsible for cleaning up illegally dumped materials and litter (USEPA, 1998). By reducing the amount of illegal dumping and littering that takes place, these significant risks to human health and the environment can also be reduced.

Economic Costs

Illegal dumping has tremendous costs to communities, and can impact tourism and economic development opportunities. The cost to west coast communities in the United States has been estimated to be more than half a billion dollars each year in the U.S. EPA Report titled “The Cost to West Coast Communities of Dealing with Trash, Reducing Marine Debris.” Marine debris also impacts tourism revenues as well as potentially impacting fishing and vessel repairs.

The cost of an effective illegal dumping and litter control program activities can vary due to economic and social factors, but with creative thinking, potential costs can be reduced. Illegal dumpers can be required to pay fines, remorse cleanup costs, or conduct cleanups. Other possible sources of labor for illegal dump site cleanup can include community and youth groups, county or state corrections programs, or corporations. Equipment for cleanup may be available through either public works or transportation agencies or through donations by private companies. Training government employees to report incidents of illegal dumping witnessed during the performance of other duties also has the potential to reduce the need for additional staff for the program.

Significant cost assumptions for this initiative include:



- 2.0 FTEs beginning in the base year remaining stable through the forecast period;
- Initial costs for a media campaign, purchase of trash containers, sign production, training, printing, sign installation and departmental overhead of $135,000 in the base year, and $80,000 annually thereafter;
- Vehicle leasing and operating costs of $45,000 in the base year, and annually thereafter; and
- GovGuam overhead costs for Department of Administration are included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.

Total costs for the litter control initiative are expected to be more than $305,000 in the base year, and $250,000 thereafter.

5. ADDITIONAL INFORMATION AND REFERENCES

The following resources can be consulted to obtain additional information regarding this Zero Waste Initiative.

Additional Resources

- USEPA, Region 5, Illegal Dumping Prevention Guidebook (EPA 905-B-97-001), March 1998; www.epa.gov/region 5/waste/illegal_dumping
- USEPA, Region 5, Illegal Dumping Economic Assessment (IDEA) Model, January 2001; www.epa.gov/region 5/waste/illegal_dumping
- USEPA, Pacific Southwest Region 9, Illegal Dumping Publications including Don't Trash Our Land: Prevent Illegal Dumping (PDF) and Don't Trash Our Land: Prevent Illegal Dumping (fill-in) (Microsoft Publisher file); www.epa.gov/region9/waste/tribal/ index.html
- USEPA, Marine Debris Websites and marine Debris Prevention Toolkit - http://water.epa.gov/type/oceb/marinedebris/index.cfm; http://www.epa.gov/region9/marine-debris/
- The Nonprofit Gateway - www.nonprofit.gov
- Grant Resources for Solid Waste Activity in Indian Country - www.epa.gov/tribalsw/finance.htm
- Summary of EPA Grant Programs - www.epa.gov/epahome/finance.htm
- Environmental Grantmaking Foundations – www.environmentalgrants.com
- Keep America Beautiful – www.kab.org
- Cigarette litter prevention - http://www.preventcigarettelitter.org/
- Bahamas National Pride - http://www.bahamasnationalpride.com/
- Hawaii Department of Environmental Services - http://opala.org/solid_waste/Stop_Illegal_Dumping.html
- Caribbean Environment Programme, Marine Litter in the Wider Caribbean, 2006 - http://www.cep.unep.org/publications-and-resources/promotional-material/publications/amep/marine-litter-wider-caribbean-unep.pdf
- Commonwealth of the Northern Mariana Islands Department of Environmental Quality - http://www.deq.gov.mp/article.aspx?secID=11&artID=31

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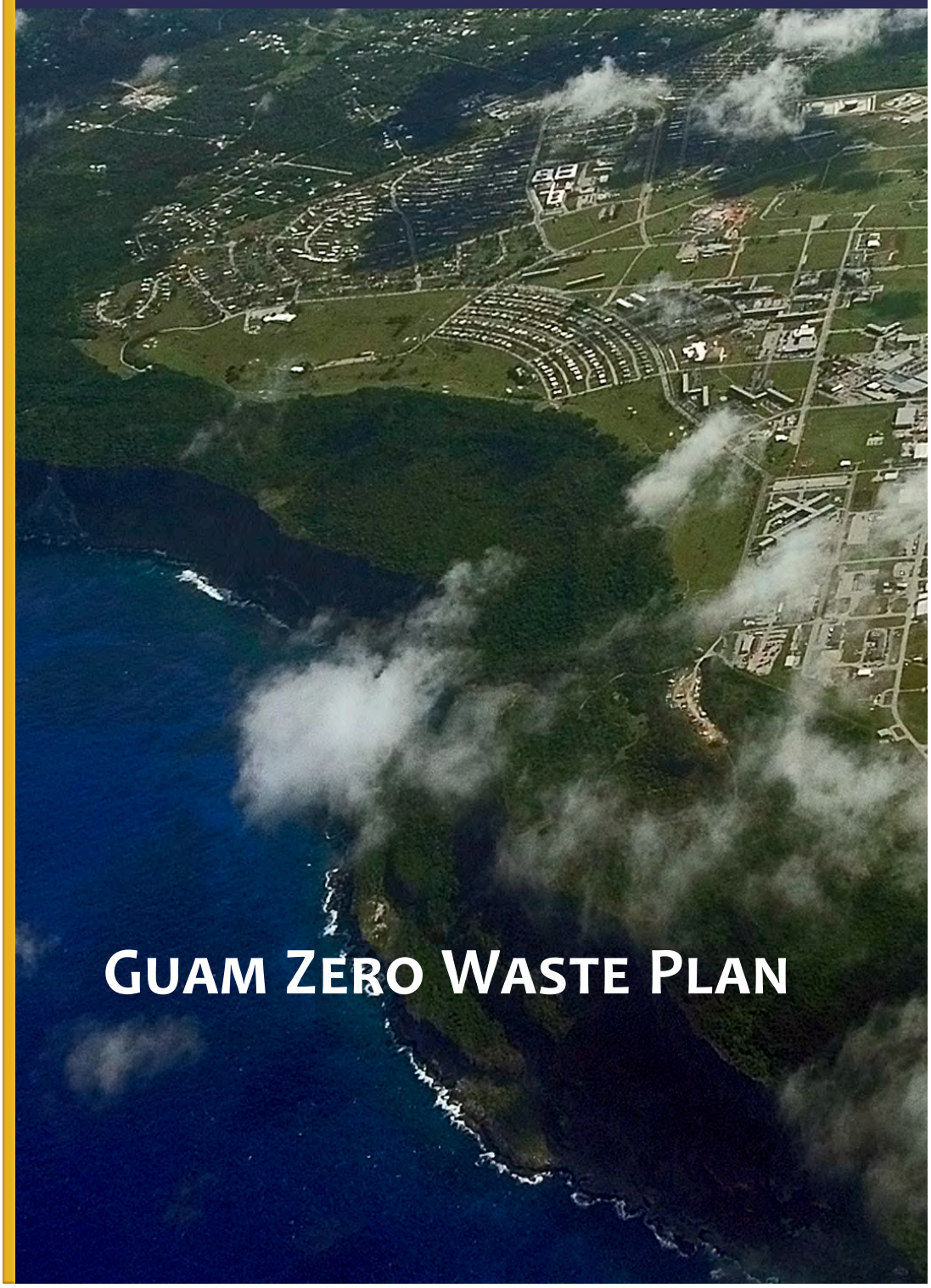
White Paper I



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP I

Please see the next page.

WHITE PAPER I

COMPOST FACILITY

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Organics Recovery Composting System*
- *Greening Roadway Paving Systems*
- *Zero Waste Association*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Green/Environmentally Preferential Purchasing Program*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be used to evaluate and plan for an organics recovery facility in the form of a commercial composting operation.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap to the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

This section includes key findings of the document. The focus of this analysis is the establishment of an organics recovery facility, i.e., a new commercial composting operation serving all civilian generators of two specific materials - yard waste and cardboard. This initiative may be difficult due to the current environment of low cost disposal in existing hardfills on-island. The major steps necessary to establish a new commercial composting facility on Guam include:

- Define Organics Waste Stream Composition and Market Opportunities.
- Determine Key Compost Operating Parameters including carbon:nitrogen ratio, particle size, moisture content, bulk density and porosity, temperature, etc. to identify optimum composting conditions.
- Determine Facility Sizing.

- Identify Facility Location.
- Determine Facility Design Parameters.
- Evaluate Equipment Needs.
- Evaluate Policy Issues Affecting New Compost Operations.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of this Zero Waste initiative, including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

The focus of this analysis is the establishment of an organics recovery facility, i.e., a new commercial composting operation serving all civilian generators of two specific materials - yard waste and cardboard. Both materials are generated by homeowners and businesses in the municipal solid waste (MSW) stream. Yard waste includes grass, leaves, plant debris and other vegetative waste, as well as woody materials including branches, limbs, tree stumps and occasionally untreated wood waste from do-it-yourself residential and commercial projects. Cardboard and paper are most commonly recycled as a commodity with the potential to earn revenues from secondary materials markets; however, some "dirty" or "soiled" cardboard and paper is too contaminated or wet to be recycled, but can still be diverted through composting.

The compost facility activities will include both active composting of yard waste and cardboard, and grinding of remaining clean wood waste into mulch/wood chip products. It is important to note that grinding or chipping wood for mulch is not the same as composting. Mulch is not a fully decomposed or stable product, and has not been processed to remove weed seeds and pathogens.

Although not further considered as part of this initiative, it should be noted that other MSW organics (especially food waste and food-contaminated paper) and non-MSW organics (such as land-clearing waste, construction scrap, pallets, deconstruction debris, and other miscellaneous materials) can also be composted. It is likely that most of the non-MSW wood generated on Guam could not be successfully composted with yard waste and cardboard unless additional feedstock organics were also processed to balance nutrient loadings.

What is Composting?

Composting is the biodegradation of organic materials in a controlled, aerobic environment at high temperatures. Composting is performed by microbes including bacteria, fungi, worms, insects and other organisms, and produces stable products that can be used as a soil amendment with many benefits.

Typical markets for compost products include homeowners, landscapers, nurseries, topsoil blenders, highway departments, parks, golf courses, agriculture and retailers. Environmental markets also include remediation activities such as erosion control, storm water filtration, bio-remediation, surface mine reclamation, wetland construction and restoration.

Existing Programs on Guam

Existing Compost and Related Operations

Currently, there are no commercial composting operations on Guam. The University of Guam (UOG) does operate a research facility in Yigo to determine the relative benefits of compost soil amendment and commercial fertilizer over time. The UOG feedstock include yard waste from commercial sources, restaurant food waste, pig manure and wood chips and uses a mobile wood chipper and small, pull-behind windrow turner. Product is used for university operations only.

Other current/planned compost operations include:

- State Department of Agriculture facility.
- Pacific Unlimited, Inc. has recently been issued a permit by GEPA for a new commercial facility in Ordot.
- Guam Cleaning Masters - has submitted a permit that is currently under review by GEPA.

Other related organics recovery facilities on Guam include:

- Hardfill operations that also passively compost green waste (this entails generally leaving stockpiled green waste to biodegrade in Guam's humid environment without additional moisture, processing, or testing) and grind wood generated by the commercial and construction/demolition sectors - includes the two military hardfills and the privately owned Eddie Cruz Hardfill. There is also anecdotal evidence that there may be other hardfill operations that are not permitted for material disposal and/or may not have a long history of operation. The second permitted hardfill, Northern Primos, continues to accept yard waste but no longer diverts this material from landfill disposal.
- Cardboard recyclers - including Guahan Waste Control, Dewitt Moving and Storage.
- Guam Waterworks Authority - currently landfills wastewater treatment plant biosolids (instead of land-applying, digesting or composting).
- Food waste is collected from large hotels, restaurants, the University of Guam, and at many island events for hog feeding.

Under Executive Order 13514, the federal facilities, including the Department of Defense (DOD), have 50% solid waste diversion and 50% construction and demolition debris diversion requirements. Composting is often a critical element in meeting high diversion requirements. As detailed in the DOD's Environmental Impact Statement documents for military buildup on Guam, the DoD planned to build a compost facility to manage green waste from land clearing operations and wood waste. Revised plans based on shifting buildup scope have not been released, but the Navy is developing an Integrated Solid Waste Management plan that will address composting.

Compost Feedstock Quantities

Without island-specific waste composition data, it is difficult to identify those materials in the MSW waste stream that may be sustainably diverted through composting and wood grinding. Estimates can be made based upon the following assumptions:

- Only yard waste and dirty cardboard from the MSW stream will be processed at the new compost facility.
- 60% of Guam's total MSW waste is generated by the civilian population.
- 10% of all cardboard is unsuitable for recycling and available for composting.
- Quantities represent 100% of the materials generated - a notably lower level will actually be diverted.

According to GEPA's recent "Recycling In Focus" factsheet, less than 23 tons of wood was diverted in 2011 through a University of Guam pilot composting operation. This represents a negligible landfill diversion rate.

While the focus of this analysis is MSW feedstock only, it is possible that vegetative and clean wood waste generated from land-clearing waste, construction scrap, pallets, deconstruction debris and other miscellaneous materials may also be composted at a new commercial facility. These non-MSW materials could potentially add up to 40,000 additional cubic yards/year (mostly wood waste). This is based on an assumption that the non-military, non-MSW is 40% of the total solid waste stream and that clean wood waste is 10% to 15% of the total C&D waste stream.

Successful Approaches Used Worldwide

There are several commonly used composting technologies according to the Solid Waste Association of North America (SWANA):

- Turned windrows involves building and mixing low-tech windrows - requires low capital and moderate operating costs, provides material and operational flexibility and produces compost relatively quickly.
- Passively aerated windrows involves building windrows on top of aeration piping - requires both low capital and operating costs, has less material flexibility and requires longer production time.
- Aerated static piles are similar to aerated windrows but require additional utilities for air flow and odor control - have higher capital and operating costs than windrow methods.
- In vessel involves high-tech construction and operation for containerized production - highest capital and operating costs, but requires smallest process area and produces compost quickly.

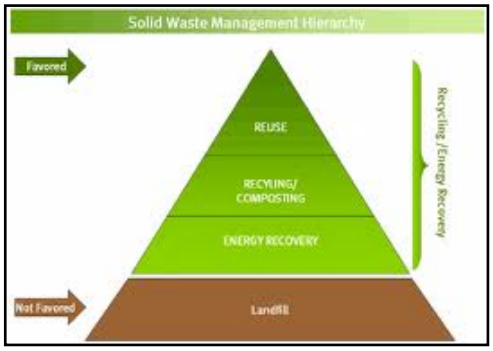
Turned windrow composting is the method of choice in low population areas where feedstock quantity and quality may vary as it provides the best combination of flexibility, process control and economics. This method does require adequate access to water, the ability to tolerate some odor generation when windrows are turned and acceptability of a three- to six-month production period, however.

Windrowing is typically accomplished by one of two approaches:

- Conventional windrowing - uses long, narrow triangular-shaped piles and turning equipment that ranges from front-end loaders to specialized turners (as front-end loaders require less access space, acreage requirements for this equipment is less than standard compost turners).
- Trapezohedron windrowing- also builds long piles but uses less land area (allows much wider windrows) and requires a specially-designed "scalping" turner (composting time may be slightly longer than with the conventional method.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with this initiative and consider constraints. Opportunities include:



- Avoided landfill disposal – organics comprise the majority of municipal solid waste (27% excluding non-recyclables paper) in the U.S. (USEPA, 2011).
- Develops sustainable on-island Zero Waste program that can support education and outreach.
- Provides many soil amendment benefits – adds organic matter and nutrients, increases soil moisture holding capacity, moderates pH, reduces erosion, increases water filtration, reduces nutrient loss from chemical fertilizers, improves soil ecology.
- Composting can overlap other operations such as wood grinding and may also share mobile equipment.
- Reduces greenhouse gas emissions and conserves resources.
- Creates more jobs than disposal of the same materials.

Constraints Include:

- Lack of composting facility regulations in Guam, which are complicated in many states. High costs associated with large facility size and equipment costs.
- Lack of incentives for private sector facility development and operations.
- Compost operations that are protective of the environment and produce quality products (especially those including food waste and biosolids) are capitally-intensive to build and operate. Feedstock tip fees and product sales are typically required.
- Compost markets need to be developed locally and may require local policy support.
- Mulch and potentially compost could spread invasive species.
- Wood grinding-only operations (a much lower-cost operation) can be confused with composting.
- Compost products can be confused with fertilizer. Compost nutrient content is lower than fertilizer. University of Guam research has shown, however, that imported fertilizer may initially be more beneficial and cheaper in initial applications, but subsequently requires greater application than compost and can deplete the soil (while compost amends).

3. IMPLEMENTATION OVERVIEW

Key Stakeholders

The development and operation of a new commercial composting facility on Guam is an ideal public/private partnership. As discussed below, GovGuam (through GEPA) can conduct market research and implement policies to encourage more organics diversion. The private sector, in turn, may be best suited to develop and operate a new facility. The facility may well be an expansion of existing hardfill operations.

Building and operating a compost facility is a capitally-intensive undertaking. Given the limited population of Guam, the development of one compost facility may be sufficient to manage all on-island composting. In considering both short and long-term alternatives, GovGuam should also work with DOD planners to evaluate the possibility of developing an off-base facility capable of handling both military and non-military feedstocks. However, an evaluation of a military/civilian partnership may well support the feasibility of processing additional feedstock materials than are addressed in this analysis (i.e., construction/demolition debris, food wastes, etc.). In that instance, the suggested implementation steps described below should be adjusted accordingly.

Major Components

The major steps necessary to establish a new commercial composting facility on Guam follow.

Define Organics Waste Stream Composition and Market Opportunities

This evaluation will be important initially in determining the design and operating needs of a new facility and should consider:

- UoG composting pilot agricultural application analysis for various potential agricultural applications.
- Projected non-military organics quantities by material types (specifically, yard waste and cardboard in the MSW stream).
- Feedstock and product associated with any other compost facilities permitted in the short-term (such as the Pacific Unlimited facility in Ordot).
- Market research to determine the specific compost and mulch product demands - i.e., quantity, quality and pricing parameters.

Determine Key Compost Operating Parameters

These parameters, especially the carbon:nitrogen (C:N) ratio, will allow verification of which targeted feedstocks (and in what relative quantities) can be actively composted to achieve the most environmentally and cost-effective operation. This determination will impact facility sizing and design (the Additional Information section includes guidance for establishing these parameters):

- Carbon to nitrogen (C:N) ratio of "recipe" mix of compost feedstocks - ideal range is 25:1 to 40:1 (higher ratios can increase processing time and associated costs, while lower ratios can hinder degradation and create odors);
- Particle size - small feedstock pieces (1/4" to 4") increases the composting rate and improves product quality;
  - Pre-process grinding especially important for composting wood waste.
  - Grinding equipment can also be used to grind wood to produce mulch products.
  - Post-process screening may be desired to produce fine-textured, uniform product.
- Moisture content - ideal range is 40% to 50% (water likely required during the active composting period, depending on initial feedstock moisture and weather conditions).
- Other key parameters;
  - Bulk density and porosity - ideal ranges are <1,000 pounds/cy and 35% to 50%, respectively (these parameters increase the rate of degradation and decrease odor).
  - Temperature - turned windrows will require at least 15 consecutive days with temperatures equal to/greater than 55 degrees Centigrade (and at least five turnings) for pathogen destruction.
  - Windrow residence times to produce stable, mature product - active composting may take two to five months and curing one to two months (times will be dependent on feedstock, recipe and operational variables).
  - Miscellaneous - include pest and odor controls, monitoring windrow and ambient weather conditions and product testing. Product value (and revenues earned) can potentially be increased by providing certifications of compliance with national testing standards. The U.S. Composting Council's Seal of Testing Assurance program has established testing frequency, parameters and acceptable levels. Not all accredited environmental laboratories perform STA testing, and it is unlikely that there are any such labs on Guam.

Determine Facility Sizing

The sizing guidance below is based on conventional windrow technology using a front-end loader for turning:

- Active composting areas can typically accommodate 4,000 to 6,000 cubic yards of material/acre:
  - Area estimates should consider peak yard waste generation months and storm events - also windrow volume shrinkage during both. composting and curing stages (50% to 60%)
  - Windrows will likely be 6' to 10' high, 16' wide at the base - with 12' aisles between each.

  - Only one to two acres may be required for peak quantities and actual diversion rate. The exact compost recipe – and ability to compost all yard waste and dirty cardboard without the addition of high-nitrogen organics- will depend on the specific feedstock composition, N:N ratio, and moisture levels.

- Curing areas can typically accommodate 6,000 to 7,000 cy/acre:
  - Windrows will likely be 10' to 12' high, 20' wide at the base - with 10' aisles.
  - Only one to two acres may be required for peak quantities and actual diversion rate.

- Additional area will be required for:
  - Feedstock receiving.
  - Grinding activities.
  - Screening cured compost.
  - Storing final compost and wood product.
  - Leachate and storm water detention pond (based on compost/curing pad run-off and peak rainfall/storm events).
  - Miscellaneous space for buildings, roadways, equipment storage and a buffer area (10% of total acreage may be required to buffer processing activities from public receptors) (see aerial photograph of composting facility in Maryland).

Identify Facility Location

The location should be in the proximity to the feedstock generation centroid and include adequate acreage with minimal grade change. The ability to co-locate the compost facility near hardfills or other facilities that could utilize the mobile equipment described above may provide the opportunity for sharing purchase and maintenance costs.

Determine Facility Design Parameters

These typically include:

- Clearing, grubbing and grading as needed - to prepare the property for construction.
- Compacted soil compost pad for active composting and curing areas (assumes this is compliant with future GEPA regulations - versus asphalt construction).
- Scale house/office building - to provide space for receiving/selling feedstock/product, record-keeping, small equipment storage and employee space.
- Drainage controls - earthen berms, channels, leachate/storm water detention pond.

- Utilities - including electrical, water (may require storage tank for fire protection as required by GEPA and local fire protection rules).
- Property fencing, gate(s) and facility signage.

Evaluate Equipment Needs

This equipment can vary depending on material process and products generated:

- Mobile grinder - to combine feedstocks and reduce material size, grind wood;
  - Horizontal grinder preferred for yard waste due to long feed tables and low feed height (tub grinders may also work, shredders are less suitable).
  - Should be heavy, duty mobile unit capable of processing brush, logs, trees, stumps and pallets.
- Front-end loader with large bucket - to move materials, load grinder, build and turn windrows.
- Water truck - to add moisture to windrows and dust control. Note that peaked compost shaped typical of this technology tends to shed water more than other shapes, requiring more vigilant moisture control.
- Curing - requires no specialized equipment.
- Mobile trommel screen (typically 1/4" to 1/2") - optional, depending on market demand).
- Miscellaneous processing equipment:
  - Scale (optional).
  - Excavator for grapple (optional) for yard waste.
  - Skid-steer loader (optional) for product management.
  - Monitoring equipment - thermometer, moisture meters, oxygen probes.
  - Safety equipment.

Determine Facility Tip Fees

Use estimated feedstock quantities, estimated capital/operating costs and projected revenues to estimate net facility costs and establish material tipping fees.

Evaluate Public Outreach Needs

To the extent applicable, pro-actively promote the value of compost and back yard composting and address any public opposition to the new compost facility. Opposition may take the form of odor, nuisance or other complaints.

Evaluate Policy Issues Affecting New Compost Operations

This should consider:

- Curbside collection of yard waste and soiled cardboard.
- Pay-as-you-throw trash pricing - to create incentives for residents to divert more materials.

- Increased hardfill tip fees (by establishing more rigorous environmental and operating controls) - and enforce prohibition of unpermitted operations.
- Mandate organics diversion by generators in the commercial and construction/demolition sectors.
- Establish a landfill disposal ban on targeted organics at all facilities (including hardfills).
- Develop new/stronger markets for compost and wood products by requiring staff and contractors utilize on government and other projects.
- Establish a recognition program for businesses and institutions that divert organics and/or utilize compost products.

Major Milestones

A suggested timeline for developing a new commercial compost facility may include:

- 2013 through 2014 – quantify/characterize organics and conduct market research (results should recommend initial feedstock materials and compost technology).
- 2014 through 2015 – determine facility ownership and operation, facility location and obtain GEPA operating permit.
- 2015 – construct facility and begin operations.
- 2016 and beyond – evaluate feedstocks, operations, fee/product pricing and market opportunities on on-going basis.

Challenges

Regulation and Policy Issues

Yard/vegetative, wood waste and recyclables (including cardboard) are banned from the Layon Landfill but are accepted for hardfill disposal. The tipping fee at the two privately-owned, permitted hardfills is as low as $6/cubic yard (or approximately $35/ton based on USEPA conversion factors for yard waste - USEPA, 1997) versus $171/ton at the commercial transfer station which serves the Layon Landfill. As a result, there is no incentive to divert these materials.

Existing solid waste regulations (22 GAR, Division IV) do not specifically address composting facilities and leave some question as to whether the landfill disposal regulations would be applicable. While GEPA does have permitting guidance for solid waste processing facilities (which can be interpreted to apply to compost operations), there are many unanswered regulatory questions. It is clear that permit applications for any processing operation must include engineered drawings and specifications, an operations plan, comply with local zoning and include a non-refundable fee. There is no regulatory guidance or constraints regarding permit terms, feedstock, product, environmental controls, aesthetics or other. Other local regulations (fire, zoning, etc.) are similarly unknown.

At this time, one private owner/operator (Pacific Unlimited, Inc.) has been issued a permit for a new commercial composting facility in Ordot and another (Guam Cleaning Masters) has submitted a compost facility permit application for GEPA review.

Other Observations

The following observations may also impact a new commercial composting facility on Guam:

- Limited backyard composting practiced - garbage disposals are popular.
- No curbside or public/private drop-site collection of any organics besides paper materials (including cardboard).
- Difficulty incentivizing the private sector to take on the risks associated with a capitally-intensive facility.
- Minimal agriculture markets for compost - most are "hobby farmers".
- Some piggeries do collect and process hotel restaurant food waste for animal feed - but there is not enough demand to manage all generated waste from these sources.
- Limestone (which predominates in central and northern Guam, is porous, and does not retain water) will impact compost facility design.

Other Challenges

- Lack of compost facilities, equipment, and collection infrastructure.
- Timing for permit approval by GEPA (given current lack of regulatory guidance).
- Diversion by organics generators – currently there are no policies that encourage diversion.
- Invasive species could be spread by moving infested materials to other parts of the island (e.g., Coconut Rhinoceros Beetle infestation in northwestern Guam).
- Appropriate feedstocks to develop an optimal compost recipe – acceptance of only yard waste and dirt cardboard is not expected to be ideal without other high-nitrogen organics.
- Cost disincentives – facility will likely charge tipping fees (which does not compare favorably with current hardfill facility fees) and sell products.
- Current markets do not create a strong demand for compost or mulch products.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that approximately 35,500 tons of total yard waste and dirty cardboard were generated in 2012. Assumptions for estimating the feasibility for a new commercial compost facility include:

- Evaluation will take at least two years - diversion associated with a new facility will not be measurable until 2015.
- Targeted materials include only MSW yard waste and dirty cardboard initially - only 10% of the total Cardboard/Kraft Paper stream is soiled cardboard.
- Diversion ranges from 5% to 50% for both materials over the planning period (these levels may change if island-wide diversion incentives or policy is established and enforced).
- Compost facility tip fees could be significantly less than current tip fees at the commercial transfer station that serves the Layon Landfill, but would likely be more than hardfill tipping fees.

TABLE WP-I.1. LANDFILL DIVERSION POTENTIAL[1]

NEW COMMERCIAL COMPOST FACILITY (Implementation expected 2015)

YEAR	YARD WASTE			SOILED CARDBOARD			MUNICIPAL SOLID WASTE		
	Assumed Range of Diversion Potential			Assumed Range of Diversion Potential			Combined Range of Diversion Potential		
	% by Weight	Tons/ Year	CY/ Year	% by Weight	Tons/ Year	CY/ Year	% by Weight	Tons/ Year	CY/ Year
2015	5-10%	1,000-2,000	6,000-11,000	5-10%	0	1,000	0-1%	1,000-2,000	7,000-12,000
2020	10-25%	2,000-7,000	11,000-40,000	20-30%	0-1,000	3,000-5,000	1-4%	2,000-8,000	14,000-45,000
2025	10-25%	2,000-6,000	11,000-34,000	30-40%	1,000	3,000-5,000	2-4%	3,000-7,000	14,000-39,000
2030	25-50%	5,000-12,000	29,000-69,000	40-50%	1,000	5,000-7,000	4-8%	6,000-13,000	34,000-76,000

Notes:

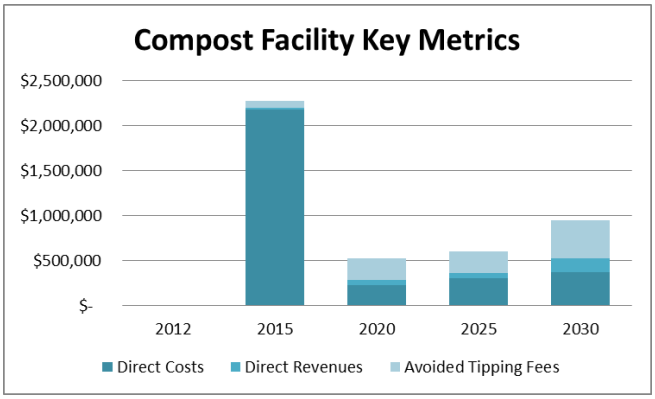
1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

Job Creation Potential and Small Business Opportunities

The estimate of job creation potential for a Guam compost operation assumes that the facility would likely be an expansion of an existing hardfill operation. It was assumed that one FTE would be added in 2015 to manage new yard waste and cardboard quantities (likely in a batch operation) and would be expanded to at least five FTEs by 2030. These are expected to be private sector jobs and are exclusive of any GovGuam staffing increase that might support the initial development of active compost processing infrastructure on the island. Of note is recent work in Maryland, which found that employment for 1,000 tons of processed mulched and composted organics was two times greater than for the same quantity of landfilled waste (ILSR, 2013).

Estimated Revenue Generation

Compost revenue potential was based on the diverted quantities in Table WP-I.1 and the assumptions for an average retail sale value of $25 per ton and resale (based on 50% volume reduction during the compost process) of up to 20% of materials diverted (25% in 2020, 30% in 2025 and 35% in 2030). The resulting revenue generation would range from $9,000 in 2015 to $76,000 in 2030. Material sales revenues would be bolstered by facility tip fees set by the owner/operator (unknown at this time but expected to both cover annual costs and provide a modest profit margin).



Avoided Landfill Disposal Costs

Based on Table WP-I.1 diverted quantities and an assumed average tipping fee of $175 per ton in 2015, avoided tipping fees would be almost $79,000 in 2015, increasing to $420,000 by 2030.

Human Health and Environmental Impacts

Human health and environmental impacts of composting include the following (CalRecycle):

- Emissions – Volatile organic compounds (VOCs) are produced from compostable material handling. VOCs react in the atmosphere with oxides of nitrogen to make ground-level ozone – a criteria pollutant. Generally, these odors are a nuisance and not a health risk, but in certain circumstances, nausea and illness have been reported.
- Bioaerosols – Bioaerosols are airborne materials comprised of organisms or biological agents, some of which may affect humans. The common types of bioaerosols that are linked to compost include aspergillus fumigates and endotoxins. Respiratory symptoms, mucosal membrane irritation, skin diseases, organic dust syndrome, and elevation of inflammatory markers are reported health effects. It is highly unusual for a community to be adversely impact by aerosols from an outdoor compost facility; however, some immuno-compromised individuals may be negatively affected.

- Fires are an increasing problem at sites handling green material, wood, lumber, and other compostable materials.

Many of these risks also occur at hardfill disposal facilities. All of these potential risks can be mitigated through best management practices utilized by the composting operation. To reduce exposure to bioaerosols in particular, a combination of engineering controls, work practices, and personal protective equipment should be employed.

Additionally, the benefits of composting far outweigh the potential for risk when best management practices are utilized. These benefits include:

- Improves soil structure, porosity, and density, thus creating a better plant root environment.
- Increases moisture infiltration and permeability of heavy soils, thus reducing erosion and runoff.
- Improves water-holding capacity, thus reducing water loss and leaching in sand soils.
- Supplies a variety of macro and micronutrients.
- May control or suppress certain soil-borne plant pathogens.
- Supplies significant quantities of organic matter.
- Improves cation exchange capacity (CEC) of soils and growing media, thus improving their ability to hold nutrients for plant use.
- Supplies beneficial micro-organisms to soils and growing media.
- Improves and stabilizes soil pH.
- Compost can bind and degrade specific pollutants.

Economic Costs

Significant cost assumptions for the compost facility initiative include:

- Expansion of existing hardfill infrastructure - with 1.0 FTEs beginning in 2015, increasing by 1.0 FTE every five years, to a maximum of 4.0 FTEs in 2030.
- Private sector staffing costs at GEPA-equivalent rates - which is expected to be an over-estimation and would either reduce on-going costs or accommodate additional composting staff.
- Land acquisition (4 acres) and facility development costs (2,500 square foot building) budgeted at just over $1.0 million in 2015.
- Equipment purchase (grinder, screen, loader and water truck) at $1.0 million.
- Vehicle operating costs of $48,000 per year.
- Utility costs included at $6 per SF of building area.
- GovGuam overhead costs for Department of Administration are included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.

Total costs for the Compost Facility initiative are expected to be almost $2.2 million in 2015, which includes $1.0 million for land acquisition and facility development, and additional $1.0 million for acquisition of equipment and vehicles. Costs are expected to be $226,000 in 2020, increasing to $375,000 in 2030.

This analysis assumes that all processing equipment is capitalized upfront – alternatives for grant funding, amortizing over the equipment life, using existing hardfill equipment and/or sharing equipment owned by other private sector or military partners may be explored to decrease initial costs. Future costs will be partially off-set by material sales revenues (assuming reasonable markets are encouraged and developed) but will likely require facility tip fees that are higher than those charged by Guam hardfills currently but notably lower than those charged at GSWA's commercial transfer station.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- BioCycle, http://www.biocycle.net/
- Cornell Waste Management Institute Compost Fact Sheets, http://cwmi.css.cornell.edu.factsheets.htm
- Northeast Regional Agricultural Engineering Service Cooperative Extension, "On-Farm Composting Handbook," 1992 - also at http://compost.css.cornell.edu/OnFarmHandbook/onfarm_TOC.html
- Pacific News Center, "University of Guam Honored by USEPA for Aero Waste Pledge," November 2012.
- SWANA, Kessler Consulting, Inc. et. al., "Florida Composting Facility Operator Training Course." 2011.
- U.S. Composting Council, http://compostingcouncil.org
- U.S. Composting Council's Test Methods for Examination of Composting and Compost - www.compostingcouncil.org/programs/tmecc/
- USEPA, "Measuring Recycling - A Guide for State and Local Governments," EPA530-R-97-011, September 1977.
- USEPA, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010," published November 2011.
- U.S. Forest Service, U.S. Department of Agriculture, et. al., "Early Detection and Risk Assessment - Coconut Rhinoceros Beetle," March 2008.
- Wyoming Department of Environmental Quality, "Wyoming State-Wide Study of Waste Diversion," prepared by LBA Associates, Inc. 2012.

Other Resources

- CalRecycle: http://www.calrecycle.ca.gov/

References

- ILSR, “Pay Dirt: Composting in Maryland to Reduce Waste, Create Jobs, and Protect the Bay.” May 2013. http://www.ilsr.org/sp-content/uploads/2013/05/ILSR-Pay-Dirt-Report-05-11-13.pdf
- SWANA, Kessler Consulting, Inc. et. al., "Florida Composting Facility Operator Training Course," 2011.
- GEPA's "Solid Waste Management Facility Permit Application - Processing," (complies with permit requirements generalized in 10 GCA paragraph 51104).

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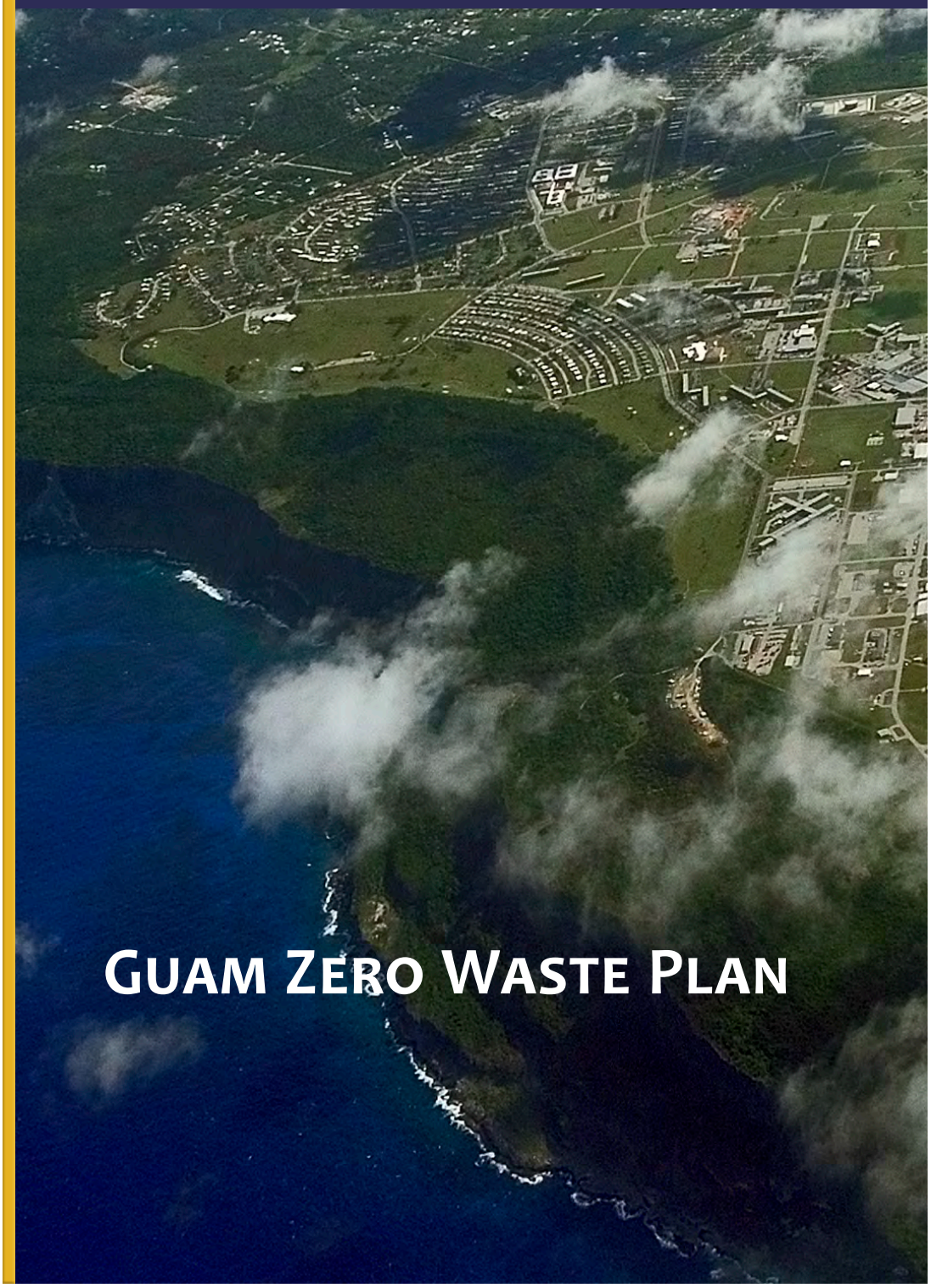
White Paper J



Guam Zero Waste Plan

GOVERNOR'S SEAL ISLAND OF GUAM

WP J

Please see the next page.

WHITE PAPER J

CONSTRUCTION AND DEMOLITION DEBRIS PROCESSING FACILITY

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Construction and Demolition Debris Processing Facility***
- Pay-As-You-Throw Pricing Policy
- Greening Roadway Paving Systems
- Zero Waste Association
- Public Education and Outreach
- Illegal Dumping and Litter Control
- Evaluation of Funding Sources
- Green/ Environmentally Preferential Purchasing Program
- Extended Producer Responsibility
- Construction and Demolition Debris Diversion Policy
- Recycling Grant Program
- Plastic Bag Disposal Ban
- "3R" Requirements for Public Buildings
- Used Building Materials Facility
- Organics Recovery Composting System

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of establishing a construction and demolition (C&D) debris processing facility on Guam.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap to the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

This section includes key findings presented within the document.

C&D materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D materials often contain bulky, heavy materials, such as concrete, wood, metals, glass, and salvaged building components (USEPA, 2013). The purpose of a C&D debris processing facility is to divert C&D debris from land disposal and to collect and process the debris for resale, reuse, recycling, and composting. The establishment of a C&D debris processing facility on Guam is likely an ideal opportunity for a public/private partnership.

The most practical approach for increasing C&D processing during at least the first half of the Zero Waste Plan planning period is to:

- Focus on building-related C&D debris.
- Improve building contractors' ability to process C&D materials and utilize them on-site by using mobile processing equipment with a staging area for storing source-separated materials.
- Implement policy to help increase the sustainability of C&D processing - this may include either minimum diversion requirements or disposal bans for hardfill operations.
- Continue to evaluate the opportunity for collaborating with the military for future C&D processing.

Later, in order to develop a dedicated C&D recycling facility, the following components must be implemented:

- Conduct Detailed Feasibility Study.
- Define C&D Waste Stream Composition and Market Opportunities.
- Evaluate Aggregate Crushing/Facility needs.
- Assess General Facility Requirements.
- Evaluate Policy Issues Affecting C&D Diversion.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of this initiative including background information, a summary of what exists on Guam today with respect to the initiative, examples of similar Construction and demolition (C&D) debris processing facilities that have successfully been implemented in other locations, and opportunities and constraints associated with the initiative.

What is a C&D Debris Processing Facility?

C&D materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D materials often contain bulky, heavy materials, such as concrete, wood, metals, glass, and salvaged building components (USEPA, 2013). The purpose of a C&D debris processing facility is to divert C&D debris from land disposal and to collect and process the debris for resale, reuse, recycling, and composting.

C&D debris comprises a significant portion of the waste stream that can be diverted from the landfill, thereby conserving resources, protecting our environment, and extending landfill life. Depending on the level and type of construction activity, C&D quantities can be a significant portion of the total solid waste stream (it is estimated that about 35% of Guam's the total solid waste stream is C&D debris). In the U.S, an estimated 163 million tons of building-related C&D were generated in 2003, and there are over 3,500 C&D recycling facilities in operation (USEPA, 2011). Diversion of these materials can decrease management costs, create jobs, reduce reliance on landfill disposal and create other environmental benefits.

Waste stream composition varies widely as a function of the:

- Type of project - residential, commercial, highway/bridge or other large civil engineering project, land-clearing or storm debris clean-up.
- Level of construction - new construction, renovations, demolition or deconstruction
  - New construction typically has more packaging, untreated scrap (drywall, metals, wood), land-clearing and soil materials while demolition often has more inert materials (concrete, asphalt, bricks), treated wood, roofing materials and interior finish components (carpets, tiles, fixtures). Demolition typically generates significantly more debris than new construction.
- Time of year and area of the country - for example, vegetative growth in winter versus summer.
- Period of construction - for example, building trends show that carpet is gradually tending to be replaced with hardwood flooring, and non-ferrous metal piping with less expensive (plastic) alternatives.

Many materials in the C&D waste stream can be sustainably diverted when material markets exist and disposal costs create a reasonable incentive.

Existing Programs on Guam

Currently, there are numerous operations for processing source-separated C&D materials on Guam. The largest operations are listed below.

Hardfill Operations

While these facilities dispose of mixed C&D debris, most (except Northern) also accept source-separated yard/land-clearing debris and inert materials for processing by mulching, grinding, "passive" composting (generally leaving stockpiled green waste to biodegrade in humid environment without additional moisture processing or testing), or crushing. Each of the following is located in the central/northern portion of Guam:

- Navy Hardfill - accepts materials from Navy projects only.
- Andersen Air Force Base Hardfill - accepts materials from Air Force projects only.
- Eddie Cruz Hardfill (Yigo) - accepts C&D (tip fee about $6/cubic yard or $35/ton for most materials).
- Northern Hardfill (Yigo) - accepts C&D and green waste for fee (disposal operation only - tipping fee about $6/cubic yard or $35/ton for most materials).
- Smithbridge Hardfill (Barrigada) - accepts materials from Smithbridge projects only.

Anecdotal evidence suggests that there may be several hardfill operations that are not permitted for material disposal and/or may not have a long history of operation. None of the island's hardfills are required to divert C&D materials.

Aggregate Recyclers

Many of the island's aggregate suppliers (e.g., Hawaiian Rock Products, Smithbridge Quarry Products, military quarries) have the ability to recycle and reuse aggregate material as fill material or for new products, though this practice is inconsistent. This inconsistency is in part due to the fact that there is no real incentive to recycle as relatively inexpensive, virgin material is readily available and processing inert waste is costly. Each of these quarry operations is also located in the central and northern Guam.

Commodity Recyclers

Existing commodity recyclers are mostly located in northern Guam and include:

- Cardboard - Guahan Waste Control, Dewitt Moving and Storage.
- Metal - Pyramid Recycling, Bali, Green Guam, Global Recycling Center, etc.
- Plastics - Pyramid Recycling.

Reuse

Reuse facilities include some outlets (such as Habitat for Humanity and the Salvation Army Thrift Store) that accept salvaged interior building components, fixtures, furniture, etc. for re-sale. See the Used Building Material Facility White Paper included in the Guam Zero Waste Plan Volume II for further detail on this topic.

C&D Diversion Policies

The following policies currently help drive diversion of C&D debris on Guam:

- Green waste, wood waste, C&D debris and recyclables (e.g., metals and cardboard) are currently banned from Guam's commercial transfer station, residential convenience centers and the Layon Landfill - however, these materials are not banned from hardfills and there are no permitted composting facilities.
- Demolition projects are required to develop Demolition and Solid Waste Plans for Guam Environmental Protection Agency (GEPA) approval.
- Additionally, Executive Order 13514 requires federal agencies and state agencies that use federal funding to divert at least 50% of all construction and demolition debris by the end of mid-2015 (Naval Facilities Engineering Command Pacific, 2010). Example components include:
    - LEED building goals which require consideration of on-site recycling and deconstruction instead of demolition - also use of salvaged building features and recycled-content building materials which help drive material markets
    - Guidance for use of compost products for soil amendment and erosion control

Successful Approaches Used in Other Locations

In the United States, solid waste is regulated at the federal level by the U.S. Environmental Protection Agency (USEPA) under the Resource Conservation and Recovery Act (RCRA). Although the USEPA does not have specific regulatory requirements for C&D debris/waste, they have established goals to find more efficient ways to reduce and utilize C&D debris/waste rather than disposal in a landfill. With respect to C&D materials, the USEPA's goals are to (USEPA, 2013):

- Characterize, measure, and increase knowledge and understanding of the C&D materials stream;
- Promote research and development on best practices for C&D materials reduction and recovery;
- Foster markets for construction materials and other recycled materials that can be incorporated into building products;
- Work with key players in the construction, remodeling, and demolition industries to implement more resource-efficient practices; and
- Incorporate C&D materials issues and projects into broader "green building" programs.

Most C&D waste is regulated at the state level, and the requirements for C&D debris facilities vary widely from state to state. About half (23) of the states have specific C&D regulations while in the remaining states (27), C&D debris is regulated under the requirements for municipal solid waste (MSW) landfills, non-MSW landfills, general inert debris landfills, or general solid waste facilities (TCEQ, 2013).

There are a number of examples of policies that states and cities have instituted to encourage C&D debris diversion from landfill disposal including locations in California, Florida, Ohio, Massachusetts, North Carolina, Texas and Washington. This in turn has led to the need for an increased number of fixed-location and mobile C&D debris processing facilities.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this initiative could be developed and managed. To establish a successful C&D debris processing facility, opportunities associated with this initiative must be taken advantage of and constraints or limitations that could make the initiative less than optimally effective should be considered.

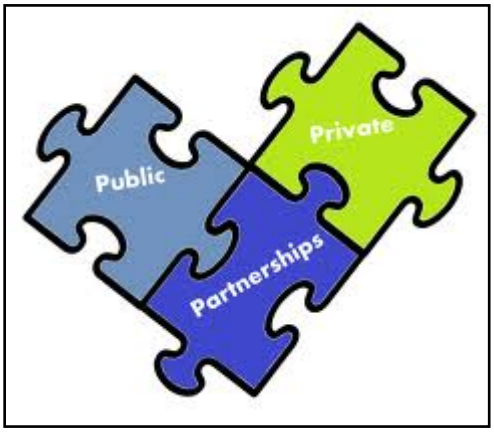
Opportunities include:

- Revenue generation from recyclables, processed aggregate and wood mulch, and avoided disposal costs for other materials.
- On-site use of job-site waste reduces construction costs.
- Supports green building and deconstruction practices.
- Drives need for reused and used building material programs.
- Many examples of effective policies requiring contractors to meet minimum diversion requirements, which increase the need for processing facilities.
- Diversion activities create more jobs relative to disposal of same materials.
- Reduce greenhouse gas emissions from both avoided landfill disposal and virgin concrete production.
- Collaboration with military to increase efficiencies and the economy of scale for C&D processing.

Constraints Include:

- Hard to find Guam-specific data to evaluate diversion feasibility as many programs don't measure all materials that might be including in a C&D program (such as inert debris).
- C&D recycling infrastructure and equipment is costly and difficult to maintain.
- Lack of current incentives to encourage private sector development and operation.
- Sorting and processing C&D materials at construction sites can be difficult in terms of both labor and space.
- Can be challenging to sort treated versus untreated materials effectively (especially wood and concrete).

3. IMPLEMENTATION OVERVIEW



The establishment of a C&D debris processing facility on Guam is likely an ideal opportunity for a public/private partnership. GovGuam through the Guam Environmental Protection Agency (GEPA) can conduct market research and implement policies to encourage more C&D diversion. The private sector, in turn, may be best suited to develop and operate a new facility. The following provides implementation considerations and an implementation overview for this initiative.

Although not specifically addresses in this analysis, future collaboration with the military may well minimize overall costs by increasing the tons managed at one or more consolidated facilities and reducing unit costs. While the military already has contracts in place with private C&D contractors, there may be opportunities in the future for a civilian-military partnership.

Major Components

Without island-specific waste composition data and market data for C&D materials, it is very difficult to identify those materials in the C&D waste stream that will sustainably be diverted over the planning period of the Guam Zero Waste Plan (i.e., through 2030). In the absence of this data, information generated from national waste composition studies is referenced. While it will be necessary to collect and evaluate this data before proceeding with a new C&D debris processing facility, the following considerations/information/observations were used during the development of this analysis:

- There is no clear mandate for diverting C&D materials from non-military projects.
- While municipal solid waste disposal costs on the island are high, hardfill tipping fees are very low (e.g., the Eddie Cruz hardfill charges $6/cy or about $35/ton for most materials) - anecdotal reports that tip fees at unpermitted facilities are even lower.
- There are currently no dedicated facilities to process a mixed C&D waste stream for diversion on the island. Given the sporadic and generally low quantities of non-military C&D generated, it is likely that management of source-separated materials will continue to be the most cost-effective approach.
- C&D processing options for non-military debris is provided by private facilities which have generally indicated their desire to expand their diversion activities to the extent it is cost-effective - adding new processing capability would potentially compete with these operations.
- Market demand for C&D materials is inconsistent. While metals are consistently recycled, yard/land-clearing debris and inert materials have less stable markets, and other materials are have no market outlets at this time (drywall, plastic resins #3 through #7, etc.).
- Limestone aggregate is readily available and actively mined in northern Guam by multiple quarry operations - however, the failure to develop options for recycling clean inert materials in order to conserve this natural resource is may be only marginally sustainable.

- Most future highway and large civil engineering construction projects will likely be undertaken by private aggregate suppliers and private contractors who have established materials management practices. These companies are not likely to use a new facility operated by others unless net costs are significantly lower than current costs.

While these observations may change as stronger material markets are developed and C&D diversion becomes more commonplace (potentially as the result of new GovGuam policy), it appears that the most practical approach for increasing C&D processing during at least the first half of the Zero Waste Plan planning period is for one or more of the following approaches:

- Focus on building-related C&D debris.
- Utilize existing hardfill operations.
- Improve building contractors' ability to process C&D materials and utilize them on-site by using mobile processing equipment with a staging area for storing source-separated materials.
- Implement policy to help increase the sustainability of C&D processing - this may include either minimum diversion requirements or disposal bans for hardfill operations.
- Continue to evaluate the opportunity for collaborating with the military for future C&D processing.

Example C&D Facility Evaluated

Based on the information presented above, for the purposes of this analysis, development of a small-scale processing/transfer operation with mobile equipment has been evaluated (this could be applied to either expansion of an existing hardfill operation or used as a temporary, mobile site near large construction projects). As it is unknown at this time what throughput capacity would best serve the island, a facility that can process the equivalent of 25% of the island's building material waste has been targeted as an initial example (and could also serve as a model pilot project). At this time, the facility location is not specified as it is unknown where new processing capacity would be effective (although most construction activity is currently centered in the central and northern part of the island).

Table WP-J.1 (below) presents building-related C&D materials composition and quantities generated in this example in 2012. The quantities tabulated below represent the total of material generated - actual diversion is likely to be notably lower (at least until additional diversion policy is implemented). The information presented below is estimated for the purpose of this analysis only and is based upon the following assumptions regarding C&D debris generation in Guam:

- Debris is generated primarily from building-related new construction or major renovations, which is about 35% of the total C&D waste stream generated on Guam (USEPA, 2011).
- Recycled materials include lead-free concrete/asphalt/aggregate (assumed to be 95% of aggregate stream), clean wood (assumed to be 50% of wood stream) and metals - these materials have existing markets through Guam recyclers or local end-users (some cardboard will also be generated but only in small quantities).
- Some of these materials may also be diverted through a used building materials reuse program (also assumed to occur in relatively small quantities).

TABLE WP-J.1. BUILDING-RELATED C&D MATERIALS COMPOSITION and POTENTIAL QUANTITIES SERVED BY EXAMPLE C&D PROCESSING FACILITY (EQUIVALENT OF 25% OF BUILDING-RELATED DEBRIS) IN 2012 (1, 2)

MATERIAL	APPROXIMATE WASTE STREAM COMPOSITION (by weight)	APPROXIMATE QUANTITIES GENERATED / AVAILABLE FOR DIVERSION (tons/year)
Lead-Free Aggregate	40-50%	3,000
Clean Wood	20-30%	1,000
Gypsum Drywall	5-15%	0-1,000
Roofing Materials	1-10%	0-1,000
Metals	1-5%	0
Bricks	1-5%	0
Plastics	1-5%	0
Total	**69%-120%**	**4,000-6,000**

Notes

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measure Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

2. While this plan does not address military waste, the buildup may well lead to more C&D debris generation than is projected on the basis of population growth. Tracking this waste stream for both civilian and military sectors will be important to the development and operation of an effective processing facility.

Conduct Detailed Feasibility Study

Additional research is needed before determining the feasibility of a new C&D debris processing facility. The implementation strategy presented in this analysis assumes initially that new equipment will be used to accept source-separated aggregate and clean wood for batch processing. It is expected that contractors will continue to divert scrap metal directly to island recyclers.

Define C&D Waste Stream Composition and Market Opportunities

This evaluation will be important initially in determining the need and feasibility for the example. These evaluation results will subsequently be used to establish equipment specifications and should include:

- Projected non-military construction quantities and material types;
- Waste composition data for construction, renovation and demolition projects;
- Market research to determine the specific aggregate, mulch and compost and salvage product demands - other materials generated in low quantities (such as asphalt paving and used building materials that could be reused) should also be evaluated;

  - Aggregate products can be used for lime stabilization, backfill, grading, road base, ditch/stream rip rap, erosion control on coastal and inland waterways, wave protection, noise barriers, etc.

- Processed wood can be used for erosion control in fire and storm areas, topsoil bedding, fuel for energy generation, agricultural applications, animal bedding, feed stock for engineered wood or compost, etc. (USEPA, 1988); and

- Materials that are not expected to be diverted cost-effectively in the foreseeable future include drywall, plastics, glass, treated wood, painted concrete, insulation, carpeting, etc.

Evaluate Wood Grinding/Facility Needs

Considerations for processing dimensional lumber, woody land-clearing debris, engineered wood products and pallets should include:

- General
  - Range of shredded, ground or chipped wood to meet market demands (e.g., 2- to 3-inch chips).
  - Coconut Rhinoceros Beetle Quarantine compliance - as the quarantine affects primarily the western coast, organics generated in the southern part of the island may not be impacted.

- Equipment
  - Heavy-duty, mobile grinder capable of processing brush, logs, trees, stumps and pallets. Although there are several mobile wood grinders on the island (at least one owned by Eddie Cruz is available for rent), these may not have the capacity to cost-effectively process this material and none have the ability to remove metal;
  - Conveyor and magnet for removing nails and other metal contamination; and
  - Facility loader to feed the grinder (contractor is expected to have loader available)

- Facility (if needed) addressed under General Facility Requirements below.

Evaluate Aggregate Crushing/Facility Needs

As shown in Table WP-J.1, lead-free aggregate is expected to be the largest waste component (given the use of concrete in building construction on Guam, this estimate may well be higher). Considerations should include:

- General
  - Range of aggregate size or gradation to meet market demands (e.g., 3"-minus material)
  - Regulatory compliance - an air pollution permit and dust control program will be required

- Equipment:
  - Mobile crusher with capability of removing rebar
  - Screen(s) to size each category of material
  - Conveyor to feed screens (optional)
  - Facility loader to feed the crusher (contractor is expected to have loader available)

- Facility (if needed) addressed under General Facility Requirements below.

General Facility Requirements

If initial research (above) indicates the need for a C&D transfer/processing facility for source-separated materials, the following requirements should be assessed:

- Land acreage requirements - for both unprocessed/processed material stockpiles, processing equipment operation, loading and unloading (space may also be needed to support limited administrative staff needs).
- Siting at a permit-compliant location central to anticipated construction needs with good access.
- Ownership/operation by same or different parties - a new C&D facility may be an ideal opportunity for a public/private partnership (for example, public agency could provide land at low lease rate for private operations).
- Site development needs - including ingress/egress, grading, storm water controls, security.
- Facility operation to include equipment operation and maintenance, screening/acceptance of in-coming materials (on-site product sales may also be considered).
- Hours of operation - this site would most likely only be open a few hours each week to provide adequate access to contractors and product buyers.
- Material disposition - processed materials need to be sold from the site or hauled to an end-user.
- Regulatory compliance will require discussion with GEPA to determine if GEPA's Solid Waste Management Facility Permit Application (22 GAR does not include regulations specifically applicable to C&D processing operations) - engineered drawings/specifications, an operations plan and compliance with local planning and rules will be required at a minimum.

Evaluate Policy Issues Affecting C&D Diversion

Policy issues affecting C&D diversion in at least the following two areas should be evaluated:

- Hardfill permitting - There may be hardfill operations operating on Guam that are not permitted
  - If so, these operations may have lower operating costs and the ability to undercut the tipping fees and product pricing of facilities that are fully compliant.
  - To maintain a healthy market and level playing field for private contractors providing needed C&D management services on the island, permitting regulations should be enforced for all applicable facilities.
  - Future permitting requirements for all facilities that manage diverted C&D materials should include a data collection/reporting requirement. As existing hardfills/C&D processors do not have scales, volumetric data could be collected and converted to weighs using standard conversion factors established by GEPA.

- C&D diversion policy - that requires a minimum level of C&D recycling from future construction projects or bans hardfill disposal of targeted materials. For further information see the C&D Diversion Policy White Paper included in the Guam Zero Waste Plan Volume II.

- Used Building Material Facility - to allow organized reuse/resale of reclaimed used building materials, household goods and miscellaneous items. For further information see the Used Building Materials White Paper included in the Guam Zero Waste Plan Volume II.
- Future policy considerations may include:
  - Tip fee surcharge on C&D disposal at hardfills to both encourage diversion and generate funds for the purchase of new processing equipment, material dumpsters and facility development (if needed)
  - Working with military to operate a centralized mixed-waste C&D processing facility to manage debris generated from all island construction and demolition projects.
  - Ban C&D hardfill and landfill disposal prior to C&D materials recovery processing.

Major Milestones

To establish C&D debris processing facility on Guam, several milestones should be focused on.

- Conduct detailed feasibility study. This activity, which is the first priority, could take up to 6 months to complete and includes an evaluation of public/private sector opportunities as well as an economic evaluation of the initiative. This activity could either be assigned to existing staff resources within GEPA and the Guam Economic Development Agency (GEDA), or outsourced if existing GovGuam resources are not available.
- Define C&D waste stream composition and evaluate market opportunities. Once a decision is made as to whether a C&D debris processing facility is needed, this activity should be undertaken. This activity is expected to take approximately 6 months to complete. This activity could either be assigned to existing staff resources within GEPA and GEDA, or outsourced if existing GovGuam resources are not available.
- Evaluate concrete crushing and wood grinding needs. This activity is expected to take approximately 3 to 6 months to complete. This activity could be assigned to existing staff resources within GEPA, or outsourced if existing GovGuam resources are not available.
- Identify general facility requirements including location. This activity is expected to take 3 to 6 months to complete. If a public/private partnership is pursued, this activity could be assigned to the private sector organization identified to building and operate the facility.
- Permit, build and begin operating the facility. Depending on the size of the facility, this activity could take 6 to 12 months to complete.
- Evaluate policy issues affecting C&D diversion. This activity is ideally suited for staff resources within GEPA, and should be conducted concurrent with the activities required to accomplish the second milestone identified above.

Challenges

Implementation of this initiative will face a number of challenges. Historical evaluations of C&D generation on Guam have indicated low quantities of materials (Rossi-Nave, 1980). The military build-up will require increased building and highway construction and subsequent generation of C&D materials. It is expected that this debris will be managed by military contractors at private

processing facilities or processed/disposed at the military hardfills and composting operations (NAVFAC, 2010). Non-military construction activities are also expected to increase as significantly. C&D debris generated from these projects will likely be managed at existing private hardfills absent expanded C&D processing capacity and/or incentives. Most of these facilities also process some diverted C&D materials.

Additional major challenges include:

- Availability of data. There is limited data available regarding the composition of the C&D waste stream or the market opportunities for key materials on Guam.
- Regulatory requirements. There is currently no clear mandate for diverting C&D materials from non-military projects.
- Costs. While municipal solid waste disposal costs on the island are high (about $174/ton), hardfill tipping fees are very low (about $35/ton). Additionally, most future highway and large civil engineering construction projects will likely be supplied and/or constructed by private companies who have established materials management practices. These companies are not likely to use a new facility operated by others unless net costs are significantly lower than current costs.
- Market demand. Market demand for C&D materials is inconsistent.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that between 78,000 and 82,000 tons of total C&D were generated in 2012. Assumptions for estimating the feasibility for a new C&D Debris Processing Facility that manages the equivalent of 25% of the building-related waste generated on the island include:

- Evaluation will take at least two years - diversion associated with a new facility will not be measurable until 2015;
- Targeted materials include C&D materials in the non-municipal waste stream, which will be primarily limited to aggregate, clean wood and metals (composition by weight was estimated in Table WP-J.1);
- C&D debris generation is based on 35% by weight building construction - the example facility was developed to process the equivalent of 25% of all building-related C&D debris on Guam;
- Clean wood (50% of total wood) is 20% to 30 by weight, lead-free aggregate (95% of total aggregate) is 40% to 50% by weight, and metals are 1% to 5% (USEPA, 2011); and
- Diversion for the 25% example ranges from 10% to 50% of aggregate and clean wood generated - 65% to 85% of metals will be diverted - these levels would increase if the facility capacity exceeds the example 25% building waste equivalent and/or new mandatory diversion policy is implemented).

TABLE WP-J.2. LANDFILL DIVERSION POTENTIAL [1]
EXAMPLE C&D PROCESSING FACILITY (EQUIVALENT OF 25% OF BUILDING-RELATED DEBRIS)
(Implementation expected 2015) [1, 2]

YEAR	CLEAN WOOD		LEAD-FREE AGGREGATE		METALS		NON-MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/Year
2015	10-20%	0	10-20%	0-1000	65-70%	0	0-1%	0-1000
2020	20-30%	0	20-30%	1000-2000	70-75%	0	0-1%	1000-2000
2025	30-40%	0	30-40%	1000-2000	75-80%	0	1-2%	1000-2000
2030	40-50%	0-1000	40-50%	1000-2000	80-85%	0	1-3%	1000-3000

Notes:

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

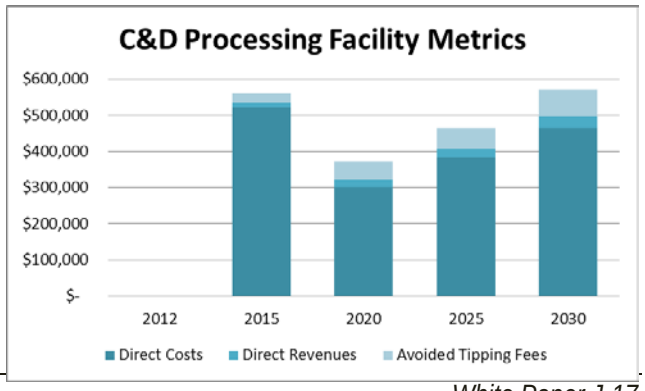
2. While this plan does not address military waste, the buildup may well lead to more C&D debris generation than is projected on the basis of population growth. Tracking this waste stream for both civilian and military sectors will be important to the development and operation of an effective processing facility.

Job Creation Potential and Small Business Opportunities

To estimate the job creation potential associated with diverting C&D debris, a small mobile operation was evaluated to either support existing hardfill operations and/or to provide mobile processing capacity for the island. It was assumed that the equivalent of one FTE would initially be added in 2015 to manage new C&D materials (likely in a batch operation) and would be expanded to at least two additional FTEs by 2030 (for a total of 3 FTEs over the planning period). These are expected to be private sector jobs and are exclusive of any GovGuam staffing increase that might support the initial development of processing infrastructure on the island.

Estimated Revenue Generation

C&D revenue potential was based on the diverted quantities summarized in Table WP-J.1 and an assumed average sales rate of $15 per ton. The estimated revenue was found to range from $12,000 in 2015 to $32,000 in 2030. Material sales revenues would be bolstered by facility tip fees set by the owner/operator (unknown at this time but expected to both cover annual costs and provide a modest profit margin).



Avoided Landfill Disposal Costs

Based on Table WP-J.1 diverted quantities and an assumed average tipping fee of $35 per ton for hardfill sites, avoided tipping fees would be $27,000 in 2015, increasing to $74,000 by 2030. It should be noted that the hardfill tipping fees are generally paid to private sector firms, such that the avoided fees could actually be considered a detriment to private operators.

Human Health and Environmental Impacts

Reducing the amount of C&D materials disposed of in landfills or combustion facilities provides numerous benefits (USEPA, 2013).

- Reducing, reusing, and recycling C&D materials offsets the need to extract and consume virgin resources, which also reduces greenhouse gas emissions, water and air pollution.
- Extends the life expectancy of regional landfills thereby helping to prevent the loss of habitat associated with new or expanding landfills.
- The degradation of some C&D debris can produce harmful substances. Reducing, reusing, and recycling C&D materials helps to prevent the air, and water quality from potentially being impacted by these harmful substances.

Economic Costs

Significant cost assumptions for the C&D Debris Processing Facility include:

- Expansion of existing hardfill infrastructure and/or mobile processing - with 1.0 FTEs beginning in the base year, increasing to a 4.0 FTEs in 2030;
- Private sector staffing costs at GEPA-equivalent rates - which is expected to be an over-estimation and would either reduce on-going costs or accommodate additional C&D staff
- Purchase of land (1 acre) and construction of a small facility (500 sf for employee space) at a cost of $275,000;
- Amortization of loader, grinder, crusher (with magnet) and loader at an annual amortized cost of $74,000;
- Vehicle operating costs of $23,000;
- Utility costs included at $6 per SF of building area; and
- A GovGuam overhead cost for Department of Administration is included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.

Total costs for the C&D processing facility are expected to be almost $493,000 in 2015, including a small land purchase and building (depending on the ultimate operation, these may be unnecessary investments). Annual costs thereafter are expected to range from $272,000 in 2020 up to $435,000 in 2030. Of particular note is the amortization of processing equipment ($74,000 per year) - if the equipment were purchased upfront in 2015, it would add another $1.5 million to the overall cost for the project.

This analysis indicates a critical challenge in purchasing new equipment to process small quantities (annual costs will be only marginally off-set by material sales revenues and this mobile facility will likely need to assess relatively high tip fees and/or find other revenue sources to address fairly high unit costs). Alternatives to improve the financial operations include utilizing this equipment to process greater tons, grant funding, using existing hardfill equipment and/or sharing equipment owned by other private sector or military partners. These alternatives will be necessary to both encourage private sector development of a mobile or hardfill-expanded operation and to set tip fees that still create an incentive when compared to those charged at GSWA's commercial transfer station.

5. INFORMATION AND REFERENCES

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Ciros Co. (mobile crusher sales on Guam) - www.india-crusher.com
- Construction and Demolition Recycling Association, http://www/cdrecycling.org
- Guam Contractors Association - www.guam conttractors.org
- Hawaiian Rock Products - www.hawaiianrock.com
- Naval Facilities Engineering Command Pacific, "Final Report - Construction and Demolition Debris Reuse and Diversion Study for DOD Bases, Guam," May 2010 (prepared by HDR/Hawaii Pacific Engineers)
- Smithbridge Quarry Products - http://smithbridgeguam.com
- USEPA, "Materials Characterization Paper in Support of Identification of Nonhazardous Secondary Materials That Are Solid Waste Construction and Demolition Materials - Building Related C&D Materials," February 2011
- USEPA, "Characterization of Building-Related Construction and Demolition Debris in the United States," June 1998 (prepared by Franklin Associates)
- USEPA. "Estimating 2003 Construction and Demolitions Materials Amounts"; http://www.epa.gov/epawaste/conserve/imr/cdm/pubs/cd-meas.pdf
- USEPA, Construction and Demolitions Materials website, http://www.epa.gov/cdmaterials

References

- Rossi-Nave, "Guam's Waste Composition Study," 1980 residential and commercial studies included in the 1996 Guam Solid Waste Management Plan (indicated negligible quantities although the rigor of the study is not described).
- NAVFAC "Final Report - Construction and Demolition Debris Reuse and Diversion Study for DOD Bases, Guam," prepared by HDR/Hawaii Pacific Engineers, 2010.
- Naval Facilities Engineering Command Pacific, "Final Report - Construction and Demolition Debris Reuse and Diversion Study for DOD Bases, Guam," May 2010 (prepared by HDR/Hawaii Pacific Engineers) - in compliance with EO 13514, NAVFAC has made plans to strengthen contractor requirements for C&D processing and develop a new C&D processing/green waste composting facility at its existing hardfill site.
- Texas Council of Environmental Quality (TCEQ), January 2013. http://www.recyclecddebris.com/rCDd/Resources/WasteStudy
- USEPA, June 1998. "Characterization of Building-Related Construction and Demolition Debris in the United States" http://www.epa.gov/epawaste/hazard/generation/sqg/cd-rpt.pdf
- USEPA, "Materials Characterization Paper in Support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials That Are solid Waste Construction and Demolition Materials - Building-Related C&D Materials," February 2011.

- USEPA, January 2013. http://www.epa.gov/wastes/conserve/imr/cdm/programs.htm
- Journal of Environmental Health, Volume 71 Number 2. "Construction and Demolition Landfills: Emerging Public and Occupational Health Issues." September 2008.

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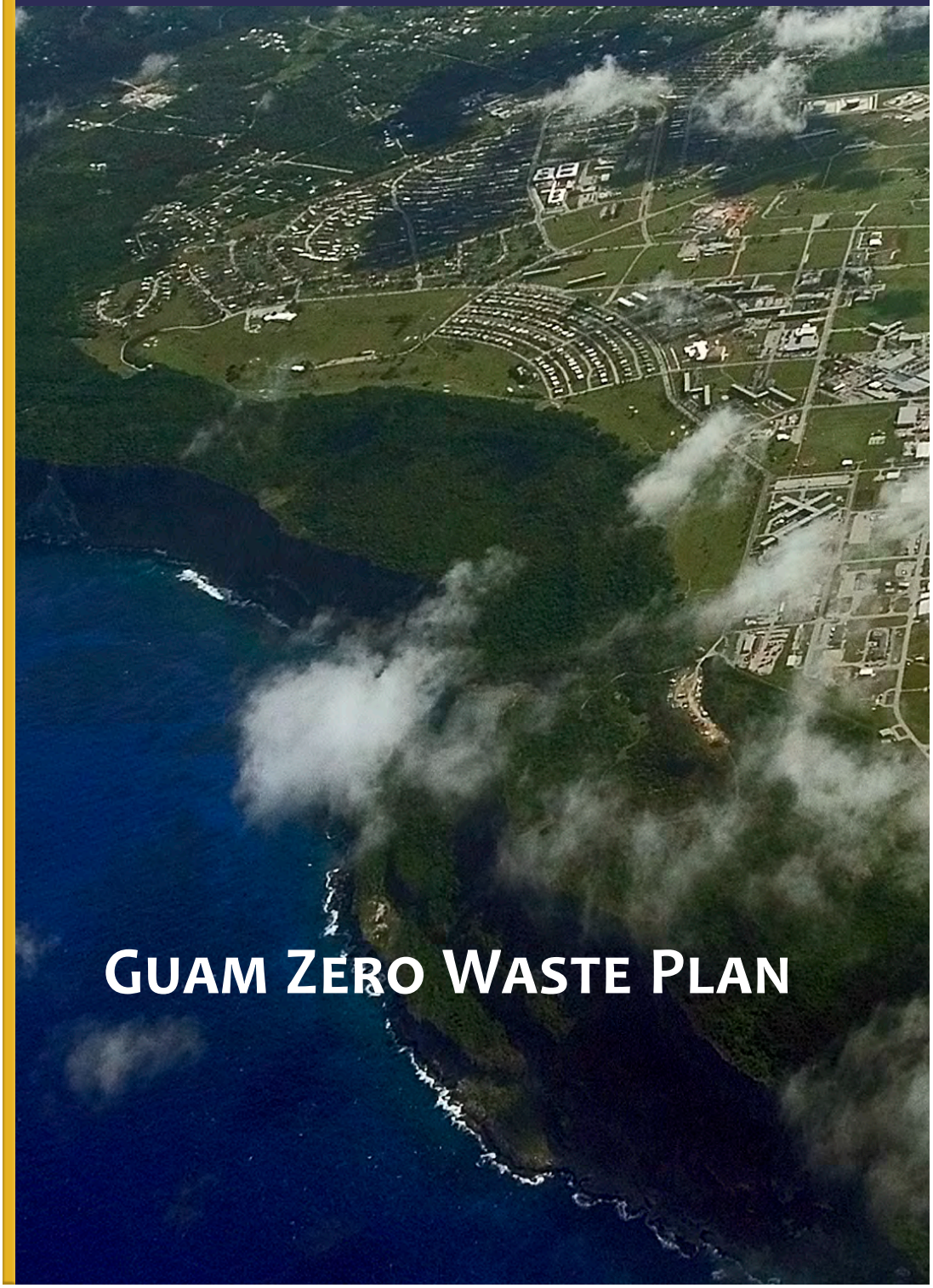
White Paper K

WP K



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

Please see the next page.

WHITE PAPER K
MANDATORY CONSTRUCTION AND DEMOLITION (C&D) DEBRIS DIVERSION POLICY

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Construction and Demolition Debris Diversion Policy***
- Public Education and Outreach
- Illegal Dumping and Litter Control
- Evaluation of Funding Sources
- Green/ Environmentally Preferential Purchasing Program
- Extended Producer Responsibility
- Zero Waste Association
- Recycling Grant Program
- Pay-As-You-Throw Pricing Policy
- Plastic Bag Disposal Ban
- "3R" Requirements for Public Buildings
- Used Building Materials Facility
- Greening Roadway Paving Systems
- Organics Recovery Composting System
- Construction and Demolition Debris Processing Facility

Purpose

This white paper, which is one in a series of fifteen, presents a summary of one initiative of that can be implemented to help GovGuam achieve the goal of Zero Waste. This initiative is to create a mandatory construction and demolition (C&D) debris diversion policy that establishes minimum standards for the diversion of materials in the C&D waste stream that have economically-sustainable markets and contains enforcement provisions if the standards are not met. A C&D diversion policy cannot be successfully implemented until adequate C&D processing infrastructure is available for reuse, recycling, and mulching/composting (the Guam Zero Waste Plan includes an alternative analysis for a new processing facility).

Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap of the document and includes a snapshot of select key findings.
- Section 2 provides an overview of the initiative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.

Key Findings

GovGuam does not currently have a mandatory construction and demolition (C&D) debris diversion policy. Most C&D materials can be diverted from landfills through reuse, recycling, composting and donation. For a C&D diversion mandate, the following will be required:

Policy Options

Enact legislation to implement a mandatory C&D diversion policy on Guam. Development needs for the legislation will include:

- Building and educating coalition of supporters including securing a bill sponsor;
- Researching desired bill components, draft bill concept and fact sheet;
- Finding and preparing parties to testify in committee hearings; and
- Organizing and conducting general lobbying.
- Pilot C&D planning and diversion with GovGuam facilities.
- Develop a territorial regulation.

Implementation Options

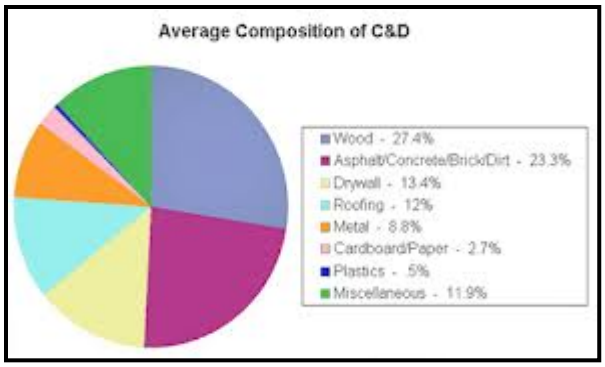
- Implement the C&D diversion policy in phases. Implementation would be island-wide affecting any targeted materials with the exception of the U.S. federal government operations on Guam.
- Report results. Reporting of results, including the final disposition of the secondary materials collected is recommended. Annual reporting of results should begin upon implementation of the regulation.
- Add materials and establish numerical diversion requirements for the entire waste stream. Once the C&D diversion policy is running smoothly and GEPA has collected adequate data to support specific requirements, numerical C&D diversion requirements should be established for all materials in the waste stream. This is a longer-term milestone that could take up to 5 years to accomplish.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of C&D debris diversion policies including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with implementing a mandatory C&D debris diversion policy, and a summary of what exists on Guam today with respect to this initiative.

What is a C&D Debris Diversion Policy?

Development and construction projects often require demolition of existing infrastructure which generates construction and demolition debris. Construction and demolition debris consists of concrete, asphalt, wood, brick, drywall, and other building materials. These building materials are non hazardous, and in many instances can be reused or recycled. Many local governments throughout the U.S. have used education campaigns; voluntary green building standards; and recognition programs that encourage contractors, haulers and recycling operators to divert C&D materials from landfills through reuse, recycling, composting and donation. Where material markets are strong and landfill disposal fees create a clear diversion incentive, these voluntary efforts have been moderately successful. In many communities, however, mandatory diversion requirements are needed to make significant progress.



Most mandatory C&D diversion policies are implemented at the city or county level and are established through code or ordinance language that can take many forms. While programs vary from community to community, common elements include:

- Applicability to moderate and large building construction projects, renovation and demolition projects - as measured in either square-foot size or dollar valuation.
- Minimum diversion goals - generally on a percent by weight basis.
- Targets specific C&D materials and/or establishes different diversion goals to each targeted material or group of materials.
- Requires waste management plans that demonstrate a feasible diversion strategy.
- Documentation (weight tickets) of C&D debris generation and diversion quantities.
- Compliance tied to issuance of building permits or certificates of occupancy, as well as the payment of penalties for failure to achieve full compliance.
- Requirement that a refundable deposit be paid when the building or demolition permit is issued with refund contingent on the degree of compliance.

It should be noted that some states take C&D debris policy one step further and actually ban materials from disposal (Massachusetts is an example).

Existing Programs on Guam

GovGuam does not have a C&D diversion policy in place. Although C&D debris is banned from the Layon landfill and public/commercial transfer stations, it can be disposed at the island hardfills where tipping fees are reportedly very low (approximately $6/cubic yard). Guam currently has no recyclers whose primary business is the reuse and/or recycling of C&D debris (there are, however, some aggregate suppliers who reuse and recycle waste concrete and asphalt generated at their construction sites). There is also very limited local building material reuse on the island.

C&D diversion on military projects is driven by Executive Order 13514 which requires federal agencies and state projects that utilize federal funding to divert at least 50% of the C&D waste stream by mid-2015. Examples include the LEED building emphasis on job-site recycling, deconstruction, use of salvaged and recycled-content materials and direction to use compost products for soil amendment and erosion control.

Building permit applications must be submitted to the Guam Department of Public Works (DPW) Building Permits Sections with appropriate fees based on project valuation. The Building Permits Section coordinates review with other applicable agencies and issues permits for approved projects. Guam DPW conducts building inspections as appropriate during construction. If the final inspection indicates compliance with the approved project plans and specifications, DPW's Building Official issues a CO.

Additionally, a Demolition and Solid Waste Disposal Plan must be submitted to Guam Environmental Protection Agency (GEPA) for review and approval on any demolition project.

Successful Approaches Used in Other Locations

There are several examples of C&D diversion policies established by local governments throughout the United States. Those presented below include a variety of diversion, plan development, and deposit requirements (all information was obtained from the cities' websites - see Section 5for links).

Chicago, Illinois

Chicago's ordinance requires a 50% diversion level by weight before a Certificate of Occupancy (CO) can be issued:

- Applicability
  - Construction or demolition of any residential buildings with four or more units
  - Non-residential buildings with more than 4,000 square feet (SF)
  - Rehabilitation projects requiring a CO
- CO tied to documentation proving compliance on City-provided forms
- Additional penalties

- Failure to reach mandatory diversion level - fee ranges from $500 to $1,000 for each percentage point below 50% (for projects less than 10,000 SF and 10,000 SF or greater, respectively)
- False reporting - fees range from $2,000 to $5,000

Lee County, Florida

Lee County also requires a 50% diversion level by weight:

- Applicability
  - Residential or commercial construction greater than $90,000 in value
  - Residential or commercial alteration greater than $10,000
  - Roofing projects requiring the removal of the existing roof
- Construction and Demolition Materials Management Plan (County provides example plan)
- Demolition projects must consider deconstruction "to the maximum extent feasible"
- CO tied to documentation proving compliance including county compliance certification
- Additional penalties (all flat fees)
  - New construction projects - $00 to $5,000 depending on building type/size
  - Alterations - $100 to $300
  - Demolition - $300 to $700
  - Roof projects - $100
  - Civil penalties of up to $15,000/day and criminal penalties including a $500 fine and imprisonment or community service

San Diego, California

The City of San Diego requires a 75% diversion level by weight:

- Applicability
  - Residential construction or alterations - 500 SF or greater
  - Non-residential construction or demolition - 1,000 SF or greater
  - Non-residential alterations and residential demolitions - 286 SF or greater
  - Roofing projects with existing roof removal
- Building permit tied to submittal of city-provided waste management form and deposit
- Refundable deposit (deposits are capped or flat for residential alterations and roof projects)
  - Non-residential and residential construction - $0.20 and $0.40/SF, respectively
  - Non-residential alterations - $0.70/SF
  - Non-residential and residential demolition - $0.20/SF and $0.70/SF, respectively
  - Roofing projects - $200
  - Residential alterations - $1,000

- Refunds are pro-rated based on achievement of the diversion requirement and submittal of City-provided compliance form

San Jose, California

The City of San Jose also requires 75% diversion through certified waste diversion facilities:

- Certificate of Final Occupancy tied to compliance and deposit for green building projects
- Required deposits
  - Projects subject to green building standards pay flat, non-refundable fee
  - Other projects pay refundable deposit (refunds contingent on weight slips from certified diversion facility or description/pictures/donation receipts for reused materials, building permit and completed C&D application
- Residential alterations - $1.16/sf ($2,000 cap)
- Non-residential alterations - $0.35/sf ($5,000 cap)
- Residential demolition - $0.35/sf ($5,000 cap)
- Non-residential demolition - $0.10/sf (no cap)
- Roof project with tear-off - no deposit

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how a mandatory C&D debris diversion policy could be developed and managed. A C&D diversion policy cannot be successfully implemented until adequate C&D reuse, recycling, and mulching/composting infrastructure is in place. To implement a successful policy, GovGuam must take advantage of the opportunities and take into consideration constraints that could make the initiative less than optimally effective.

Opportunities include:

- Supports green building and deconstruction practices.
- Drives markets and used building material programs, more than voluntary programs do.
- Many examples of successful policies have been implemented by other local governments.
- Creates administrative and recycling jobs.
- Limits debris disposed in landfill or hardfill.

Constraints Include:

- Requires C&D recycling and reuse facility infrastructure and equipment.
- Regulating agency/department needs to set standards, review plans, approve exemptions, verify data and provide enforcement.

- Controller function needed with deposit systems to track payments and refunds.
- Requires new coordination between solid waste and building permit agencies.
- Requires contractors/recyclers to provide documentation on quantities generated and diverted.

3. IMPLEMENTATION OVERVIEW

The establishment of a mandatory C&D debris diversion policy can provide significant positive environmental impacts. The following overview provides information on how to turn this initiative into action.

Major Components

For a C&D diversion mandate, it is expected that legislation will be required for implementation. Successful legislation would be followed by the development of territorial regulations that detail how the law will be implemented, enforced, monitored and reported. It is expected that GEPA and GDPW would coordinate ongoing implementation of this policy. Non-regulatory staff and volunteer professionals will likely champion the legislative process with input from these agencies.

Given the changes required by mandatory diversion, it is likely that this policy will be more successful if it is implemented in stages. Phasing in this policy will also allow time for:

- Markets to be strengthened - including a used building materials market;
- Contractors, processors and regulators to become familiar with the policy elements; and
- Data to be collected to support eventual establishment of a specific waste diversion requirement (e.g., percent by weight of waste generated).

Key implementation steps for the diversion of C&D debris from building projects are described below.

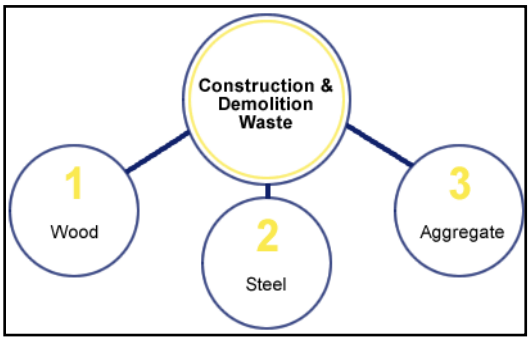
Define Initial and Ongoing Waste Stream Composition and Market Opportunities

This evaluation may be completed as part of exploring new C&D processing capacity (see the C&D Debris Processing Facility White Paper) and will be extremely important for establishing policy requirements that both meet diversion goals and are feasible for contractors and processors to implement. The data will require regular updating to provide GovGuam with feedback for implementing subsequent policy phases.

Phased Approach

Suggested steps for phasing in the C&D diversion policy include the following:

- C&D debris diversion requirements must be established. Instead of setting numerical goals initially, it may be more practical to simply require contractors to source-separate a short-list of targeted C&D materials and to simultaneously ban disposal of those materials at hardfill facilities. Considerations include:



- Initial list of targeted materials - including scrap metal, clean wood and clean concrete and asphalt rubble but may vary depending on waste stream composition and markets.

- Until the growth of non-military C&D debris justifies mixed waste processing on the island, contractors will need to source-separate materials. Targeting a short list of materials will help minimize job-site space requirements (e.g., two or three dumpsters would replace a larger roll-off container previously used for mixed waste).
- Contractors are likely to continue diverting scrap metal for direct sale to local recyclers.
- Wood waste and land-clearing debris could be diverted directly to compost facilities (currently there are no permitted compost facilities operating in Guam).
- Significant increases on building-related waste can be anticipated with the military build-up and induced growth.
- Demolition projects will typically generate more waste than new construction. The types of waste generated will vary as well.

Subsequently, require demolition projects to develop waste management plans identifying estimated generation and recycling or reuse plans, by material type. While deconstruction activities and successes can be extensive with total diversion levels reaching 90% in mature programs, it is possible to gradually modify demolition practices to salvage those items with existing markets. The ability to manage salvaged items such as architectural components, household goods, appliances, interior fixtures, etc., in addition to recycled materials needs to be developed on Guam (other Guam Zero Waste Plan alternatives have been developed to address used building material needs). Once a used building material facility is developed, plans could be required to identify which items can feasibly be removed and sold for reuse. Although deconstruction takes longer and costs more than demolition, this constraint is generally offset by the tax deductions available for donating reusable/re-saleable salvage items. Ultimately, establish C&D diversion requirements for the total waste stream. Once contractors have become familiar with source-separating targeted materials, hardfills have gotten used to complying with disposal bans and GEPA has collected adequate data to support a specific numerical requirement, establishing a minimum C&D diversion rate (percent by weight) may be appropriate.

Potential interim opportunities for GovGuam:

- Coordinate with the Department of Defense (DOD) on shared C&D recycling and reuse opportunities.
- Pilot waste management planning, and associated deconstruction, recycling, and reuse on GovGuam building projects.
- Convert HUD public housing demolition program funds to deconstruction program funds focusing on community enterprise development.

Develop Ordinance Requirements to Accommodate the Various Policy Stages

It is expected that GEPA and DPW would obtain input from contractors, hardfill owners/operators, recyclers, aggregate suppliers, reuse facilities and other stakeholders. Policy considerations are expected to include:

- Types/size projects to target. This policy may apply initially only to large multi-family and non-residential projects. Research will need to be accomplished to help GovGuam understand whether most construction is coming from small or large projects.
- Exemptions. Examples might include:
  - Types of projects such as plumbing-, electrical- or mechanical permit- only; roofing projects with tear-offs; emergency projects; retaining wall, balcony or other small projects.
  - Hardship projects - where lack of space, temporary lack of economically-sustainable market conditions exist.
- Reporting. Contractors should be required to submit estimates of C&D waste generated and diverted for each applicable project. Volumetric estimates can be converted to weights based on conversion factors established by GEPA.
- Compliance and penalties. Compliance can be tied to DPW's issuance of a building permit or occupancy certificate and/or financial penalties (see the Additional Information Section for examples).
- Enforcement. Inspections will need to be conducted to confirm contractor job-sites, hardfill disposal, and quantity reporting.
- Stakeholder education and technical assistance. This is a critical component of the policy that should include:
  - Comprehensive outreach to all stakeholders on the intent and expectation of each policy element as it is phased in;
  - Technical assistance in sizing job-site dumpsters, identifying on-site uses for recycled materials, determining processing needs, providing information on island processors and recyclers, tracking and reporting data; and
- On-site inspections that provide information and guidance as well as compliance activities.

An alternative policy approach (see the Additional Information section) is to require contractors to pay refundable deposits when the construction permit is issued with the deposit refunded in part or full depending on compliance with the diversion policy. This approach may be difficult for GovGuam to implement until numerical diversion requirements are established, but it would provide GovGuam with additional revenue.

Evaluate Basic Solid Waste Policy Issues Affecting C&D Management

During this implementation step, consideration should be given to:

- Efforts to support economically-sustainable markets such as those associated with GovGuam's ability to ultimately prioritize the use of:
  - Recycled wood mulch and/or compost at government and school facilities;
  - Recycled concrete (base material); and
  - Recycled asphalt pavement (base material).

Future policy considerations may include:

- Tip fee surcharge on C&D materials disposed at hardfills to both encourage diversion and generate a fund to implement new policy, purchase materials, dumpsters and other C&D diversion activities; and
- Market development for additional C&D materials such as supporting a new pallet recycling business on Guam and research into sustainable drywall applications (soil amendment, lime stabilization, etc.).

Major Milestones

To implement this alternative, the following key milestones should be focused on.

Enact Legislation to Implement a Mandatory C&D Diversion Policy on Guam

It is expected that this legislation will be pursued by GovGuam staff and volunteer island recyclers, organizations and citizens. As GovGuam staff will have limited ability to actively lobby a bill through the Guam Legislature, business and volunteers will likely need to champion this policy. It is recommended that the legislation be developed as framework legislation with the flexibility to start with an initial list of targeted materials, and then be modified to address additional materials and diversion requirements in the future without new legislation each time. Legislation is expected to take a minimum of 12 months to enact, possibly longer. Development needs for the legislation will include:

- Building and educating coalition of supporters including securing a bill sponsor;
- Researching desired bill components, draft bill concept and fact sheet;
- Finding and preparing parties to testify in committee hearings; and
- Organizing and conducting general lobbying.
- Pilot C&D planning and diversion with GovGuam facilities.
- Develop a territorial regulation. The regulation should detail how the law will be implemented, enforced, monitored and reported. It is expected that these activities could be completed within 6 to 12 months of the enactment of the C&D diversion policy legislation with existing staff resources.

- Implement the C&D diversion policy in phases. Implementation would be island-wide affecting any targeted materials with the exception of the U.S. federal government operations on Guam. Implementation would begin as soon as regulations are finalized and phased in over a to-be-determined period of time.
- Report results. Reporting of results, including the final disposition of the secondary materials collected is recommended. Annual reporting of results should begin upon implementation of the regulation.
- Add materials and establish numerical diversion requirements for the entire waste stream. Once the C&D diversion policy is running smoothly and GEPA has collected adequate data to support specific requirements, numerical C&D diversion requirements should be established for all materials in the waste stream. This is a longer-term milestone that could take up to 5 years to accomplish.

Challenges

Major challenges to implementing a mandatory C&D debris diversion program include having:

- Adequate information to set effective policy requirements.
- Existing markets to support the economic practicality of diverting targeted materials.
- Existing processing capacity for source-separated materials. For mixed C&D waste stream, this capacity is even more significant.
- A level playing field for all stakeholders so no competitive advantage or disadvantage is created.
- Ability to provide adequate education and technical assistance to contractors and processors.
- Funding/staff/resources to enforce policy elements.

Additional challenges include:

- Overall markets for diverted materials are challenged to compete with low tipping fees charge for disposal at existing private hardfill facilities.
- Recycled aggregate markets may also need to be mandated to compete with readily available virgin limestone sources on the island. Use of recycled base is not consistently supported by Guam Department of Highway's demand for recycled aggregate in road base and pavement layers. Contractors do not generally have access to processing equipment that can remove rebar from structural concrete.
- Recycled clean wood markets:
  - Don’t have existing compost facilities or access to appropriately-sized grinding equipment;
  - Concerns about spreading invasive species infestation to other parts of Guam (e.g., Coconut Rhinoceros Beetle);
  - Lack of a pallet recycler on the island and difficulty removing nails from chipped pallet wood;

- Other materials are expected to be generated in low quantities and/or do not have sustainable markets (e.g., drywall, plastic, glass, treated wood, painted concrete, insulation, carpeting, etc.);
- The military either has or will have adequate processing capacity for its C&D streams through the planning period (but in turn, this could be an opportunity for collaboration);
- C&D generated from non-military projects has outlets through privately-operated hardfill facilities and recyclers in northern Guam which may be interested in expanding to meet increased C&D diversion needs created by the new policy. If existing facilities do not expand to meet demand, additional processing capacity will need to be developed; and
- Given low quantities and inconsistent markets, source-separation of key C&D materials (i.e., scrap metal, clean wood and concrete rubble) by contractors will be more cost-effective than processing a mixed C&D waste stream, at least initially.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is estimated that between 78,000 and 82,000 tons of total C&D debris were generated on Guam in 2012. Table WP-K.1 presents landfill diversion potential over a period of fifteen years if a mandatory C&D debris diversion policy is enacted, assuming a 2015 implementation date for this policy. Assumptions used in the estimation of landfill diversion potential include:

- Implementation of this policy cannot occur until C&D processing and used building material infrastructure is in place
  - It is expected that infrastructure will not be in place until at least 2015.
  - Subsequent legislation and rule-making for a C&D diversion mandate will take will take at least two years.
  - As a result, the mandate will not likely be in place until 2017 of 2018 - associated diversion will not be measurable until 2020.
- Targeted materials include building-related C&D materials (i.e., from the non-municipal waste stream) generated from non-military sources - primarily including lead-free aggregate, clean wood, metals and used building materials.
- Total quantities available for diversion- consider available infrastructure and are therefore duplicative of quantities considered in Guam Zero Waste Plan analyses that evaluated C&D processing and used building material alternatives. Specific quantity assumptions include:
  - Building-related waste represents 35% of the total C&D waste stream (USEPA, 2011).
  - Civilian-generated C&D is roughly 40% of total C&D waste stream (HDR/Hawaii Pacific Engineers, 2010).
  - Clean wood (50% of total wood) is 20-30% by weight, lead-free aggregate (95% of total aggregate) is 40-50%, metals are 1-5% (USEPA, 2011).
  - Approximately 30% of all building-related waste is available for reuse (assumes that the military will utilize civilian used building material infrastructure to meet their diversion goals instead of developing new).
- Assumed diversion ranges from 10% to 90% will vary with the material - these rates will be heavily dependent on GEPA's success in educating contractors and recyclers, as well as effectively enforcing the policy.

TABLE WP-K.1. LANDFILL DIVERSION POTENTIAL [1, 2]
MANDATORY C&D DEBRIS DIVERSION
(Implementation expected 2020)

YEAR	CLEAN WOOD		LEAD-FREE AGGREGATE		METALS		REUSED MATERIALS		NON-MUNICIPAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Combined Range of Diversion Potential	
	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year	% by Weight	Tons/ Year
2020	40-50%	1,000	40-50%	2,000-4,000	70-75%	0-1,000	20-30%	2,000-3,000	0%	4,000-9,000
2025	60-70%	1,000	60-70%	3,000-4,000	75-80%	0-1,000	30-40%	3,000-4,000	0%	7,000-10,000
2030	80-90%	1,000-2,000	80-90%	4,000-6,000	80-85%	0-1,000	40-50%	4,000-5,000	0%	9,000-13,000

Notes:

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Yar Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

2. While this plan does not address military waste, the buildup may well lead to more C&D debris generation than is projected on the basis of population growth. Tracking this waste stream for both civilian and military sectors will be important to the development and operation of an effective processing facility.

Job Creation Potential and Small Business Opportunities

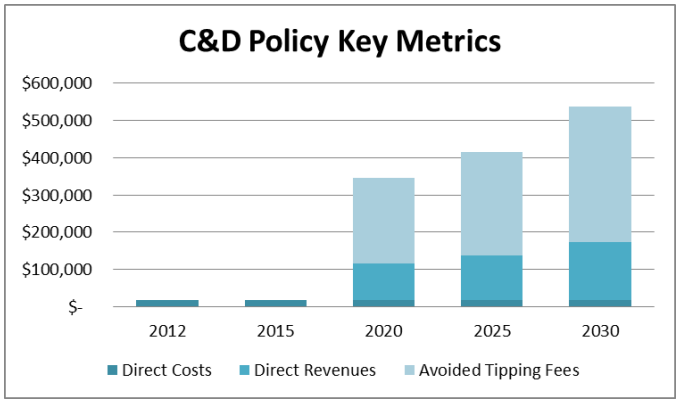
To estimate the potential job creation associated with diverting recyclables and organics from Guam's total solid waste stream, the following assumptions have been made (see the Basis for Job Creation Potential Estimates Technical Memorandum):

- Processing organics will likely generate less than one job for every 1,000 tons managed.
- Processing aggregate will generate notably less than one job for every 1,000 tons.
- Processing metals may generate slightly more than one job for every 1,000 tons.
- Reuse and resale of used building materials may generate just under 5 new FTEs for a mature program.

Based on these assumptions and the projections of diverted quantities in the previous table, it is possible that up to three new FTEs could be created by 2020. These are expected to be all private sector jobs (with the possible exception of reused materials). These estimates are exclusive of any GEPA staffing increases needed to implement and enforce policy (but likely duplicate job estimates made for stand-alone used building materials or C&D processing facility alternatives). These jobs are expected to occur within existing small businesses, and also potentially represent new small business opportunities.

Estimated Revenue Generation

Revenue potential associated with a new C&D diversion policy will likely duplicate job estimates made for stand-alone Used Building Materials or C&D processing facility alternatives. The estimate is based on Table WP-K.1 diverted quantities, and assumptions for resale of wood, aggregate and metals (at $15 per ton) and used building materials (at $150/ton but only 50% of salvaged materials would be resold). The resulting estimated revenue ranges from $98,000 in 2020 to $156,000 in 2030.



Avoided Landfill Disposal Costs

Based on Table WP-K.1 diverted quantities and an assumed tipping fee of $35 per ton for hardfill sites, avoided tipping fees would be $229,000 in 2020, increasing to $363,000 by 2030.

Human Health and Environmental Impacts

Although logistical constraints exist, the benefits to human health and the environment far outweigh any negatives. Mandating C&D debris diversion would:

- Reduce environmental impacts from the extraction, transportation, and distribution of raw materials.
- Extend the life expectancy of existing regional landfills which will help to reduce future pollution from said landfills from impacting the environment and risking human health.
- Reduce greenhouse gas emissions and the burning of fossil fuels.
- Reduce air and water pollution.

Economic Costs

Significant cost assumptions for developing a new C&D diversion policy on Guam include 0.25 new FTEs in GEPA beginning in 2012, maintaining that level through the forecast period.

GovGuam overhead cost for Department of Administration is included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.

Total costs for the C&D Debris Diversion Policy initiative are expected to be $19,000 annually.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Cal Recycles, Developing a C&D Ordinance, http://www.calrecycl.ca.gov/LGCentral/Library/CandDModel/Instruction/
- HDR/Hawaii Pacific Engineers, "Final Report - Recycling and Solid Waste Diversion Study for DOD Bases, Guam," prepared for Naval Facilities Engineering Command Pacific - Pearl Harbor, Hawaii, April 25, 2010
- USEPA, "Materials Characterization Paper in Support of the Final Rulemaking: Identification of Nonhazardous Secondary Materials That Are Solid Waste Construction and Demolition Materials - Building-Related C&D Materials," February 2011

References

- Boulder County, Colorado's "Overview of Building Deconstruction - A National Glance with Local Focus").
- www.leegov.com/gov/dept/SolidWaste/Pages/default.aspx (click on mandatory recycling ordinance)
- http://www.mass.gov/eea/agencies/massdep/recycle/solid/massachusetts-waste-disposal-bans.html
- http://www.sandiego.gov/environmental-services/recycling/cd/index.shtml
- http://www.sanjoseca.gov/index.aspx?NID=1532
- www.cityofchicago.org/city/en/depts/cdph/supp_info/environmental_permitsandregulation/construction_anddemolitiondebrisrecycling.html

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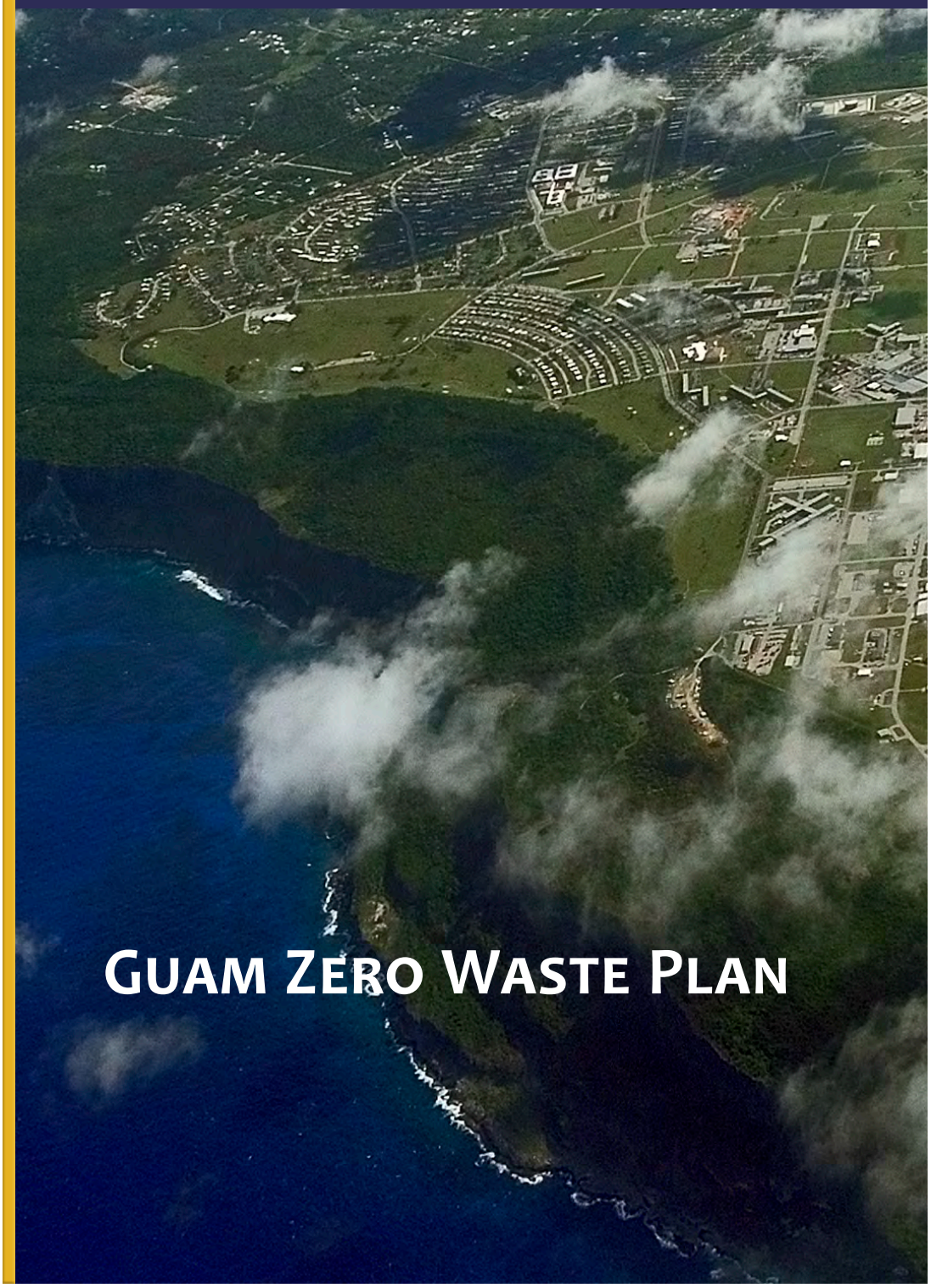
ONE ISLAND. ONE VISION. ONE FUTURE.

White Paper L



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP L

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WHITE PAPER L
ZERO WASTE ASSOCIATION OF GUAM

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Zero Waste Association of Guam (ZWAG)***
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Green/Environmentally Preferential Purchasing Program*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be implemented to aid in the development of a professional association of public, non-profit, and private sector stakeholders whose mission is to promote and support waste diversion infrastructure, programs, and policies in pursuit of Zero Waste goals on Guam. For the purpose of this analysis, it is assumed that a new Zero Waste association will be built from one or more of the existing organizations on Guam that address waste diversion and resource conservation including the Recycling Association of Guam, iRecycle and the University of Guam's Island Sustainability Center.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this white paper, provides a roadmap of the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.
- Tables and figures, which assist in the interpretation of the narrative information, are provided at the end of the white paper.

Key Findings

This section presents the key findings in the document. Development of a Zero Waste Association of Guam (ZWAG) is recommended to promote Guam's goal of Zero Waste.

Key Functions

Key functions of effective waste diversion associations typically include (but are not limited to):

- Serving as a voice and catalyst within the industry.
- Creating opportunities for networking and discussion.
- Advocating policy positions (most governments cannot actively lobby their legislators).
- Providing resources for benchmarking, research, market development, etc.
- Serving as an information clearinghouse.
- Providing membership outreach.
- Recognizing membership and industry stakeholders through awards/recognition programs.

Key Stakeholders

It is expected that the development of a new Zero Waste association will be built from the existing Recycle Association of Guam (RAG) organization, and that this work will be accomplished by volunteers who are current industry stakeholders from all sectors. These are expected to include but not be limited to:

- Government agencies (GSWA, GEPA, GPW, villages, USEPA).
- University of Guam.
- Military representatives.
- Haulers.
- Facility operators (including transfer stations, landfill, hardfills).
- Recyclers (private, non-profit) - including reuse, thrift operations.
- Composters (including farmers who use food waste for animal feed).
- Commercial waste generators (GWA, hotel and restaurant associations, etc.).
- Consultants, lawyers, vendors and other service providers.
- Legislators and staff.
- Interested citizens.
- Students.

Key Policy Steps

Key policy steps for expanding RAG into an active Zero Waste association include:

- Develop a steering committee and initial association direction and leadership.
- Develop Initial ZWAG Strategy and Structure.
- Evaluate, modify and grow ZWAG Over Time.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of the Zero Waste initiative including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What Do Professional Waste Associations Look Like?

Professional associations can have any number of mission, organizational structure, service area and membership variations. The mission of most waste diversion associations includes some combination of education, advocacy, training, marketing and leadership within their service area. Some associations address diversion as part of overall solid waste management (e.g., the Solid Waste Association of North America), others broadly tackle Zero Waste (e.g., the Zero Waste Alliance), while others focus primarily on downstream diversion (e.g., the Colorado Association for Recycling) or even on a single diversion process (e.g., the U.S. Composting Council).

Most waste diversion associations are organized as non-profit, tax-exempt organizations and have the Internal Revenue Status code of 501c(3). 501c(3) organizations are exempt from most federal taxes and are subject to some lobbying limitations (their ability to spend a specific percentage of their annual budget on direct and grassroots lobbying is tied to income level). These associations can serve local areas (neighborhoods, cities or counties), states or territories (e.g., Recycle Hawaii), multi-state areas or the entire country. Membership can be public, non-profit, private or a mix of members - dues structures are often established to vary by membership class within the association.

Key functions of effective waste diversion associations typically include (but are not limited to):

- Serving as a voice and catalyst within the industry
- Creating opportunities for networking and discussion
- Advocating policy positions (most governments cannot actively lobby their legislators)
- Providing resources for benchmarking, research, market development, etc.
- Serving as an information clearinghouse
- Providing membership outreach
- Recognizing membership and industry stakeholders through awards/recognition programs

Existing Programs on Guam

The Recycling Association of Guam (RAG)

RAG is a non-profit community service organization founded in 1988. RAG's mission is to promote awareness about source reduction, reuse, recycling and composting. The organization accomplishes this by providing recycling news in a periodic newsletter (published one or two times/year) and on website and Facebook pages. RAG representatives

are also available upon request to make presentations at schools and public events (RAG also participated in the Guam Zero Waste Plan visioning meeting in February, 2012). RAG resources include a Guam recycling directory (on its website) and library of educational materials.

RAG's voluntary leadership includes four officers and a newsletter editor. The officers are elected and serve one-year terms. RAG's revenues sources are limited to membership dues. Membership categories include families, students, seniors, benefactors and corporate. RAG's typical annual budget is $3,000 to $4,000/year (Shambach, 2013).

iRecycle

This aluminum can recycling program financially benefits Guam's schools and is sponsored by Guam Business Partners for Recycling, Inc., a non-profit group. The program sponsors 8-cy recycling dumpsters at schools, and the schools receive revenues from the sale of aluminum. This year it plans to expand to collect telephone books through a program with Mr. Rubbishman for a potential revenue of $10,000. In addition, the program:

- Makes school presentations and is developing a service-learning program at the high school for graduating seniors that will high Zero Waste (may also be extended to lower grades.
- Provides recycling at special events and has diversion guidelines for event sponsors.
- Works with the Guam Public schools, private schools, two Navy schools and two Department of Defense Education Activity schools (Denney, 2013).

University of Guam Center for Island Sustainability

The Center for Island Sustainability concentrates on outreach across the curricula for sustainability:

- Reaches approximately 85% of the UOG's students with its recycling and food waste outreach program's presentations each semester.
- Offers a food waste diversion program at the student center, and the program visits K-12 classrooms throughout the school year with presentations and hands-on bin-sorting demonstrations.
- Sponsors the Green Army - a student service group that provides outreach including recycling and food waste recovery at Liberation Day events, the Micronesian Fair (through a partnership with the Guam Visitors' Bureau), Japan Fair and 5-K running events (Tyler, 2013).

Additional Successful Approaches Used Worldwide

There are numerous waste diversion associations throughout the U.S. A brief description of representative associations is included below. Common threads between these associations include their focused missions, partnerships with other organizations and industry outreach.

Colorado Association for Recycling (CAFR)

CAFR is an active 501c(3) organization whose mission is to "support, educate and guide individuals and leaders in business, educations, nonprofits and government to take action that turns ever greater amounts of waste into marketable resources". CAFR is an association with the following attributes:

- Membership - 250 individuals, students, small/large businesses, small/large governments, universities, non-profits.
- Key activities - annual conference/exhibition, legislative advocacy, advisor to state recycling grant program.
- Leadership - 15-person, voluntary board of directors.
- Staff - full-time executive director, half-time executive assistance (also contract accountant, conference planner, lobbyist).
- Annual budget - $200,000 (2013).

Recycle Hawaii

Recycle Hawaii is a 501c(3) serving primarily the Big Island, whose mission is to "promote resource awareness and recycling enterprises". Recycle Hawaii is somewhat unique in that its primary functions include the administration of Hawaii County and State of Hawaii Department of Health waste management and diversion contracts - the association obtains most of its funding from these agencies.

- Membership - 70 voting members (individuals, families, seniors, students), corporate sponsors are non-voting.
- Key services - operate four recycling drop-sites, backyard compost training, community outreach, recycling guide, do-it-yourself oil collection sites, statewide e-waste task force.
- Leadership - 7-person, voluntary board of directors (can have up to 12).
- Staff - 13 staffers who operate drop-sites, manage contracts, conduct outreach, etc.
- Annual budget - between $0.5M and $1M.

Solid Waste Association of North America (SWANA)

SWANA is an international association whose mission is "advancing the practice of environmentally and economically sound management of municipal solid waste in North America". Unlike the other examples, SWANA's focus includes all aspects of solid waste (i.e., planning, education, collection, transfer, landfilling, waste-to-energy and diversion):

- Membership - 8,000 individuals representing governments, businesses, non-profits.
- Key activities - training certifications, annual industry and technical specialty conferences, research foundation, national advocacy, member awards.
- Leadership - 70-person, voluntary board of directors (representing states, provinces, territories in U.S. and Canada).
- Staff - 22 full-time staff, part-time general counsel, contractors as needed.
- Annual budget -approximately $6M.

U.S. Composting Council (USCC)

USCC is a 501c(6) organization that also directs the Composting Council Research and Education Foundations (a 501c(3)). USCC's mission is "advancing composting and promotes compost use to enhance soils and provide economic and environmental benefits for our members and society":

- Membership - over 800 organizations (governments, businesses, non-profits, composters, universities) as well as individuals, students.
- Key activities - annual conference/tradeshow, compost testing program (Seal of Testing Assurance), legislative advocacy, market development.
- Leadership - 14-person, voluntary board of directors.
- Staff - 5 full-time staff plus contractors.
- Annual budget - $1.2M.

Zero Waste Alliance (ZWA)

ZWA is a 501c(3) that focuses on Zero Waste strategies with a mission to "support organizations in the creation of a more sustainable future". ZWA is operated as a program of the International Sustainable Development Fund (ISDF) and has historically focused on providing waste consulting services through affiliated professionals (or "associates"). Recently, ZWA has been transitioning to a hybrid approach that includes more universal services (ZWA tools and strategies) for a membership-based association (Coalson, 2013):

- Membership - includes primarily businesses (currently about 15 members, although the transition to member-based association may take as many as three years).
- Key services - training, education, management support, technical services (especially Zero Waste mapping, life-cycle analysis, industrial waste exchange, product stewardship, etc.).
- Staff - ZWA has one full-time director and some occasional support staff from ISDF (ZWA currently has about 5 active associates available for consulting services).

Zero Waste International Alliance (ZWIA)

The Zero Waste International Alliance (ZWIA) is a 501c(3) that was established to promote positive alternatives to landfill and incineration and to raise community awareness of the social and economic benefits to be gained when waste is regarded as a resource base upon which can be built both employment and business opportunity (http://zwia.org/aboutus). The ZWIA is an international alliance working toward a world without waste through public education and practical application of Zero Waste principles. ZWIA hosts events and dialogues with representatives from around the world, including significant participation from the Philippines.

Members can be individuals, Nongovernmental organizations, government agencies, institutions, Zero Waste business, other commercial waste generators, or Zero Waste service provides (e.g., reuse, recycling and composting businesses or NG0s). There are two public membership categories: organizational members and individual members. All are nonpaying, nonvoting members.

Other organizational examples include:

- California Resource Recovery Association (CRRA) - hosts annual Zero Waste conference and exposition (has been attended by Guam officials in the past)Northern California Recycling Association (NCRA) - hosts annual Recycling Update and Zero Waste Week with tours, speakers, and receptions.
- U.S. Zero Waste Business Council.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste initiative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Associations can be beneficial in driving Zero Waste activities as described above, especially when they work to bolster efforts by other organizations (especially local and state environmental agencies).

In order to be measurably effective, however, active associations require two key features that can be challenging for some groups to develop and maintain. The first is organized leadership, which is typically a governing board of directors who volunteer their time. This time commitment can be significant depending on responsibilities (both RAG and CAFR officers can spend as many as 20 hours/month on association activities) and associations can struggle with finding committed volunteers to take on these roles:

- Setting/following the association's mission and strategic plan.
- Developing organizational policies and procedures.
- Establishing and tracking the association's budgets.
- Overseeing staff and contractors.
- Fundraising.
- Assisting staff in implementing events.
- Being an association ambassador (public speaking and outreach).

The second important feature is the ability to hire staff and/or contractors to conduct day to day activities. These needs will likely vary as the association grows - many associations will not have the need for (or the financial ability to hire) staff initially. Over time, staff can be hired on a part-time basis and contractors can be used for specific projects. While there is a "catch 22" aspect to hiring professionals (i.e., need the ability to provide member services that earn dues to pay staff to develop services), most associations find that relying solely on volunteer directors limits their ability to be a consistent industry voice and respond to waste diversion opportunities for their members. Staff/contractor resource requirements can also be significant depending on their responsibilities:

- Staff may be charged with organizing/implementing events, conducting fundraising and membership drives, advocacy, representing the association throughout the industry, etc.

- Contractors may be used for basic organizational duties (such as accounting or taxes), lobbying, training, event planning or other.

Other challenges - such as economic downturns that depress membership renewals and political climates that constrain environmental policies and programs - can also hinder the ability for waste diversion associations to be active and effective periodically.

3. IMPLEMENTATION OVERVIEW

Key Stakeholders

It is expected that the development of a new Zero Waste association will be built from the existing RAG organization, and that this work will be accomplished by volunteers who are current industry stakeholders from all sectors. These are expected to include but not be limited to:

- Government agencies (GSWA, GEPA, GPW, villages, USEPA, US DoD)
- University of Guam
- Military representatives
- Haulers
- Facility operators (including transfer stations, landfill, hardfills)
- Recyclers (private, non-profit) - including reuse, thrift operations
- Composters (including farmers who use food waste for animal feed)
- Commercial waste generators (GWA, hotel and restaurant associations, etc.)
- Consultants, lawyers, vendors and other service providers
- Legislators and staff
- Interested citizens
- Students

It is important to note that while ZWAG will collaborate heavily with all of its members, one of its most useful roles may be to challenge GovGuam agencies to remain focused on Zero Waste.

Major Components

Key policy steps for expanding RAG into an active Zero Waste association are described below.

1. Develop a Steering Committee and Develop Initial Association Direction and Leadership - The Steering Committee should be provisional of volunteers including current offices and members from RAG, iRecycle and UOG as well as representative public, private and non-profit waste management stakeholders on the island who assume the responsibility of laying the groundwork for taking the new/expanded Zero Waste association of Guam (or "ZWAG"). Steering Committee activities should include:

    - Develop a vision and mission (relatively easy to develop from other association examples);

- Vision is a general statement of what ZWAG wants to accomplish or become as an association (Yahoo! Voices).
- Mission defines specific association actions that are realistic and measureable, and provide guidance for strategic planning (Wikipedia).

- Develop organizational bylaws - to describe parameters for membership, board directors and officers, meeting and voting procedures, finance, indemnities and a process for changing the bylaws themselves (also relatively simple to develop from other associations).
- Elect a Board of Directors - this will require the establishment of a nomination and election process (candidates will likely have to be solicited for the first term).

2. Develop Initial ZWAG Strategy and Structure - This should include:

- Board Directors will direct the association, develop, and implement the short-term strategic plan.
- Develop short-term strategic plan - to identify key actions for first one to two years of operation, which may include:
  - Implementing the Guam Zero Waste Plan which may ultimately include new programs like a territorial recycling grant program, litter enforcement, a plastic bag ban, residential pay-as-you-throw or other (many of these actions are likely to require legislative advocacy or policy development on some level) - one of the most important ZWAG strategies is likely to be legislative advocacy and policy development as GEPA, GSA, GSWA and other territorial agencies do not have the ability to actively lobby.
  - Membership drive - including refining member categories and dues.
  - Identify basic member services (needed to justify the dues structure - such as regularly updated website/newsletter communication, networking/conference events, etc.
  - Other fundraising - such as sponsorships, event registration fees (these are more than 50% of the revenue stream for associations like CAFR and SWANA), grants, etc.
  - Branding Zero Waste island-wide - so these programs are instantly recognizable and compelling for all Guam's waste generators.

- Develop an initial annual budget - which should be balanced and address anticipated income and expenses for the short-term (these most likely will be small as revenues will not be well-developed).
- Establishing critical committees - such as the Nominating Committee (for future elections), Outreach Committee (to direct public outreach and education efforts) and Policy Committee (to lead advocacy efforts, which are expected to be important in implementing the Guam Zero Waste Plan - note that ZWAG may want to consult a tax attorney to confirm lobbying limitations).

3. Evaluate, Modify and Grow ZWAG Over Time - As early as the second year, it is likely that the original bylaws, strategic plan and income/revenue projections require revision (these should be reviewed on an annual basis). Required changes (or growth) will likely be tied to the desire by ZWAG members to pursue specific opportunities and responsibilities, the ability to raise funds and the industry need for a stronger leadership voice. Future actions may include:

- Next steps in implementing the Guam Zero Waste Plan (this will take multiple years to be fully developed).
- Evaluate need/opportunity for independent policy action - for example, setting quantifiable Zero Waste diversion goals for Guam and assisting GEPA with on-going diversion quantity data collection.
- New fundraising opportunities.
- New networking needs - such as regular conference, workshop or training events.
- Need for dedicated part-time staff (or contractors) and associated human resource procedures - many associations initially hire project-specific contractors, then move to a single staffer (e.g., 0.25 or 0.3 FTE) and grow from there.

Major Milestones

Development of an expanded ZWAG association can be initiated with primarily volunteer efforts to become pivotal to implementing many of the policies programs and infrastructure considered in this Guam Zero Waste Plan. Therefore, development should be undertaken immediately:
Beginning in 2013 - develop organizational leadership and implementing the short-term strategic plan

  - First six months - completion of Steering Committee activities including election of first Board of Directors.
  - Next three months - completion of initial strategic plan, budget and committee structure

- 2014 and beyond - continually revise the association direction, leadership and strategies to allow expanding services, networking, membership and industry representation.

Challenges

- Limited membership base - while GEPA agencies and private sector recyclers may be well represented in ZWAG, local governments (villages) may have lower membership potential.
- Ability to earn other revenues through sponsorships and other sources - cost of waste management is already high on Guam and dollars available for donation may be limited.
- Ability to influence GEPA in implementing new waste diversion policy and programs - given the agency's current lack of direction, funding and dedicated waste diversion staff.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

Landfill Diversion Potential

It is not expected that a new Zero Waste association will directly lead to diversion of materials on Guam. However, ZWAG will hopefully have the potential to make significant progress towards Guam's Zero Waste goals by catalyzing the development and implementation of a wide range of waste diversion programs, policy and infrastructure.

Job Creation Potential and Small Business Opportunities

The Zero Waste Association initiative is expected to have minimal opportunities for job creation or small business opportunities - although the ability to hire part-time staff or lobbying assistance to support early legislative activities would be extremely helpful in advance strategic Zero Waste initiatives early in the planning period. It is therefore possible that ZWAG may hire a small business to help with advocacy efforts and/or general membership and fundraising needs.

Estimated Revenue Generation

Given that the vision for the Zero Waste Association is to be operated as a membership organization, it is anticipated that membership fees would provide the only direct revenues for the project. Assuming an average membership rate of $100, the organization would breakeven at 250 members. Staggered membership rates could be developed for individuals, smaller businesses and larger businesses. Alternative revenue sources could include grants, foundation funding or sponsors for specific activities like the website, newsletters and meeting events.

Avoided Landfill Disposal Costs

No avoided landfill costs are expected as a result of the Zero Waste Association initiative.

Human Health and Environmental Impacts

Though the creation of a Zero Waste Association will not have direct human health and environmental impacts, it will help to create some combination of education, advocacy, training, marketing and leadership to encourage recycling programs that will in turn:

- Yield dramatic and usually permanent diversion of MSW.
- Extend landfill life and thus protect habitat that may otherwise be appropriated for a new or expanded landfill.
- Conserve resources, and with the reduced need to extract and consume virgin resources, will also reduce greenhouse gas emissions, water and air pollution.

Economic Costs

Significant cost assumptions for the Zero Waste Association initiative include:

- A budget of $3,000 annually for materials and miscellaneous costs;
- Assumed involvement for GEPA attendance in ZWAG meetings (0..3 FTEs beginning in the base year, and continuing at that level thereafter); and
- GovGuam overhead costs for Department of Administration is included at 7% of departmental costs, and departmental overhead is included at 18% of salaries

As noted above, an expanded ZWAG association would most likely be initially built upon the existing RAG organization and will rely on volunteers and donated services. As a result, in the first two years of operation (2013 through 2014), expenses could probably be limited to approximately $25,000:

- Membership materials - graphics and production (although there are likely many members and external audiences that cannot access the internet and e-mail, printing hard copies and mailing should be limited to minimize costs and - subsequently - member dues);
- Website/Facebook maintenance - with membership, newsletter, advocacy, meeting and other regularly-updated information;
- Board meeting space with speaker phone capability (may be donated) - "headquarters" are expected to be virtual during first year or two of operation; and
- Hosting member networking/conference events - ideally these would be developed as net zero cost events based on sponsorship dollars (although cash flow until sponsorship dollars are received may be a consideration).

As the association grows (potentially as early as 2015), costs may include but not be limited to:

- Office space and utilities;
- Liability insurance for directors and officers;
- Unsponsored events (if any);
- Additional education and outreach;
- Contractors for task-specific work - may include bookkeeper/accountant, event planners, trainers/facilitators, lobbyist, etc.;
- Part-time labor, taxes and benefits; and
- Travel expenses for staff and directors.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Alliance for Nonprofit Management - www.allianceonline.org/
- California Resource Recovery Association - www.crra.com
- Coalson, Jay - Zero Waste Alliance Executive Director, personal communication February 18, 2013
- Colorado Association for Recycling - www.cafr.org
- Denney, Peggy, iRecycle Executive Director, personal communication February 21, 2013
- Guam Department of Revenue and Taxation's General Business License Branch and Gross Receipts Tax Branch (to register non-profit association) - www.revtax.gov.gu
- Northern California Recycling Association - www.ncrarecycling.org
- Recycling Association of Guam - www.guamrecycling.org
- Recycle Hawaii - www.recyclehawaii.org
- Shambach, Bob - Recycle Association of Guam President, email communication February 27, 2013
- Solid Waste Association of North America - www.swana.org
- Tyler, Elvie, UOG Center for Island Sustainability Program Director, personal communication February 24, 2013
- U.S. Composting Council - http://compostingcouncil.org/
- U.S. Zero Waste Business Council - http://uszerowaste.org
- Zero Waste Alliance - www.zerowaste.org
- Zero Waste International Alliance - http://zwia.org

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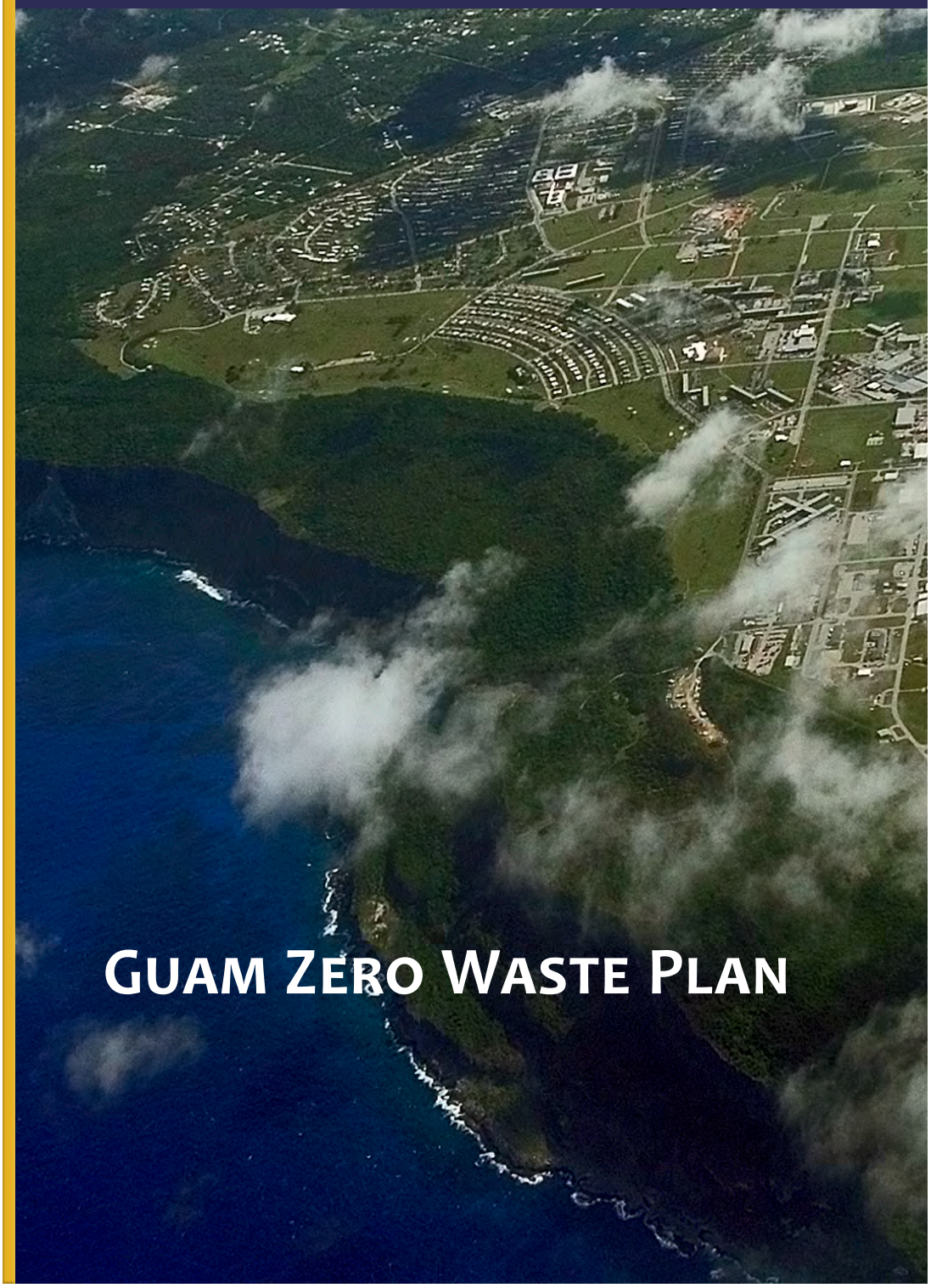
White Paper M



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP M

Please see the next page.

WHITE PAPER M
ZERO WASTE GRANT PROGRAM

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- *Zero Waste Grant Program*
- *Green/Environmentally Preferential Purchasing Program*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Evaluation of Funding Sources*
- *Zero Waste Association*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

This white paper, which is one in a series of fifteen, presents an analysis of measures that can be implemented to establish a territorial grant program for Zero Waste activities.

White Paper Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap of the document, and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.
- Tables and figures, which assist in the interpretation of the narrative information, are provided throughout the white paper.

Key Findings

This section presents key findings. Grant programs are an effective way to provide resources to public, private and non-profit organizations to research, develop and/or operate new Zero Waste programs or infrastructure.

Key components necessary to the development of a new grant program on Guam will include:

- Establish Advocacy Strategy for Enabling Legislation

- Champion(s) to coordinate and lead the advocacy efforts - can be an individual, organization or GovGuam itself (GEPA may not be able lobby actively) - champions may come from organizations like RAG, iRecycle, UOG, private recyclers and others.
- Coalition of supporters from all sectors to assist in formulating bill language, contacting legislators, testifying and generally promoting grant legislation - these are expected to include GEPA, the Recycling Association of Guam, Guam's Solid Waste Receiver, municipalities, villages, haulers, recycling/composting businesses and others.
- Knowledge of opponents' positions - such as parties adversely impacted by the targeted funding source.
- Legislative sponsors (ideally representing both political parties).
- Professional lobbying assistance (though an additional cost) can also be beneficial.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of the Zero Waste Grant Program initiative including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What is a Zero Waste Grant Program?

Grant programs are an effective way to provide resources to public, private and non-profit organizations to research, develop and/or operate new Zero Waste programs or infrastructure. They have been implemented throughout the U.S. for nearly 30 years. Grant programs can be competitive (like those in California, Colorado, Florida and Pennsylvania) with eligible organizations submitting proposals and being selected on the basis of how well they meet established criteria and the availability of funding). They can also be non-competitive (like those in Hawaii and Wisconsin) with certain types of organizations being automatically entitled to grant payments as long as they meet minimum standards. Non-competitive grant programs are most often implemented to provide financial relief to communities in states that impose recycling mandates. A competitive grant program has been assumed for this analysis.

Existing Programs on Guam

Currently GovGuam does not have any Zero Waste-related grant programs. However, efforts to develop implementing regulations for the Guam Beverage Container Recycling Act of 2010 (PL 30-221) are underway, and Guam has implemented an Abandoned Vehicle Program.

Successful Approaches Used Worldwide

There are limited examples of Zero Waste Grant Programs in island settings, but there are several helpful state grant programs. Colorado may provide one of the best examples of competitive programming as the annual funding is more in line with what is expected for Guam and the program's administration focuses more heavily on tracking project metrics to verify the value of the government's investment. Most of the examples provided below serve populations that far exceed those of Guam, although many award projects are ultimately undertaken by small local governments and innovative businesses. Regardless of size, the structure of these programs provides useful information to a future Guam Zero Waste Grant Program.

Colorado Recycling Resources Economic Opportunity Grant Program (2010 State Population 5 Million)

Colorado's Zero Waste Grant legislation (championed by the Colorado Association for Recycling) also included regulatory provisions for state-collection of recycling quantity data collection and new staff for the Colorado Department of Public Health and the Environment (CDPHE) to administer the grant as well as collect and report quantity data. As amended, this program will sunset in 2017. Program details include:

- Colorado has no recycling mandates - this is a competitive grant program for private, public and non-profit organizations.
- Annual awards approximately $1.3 million - since 2008, nearly $6.5M has been awarded to 81 applicants (56% were small governments, schools or non-profit organizations, 77% of grant monies have been used for infrastructure or equipment).
- Two funding sources:
  - Landfill tip fee surcharge of $.07/cubic yard ($1.5M was generated in 2011).
  - Waste tire fee of $0.25/new tire purchase ($1M was generated in 2011) - appropriation from this fund for the grant recycling program was halted in 2011.
- CDPHE administration includes 1 FTE program manager and 0.6 staff FTE for contracting and payments - augmented by a multi-sector advisory board that has a strong role in recommending annual award criteria, developing annual RFP language and selecting award recipients.
- Results during first 4 years - 104,000 tons diverted (2% of Colorado's MSW), 135 jobs created and net investment of $39/ton of waste diverted.
- 2013 legislation (also led by the state recycling association) - underway to increase landfill tip fee surcharge funding and extend the sunset date.
- Grant references - www.cdphe.state.co.us/oeis/p2_program/rreorfo.html (general program information) and www.state.co.us/gov_dir/leg_dir/olls/sl2007a/2007aSLHOU.htm (scroll to bill number 1288 for copy of state statute).

California Beverage Container Zero Waste Grant Program (2010 state population 37 million)

California implements multiple grant programs. This program was legislated and put in place in 1987. Administration is through the California Department of Resources Recycling and Recovery CalRecycle:

- California requires its local governments to develop solid waste plans and accomplish 50% diversion - this is a competitive program, however, for eligible public, private and non-profit organizations.
- Annual awards of $1.5M - approximately 700 awards made over 25 years (majority of grants support new facilities or equipment).
- Funding source - the state's container redemption program.
- Results such as diverted tons or job creation have not been tracked.
- Grant references - www.calrecycle.ca.gov/BevContainer/Grants/BevContainer/default.htm

California also had a Recycling Market Development and Expansion Grant program from 2002 through 2010 (also funded through the state's container redemption program). This program awarded 81 grants and $8M over eight years. At the time that enabling legislation sunset, the recycling of 6.2billion containers and creation of 600 new jobs was reported.

Florida Innovative Recycling/Waste Reduction Grant Program (2010 state population 19 million)

Florida operates several programs including this one legislated to make grant funds available to cities and counties for innovative programs. It is administered by the Florida Department of Environmental Protection:

- Despite an aggressive 75% diversion goal, Florida does not impose recycling mandates - this was a competitive grant program for eligible local governments.
- Program was eliminated in 2010 - awarded nearly $13M to 73 projects over 13 years with funding ranging from less than $100K to nearly $2M.
- Funding source - state waste tire fund ($1/every new tire purchased).
- Results such as diverted tons or job creation were not tracked.
- Grant references - www.dep.state.fl.us/waste/categories/recycling/pages/grants.htm

Florida also operated non-competitive small county and household hazardous waste grants, as well as provides a recycling local program for small businesses.

Pennsylvania Recycling Program Development and Implementation Grant Program (2010 state population 13 million)

This program is administered by the Pennsylvania Department of Environmental Protection and is dependent upon the state's legislature to allocate funds annually:

- Pennsylvania requires county solid waste plans, cities with populations greater than 5,000 to operate curbside recycling collection and comply with disposal bans (notably yard waste) - this is a competitive grant program, however, for local governments that provides up to 90% of program development and implementation costs for award recipients.
- Annual award - depend on legislative rulings but was $20M in 2010 to 112 local governments.
- Funding source is a $2/ton landfill tip fee surcharge on all MSW.
- Results are not tracked directly for grant projects - but as this grant program and those identified below support the overall diversion programs of most municipalities and counties across the state, state-wide metrics are considered representative of these programs (in 2009, Pennsylvania recycling rate was ___% and the industry supported 52,000 jobs with an annual payroll of $2B and generated $20B in gross receipts).
- Grant references - www.portal.state.pa.us/portal/server.pt/community/financial_assistance/14065/recycling_program_development_and_implementation_grants_/589534

Non-competitive funding programs operated by PADEP for local governments include county planning, recycling performance, recycling coordinator and household hazardous waste collection grants.

Hawaii Funding Programs (2010 State Population 1 Million)

The State of Hawaii (whose waste diversion rate was 35.1% in 2011) derives funding from three programs that is passed through to counties for waste diversion activities. Each of these funding sources is non-competitive, includes a contract for services, and is administered by the Hawaii Department of Health:

- HI-5 Hawaii Beverage Container Deposit Program - provides funding to counties that operate redemption centers ($0.05 container deposit has recycled 4.7B containers since 2005, payments to counties were $1.7M in 2011).
- Glass Advanced Disposal Fee Program - provides funding to all counties based on population ($0.15 deposit on glass containers not included in the HI-5 program, funding ranged from $40,000 in Kauai to $745,000 in Oahu in 2011).
- Electronic Device Recycling Fund - will eventually be used to provide county funding for electronics collection programs (revenues generated from annual manufacturer registrations were $0.3M in 2011).

Additional grant funding is also provided directly by the state to beverage container recyclers for containers, processing equipment and vehicles.

Wisconsin Recycling Consolidation Grant Program (2010 State Population 5 Million)

Like many described above, Wisconsin has implemented several grant programs over the last two decades. This program has been in place since 1990 and is administered by the Wisconsin Department of Natural Resources and has no sunset date:

- Wisconsin requires local governments to implement recycling programs and comply with material disposal bans - this is a non-competitive program for local governments and tribes.
- Annual awards have varied from $19M to $32M (covering 17% to 30% of government compliance costs).
- Two funding sources:
  - Surcharge on businesses - 3% of gross tax liability for most corporations, 0.2% of net business income for partnerships and S corporations (generated $21M in 2010).
  - Landfill tip fee surcharge - has ranged from $0.30/ton (2001) to $7/ton currently (generated $29M in 2010).
- Program promotion and outreach provided by the University of Wisconsin Extension Service, the Associated Recyclers of Wisconsin and the Wisconsin Council on Recycling.
- Results from this program are presented as diversion of paper, container and miscellaneous recyclables diverted (i.e., not all recyclables counted) state-wide - or 0.7M tons diverted in 2010 (this does not include all materials diverted - the 2010 in-state landfill tonnage was 8.3M).
- Grant references - http://dnr.wi.gov/Aid/Recycling.html and http://dnr.wi.gov/Aid/Consolidation.html

Wisconsin has also operated waste reduction, waste reduction and recycling demonstration, business waste reduction, and recycling assistance/recycling market development grant/award programs over the last two decades.

Other exemplary funding programs are the mini-grants and low interest offered by the StopWaste Business Partnership to companies and institutions in Alameda County, CA. These funds are dedicated to waste diversion activities and include:

- Mini-grants - these provide up to $5,000 to businesses for food waste collection program and/or employee educational materials.
- Low-interest loans - available in the range of $50,000 to $240,000 for reuse, recycling or composting (can be used to purchase equipment, program start-up or expansion, or operating expenses (past funding examples have included new balers, compactors, shredders, trucks and other equipment.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste alternative could be developed and managed. To implement a successful Zero Waste Plan, GovGuam must take advantage of the opportunities associated with an alternative and also take into consideration constraints or limitations that could make the alternative less than optimally effective.

Opportunities include:

- Establishes stable funding source for Zero Waste activities for the grant period and builds local capacity for long term program support and effective implementation.
- Yields dramatic and usually permanent diversion of municipal solid waste as grant dollars that start diversion in year one continue to yield diversion in later years, with no additional dollars. This is especially true if sustainability is a grant criterion.
- Builds Zero Waste infrastructure (reuse, recycling, and composting facilities and equipment).
- Creates jobs.
- Builds professional knowledge base in various aspects of Zero Waste in a region, such as marine debris, environmentally preferable purchasing, reuse, composting, recycling, etc.
- Extends landfill life.

Constraints Include:

- Creates government program management and oversight, even when there may not be a fiscal note.
- Grantor needs to understand recycling and composting market drivers in Guam to ensure grants are strategically given to build Zero Waste infrastructure.
- Long-term funding can be challenging to obtain. Multiple funding sources are preferred to reduce reliance on any one source.

3. IMPLEMENTATION OVERVIEW

Key Stakeholders

It is expected that Guam Environmental Protection Agency (GEPA) will be the lead agency for development and on-going implementation of a territorial grant program. Volunteer professionals (such as those from RAG, iRecycle, UOG and others) will be needed to champion this policy through the legislative process. It is also recommended that an advisory committee comprised of these same professional groups be developed for on-going programming to both reduce GEPA's future responsibilities and provide a broad range of inputs and perspectives to the future award process.

Key implementation steps, based on the recycler-based model described above and broken out by stakeholder responsibilities, are described below.

Major Components

Key components necessary to the development of a new grant program on Guam will include:

- Establish Advocacy Strategy for Enabling Legislation
- Champion(s) to coordinate and lead the advocacy efforts - can be an individual, organization or GovGuam itself (GEPA may not be able lobby actively) - champions may come from organizations like RAG, iRecycle, UOG, private recyclers and others.
- Coalition of supporters from all sectors to assist in formulating bill language, contacting legislators, testifying and generally promoting grant legislation - these are expected to include GEPA, the Recycling Association of Guam, Guam's Solid Waste Receiver, municipalities, villages, haulers, recycling/composting businesses and others.
- Knowledge of opponents' positions - such as parties adversely impacted by the targeted funding source.
- Legislative sponsors (ideally representing both political parties).
- Professional lobbying assistance (though an additional cost) can also be beneficial.

Determine Funding Strategy

Over the long-term, the use of a combination of internal (i.e., GovGuam) and external (i.e., federal and private foundation) funding sources to build a strong financial foundation for the Zero Waste Program will be necessary. One initial funding strategy that may be viable for the larger Zero Waste Program, which includes the Zero Waste Grant Program initiative includes a combination of a landfill tipping fee surcharge and a Gross Receipts Tax (GRT) Rate surcharge. Other strategies are also available (see the Creating a Sustainable Funding Strategy for a Zero Waste Future on Guam White Paper for further details).

Develop Bill Language

Once a grant funding mechanism is established, other legislative components should consider;

- Eligible organizations - ideally will include any private or public sector organization.
- Eligible projects can include a broad range (covering market research, feasibility studies, program/facility design, construction, equipment purchase, operations staff training, public education and more) or can be focused in key areas (such as yard waste processing, public/private partnership projects or similar) - the grant program focus can also vary from year to year.
- Grant cycle - may be one or more years and may vary with the project.
- Grant administration - by a combination of GovGuam and voluntary advisory committee.
- Reporting to provide legislators, GovGuam and stakeholders with outcomes (such as tons diverted, jobs created and greenhouse gas emissions reduced).

Complete Legislative Process

The Guam legislative process is spelled out in the Guam Legislature Standing Rules. A prime sponsor and potential co-sponsors will shepherd the bill through the legislature. Once introduced, the grant bill may well be assigned to the Committee on Appropriations, Taxation, Public Debt, Banking, Insurance, Retirement and Land due to its fiscal implications (the Committee on Rules, Federal, Foreign and Micronesian Affairs and Human and Natural Resources may also review due to GEPA's involvement). If successful after a public hearing and committee debate, the bill will be heard and debated by the Committee of the Whole. On-going stakeholder lobbying of committee members the full senate including effective and compelling testimony during public hearings will be key during this process.

Undertake Rule-Making

Once successful legislation has been passed, development of regulation will likely be developed by GEPA, although stakeholders should be actively involved throughout. Regulations will specify the process and requirements of the competitive grant process, and will identify the roles and responsibilities for administration.

Implement Program Administration

This is expected to include annually:

- Coordinate with stakeholders/advisory groups.
- Regular grant criteria review and adjustment.
- Development of a request for proposals.
- Review proposals and make award selections.
- Contract with recipients and make payments (or reimbursements).
- Monitor projects and review regular status reports.
- Develop annual project results summaries and present to stakeholders.

Education/Outreach/Public Awareness Needs

Outreach efforts targeted to stakeholders on the island in all sectors and including elected officials and bill sponsors will be needed to create an effective lobbying base around the proposed bill language. These parties, in turn, will promote the bill by educating and lobbying their legislators. The champion(s) will need to develop tools and a strategy for this sequential outreach including a bill fact sheet, stakeholder meetings, website postings, a phone/e-mail campaign for stakeholders to use in contacting legislators and legislative testimony (some of these components will be put into action multiple times). Key components will include:

- Stakeholder meetings - to educate stakeholders and encourage their promotion of bill;
- Lobby legislators;
- Key tool - compelling 1- to 2-page fact sheet (can be used when contacting legislators, testifying in public hearings, writing press releases, posting websites, etc.); and
- Outreach methods - stakeholder websites, press releases and speaking opportunities.

Major Milestones

Enact legislation to implement a Zero Waste grant program on Guam. It is expected that legislation will be required and will be pursued by GovGuam staff and volunteer island recycling organizations and citizens. As GovGuam staff will have limited ability to actively lobby a bill through the Guam Legislature, business and volunteers will likely need to champion this policy. Legislation is expected to take a minimum of 12 months to enact, possibly longer. Development needs will include:

- Building and education a coalition of supporters including securing a bill sponsor.
- Researching desired bill components, draft bill concept and fact sheet.
- Finding and preparing parties to testify in committee hearings.
- Organizing and conducting general lobbying.
- Developing a territorial regulation. The regulation should detail how the law will be implemented, monitored and reported. It is expected that these activities could be completed within 6 to 12 months of the enactment of grant legislation with existing staff resources.
- Implementation of a grant program as soon as regulations are finalized or on the effective date of statute if that date is later.
- Report results. Reporting of grant project results is strongly recommended at the end of each grant cycle to demonstration grant value and effectiveness.

Challenges

As a new grant program will largely hinge on obtaining a funding source(s) and enabling policy. Important considerations will include:

- Successful legislation may require multiple years to educate legislators and mobilize supporters willing to reach out to their representatives with a

compelling argument - for the purpose of this analysis we have assumed a lobbying effort covering a full 2-year legislative session (the 32nd Legislature will extend from January 2013 through December 2014).

- Legislators may not be willing to commit funding for the full 20-year period analyzed for all of the options in the Guam Zero Waste Plan - in some cases, the ability to compromise with a mid-point sunset date (that can be extended or even eliminated in future legislation) can improve initial success.
- Legislation to support a grant program can include other waste diversion-related components that may/may not be related to the grant program.
- A well-publicized Zero Waste Grant pilot project with only a single one- or two-year grant cycle can be an excellent way to "test the waters" and gauge interest in a long-term Zero Waste Grant Program - depending on available resources, a pilot approach may not require legislation.
- Increasing funding to allow more substantial grant funding supportive of programming and infrastructure in the future.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation. Additional details regarding the summary costs presented in this Section can be found in the Financial Model Technical Memorandum.

While it is hard to estimate the overlap, it is likely that a new Zero Waste grant program on Guam will provide funding and support for many of the other initiatives evaluated in this plan.

Landfill Diversion Potential

The size of the grant program implemented for Guam may vary over the 20-year planning period. For the purpose of this analysis, the following has been assumed:

- Legislation and rule-making will take at least two years to develop and become effective - diversion associated with a new grant program will not be measureable until 2015
- Targeted materials will include both MSW and non-MSW materials - up to 5% of the total MSW and non-MSW waste streams will be diverted initially and up to 10% later in the planning period when demand for grants increase and funding mechanisms improve (indirect, long-term diversion rates would be notably higher)

TABLE WP-M.1. LANDFILL DIVERSION POTENTIAL: ZERO WASTE GRANT PROGRAM[1]

YEAR	MSW DIVERSION		NON-MSW DIVERSION		TOTAL SOLID WASTE	
	Assumed Range of Diversion Potential		Assumed Range of Diversion Potential		Resulting Range of Diversion Potential	
	% by Weight	Tons	% by Weight	Tons	% by Weight	Tons
2015	0-5%	0-9,000	0-5%	0-5,000	0-4%	0-12,000
2020	0-5%	0,000-10,000	0-5%	0-6,000	0-5%	0,000-15,000
2025	5-10%	7,000-17,000	5-10%	5,000-10,000	4-11%	10,000-29,000
2030	5-10%	7,000-17,000	5-10%	5,000-10,000	4-11%	10,000-29,000

Notes:

1. Diversion ranges and tonnages estimated as detailed in the 2010 Baseline Measurement Data and 20-Year Waste Quantity Projections Technical Memorandum. Tonnage ranges represent low end of lowest percent diverted to high end of highest percent diverted. Quantities are rounded to the nearest 1,000 tons (i.e., value of "0" tons means less than 500 tons).

It is important to note that the benefits of a grant program will far exceed the direct diversion potential associated with the award project. Grant awards are often being applied to only part of a program (such as research, feasibility, equipment purchase, etc.). The real benefit of each grant is the overall program or infrastructure development that leads to increasing diversion, job creation and greenhouse gas reductions that will continue to occur year after year with no additional funding.

Job Creation Potential and Small Business Opportunities

To estimate the potential job creation associated with diverting recyclables and organics from Guam's total solid waste stream, the following assumptions have been made (see the Basis for Job Creation Potential Estimates Technical Memorandum):

- Processing of paper and containers may generate slightly more than one job for every 1,000 tons of managed
- Processing organics will likely generate less than one job for every 1,000 tons
- 60% of diverted MSW materials will be paper/containers - 40% will be organics

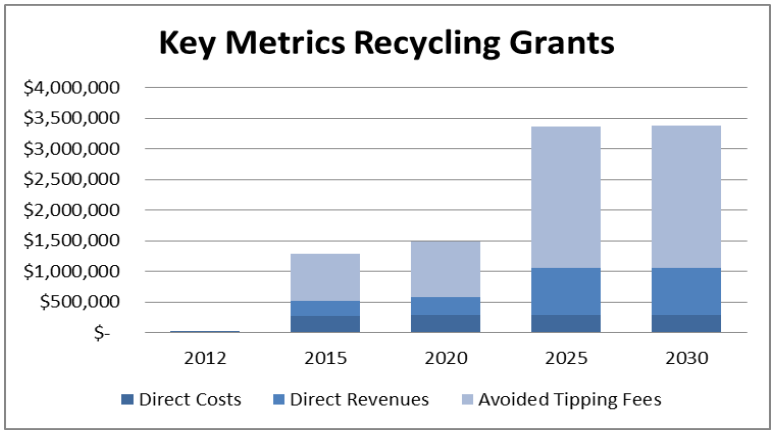
Based on these assumptions and the projections of diverted quantities in the previous table, it is possible that five or six new FTEs could be created in 2015 (up to 15 by 2030). It is noted that all of these jobs are expected to be local, Guam jobs for initial processing (jobs associated with secondary recyclables processing and manufacturing are likely to occur off-island and have not been estimated here but would increase the total job creation potential). Any staffing increases at GEPA would be in addition to these estimates.

Estimated Revenue Generation

Based on Table WP-M.1 diverted quantities, market pricing for traditional recyclables (Markets for Recovered Material Technical Memorandum) and an assumed $15 resale rate for non-MSW materials, the grant program revenue potential could range from $255,000 in 2015 to $770,000 in 2030.

Avoided Landfill Disposal Costs

Based on Table WP-M.1 diverted quantities, an MSW tip fees of $175 per ton at GSWA's commercial transfer station and a non-MSW tip fee of $35 per ton an hardfills, the landfill savings is estimated to range from $770,000 in avoided landfill costs in 2015 to more than $2.3 million by 2030. It is important to recognize that this diversion estimate is a combination of many of the materials diverted from the waste stream as part of other Zero Waste initiatives evaluated in this Plan, and therefore these estimates could be considered as “double counting”.



Human Health and Environmental Impacts

An effective waste diversion grant program will help to fund and incentivize recycling programs that will in turn:

- Yield dramatic and usually permanent diversion of MSW.
- Extend landfill life and thus protect habitat that may otherwise be appropriated for a new or expanded landfill.
- Conserve resources, and with the reduced need to extract and consume virgin resources, will also reduce greenhouse gas emissions, water and air pollution.

Economic Costs

Significant cost assumptions for a new Zero Waste grant program include:

- 0.25 FTEs in GEPA beginning in 2015, increasing to 0.5 FTEs in 2020, and remaining at that level through 2030;
- GovGuam overhead costs for Department of Administration is included at 7% of departmental costs, and departmental overhead is included at 18% of salaries; and
- An annual pool of grant funds recommended to be in the range of $250,000 and equivalent to about ten $25,000 grants each year. It should be noted that this could be adjusted to equate to one $250,000 grant or something in between.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Stop Waste Business Partnership (Alameda, CA) - www.stopwaste.org/home/index.asp?page=96

Grant Resources

Colorado

- www.cdphe.state.co.us/oeis/p2_program/rreorfo.html (general program information)
- www.state.co.us/gov_dir/leg_dir/olls/sl2007a/2007aSLHOU.htm (scroll to bill number 1288 for copy of state statute)

Florida

- Grant references - www.dep.state.fl.us/waste/categories/recycling/pages/grants.htm

California

- Grant references - www.calrecycle.ca.gov/BevContainer/Grants/BevContainer/default.htm

Pennsylvania

- www.portal.state.pa.us/portal/server.pt/community/financial_assistance/14065/recycling_program_development_and_implementation_grants_/589534

Wisconsin

- Grant references - http://dnr.wi.gov/Aid/Recycling.html and http://dnr.wi.gov/Aid/Consolidation.html

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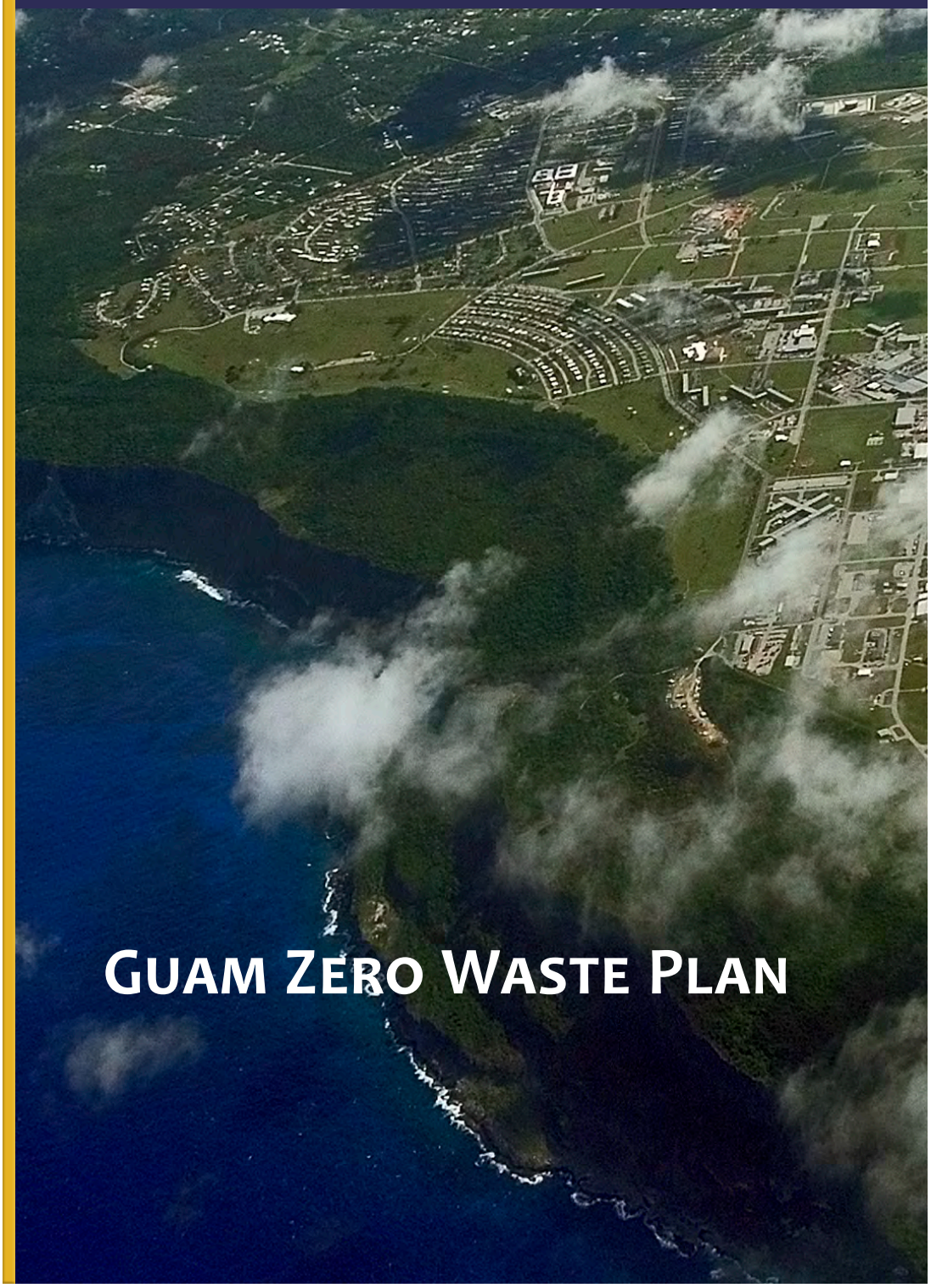
White Paper N



Guam Zero Waste Plan

WP N

Please see the next page.

WHITE PAPER N

PUBLIC EDUCATION AND OUTREACH

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment.

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper.

ZERO WASTE INITIATIVES

- ***Public Education and Outreach***
- Illegal Dumping and Litter Control
- Evaluation of Funding Sources
- Green Purchasing Program
- Extended Producer Responsibility
- Zero Waste Association
- Recycling Grant Program
- Pay-As-You-Throw Pricing Policy
- Plastic Bag Disposal Ban
- "3R" Requirements for Public Buildings
- Used Building Materials Facility
- Greening Roadway Paving Systems
- Construction and Demolition Diversion Policy
- Organics Recovery Composting System
- Construction and Demolition Debris Processing Facility

Purpose

This white paper, which is one in a series of fifteen, presents a summary of one initiative of that can be implemented to help GovGuam achieve the goal of Zero Waste. This initiative is to develop an island-wide education and outreach program to explain, promote, and incentivize participation in Guam's future Zero Waste programming.

Organization

This white paper is organized into the following primary sections:

- Section 1 presents the purpose of this paper, provides a roadmap of the document, and includes a snapshot of key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presents an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 presents a list of resources and references that can be consulted for additional information.
- Tables and figures, which assist in the interpretation of the narrative information, are provided throughout the white paper.

Key Findings

This section presents the key findings in the document.

Most of the Zero Waste initiatives identified in the Zero Waste Plan have a public education and outreach component. Many different marketing and communication strategies can be implemented to get the word out. There are numerous volunteer and business programs currently in place to promote recycling and Zero Waste awareness on the island of Guam. Non-profit organizations and volunteers have accomplished much of the public education and outreach efforts on Guam to date. To reach higher levels of diversion and the goals of Zero

Waste, a formal public education program needs to be established, which requires staff, budget, supplies, outside expertise, and political and institutional support.

Establishing an education program will need permanency of funding and staffing. Fortunately for the effort, it has an existing network of education and outreach providers to draw from including the RAG, iRecycle, GEPA and its public relations program, ECC, the USEPA Region 9, the local recycling community and GSWA as well as committed academic resources from the UOG faculty and students and its Center for Island Sustainability.

The program must be developed after careful consideration of the unique characteristics specific to Guam, including distinct language and cultural considerations, large military presence, large influx of people moving to Guam, tourism and hospitality industries, local media, and existing businesses.

Immediate actions to be implemented include:

- Form a Public Education and Outreach Advisory Committee consisting of members of stakeholder groups
- Hire part-time staff dedicated the Outreach program
- Conduct community relations surveys
- Develop a strategy
- Develop program logo, brand and graphics
- Develop program identity and branding
- Continue and build upon current education and outreach efforts
- Develop information for Guam newcomers
- Develop information systems to support tourists' understanding of the Zero Waste program
- Launch a website and social media campaign to link with supporters.
- Evaluate effective means for promoting the Guam Zero Waste Plan to the public and using it as an educational stepping stone.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of the Public Education and Outreach initiative, including background information, examples of similar initiatives that have successfully been implemented, opportunities and constraints associated with the initiative, and a summary of what exists on Guam today with respect to the initiative.

What is an Education and Outreach Campaign?

Zero waste education has its roots in the mid to late 1970s through the 1980s, and the motto "reduce, reuse, recycle" is now a recognizable branding tagline for Zero Waste programs. In an era of growing concern for the environment, recycling, composting and waste reduction are recognized as being socially responsible. Early recycling and waste reduction programs were often grass-root efforts that spread by word of mouth, and eventually were expanded to state and federal agencies. Professionals in advertising, marketing and academics have expanded this body of knowledge and increased the effectiveness of program promotions, outreach, and education.

Summary of Universal "Reduce, Reuse, Recycle" Public Education and Outreach Efforts

The foundation of Zero Waste public outreach and education are the programs developed in the preceding 40 years for "Reduce, Reuse, and Recycle." Appendix 1 is a summary of "reduce, reuse, recycling" approaches under headings like program identity, reinforcing policy support, written information for printed and electronic distribution, and face-to-face contacts. It also lists programs for paid and free media coverage and for signage, badges, and giveaways. These can immediately be used as resources for preparing a future outreach plan or for offering ideas before a formal planned program is launched. Some of the table entries note the appropriateness to Guam's Zero Waste efforts, and the table includes comments to describe the degree of effort required to implement, and anticipated costs. Not all of these programs will apply immediately to Guam; however, this is a resource that may be useful as Zero Waste on Guam matures.

Advertising and Marketing

Different types of marketing have been used to promote Zero Waste and recycling programs. These are briefly described below.

- Cause Marketing. Cause marketing focuses on a clear objective and message targeted to people to whom the behavior change is intended. Cause campaigns provide issue recognition that may persuade behavioral changes, and reinforce views of people who already support the cause. Examples of "Cause Marketing" include such recognizable campaigns as Smokey the Bear "Only You Can Prevent Forest Fires", and numerous anti-street drug campaigns like the frying egg representing "this is your brain on drugs" (Earle, 2000).

- Social Marketing. Social marketing combines Cause Marketing with academic research, and focuses on behaviors that will improve health, prevent injuries, protect the environment, and contribute to communities (Lee & Kotler, 2011). Social Marketing shares an emphasis on market research and a focus on product, price, place, and promotion from Cause Marketing; it also includes a situation analysis that addresses the strengths and weaknesses of the organization, the planning environment, and previous research and trials. The target audience includes research to determine what barriers and benefits affect changing behaviors and willingness to change. It includes multiple communication strategies and has a strong monitoring and evaluation component (Lee and Kotler, 2011). For example, Social Marketing is demonstrated in the updated Smokey the Bear campaign to show a more relatable bear for today's society (picture shown at right). The updated campaign included a website, interactive maps, etc. to appeal to a broader audience.

- Community-Based Social Marketing (CBSM) is an approach rooted in social science that attempts to achieve sustainable behavior in communities. It involves more than just education; it encourages a community to implement an action for the community. Strategies include public commitments (pledges), prompts (a reminder provided where the action takes place, like a sticker on a recycling can), visible norms and social diffusion (doing what one's friends and colleagues do), price incentives and disincentives (as an example, the pay-as-you-throw price system), and convenience of place (McKenzie-Mohr, Lee, Schultz, & Kotler 2012).

Existing Programs on Guam

Guam's 17.85% recycling rate for the 2011 calendar year is an indicator of the growing commitment in the community toward recycling and the effective efforts undertaken by local organizations and community groups. Key public education and outreach programming that is already in place for waste management is summarized below.

Guam Recycling Workgroup

Starting in 2011, GEPA and U.S. EPA Region 9 began convening stakeholders working to measure and increase recycling rates in Guam together form monthly meetings and calls. The group includes members from all of the groups listed below, GovGuam Office and Senate staff, island recyclers, Department of Defense environmental staff and contractors working on Zero Waste initiatives in Guam. This group worked together with island recyclers to establish and publicize Guam's recycling rate for the first time in 2012 and encourage the celebration of America Recycles Day.

America Recycles Day

America Recycles Day is an annual event to encourage local activities, pledges, and publicity to advance recycling and recycled product purchasing. In 2012, Guam held a successful celebration of America Recycles Day at elementary schools and the University of Guam organized by political leaders in Guam, GEPA, and UoG with broad press coverage and a large following through Facebook and Twitter that focused on the announcement of Guam's recycling rate. Guam has a unique advantage in receiving media coverage because it is the first US state or territory to celebrate (Hood, 2013 and Taft, 2013).

GEPA

GEPA actively posts waste reduction messages on its website, sponsors a highly effective Facebook page, uses Twitter, and regularly issues "calls to action". GEPA also staffs the Guam Environmental Education Committee and the Guam Recycling Workgroup (in partnership with U.S. EPA Region 9 - Taft, 2013).

iRecycle

This school recycling program financially benefits Guam's schools and is sponsored by Guam Business Partners for Recycling, Inc., a non-profit group. The program sponsors 8-cy recycling dumpsters at schools, and the schools receive revenues from the sale of aluminum cans. This year it plans to expand to collect telephone books through a program with Mr. Rubbishman for potential revenue of $10,000. In addition, the program:

- Makes school presentations and is developing a service-learning program at the high school for graduating seniors that will high Zero Waste (may also be extended to lower grades)
- Provides recycling at special events and has diversion guidelines for event sponsors
- Works with the Guam Public schools, private schools, two Navy schools and two Department of Defense Education Activity schools (Denney, 2013)

iRecycle also organizes Zero Waste events in the community (sports, concerts, cultural events, etc.), diverting materials for recycling and food waste to be used as pig feed, and providing outreach to event vendors and attendees.

Guam Environmental Education Committee (EEC)

Staffed by GEPA, EEC includes government, nonprofit and educational organizations interested in promoting environmental education. It provides information, speakers and outreach materials dedicated to environmental stewardship for thriving and resilient terrestrial and marine ecosystems. Its strategic plan addresses a commitment to waste reduction and its membership overlaps with iRecycle and RAG. The EEC has a mascot fish, Kika Clearwater, and it is actively involved in Earth Day activities (Taft, 2013).

Recycling Association of Guam (RAG)

This voluntary organization is committed to reduce, reuse, recycle and compost. It is comprised of members committed to this purpose, some of whom have extensive experience and technical knowledge in the field of waste diversion management. RAG sponsors the Environmental Heroes award program and hosts booths at events and other promotions. The RAG website is a valuable resource for tips, recycling directory, fact sheets, guides, clip art, and useful links.

University of Guam Center for Island Sustainability

The Center for Island Sustainability concentrates on outreach across the curricula for sustainability:

- Reaches approximately 85% of the UOG's students with its recycling and food waste outreach programs presentations each semester.
- Offers a food waste diversion program at the student center, and the program visits K-12 classrooms throughout the school year with presentations and hands-on bin-sorting demonstrations.
- Sponsors the Green Army - a student service group that provides outreach including recycling and food waste recovery at Liberation Day events, the Micronesian Fair (through a partnership with the Guam Visitors' Bureau), Japan Fair and 5-K running events (Tyler, 2013).

Guam Solid Waste Authority (GSWA, Receiver)

As the current operator of the Layon Landfill, residential transfer stations and solid waste collection programs, GSWA offers public education related to its services. Public education was been a component of GSWA's rollout of the island-wide curbside trash and pilot curbside recycling collection programs. The later included developing educational stickers for recycling carts, and holding meetings with the neighborhoods, communities, Village Mayors and Council of Mayors. It also enlisted the University of Guam's Green Army to attend neighborhood meetings and to go door-to-door to inform participants about the proper use of the carts. GSWA also provides tours of the landfill and has required contractors associated with developing the new household hazardous waste facility to also conduct public outreach (GBB Quarterly Reports - see Section 5 for more information).

Mission Zero Bags Campaign

Pay-Less Supermarkets implemented the Mission Zero Bags program in early 2012. Pay-Less is the largest supermarket chain in Guam and Pay-Less estimates that it contributes 28% of the plastic bags used in Guam. Every Wednesday, the stores do not provide plastic check-out bags. Customers can either purchase paper bags at 5 cents each or use their own bags for a 5-cent/bag refund. All revenues earned from the paper bag sales support a grant program (grantees include public and non-profit organizations with green programs). Pay-Less has done significant outreach on Mission Zero Bags in Guam through television, radio, billboards, store events and signage, and social media.

Pay-Less held a celebration to report that they achieved the 1.1 million bag reduction goal in September, three months prior to the deadline Payless also established a new goal of eliminating 5 million plastic bags. Pay-Less data indicates that the grocer's sales events on Wednesdays and outreach efforts have successfully encouraged public participation and support (see Section 5 for links to this data).

Guam Statutes

Lastly, Guam's territorial statutes (Title 10) require GEPA to work with the Mayors Council on public outreach on solid waste issues including a recycling hotline and media advertising, surveys, seminars, workshops and other campaigns to promote waste diversion awareness.

Additional Successful Approaches Used Worldwide

Zero Waste Plans commonly call for public outreach/education that augment programs already in place. Usually for reduce, reuse, recycle programs, a detailed education/outreach plan or strategy is typically developed by staff or a contracted consultant and is periodically updated. Because cultural resources and communication considerations are specific to the area, preparation ideally involves an oversight committee to ensure that the community can support the plan goals, funding, and activities, and that knowledgeable local people have confidence the resources are directed appropriately.

Detail for public outreach/education recommendations varies, depending upon if it is building upon an infrastructure or establishing many new programs. Particularly useful examples are described below.

Hawai'i

The Zero Waste Plan for the County of Hawai'i (March 2009) summarized numerous events, collections, school lesson plans for K-college, and advertising programs that were already in place under the auspice of Recycle Hawai'i. Plan recommendations associated with Zero Waste efforts included:

- Developing a community-wide social marketing plan, hiring a recycling and public awareness coordinator, and funding public education at a level of $4.00 per capita per year (170,000 residents) - the initial budget was $880,000/year for these programs

- Recommendations for the subsequent five years included a recycle art campaign, outreach for extended producer responsibility, internships, library programs, outreach to outlying areas and transfer stations, essay contests, helping grocery stores feature products with 100% recyclable packaging, a communitywide social marketing campaign and intensified in-school program.

New Zealand

New Zealand's Getting There! The Road to Zero Waste Strategies for Sustainable Communities (August 2003) built upon a Zero Waste plan from the preceding decade and deferred the outreach and education approaches to local governments with guidelines and program objectives. Specific recommendations included:

- Communicated a vision for "doing things differently" with a whole system approach to changing the way resources and wastes are managed
- Called for consistent messaging with local creativity, low-cost local outreach that linked to nationally-run campaigns, community research, adopting a message that is "more pro than anti", educating the media, reporting regularly so everyone knows how well they are doing and involving local recyclers, educators and community groups
- Recommendations for Zero Waste input from businesses and promoting consumer buying power and behavior - such as buying local, buying second-hand, careful choice of products (i.e., less packaging, quality, durable products and repairing products) and reducing junk mail
- Encouraged local communities to name their outreach efforts individually and budget for their own activities - one community demonstrating considerable creativity by issuing its report of Zero Waste accomplishments as a board game

City of Austin, Texas

Austin's Resource Recovery Master Plan (December 2011) recommended preparing a "comprehensive communications plan that is research-based to ensure effective targeting of audiences and development of key messages, as well as to measure success over time":

- Directed that key messages (who, what, where, when, how and whys) be strategically crafted for each plan objective and audience - with emphasis on addressing issues before they occurred
- Communication strategies called for direct mail, email, media, advertising (newspaper, TV, radio, online), public service announcements, videos, newsletters, brochures, fact sheets, utility bill inserts, website, social media, message boards, face-to-face meetings, group presentations, classes and workshops, outreach to school children, special event booths, memos and letters, and annual reports
- Implementation specified two full time equivalents (FTEs) and a budget of $3,466,000 for the first year.

3. IMPLEMENTATION OVERVIEW

A commitment is essential to public outreach and education for the Zero Waste planning effort to move forward. Non-profit organizations and volunteers have accomplished much of the public education and outreach efforts on Guam to date. To reach higher levels of diversion and the goals of Zero Waste, a formal public education program needs to be established, which requires staff, budget, supplies, outside expertise, and political and institutional support. Education/outreach programs offer good value: they can be, but do not have to be expensive, but they are essential.

Guam differs from other communities initiating Zero Waste planning in that other communities now reaching for Zero Waste already have infrastructure, like departments, staffs, budgets, programs, and facilities in place that have achieved a certain measure of success in diversion. It is to Guam's credit that it has achieved a rate in the range of 17.85% without this infrastructure.

Establishing an education program will need permanency of funding and staffing. Fortunately for the effort, it has an existing network of education and outreach providers to draw from including the RAG, iRecycle, GEPA and its public relations program, ECC, the USEPA Region 9, the local recycling community and GSWA as well as committed academic resources from the UOG faculty and students and its Center for Island Sustainability.

Zero Waste Plan Recommendations Calling for Public Education and Outreach

The Guam Zero Waste Plan has identified and analyzed numerous Zero Waste initiatives that will benefit significantly from a focused, well-implemented education and outreach strategy. Specific components are called out in the following table.

SUMMARY ZERO WASTE PLAN NEEDS FOR PUBLIC ECUATION AND OUTREACH

INITIATIVE	PUBLIC OUTREACH AND EDUCATIN ACTIONS
Compost	Evaluate public outreach needs
	Proactively address opposition
New Zero Waste Association	Identify communication necessary for basic members' services. Brand Zero Waste island-wide
Plastic Bag Ban	Share successful program information from other communities (speakers, webinars, etc.). Report progress in tracked metrics on progress to legislators, businesses, and public. Evaluate public and stakeholder outreach needs
Pay As you Throw (PAYT)	Share successful program information from other communities (speakers, webinars, etc.). Explain benefits and policy objectives in advance of rollout to customers by targeting village mayors, community groups, individual homeowners, and representatives of multi-family units.
	Immediately prior to cart delivery, directly ask customers for choice of cart size (GSWA).
	Provide customer service during and after rollout for questions and need for service changes (GSWA).
	Extend additional customer service for one year.
Illegal Dumping & Litter Control	Organize community clean ups and community-oriented policing.
	Teach prevention measures to public.
	Provide clear point of contact to report illegal dumping and request assistance.
	Sustain efforts
	Provide clear simple messages
	Publicize successes
	Go beyond enforcement
Greening Roadway Pavement	Convene stakeholders affected by initiative, invite ideas, and discuss. Share successful program information from other communities (speakers, webinars, etc.). Evaluate public and stakeholder outreach needs
Used Building Materials Facility	Share successful program information from other communities (speakers, webinars, etc.). Develop a sales and outreach plan. Provide donors with an acknowledgement. Require a proof of identification and ownership before accepting.
Extended Producer Responsibility and Environmentally Preferable Purchasing	Share successful program information from other communities (speakers, webinars, etc.). Provide staff training that targets IT and purchasing departments. Actively debunk myths and incorrect information. Assign responsibility for education and training across retailers, first importers, and others.
	Track and share results regarding product quality and environmental benefits.

Key Public Education Considerations Unique to Guam

The following section describes the unique conditions on Guam that drive the selection of the priority public outreach and education efforts or effect how education may be directed.

- Current Support - The support and enthusiasm for America Recycles Day, volunteer efforts of RAG, iRecycle business cooperation, efforts of UOG and the Center for Sustainability, the Mission Zero Bag programs, and the support of the Governor and key senators indicate the timing may be right for a more aggressive Zero Waste effort. There is considerable support upon which to build and extend public education/outreach.
- Distinct Language, Cultural and Economic Differences Exist Amongst the Population - To successfully reach all the people will take a more sensitively and carefully executed program than required for other communities and input from local experts. Working to advance Zero Waste activities and messaging at cultural events and sites can increase outreach to both the community and tourists (e.g., Chamorro Village, parks, etc.).
- Strong and Growing Military Presence - The military and civilian presences rely on different information pathways and will likely require new or expanded relationships to serve both. The populations served may also offer very different and individual responses to surveys, focus groups, incentives, and analyses of barriers and motivations.
- Large Influxes of People Moving to Guam - A transitory population presents unique challenges to public information and outreach. With large numbers of people moving on and off the island, an "information threshold" may not be reached where the public is familiar with the program messages and has a context for further, more complex messaging (as is the case with more stable populations). Along with this challenge is an opportunity, however. People relocating and moving to a new home are more open to new information, and including Zero Waste outreach and educational materials in a “welcome to the community” basket or information packet are well received.
- Tourists – Guam is a major tourist destination. Working to include clear Zero Waste information and collection containers at airports, hotels, beaches, and tourist attractions can advance both Guam’s Zero Waste outreach and support expanded green tourism.
- Local Media - This media uses local programming (rather than streaming) and willingly participates in public conversations on local issues and publicizes local events (these outlets committed to serving the community are rapidly vanishing in other parts of the world). Excellent opportunities for contacting people exist through the Pacific News Center, Pacific Daily News, Marianas Business Journal, Marianas Variety and the many KUAM News outlets, including KUAM Chat, TV 8 and TV 11. In addition, Peggy Denny of iRecycle hosts the weekly "Where We Live" environmental radio talk show on K57 AM.
- Role of Mayors, Mayors’ Association and Village Organization - These individuals and organizations serve and important role in supporting programs and sharing information. The enthusiastic support from the Mayors and Mayors’ Association has been called out as highly important by numerous parties, and their future support could assist with presentations and information repositories.
- Small Group of Commercial Recyclers - These companies may be possible partners in future education and outreach efforts. The recyclers could potentially distribute recycling directories and offer promotional events.
- GEPA's Public Information System - This system has a social media presence whose call-to-actions informs, unite and encourage voluntarism of a large number of young adults with a high environmental awareness and commitment.

- GSWA's Expanded Services - GSWA's new and expanded services and facilities introduce change. As new programs roll out and facilities open, this is a promotional opportunity for Zero Waste and an opportunity to apply coordinated message strategies.
- Large Tourism and Hospitality Industries - These industries may have corporate resources to support Zero Waste. Hotel chains and the hospitality industry have already developed materials to reduce water use, recycle and use fewer disposables for other areas in the world. These are ready resources for initiating Zero Waste programs in Guam's large industry.

Key Stakeholders

It is expected that GEPA will provide general leadership to guide future education and outreach efforts associated with achieving Zero Waste goals on Guam. However representative stakeholders should be involved - including non-profit, private, individual, school and local government organizations as well as different populations that will be affected by proposed new programs. It is recommended that a new Public Education and Outreach Advisory Committee be formed as a first step. This committee should include representatives from all stakeholder groups and be charged with overseeing education and outreach efforts. It is possible that the new or expanded Zero Waste Association (referred to for purposed of the Guam Zero Waste Plan as the Zero Waste Association of Guam or ZWAG) may be a natural environment for stakeholders to review and comment on public education and outreach materials and messages.

Major Components

A "do more with less" approach is recommended for implementing the public education/outreach program. The proposed program is greatly scaled back from the efforts proposed for the County of Hawai'i and the City of Austin, which called for expenditures in the millions of dollars over three years. Guam's proposed implementation efforts build upon those already in place.

Actions Immediate Term (Year One to Year Two)

1. Organize Public Education and Outreach Advisory Committee - In addition to identifying members, the goals, focus and general schedule of committee activities should be identified.
2. Hire Part-Time Staff - This person should be skilled in education, advertising and contracting services, and who can readily prepare education materials, make presentations and conduct trainings, understand quantitative recordkeeping and reporting requirements and personal qualities that constructively build relationships. This is expected to initially require 0.5 full time equivalent (FTE). Assuming that GEPA's part-time staffer is not highly trained in Zero Waste and associated education/outreach, it is expected that out-sourced services may be needed to develop an effective strategy (and may require procuring a consultant from off-island). A consultant could be obtained through competitive selection that emphasizes knowledge of Guam. It is expected that contractor procurement and initial strategy development will begin in year one, but may potentially take more than the first 12 months to develop and roll out.
3. Begin Developing an Island-Wide Zero Waste Education/Outreach Strategy - The strategy should address all aspects of Zero Waste education/outreach. It should target the key Zero Waste components analyzed in the

Guam Zero Waste Plan. It should consider the key public education considerations for Guam (addressed above) and evaluate the effectiveness of the various tools identified in Appendix 1.

4. Develop Program Logo, Brand and Graphics - It is also likely that GEPA staff will not have the specialized expertise needed for this work, and out-sourced graphic artist/web designer services will be needed to help develop creative program materials. This could also be an opportunity to develop a school competition to develop slogans and logos.
5. Develop Program Identity/Branding - These components should address:
   - Overall goal of the Zero Waste program
   - Visual identity through a logo, colors and possibly mascot
   - Centralized point of contact (hotline number and/or website)
   - Current key message points and call-to-actions
   - Centralized reporting for key performance statistics
   - Barriers and opportunities to audience communication (e.g., language and cultural differences)
6. Conduct Survey - Survey should target a statistically valid sample that represents various ages, incomes, cultural backgrounds, education, and locations on the island to determine how they inform themselves through media, and how they prefer to receive information and for baseline data like whether they recycle and are aware of Zero Waste efforts.
7. Continue Current Education and Outreach Efforts - These include:
   - Recycling directory - both printed and electronic with quarterly updates and assess whether it should be published in the phone book as it was in the past
   - Special events with national support materials (especially America Recycles Day, Earth Day, and school and University competitions like Food Waste challenges and RecycleMania)
   - Special event booths and recycling efforts (especially at Liberation Day and Carnival events, Micronesian Fair, and Japan Fair)
   - Coordination with non-profit, service provider, government, university and business events
   - Education outreach to school children and UOG
8. Develop Information for Guam Newcomers - This should balance the contradiction of printing program materials against the ability to reach newcomers who do not utilize the internet:
   - Information on Guam's Zero Waste goals, the recycling directory and any other information
   - Distribution with existing newcomer welcome programs (such as the Guam Chamber of Commerce, military bases, realtors, rental property managers and utility providers)
   - Newcomer Zero Waste pledges - reward pledges with small gift and website acknowledgement Newcomer connections to social media call-to-actions so they can volunteer at events/cleanups and become connected with community
9. Develop Information and Systems to Support Tourists – Meet with Hotel/Hospitality Industries - Work with these industries to develop Zero Waste hospitality programs, such as those their hotel chains may be using

in other areas. Again, printed materials should be avoided, but appropriate outreach at the airport, with tourist agencies, hotels, and at tourist destinations should be provided both to support Zero Waste activities and develop Guam's attraction as a Green tourism destination.

10. Launch Website and Social Media Campaign to Link With Supporters. Use both new Zero Waste outreach efforts and existing partner sites and social media to support the effort.

Actions Following Year Two

Depending on progress during the first year, the Public Education and Outreach Strategy may need to be implemented in the second year. The strategy itself will dictate specific and subsequent actions. It is expected that the strategy will specifically address and support the Guam Zero Waste Plan programming, policy and infrastructure ultimately implemented by GEPA, GSWA, the Guam Legislature and other stakeholders.

Major Milestones

First Six Months of 2014

- Hire new part-time (0.5 FTE) educator/program manager
- Organize Public Education and Outreach Advisory Committee
- Contract with graphic/web designer
- Initiate branding/identity measures
- Procure contractor for development of Public Education and Outreach Strategy
- Meet with hotel/hospitality industry representatives to initiate a voluntary Zero Waste program

Second Six Months of 2014

- Conduct community survey
- Launch website
- Update, print, post and link recycling directory
- Continue and support successful outreach activities *(America Recycles Day, Earth Day, Liberation Carnival and Parade, Micronesia Fair, and Japan Fair)
- Brief policy makers quarterly to inform them of activities so they have up-to-date information when in contact with constituents and the press (on-going)

2015

- Establish distribution system for newcomers' Zero Waste outreach materials

Challenges

- This Zero Waste public education/outreach program is starting from scratch, unlike other Zero Waste programs and is without permanent programs, staff, branding, or budgets.
- New education programs should not discourage the voluntary and community participants who have contributed so much in the past, or reduce their future involvement.
- There are multiple populations with language and cultural differences to be addressed, and this will require care in messaging and in many cases separate approaches.
- The military populations rely on different media sources for information, use separate community facilities, and operate separate school systems - and because of temporary duty assignments, educators will constantly have to ensure that messages are repeated.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation.

Landfill Diversion Potential

It is not expected that public education and outreach will directly lead to diversion of waste generated on Guam. However, these programs will be critical to raising awareness, participation and support for achieving Guam's overall Zero Waste goals and will indirectly lead to diversion of waste generated on Guam.

Job Creation Potential and Small Business Opportunities

There is not expected to be measurable job creation associated with new/expanded public outreach and education efforts beyond internal job allocation within the implementing agencies.

Estimated Revenue Generation

No direct revenue generation is expected as a result of the Zero Waste Public Education and Outreach initiative. Some funding may be acquired through grant opportunities.

Avoided Disposal Costs

No direct avoided landfill disposal costs are expected as a result of this initiative.

Human Health and Environmental Impacts

An effective education and outreach program will help to raise awareness and encourage participation in waste diversion programs that will in turn:

- Yield dramatic and usually permanent diversion of MSW.
- Extend landfill life and thus protect habitat that may otherwise be appropriated for a new or expanded landfill.
- Conserve resources, and with the reduced need to extract and consume virgin resources, will also reduce greenhouse gas emissions, water and air pollution.

Economic Costs

Significant cost assumptions for the Zero Waste Public Education and Outreach initiative include:

- 0.5 FTEs beginning in the base year, and continuing at that level thereafter through 2030;
- GovGuam overhead costs for the Department of Administration are included at 7% of departmental costs, and departmental overhead is included at 18% of salaries.
- Funding for graphic design, website development, strategy development and public relations/ educational materials of $35,000 in the base year, and $9,000 annually thereafter.

Total costs for this initiative are expected to be just over $72,000 in the base year, which includes $35,000 for initial strategy development, graphic design, supplies, website and other startup costs. Costs are expected to decrease to more than $46,000 annually in 2015, and remain stable for the remainder of the forecast period.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

- Anderson Taft, Tammy Jo, GEPA Public Relations, personal communication February 21, 2013
- Community-Based Solid Marketing website - www.CBSM.com
- Denney, Peggy, iRecycle Executive Director, personal communication February 21, 2013
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- Guam Environmental Education Committee - http://sites.google/site/guardiansofthereef
- Guam Solid Waste Receivership Information Center - www.guamsolidwastereceiver.org/documents.html#receiver
- Hood, Timonie, USEPA Region 9, personal communication February 15, 2013
- iRecycle - www.irecycleguam.org/
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- Lee, Nancy R., and Kotler, Philip, "Social Marketing: Influencing Behaviors for Good", Fourth Edition, SAGE Publications, Inc., 2011
- Mazur-Sommen, Susan, "Beyond Energy Efficiency: Behavior Tactics for the Pollution Prevention Community," American Council for an Energy-Efficient Economy, Pollution Prevention Resource Exchange, webinar presentation, January 17, 2013
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- McKenzie-Mohr, Doug, Lee, Nancy R., Schultz, P. Wesley, and Kotler, Philip, *"Social Marketing to Protect the Environment: What Works",* SAGE Publications, Inc., 2012
- Pay-Less Supermarkets (Mission Zero Waste Program) - www.paylessmarkets.com
- Public Education and Community Outreach, "Building Support for your Program," Appendix 2, Solid Waste Management & Planning for Rural Communities in Alaska: Community Resource Guide & Planning Workbook - www.anth.org/cs/sustops/rasc/upload/Appendix%202.pdf
- Recycle Association of Guam - www.guam.net/pub/rag/
- Tyler, Elvie, UOG Center for Island Sustainability Program Director, personal communication February 24, 2013
- USEPA, "Decision-Makers Guide to Solid Waste Management," Volumes 1 & 2, 1995

APPENDIX 1

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Program Identity: Create recognizable and consistent visual and verbal messages			
Identify overall goal	Clearly state the intent of the outreach/educational efforts	Work with knowledgeable community program supporters and sponsors with sensitivity to local cultures.	Low
Identify target audience(s)	Surveys provide an agreed to understanding of who needs to receive information and any barriers to receiving it such as language differences, cultural differences, lack of services such as internet or mail, and preferred communication outlets.	Best initially done with a broad-based group familiar with the issues and community and updated with new information.	High
Create a visual identity	Design an easily recognizable logo, color scheme, possibly mascot, and other visual cues such as fonts, other artwork that tie messages with overall efforts	Involve professional designers collaborating with local zero-waste professionals with review for cultural acceptability.	Med.
Key message points	Develop key agreed upon message points for specific programs and efforts that are shared with all involved with developing materials and interacting with press and public. Update by need and at least quarterly. “Call to Action” messages for social media included.	Best done through a standing group or committee with a mix of technical and public relations experience and consolidation through a key staffer. Update regularly—at least twice a year.	Low
Maintain and distribute statistics and figures regarding program performance	Establish a method and schedule for measurement and reporting program successes (i.e. photo journal for litter, recycling tonnages, or quantities compost sold]	Report and disseminate to policy-makers, supporters, press releases, social media, prepared articles, etc. through a key staffer	Low–Med.
Hotline/Website	Provide a single number and/or web address for program information	Staff or update with current message points. Brand it as the place to go for correct information and questions. Provide links rather than have affiliates post documents so information is consistent and current.	Med.
Develop Program Contacts			
List all Contacts Made	Maintain a list of all contacts with the public, including individuals, organizations, and businesses with their contact information and preferred means of contact	High staff effort to maintain, but low cost. Serves as base for informing, notifications of events, and call to actions.	Med
Reinforce Policy Support: Maximize elected officials’ involvement in program promotion.			
Proclamations & Resolutions	Issue proclamations and resolutions in support of celebratory days. Issue press releases announcing proclamations and resolutions noting the supportive elected official contact information	Provide outline of program details or draft resolution to staffs of supportive elected officials.	Low
Invite elected officials to public events.	Feature elected officials at grand openings, ribbon-cuttings, press conferences, and parades	Issue letters of invitation and coordinate arrangements. Feature elected official in press announcements	Low

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Public Award Ceremonies	Invite elected officials to preside over award ceremonies such as "Recycler of the Year," "Outstanding Litter Collection," etc.	Issue letters of invitation and coordinate arrangements. Feature elected official in press announcements	Low
Briefings	Conduct regular briefings of elected officials to update them on project, inform them of program measurements, and allow a back and forth information exchange with program officials.	Schedule with staff well in advance. Prepare briefing packages with recent newsletters, fact sheets, and other helpful information.	Low
Free Media: Maximize free media exposure to benefit program promotions			
Maintain current list of media contacts.	Develop and maintain a list of media contacts with the contacts' preferred method of communications. Update regularly as personnel often shift jobs.	Request program supporters to assist by providing their contacts.	Low
Develop relationships with the press.	Initiate professional relationships with members of the media and editorial boards.	Create relationships through organizational networking, and generously offering one's contact information.	Low
Regularly issue news releases and advisories.	Prepare these for newsworthy events in a short format. Attach supporting information in a PDF file or a web link for background and greater depth information on issue.	Issue in advance and follow up the preceding day or early morning with a phone call or email.	Low
Public Affairs Programs	Identify speakers who are current with new issues and the message points and can express themselves will on radio and TV.	Contact public affairs program directors with a letter and/or news release and brief bio on potential guests.	Low
Stage events for news coverage.	Contests, relays, fashion shows, art contests, essay contests, awards.	Issue press releases with event details and program message points. Brief the spokespersons on message points.	Med.
Participate in international organized events.	Organize events and work with other supporters for American Recycles Day, Earth Day, the EPA-sponsored Food Challenge, Recycle Mania, and others.	Issue press releases for events, involve volunteers, promote local message points.	Med.
Paid Media: Buy advertising.			
Promote celebrity endorsements	Through print advertisements or billboards, feature photograph, name, and behavior, such as "I compost." "I shop carefully for less waste."	People emulate behaviors, and celebrities catch attention.	Med. to High
Billboards and simple ads	Promote the program logo and tagline with a very simple number or website	Note: Studies indicate these do not change behavior, but they reinforce message, especially to introduce programs and support the loyalty of program participants	High

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Promote pledges, acknowledge positive behavior, and publicize poor behavior.	Prepare ads that list the names of businesses and individuals who have pledged to participate in programs. Highlight individuals participating positively in programs; create a shame list for bad or illegal behavior. [Note: buying ads enhances relationships with media outlet; may cooperate better for free media.]	Obtain permission through releases. (May be part of pledge.) Include key message in advertising (Pledges are effective behavior changers; studies show 10% increase in participation.) Photos and names of people who participate positively acknowledges, reinforces, and promotes behavior, and serves as "modeling" where people try to emulate the desired behavior of respected people. Publicizing names of litterers and those who illegally dump in a "shame" list should be undertaken with legal advice.	Med.
Face-to-Face Contacts			
Speakers' Bureau	Prepare visuals and a script for a presentation length typical for local clubs and civic groups (contact to learn optimum length, but usually 15 minutes). Cover key message points, incorporate visual ID, and train speakers.	This can be a task for a trained and motivated volunteer or a staff person. Also works in tandem or accompanied by an elected official. Issue letters announcing the availability of presentations. For large, high-profile presentations, issue press release. Presentations offer an opportunity to ask for pledges. Good opportunity to connect with business professionals.	High
Classes	UOG Center for Sustainability offers classes at university level & K-12. Meet with educators to ensure presentations address educational objectives.	Coordinate resources; draw on visuals from speakers' bureau. Address message points, as well as ed. objectives. [Students are generally open to behavioral change and can influence others.]	High
School Outreach	Programs already developed and operating, especially. through iRecycle and UOG. Service-based learning in place, but not curricula. Numerous effective school curriculums offer public use. University Center for Sustainability comes to schools.	Coordinate with iRecycle to provide up-to-date information. Ensure that both the local schools and the military base school system have adequate access to information.	Low
Booths	Prepare a portable booth and signage for fairs, events, and exhibitions.	Professional resources available for products. Signage and colors should be consistent with overall messaging.	High
Business and Tradeshow Presentations	Prepare visuals and narrative presentations tailored for the group. Time varies. Include key message points but targeted to audience.	Cost and effort may be high because of individual requirements. Good way to create relationships with businesses.	High
Door-to-Door	Train paid staff or volunteers to go door-to-door with information, one-to-one questions, and ask for signed pledges. Also an opportunity for questionnaires. The UOG Green Team did this work for GSWA.	Potential grant program for teen summer job training. Questionnaires should be prepared by expert; may address CBSM perceived barriers	High
Facility Tours	Prepare presentation guide and train tour guide. Support presentation with handout and giveaways. Layton Landfill has offered tours.	Good opportunity for motivated volunteers. Target groups are schools, universities, civic groups.	Med.–High

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Zero Waste Ambassadors	Train young volunteers to staff information kiosks or drop-off facilities to assist unloading, address questions, provide information, and perhaps ask for pledges. Potential resource is Green Army.	Requires training, oversight, and monitoring. Good grant proposal to fund.	High
Surveys and Questionnaires	Deliver by mail, over the telephone, electronically, or in person. Good opportunity for grant proposal and to train volunteers in a meaningful skill.	Requires expertise to develop and testing and statistical evaluation of results. Reporting is opportunity for promotion.	High
Focus Groups	Assemble representative people to answer prepared questions; process determines barriers and opportunities; tests concepts; and provides feedback for pilots	Requires expertise to develop and test questions and to select a representative	High
Written Information: Disseminate through print medium or electronically			
Recycling Directories	Develop list of recyclers, materials accepted, separation required, location, terms whether donated or paid for, and contact for questions and hours of operation. Include outlets for hard-to-handle or special wastes and materials. Include permitted disposal sites. Incorporate identity logo and overall Zero Waste program promotion statement. Use easy to read graphic presentation.	Important to centralize the directory and update minimally quarterly. Encourage other organizations to link to directory, rather than copy so directory updates. Offer printed directories at recycling centers, waste facilities, Village information repositories, Community "Welcome Baskets." Attach to news releases as appropriate. Note that software on a shareware platform is available for website for "Where do I take __" format.	Med.
Newsletters	Prepare on a regular basis, address message points, include photos and graphics, list supporters and "pledges" where appropriate, announce upcoming events, publish statistics and rates, highlight volunteer accomplishments, and use it to keep people informed, motivated, and create a sense of belonging to a winning endeavor. Maintain consistency with overall message delivery (logo, etc.)	Create a distribution list based on the media list, groups that have had a face-to-face contact, volunteers, supporting organization (if small, include full membership), elected officials, government agencies, waste and recycling businesses. Distribute electronically and in print, as appropriate. Maintain copies on website. Ask others to create a we blink.	High
Fact Sheets	Compile regular statistics as far as volumes, tonnages, diversion rates, litter clean ups, drops in litter, and other tracked data. Use GEPA data. Consider also data on public outreach, such as percent that recognizes logo, number of commitments to embrace Zero Waste actions.	Good attachments for press-releases; incorporate into current message points; create articles with data; request interviews for public service shows to highlight; incorporate in presentations; and use in briefings.	Low–Med,
Pamphlets/Door Hangers	Program "How to" information: provide clear and concise instructions for participating in programs such as curbside recycling, construction waste separation. Have numerous reviews of drafts to ensure clarity.	Include with containers, issue with new service, distribute with trainings, share with new residents, and offer at booths	Med.

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Utility Bill Inserts	Ideal for short clear messages and announcements.	Pick one key message and state it clearly and graphically. Low readership but broad distribution.	Low
Posters	Carry key messages and call to actions graphically; pick up posters on website and social media page.	Appropriate for contests, as well.	Med.
Progress Reports	Prepare an annual report that details program evaluations.	Distribution varies, but share with Guam Zero Waste Authority and appropriate committees, funders, and policy-makers.	Low
Information Repositories	Central information availability for each village. This could include recycling directories, newsletters, backyard composting, substitute products for household hazardous waste, and program pamphlets and fact sheets.	Work with the Mayors to determine the most appropriate location for everyone's convenience. Often, place where people pay bills is good location.	Low
Websites	Key to offering outreach/education and providing the definitive source of Zero Waste information. Offer recycling directory, newsletters, fact sheets and other resources on site and link to key public information providers, such as EPA.	Link to RAG, University, GEPA, GSWA, military bases' waste education, etc. Expensive to establish, but less to maintain.	Med.
Social Media	Guam EPA has demonstrated the local effectiveness of this outlet through its Facebook page, use of Twitter, and the number of hits.	Frequent updates retain interest. Benefit is two-way communication to get comments and ideas from public.	Low
Articles for Newsletters	Prepare and distribute articles tied to key message points for inclusion in other organization's newsletters or similar electronic posting. Examples are environmental groups and clubs and church bulletins.	Establish contacts and create and maintain distribution list. Issue electronically on a regular, reliable cycle. Have an agreement that they will not alter content without approval.	Med.
"Welcome" Packets	Bundle key Zero Waste information for new residents. Include "giveaways." Good opportunity to develop a system to take pledges.	If there isn't already a system through the Guam Chamber of Commerce or the military to welcome residents, work through realtors, property managers, and the military for contacts. Seek to develop a volunteer organization to staff as it is too time demanding for in-house staff. Relocating and establishing a new home is a good time for change; people are creating new behaviors and resistance to anything new is low.	Med.
Visual Imagery: Create and maintain a library of visual imagery for use in promotion materials			
Photographic Resources	Photograph events, facilities, personnel, volunteers, problems (such as illegal dumping or litter). File and include photographs from others where full signed permission is granted	Use as appropriate in printed media.	Low

PROVEN COMMUNITY EDUCATION/OUTREACH APPROACHES DEVELOPED FOR RECYCLING WASTE/REDUCTION APPLICABLE TO GUAM ZERO WASTE			
Program	**Description**	**Effort**	**Costs**
Film Resources	Similar to photos, record conditions, facilities, people, and events. Obtain written permissions from other filmmakers. Example in San Francisco of providing and loaning cameras for events to gather new perspectives.	Post on YouTube and similar sites with links. Could graphically demonstrate problems of illegal dumping and littering and acknowledge volunteer and community efforts.	Low–Medium
Other: Signage, giveaways, stickers, badges, etc.			
Signs	Sign facilities, bins, and equipment with overall program identity (logo, colors) and provide basic information.	There is an art to providing enough but not too much information on signs. Draft messages, have multiple reviews for clarity and cultural and language appropriateness, and review with sign company. Budget to replace damaged and defaced signs.	High
Stickers	Stickers are useful to communicate support. They can indicate a leadership or peer pressure. Stickers are also used as prompts, meaning they are placed near where the action will take place like “turn off the lights” on switch plates. Stickers on waste, recycling, or green waste cans may indicate acceptable or prohibited materials, and are especially useful to update accepted material, and new instructions on recycling and composting containers.	Can be used on doors of businesses that support Zero Waste goals or that have conducted a waste audit and enacted recommendations. Because there are illegal landfills, it can be used as a branding for a campaign to only take materials to the “right” facilities.	Low
Giveaways	Examples include pencils made from destroyed money, magnets with waste pickup & recycling dates and hotline numbers, badges, and many other giveaways.	While seemingly contradictory to Zero Waste, gifts inspire good will and are useful in “welcome baskets,” or face-to-face presentations and information kiosks. Badges reinforce pledged commitments, such as “I recycle,” or “I took the Zero Pledge,” and tee shirts are a good thank you for litter clean ups. Recycling old trophies with a new plaque make award ceremonies more affordable.	Med.

ONEGUAM
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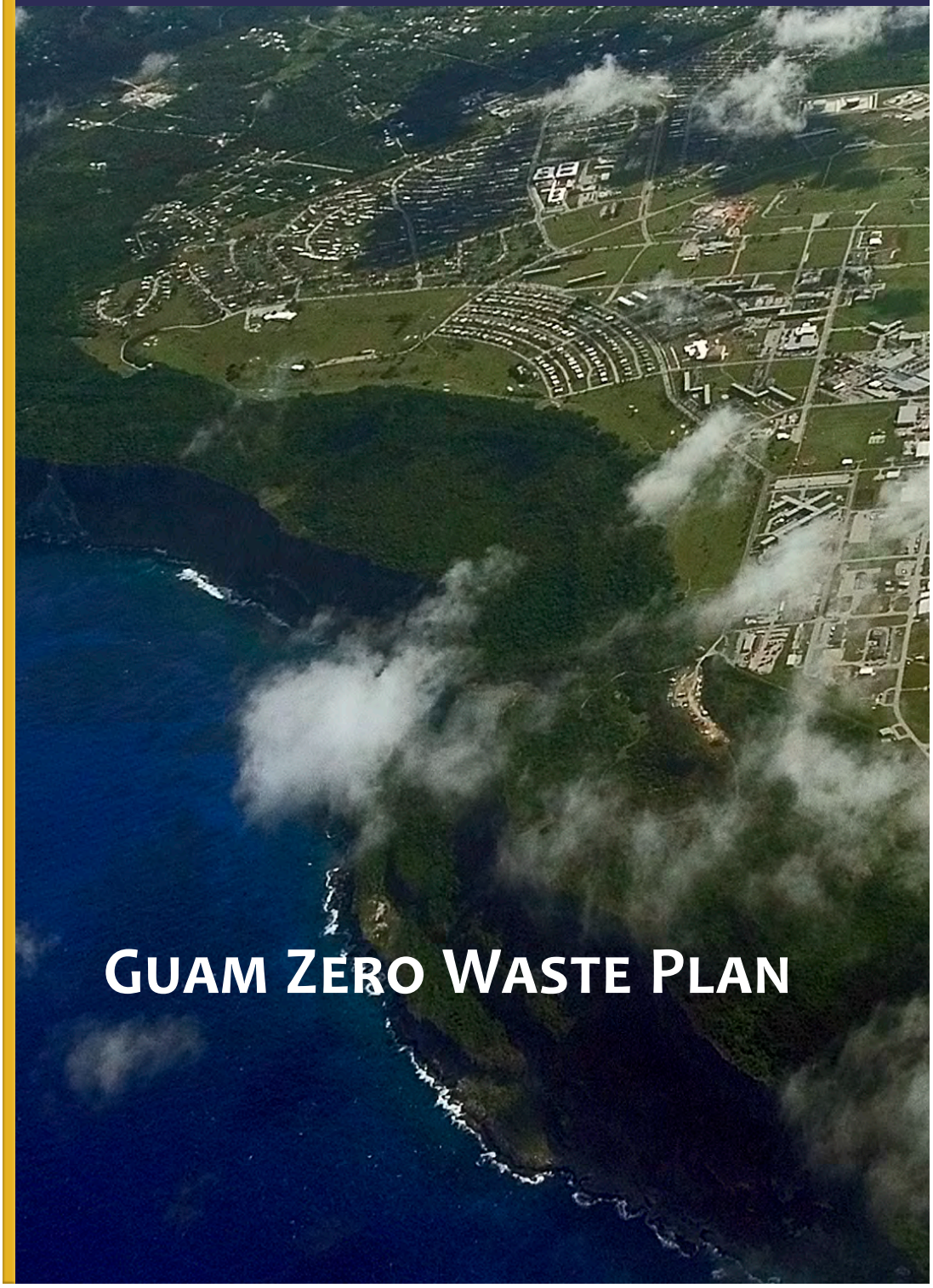
White Paper O



Guam Zero Waste Plan

GOVERNOR'S SEAL
ISLAND OF GUAM

WP O

Please see the next page.

WHITE PAPER O
CREATING A SUSTAINABLE FUNDING STRATEGY FOR A ZERO WASTE FUTURE ON GUAM

This study was prepared under contract with the Government of Guam, with financial support from the Office of Economic Adjustment, Department of Defense. The content reflects the views of the Government of Guam and does not necessarily reflect the views of the Office of Economic Adjustment

This document was prepared as an electronic document to support Zero Waste. A limited number of paper copies were printed on 100% Recycled Post-Consumer Waste – Process Chlorine Free.

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1. INTRODUCTION AND KEY FINDINGS

In 2011, the Government of Guam (GovGuam) began a planning process to identify new policies, programs, and facilities needed to implement a Zero Waste plan for the island of Guam. No single initiative, alternative or strategy can be put in place to achieve the goal of Zero Waste; rather multiple initiatives will be needed for an effective Zero Waste program. Numerous options to achieve Zero Waste on Guam were suggested during working sessions with key solid waste stakeholders. Of these options, fifteen initiatives were selected by GovGuam, Guam Environmental Protection Agency (GEPA), and the United States EPA as the improvements most likely to advance Zero Waste on Guam (see text box). Each of the initiatives is evaluated in detail in the Guam Zero Waste Plan, and is summarized in its own white paper

ZERO WASTE INITIATIVES

- *Evaluation of Funding Sources*
- *Public Education and Outreach*
- *Illegal Dumping and Litter Control*
- *Green/Environmentally-Preferable Purchasing*
- *Zero Waste Association*
- *Extended Producer Responsibility*
- *Construction and Demolition Debris Diversion Policy*
- *Recycling Grant Program*
- *Pay-As-You-Throw Pricing Policy*
- *Plastic Bag Disposal Ban*
- *"3R" Requirements for Public Buildings*
- *Used Building Materials Facility*
- *Greening Roadway Paving Systems*
- *Organics Recovery Composting System*
- *Construction and Demolition Debris Processing Facility*

Purpose

All federal, state or local government programs, as well as for-profit and non-profit business organizations must have a viable, long-term funding strategy in place in order to operate. This white paper, which is one in a series of fifteen, presents an analysis of sustainable funding sources which can be used to cover the net costs associated with implementing a Zero Waste Program on Guam.

White Paper Organization

This white paper is divided into five sections:

- Section 1 presents the purpose of this white paper, provides a roadmap of the document and includes a snapshot of select key findings.
- Section 2 provides an overview of the alternative.
- Section 3 presets an implementation overview.
- Section 4 summarizes benefits and impacts that may occur if/when the alternative is implemented.
- Section 5 provides a list of resources for additional information and references.

Key Findings

The long-term savings and economic benefits from implementing a Zero Waste program will eventually dwarf the initial investment. Over the long-term, the use of a combination of internal (i.e., GovGuam) and external (i.e., federal and private foundation) funding sources to build a strong financial foundation for the Zero Waste Program will be necessary.

The development of a sustainable funding strategy should be initiated immediately following the recommended implementation strategy presented in Section 3 of this White Paper. If the initial funding strategy for the Zero Waste Program suggested in this White Paper is acceptable (i.e., a combination of a landfill tipping fee surcharge and a Gross Receipts Tax (GRT) Rate surcharge), formal approval to allocate this funding should be

sought. If not, then an alternate funding strategy will need to be developed and approved. Over time, the use of a more diversified funding strategy, which potentially includes the addition of revenues generated by the various Zero Waste initiatives implemented and grant awards, should be phased-in.

2. INITIATIVE OVERVIEW

Section 2.0 presents an overview of this Zero Waste alternative including either a definition or explanation of what the alternative is and involves, a summary of what exists on Guam today with respect to solid waste management program funding, examples of similar initiatives that have successfully been implemented in other locations, and opportunities and constraints that should be anticipated during the development of a sustainable funding strategy for a Zero Waste program.

Why is a Funding Strategy Needed?

All federal, state or local government programs, as well as for-profit and non-profit business organizations must have a viable, long-term funding strategy in place in order to operate. Simply put, all of these entities must have funding available to conduct their operations. Developing and implementing an island-wide Zero Waste Program for Guam will require a well-defined funding strategy. The funding strategy will need to identify a variety of sustainable funding sources to cover the initial capital costs as well as long-term operation and maintenance costs associated with implementing any of the Zero Waste alternatives evaluated in the Guam Zero Waste Plan.

There are two primary funding sources available for a Zero Waste Program on Guam: internal sources within the Territory of Guam (i.e., taxes and fees) and external sources (i.e., grants). A viable Zero Waste program funding strategy will require the identification and development of a mix of different funding sources. Traditional funding sources include the following:

Internal Funding Sources	External Funding Sources[1]
Landfill tipping fees	Federal Grants: Including but not limited to grants from the Environmental Protection Agency, Department of Health and Human Services, Department of Agriculture Rural Development, Department of Commerce, Housing and Urban Development and Department of Interior Bureau of Indian Affairs. For a more complete list, go to: http://www.epa.gov/osw/wyl/tribal/pdftxt/tribfund.pdf.
Franchise fees	
Solid waste collection fees and/or litter taxes	
Service fees (business license fee, developer impact fee, litter abatement fee)	
General revenue funds	
Real Property Tax	Private and Nonprofit Foundation Grants: Including but not limited to grants from the Kresge Foundation, Charles W. Mott Foundation, ARCO Fund, Ford Foundation, Give to the Earth Fund, Sierra Club, Captain Planet Foundation and Ben & Jerry's Foundation. For a more complete list, go to: http://www.epa.gov/osw/wyl/tribal/pdftxt/tribfund.pdf.
Non-property based fees/taxes (Gross Receipt Tax, Bottle Bill fees)	
Development fees	
Import/Export Fees	
Vehicle impact fees	

Notes:

1. *See also Section 5 of this White Paper for additional resources.*

Existing Programs on Guam

GovGuam utilizes internal and external funding sources to operate its existing solid waste management program. Funding sources currently used include:

- Landfill tipping fees;
- Solid waste collection fees;
- Litter fees/penalties;
- General revenue fund;
- Vehicle impact fees;
- Bottle bill fees (currently pending implementation); and
- A small amount of federal grant money from the EPA and DOD.

Successful Approaches Used Worldwide

The following information is reported in publications commissioned by the Solid Waste Association of North America (SWANA), the U.S. EPA and the Pennsylvania Department of Environmental Protection (SWANA, 2010; USEPA, 2008; PDEP, 2005). Sustainable funding sources used for Zero Waste programs by many states and countries are similar to the sources used for other solid waste management initiatives, such as recycling.

Funding Sources for Local Government Recycling Programs in the United States in the Early 1990s		
No.	Funding Source	% of US Recycling Programs
1	General funds	50%
2	Waste collection fees	11%
3	Material sales revenues	11%
4	State grants	9%
5	Tipping fees/surcharges	8%
6	Special recycling collection fees	4%
7	Other	7%
	Total	100%

A number of the more effective taxes and fees used to provide sustainable funding for recycling programs, which could also be used for Zero Waste programs are discussed below.

- **Tipping Fees/Surcharges –** All landfills charge a tipping fee or "gate" fee. A small increase in the fee paid per ton by commercial customers and by service address for residential units can generate significant fees. Many states and municipalities use tipping fee surcharges to fund source diversion programs. However, it should be noted that the more a successful source diversion program will result in lower volumes/tons being disposed of in a landfill, which is turn results in a lower and lower amount of funding available from this internal funding source over the long term.
- **Waste Collection Fees –**Taxes can be imposed on solid waste collection services to fund recycling and Zero Waste programs.
  - For example, the state of Minnesota requires waste management service providers within its borders to charge waste collection taxes, called solid waste management taxes, to their customers. Seventy percent of the revenues from Minnesota's solid waste management tax, or at least $33.76 million, are deposited into the state's Solid Waste Fund. The remainder is deposited into Minnesota's general fund with biennial appropriations for county recycling block grants and related solid waste activities. Since solid waste collection services are generally considered to be essential to promote public health and sanitation, the use of such taxes can be considered a sustainable funding method.
  - Product-based disposal taxes/fees could be levied on manufacturers based on the materials used in products and packaging (i.e., non-recycled content fast food containers, Styrofoam packing materials, cardboard boxes, wood pallets or other materials that pose a unique disposal challenge). The level of the surcharge affects the size of its impact. Even a small charge could generate considerable revenue depending on the number of entities paying the tax. This kind of disposal charge is attractive for several reasons: it spreads disposal costs more equitably by incorporating them into the manufacturing process and would begin to compensate for market systems that ignore a product's life cycle costs.

- **Litter Taxes—**Litter taxes are imposed on businesses that produce, distribute, or sell consumer products that contribute to litter problems. These taxes are levied by state governments and municipalities. A few states charge all businesses in their state, while others specify only that

litter-producing companies must pay. For example, the state of Virginia levies a litter tax on manufacturers, wholesalers, distributors, and retailers of consumer products. Ninety-five percent of Virginia's litter tax revenues are used for litter prevention and recycling grants. The other 5% of Virginia's litter tax revenues goes to the Virginia Department of Environmental Quality to administer the grant program and provide support for the Litter Control and Recycling Fund Advisory Board. Generally these measures are easy to administer because calculation and collection is simple. They also produce a consistent although the amount depends on the number of entities taxed and the tax rate. In Nebraska, taxes are levied against wholesalers and retailers of litter-producing industries in 10 different product categories. The tax rate of $150 per $1 million in annual sales generates $350,000 annually. A way around anti-business concerns would be to broaden the tax base and keep rates low.

- **Availability Fees—**An availability fee can be charged to persons who have an opportunity to benefit from a solid waste management facility. For example, according to the North Carolina statutes, "The board of county commissioners may impose a fee for the use of a disposal facility provided by the county. A fee for availability may not exceed the costs of providing the facility and may be imposed on all improved property in the county that benefits from the availability of the facility. In determining the costs of providing and operating a disposal facility, a county may consider solid waste management costs incidental to a county's handling and disposal of solid waste at its disposal facility, including the costs of the methods of solid waste management specified in G.S. 130A-309.04(a) of the Solid Waste Management Act of 1989." Based on this statute, Mecklenburg County, North Carolina, adopted an availability fee in 1993 of $10 per residence (both single and multifamily) per year. This fee, which is now $12 per year, is used to pay for a variety of recycling facilities, as well as programs that manage items banned from landfill disposal, such as white goods.

Innovative, but less common funding options which can also be pursued include:

- **Processing Fees/Credit Systems** which are financing schemes in which manufacturers must guarantee some minimum level of recycling or minimum scrap value for their products. Under a credit approach, the manufacturer can fulfill this guarantee by recycling the products themselves or purchasing credit from an independent recycler, essentially paying someone else to recycle their products. Products targeted to date in this manner by various states include used oil, tires, and newspaper.
- **Sale of Greenhouse Gas Offset Credits:** The following information is largely adapted from the June 2007 report titled "Climate Change and Planning for Solid Waste Management" prepared for the City of Fort Collins, Colorado. There are significant and quantifiable carbon reductions associated with solid waste diversion strategies. Voluntary programs are available in the United States and abroad for buying and selling carbon offsets. As a primer, carbon offsets offer individuals, businesses, and other organizations the opportunity to neutralize their impacts on the climate by buying GHG reductions from other sources. In other words, offsets are quantifiable reductions from emissions-reducing projects that can be sold to consumers to counterbalance their own emissions. Currently, there are a variety of offset options and providers available to consumers. Similarly, the types of products and services available are varied and include anything from offsets for travel, to green tags (renewable energy credits) and wind power, to reforestation. The costs for

- **Products and Services** vary given the different ways providers offer offsets to consumers and can If a markets exists in which these reductions could be traded for cash. The idea is for communities to get financial credit for their GHG emissions reductions that result from their solid waste diversion strategies. This financial credit would then be turned back into supporting existing strategies and developing new ones for additional reductions, and ultimately greater climate protection.

Opportunities and Constraints

The information provided in this analysis presents parameters that may influence how this Zero Waste alternative could be developed and managed. To implement a successful funding strategy to support a future Zero Waste Program on Guam, GovGuam must take advantage of the opportunities associated with this initiative and also take into consideration constraints or limitations that could make the initiative less than optimally effective.

Opportunities include:

- A wide variety of funding sources exist which can be layered to create a sustainable funding strategy;
- If multiple funding sources are used, no single source should bear an unreasonable financial burden;
- Over time, the implementation of a comprehensive Zero Waste program will reduce Guam's reliance on land disposal of waste; and
- Most federal grants are awarded to organizations, institutions, and state or local governments planning major projects that will benefit specific sectors of the population or community as a whole.

Constraints include:

- Many government programs have typically been viewed and sometimes promoted as free services. These services are not free, and the public will need to be educated on the costs and decide through their elected officials how important Zero Waste is for their future;
- Determining the amount and timing of money needed can be difficult. Costs and subsequent funding needed will depend on the ultimate scope and design of the Zero Waste Program and the level of support needed.
- Traditional internal funding sources include property taxes, the use of general funds and other fees. In the current economic climate, it could be difficult to increase taxes and fees to offset these costs;
- Proposed tax increases may require legislative approval and could take a considerable amount of time to obtain; and
- If landfill tipping fees are used as a funding source:
  - long term use of these fees will need to reflect an expected decrease in the amount of waste that is land disposed; and
  - Any proposed increase to the tipping fee structure will need to be closely coordinated with the Guam Solid Waste Management Authority, Guam EPA, Federal District Court and will ultimately require approval by the Public Utility Commission.
- The use of grants entails certain obligations that the grantee must adhere to. Organizations that receive government grants are subject to strict government oversight and must meet detailed government performance standards during the duration of the project and funding period of the grant. Further, program changes may need to be approved by the Agency or private foundation sponsoring the grant.

3. IMPLEMENTATION OVERVIEW

Raising taxes or fees is never a popular exercise. GovGuam is likely to receive "pushback" from the business community and others, should they request significant fee increases. However, the Zero Waste Program on Guam will need to be funded and having a viable and diversified funding strategy, which may include raising taxes and fees, will be necessary. Without funding of the initial capital and long-term operation and maintenance costs associated with the implementation of a Zero Waste Program, the program simply becomes another unfunded mandate and is doomed to failure.

Key Stakeholders

The development of a sustainable funding strategy for a Zero Waste Program will initially require the expertise of individuals within a number of different government agencies including the:

- Governor's Office;
- Guam Environmental Protection Agency (GEPA);
- Guam Solid Waste Management Authority (GSWA);
- Guam Department of Administration (GDOA);
- U.S. Environmental Protection Agency (USEPA); and
- Legislators and staff.

Major Components

Raising taxes or fees is never a popular exercise. GovGuam is likely to receive "pushback" from the business community and others, should they request significant fee increases. The process for requesting fee or tax revenue will need to comply with the requirements of the Guam Administrative Adjudication Act (AAA) process, which can be cumbersome. However, the AAA includes an exemption for all proposals which have an annual impact of $500,000 or less. GovGuam will need to evaluate the potential impact of fee increases proposed to determine whether any proposed increases meet the exemption threshold.

The following information was largely adapted from a variety of publications found on USEPA's website at www.epa.gov/wastes/wyl/tribal/index.htm.

For many rural and isolated communities, securing a sustainable source of funding is the most difficult solid waste management challenge they face. Every step in developing, implementing, and maintaining a waste management program requires funding. Many smaller rural and/or isolated communities do not have the economic base to fully support a locally-based waste management program. One of the key requirements to developing a successful Zero Waste program for Guam will be to develop a sustainable funding strategy. To begin this process, the following major components are needed:

1) Determine Major Program Costs. The major costs associated with a Zero Waste Program include planning, facility design and construction, equipment purchases, personnel labor and training expenses, and other miscellaneous costs. As part of the Zero Waste Plan being developed for Guam, initial capital costs and long-term operation and maintenance costs have been developed so that the overall major program costs can be

defined. This approach allows for GovGuam to compare the various alternatives against each other, in order to better understand which strategies offer the best return on investment.

2) Sources of Funding. A committee composed of the Key Stakeholders identified in the beginning of Section 3 should be convened to provide recommendations to the Guam Legislature and Governor's Office regarding the funding sources that are most viable to utilize in the development of a sustainable funding strategy. Section 2 of this White Paper provides a discussion regarding the primary sources of funds that can be used in the development of a sustainable funding strategy. A mix of internal and external funding sources is an ideal way to fully support the Zero Waste Program. It is important to note that many external funding (i.e., grants) cannot usually be used to pay for long-term operation and maintenance costs, so these costs typically need to be funded through internal funding sources (i.e., the General Fund, user fees, etc.) or through other means. One potentially reasonable funding strategy that could be used to fund the first several years of the Zero Waste Program is presented in Section 4 of this White Paper. Other potential funding strategies can also be developed.

3) Agree on a Plan of Action to Obtain Internal Funding and Implement the Plan. The key stakeholders, led by the Governor's Office or GEPA, should agree to a plan of action to obtain funding, assign responsibilities and deadlines and follow through to ensure that assigned responsibilities are achieved.

4) Explore Opportunities for External Funding. It is highly unlikely that initially external funds will be available to finance the Zero Waste Program on Guam, since obtaining grants takes time. GovGuam needs to explore opportunities for external funding, develop a plan of action and implement the plan. There are numerous ways that Guam can search for external funding sources. A subcommittee could be formed from existing staff within the key stakeholder agencies (i.e., GEPA, USEPA, GSWA and GDOA) to identify a "short-list" of external funds. Potential external funding sources can be identified through a number of means, including but not limited to: announcements from Federal Agencies; internet searches, communication with other states and territories; communication with regional agency representatives and by building strong relationships with the representatives of various organizations. See Section 5 of this White Paper for potential resources that it may be beneficial to consult when exploring for funding opportunities. Tips for writing a successful grant application are included in Appendix A to this document.

5) Evaluate, Modify and Grow the Zero Waste Program Over Time. The Guam Zero Waste Plan will take a number of years to fully implement. The program goals, schedules, and responsibilities should be evaluated annually and modified as appropriate. Required changes (or growth) will likely be tied to the desire by the Government of Guam to pursue specific opportunities and responsibilities, the ability to raise funds and the need for implementation of additional Zero Waste alternatives.

Major Milestones

Development of a sustainable funding strategy should be undertaken immediately.

- Beginning in 2013 – Initial recommendations for implementation provided in the Guam Zero Waste Plan should be evaluated to determine major program costs.

- Beginning in 2014 – Sources of funding should be evaluated and the mix of internal and external funds that GovGuam wants to use to develop a sustainable funding strategy should be finalized. As soon as this step is complete, a Plan of Action should be developed and implemented.
- Beginning in 2015 the Zero Waste Program's funding strategy should be evaluated on an annual basis and modified/updated as appropriate.

Challenges

Raising taxes and fees is never a popular option. Key challenges to developing and gaining approval to implement a sustainable funding strategy for the Zero Waste Program will include:

- Securing funding must be a high priority or the Zero Waste Program will ultimately not be successful.
- Competition for funding from internal sources is likely to be high and obtaining funds from internal sources may be difficult in the current economic climate.
- Approval to increase landfill tipping fees (one potential funding source) may require approval of the Federal District Court and the Public Utilities Commission, which could impact the overall schedule for implementing the Zero Waste Program.

4. SUMMARY OF BENEFITS AND IMPACTS

Estimates for landfill diversion potential, job creation potential, small business opportunities, revenues, avoided landfill disposal cost and economic costs potentially associated with this Zero Waste initiative, as well as human health and environmental impacts are presented in this Section. Numerical estimates represent a general approximation of the most significant benefits and impacts to Guam. They should not be construed as definitive projections as available data in many cases was limited to national averages as well as assumptions and observations from other U.S. communities. It is recommended that Guam-specific data be generated such that these estimates can be refined and verified prior to implementation.

Landfill Diversion Potential

By itself, development of a sustainable funding strategy will not directly affect waste diversion on Guam. However, the implementation of the various alternatives included in the Zero Waste Program will affect waste diversion on Guam and is described further in each of the White Papers included as appendixes to the Guam Zero Waste Plan.

Job Creation Potential and Small Business Opportunities

As a stand-alone initiative, development of a sustainable funding strategy will not directly affect the creation of jobs on Guam, nor will it create small business opportunities. However, implementation of the various initiatives described further in each of the White Papers included as appendixes to the Guam Zero Waste Plan will create both public and private-sector jobs and small business opportunities. The development of a sustainable funding strategy and approval for a dedicated funding source is necessary for the Zero Waste Program to ultimately be successful.

Estimated Revenue Generation

No direct revenue is expected as a result of this initiative, as no waste materials will be directly diverted from landfill disposal.

Avoided Landfill Disposal Costs

Although implementation of this initiative is not expected to directly result in any avoided landfill disposal costs, the only way to help off-set new Zero Waste Program costs is if GovGuam agencies re-allocate historical landfill budget line items to new programs (i.e., existing budget line items may need to be moved to a “new” Zero Waste Program budget.

Human Health and Environmental Impacts

Though there are no direct human health or environmental impacts due to the development of a funding strategy, direct and indirect benefits that will occur as a result of a Zero Waste Program being implemented on Guam include:

- Dramatic and usually permanent diversion of MSW.
- An extension of landfill life.

- Conservation of resources.
- A reduced need to extract and consume virgin resources
- Greenhouse gas emission reductions: There are reductions in the amounts of organic material going into landfill, reductions in transportation requirements for moving material goods through their life cycle, and reductions in energy use when recycled materials are used in remanufacturing new products.
- Increased opportunities to innovate and drive improved performance by identifying new strategies for eliminating waste.
- An estimated 9 jobs created for every 15,000 ton of solid waste recycled, resulting in improved living conditions and better overall human health.
- Remanufacturing from recycled materials creates 25 times as many jobs as landfill disposal; and reuse can create 100 times more jobs.

Economic Costs

The following internal funding strategy presents one potential way, but by no means the only way, by which Guam's Zero Waste Program could be funded.

Tipping Fee Surcharge

All landfills charge a tipping fee or "gate" fee. A small increase in the fee paid per ton by commercial customers and by service address for residential units can generate significant fees. For example, during 2012 approximately 89,500 tons of solid waste were disposed of at the Layon Landfill, including waste from 17,000 residential homes receiving pickup. The potential revenue impacts of a 1% to 5% increase over current tipping fees/collection rates are summarized in the Table below. As shown, a 1% increase in commercial tipping fees would generate more than $106,000, while a 5% increase would generate more than $530,000 in funding. Similarly, an increase of 1% in residential collection costs would generate more than $61,000 in annual funding, while a 5% increase would generate more than $300,000 in annual funding.

Estimated Funding for Zero Waste Initiatives

	Basis	Units	Fee	Per	Funds Generated
Commercial	61,000	tons	1%	Ton	$ 106,488
Commercial	61,000	tons	2%	Ton	$ 212,975
Commercial	61,000	tons	3%	Ton	$ 319,463
Commercial	61,000	tons	4%	Ton	$ 425,951
Commercial	61,000	tons	5%	Ton	$ 532,439
Residential	17,000	homes	1%	Year	$ 61,200
Residential	17,000	homes	2%	Year	$ 122,400
Residential	17,000	homes	3%	Year	$ 183,600
Residential	17,000	homes	4%	Year	$ 244,800
Residential	17,000	homes	5%	Year	$ 306,000

From a practical perspective, a combination of residential and commercial fees dedicated to Zero Waste initiatives is potentially a reasonable approach to funding a program which can have a positive effect on Guam's solid waste management practices. For example, a 3% fee for both commercial and residential customers would generate just over $500,000 annually.

Gross Receipts Tax Surcharge

According to the Governor's FY 2013 budget request, revenues are expected to exceed $693.7 million. Expected revenue sources include:

- Income Tax- $412,892,666;
- Business Privilege -$218,282,984;
- Federal Sources- $50,669,528;
- Other Taxes -$3,619,372;
- Other Sources - $ 8,274,204.

Among these sources, the Business Privilege Tax (also referred to as the Gross Receipts Tax or GRT) offers the next highest potential as an internal source of funds to support the Zero Waste program. As shown, the GRT is projected to generate $218.3 million at its present rate of 4.1%. Incremental changes to the GRT could generate significant funding for the implementation of Zero Waste initiatives. As shown in the Table below, every incremental increase in the GRT rate would produce an estimated $218,000 for Zero Waste Programs. An increase in the GRT rate from 4.0% to 4.25% would generate an additional $545,000.

GRT Rate	Incremental Revenue
4.0%	$ -
4.1%	$ 218,283
4.2%	$ 436,566
4.3%	$ 654,849
4.4%	$ 873,132
4.5%	$ 1,091,415

Over time, the use of a more diversified funding strategy, which potentially includes the addition of revenues generated by the various Zero Waste initiatives implemented and grant awards, should be phased-in.

5. ADDITIONAL INFORMATION

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative.

General Resources

Grants.gov is a centralized, online program that assists in locating and applying for grants. This program is one of the 24 federal cross-agency E-Government initiatives focused on improving access to services via the internet. Grants.gov provides a simple, unified source to electronically find, apply and manage grant opportunities.

The online registry will explain:

- Who can apply for the specific grant in question;
- How the grant money can be used;
- How to apply, including detailed contact information;
- How applications will be reviewed, judged, and awarded; and
- What is expected of successful grantees including reports, audits, and performance standards.

Additional Information about Potential Funding Sources

The following resources can be consulted to obtain additional information regarding this Zero Waste alternative. Below is a list of grants that could potentially be pursued and used to help fund the Zero Waste effort on Guam.

- http://www.grants.gov/search/announce.do;jsessionid=sQ2xRnRPFpv13NF7pwfRfLnFlMsHXw9ky10vhx2mkjMJD1lxJ5lT!-1238248713
- http://www.epa.gov/epawaste/conserve/tools/rmd/finance.htm
- http://www.epa.gov/region09/funding/index.html
- http://www.cfda.gov
- Understanding and promoting Health Literacy – (Could potentially be used to research and promote environmental health topics, such as public outreach for greening systems)
- http://www.grants.gov/search/search.do;jsessionid=P90hRwJd0JQhpHQjsHTVtr0WTDZGG5wk74DPhNvYmlTrnv9vBYZV!-1679864363?oppId=52757&mode=VIEW
- http://www.grants.gov/search/search.do;jsessionid=P90hRwJd0JQhpHQjsHTVtr0WTDZGG5wk74DPhNvYmlTrnv9vBYZV!-1679864363?oppId=223975&mode=VIEW
- Environmental policies and innovations: http://www.federalgrantswire.com/environmental-policy-and-innovation-grants.html

References

- City of Fort Collins, 2008. Climate Action Plan.
- PDEP, 2005. Building Sustainable Funding Recycling Systems: A Technical Report for Pennsylvania Local Governments by R.W. Beck. August.
- SWANA, 2010. Sustainable Funding Strategies for Local government Recycling Programs by Jeremy O'Brien, December.
- USEPA, 2008. Guidebook of Financial Tools: Paying for Environmental Systems. April.

APPENDIX A: Approach for Writing Successful Grant Applications

The most important approach to writing a successful federal grant proposal is to carefully review the terms of the announcement and make sure that the proposal complies with the requirements of the announcement. Proposals must be submitted by the deadlines specified in the announcement and address all of the evaluation criteria in the announcement. Proposals must also comply with any threshold eligibility requirements and meet any match requirements in the announcements.

- Follow the funding agencies guidelines, particularly concerning form and length (single- or double-spaced, number of pages, etc.). Live within the limits. Don't try to get around the page limit by shrinking the font size and narrowing the margins. An attractive layout with white space and a readable font is more likely to endear you to the foundation staff and trustees.
- Keep ongoing contact with organizations that award grants.
- Use active, not passive, voice. For example, "The Chemistry Department will build the laboratory in 2006." sounds better than "The laboratory will be completed in 2006."
- Use a title that suggests the results you hope to achieve rather than what you plan to do. For example, "Improving Reading of Fifth Graders at Lewis & Clark School" is better than "A Proposal for Reading Machines in Lewis & Clark School."
- In your abstract or summary, emphasize the benefits of your work and why the project should be funded now.
- Focus on the positive. Talk about success, how your program will help, and how the funds will be a part of the solution. Emphasize opportunities rather than problems whenever possible.

- Write self-sufficiency plans into the request. Most funding sources are not interested in funding your organization long-term. They will fund you to start programs and to keep them going for a few years. In the proposal, write a section on how you will sustain the program once the funding expires.
- The first paragraph is critical. Ask for the dollars in the first paragraph so the grant officer does not have to hunt for how much you are seeking. Make sure that the grantor knows early in the proposal how much you want, for what purpose, for what time period, and state the importance of the money.
- Summary of the proposal is valuable. Write a one or two paragraph, well-crafted summary of the proposal is very important.
- Continuously seek grant opportunities.
- Be specific and concise with information in the grant application.
- Be complete; try to allow time for review.
- Do not miss deadlines.
- Get support from elected officials, business leaders and community leaders.

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