

Economics of rural waste management in the Rewa Province and development of a rural solid waste management policy for Fiji

By Padma Lal, Margaret Tabunakawai and Sandeep
K. Singh

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SPREP
PO BOX 240, Apia Samoa
Email: sprep@sprep.org
T: +685 21 929
F: +685 20 231
Website: www.sprep.org

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Abbreviations

BCA	benefit–cost analysis
EMA	Environment Management Act
EU	European Union
FIRCA	Fiji Islands Revenue Customs Authority
HH	household
IWP	International Waters Project
MOE	Ministry of Environment
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
PET	polyethylene terephthalate
PIFS	Pacific Islands Forum Secretariat
SCC	Suva City Council
SPREP	Secretariat of the Pacific Regional Environment Programme
WTP	willingness to pay

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Implementation of the action points of this policy paper will depend on continuous effort and effective monitoring at the provincial level, and on action by the Ministry of Environment, to ensure proper waste management practices are adopted and practiced.

Introduction

Fiji's rural population is decreasing, but solid waste management in rural areas is nevertheless slowly becoming a major concern. Increasing globalization and changing lifestyles have resulted in increased consumption of packaged and processed goods in recent years, including food and other items. Rural areas typically lack appropriate infrastructure and formally organized solid waste management system, resulting in increasing problems relating to solid waste, including impacts on human health and decreasing aesthetic values of rural villages and their surroundings.

Reliable rural statistics and general information about waste generation and waste management are generally unavailable. In 2000, Sinclair, Knights, and Mertz, estimated that rural households (HH) produced some 405 tonnes (t) of solid waste, much of which was believed to be discarded in the foreshore, along river banks, and in similar areas. Poor waste management is a serious source of pollution in coastal areas.

More recently, in 2005, the Ministry of Environment (MOE) found that in the rural villages selected as pilot project sites for the International Waters Project (Vunisunu and Nalase), people tend to dispose of their rubbish in the nearby mangroves and coastal foreshore, or in the adjacent river or streams. The pollution-related effect of indiscriminate waste disposal in rural areas is not known, but in coastal areas close to Suva's Lami rubbish dump (which receives solid wastes from urban households as well as light and heavy industries), concentrations of heavy metals are very high. The Lami dump site itself has heavy metal concentrations that exceeds the internationally accepted Dutch standards (Chandra, 2002). The Suva harbour has been reported to be contaminated with metals and Lami dump has been said to be the source of metal contamination.

The waste stream survey of these two villages also revealed that more than 80% of village "waste" actually consists of organic and recyclable material. This suggests that proper management would make it possible to minimize the amount of residual waste, as well as help generate some much needed income in rural areas (through recycling).

In rural areas outside of city or local municipal boundaries, management of waste is under the authority of the Rural Local Authorities; wastes from designated Fijian villages are under the jurisdiction of the local health officers under village health bylaws. These are considered to be "not ... particularly effective" (Fiji National Solid Waste Management Strategy; see Government of Fiji 2006).

Rural areas generally have little if any systematic waste management, and Fiji lacks a specific strategy to handle rural solid waste (the government's National Solid Waste Management Strategy, which was endorsed by cabinet in October 2006, focuses on urban solid waste management).

Rural areas have benefited from aspects of the National Solid Waste Management Strategy, particularly measures relating to Thematic Area 3: Communication/Information Management. Education and community awareness campaigns, conducted primarily by IWP, have produced some spillover impact on rural waste management. For example, in response to general waste management awareness programs on TV and radio (in English, Fijian and Hindustani), a number of villages along the Suva to Nadi corridor, and from the Province of Naitasiri, have sought assistance from the Ministry of Environment to establish recycling centres for plastic bottles, tins and other metals, and other recyclable materials such as aluminum cans. The income generated by the villages is not yet known, but different recycling firms visit the villages to collect and pay cash for the recyclable materials. Coca Cola collects polyethylene terephthalate (PET) bottles and Coca Cola cans and pays 0.50 Fijian dollars (FJD) per kilogram (kg) for PET bottles and FJD 0.60/kg for aluminum cans; Waste Recyclers, which exports metal, pays FJD 0.10/kg for tin, aluminum and other metals. Similar responses have

been observed in a few places along the Suva-Nausori corridor.

The Ministry of Environment has been encouraging local councils to supply waste collection dumpsters to villages along the Suva-Nadi Corridor in an effort to reduce the amount of waste litter along the valuable Coral Coast tourism centre. Some communities have established recycling centres with assistance from non-government organisations (NGOs). Suva City Council has also been making a concerted effort to get local suppliers of large waste bins to provide waste collection dumpsters to squatter settlements around Suva and Nausori. Such initiatives have limited coverage, however, and the Government has acknowledged the need to take a more systematic approach to rural waste management.

This study of solid waste management in the Rewa Province is an attempt to better understand rural solid waste management issues and to identify key management strategies that may be suitable for rural areas located in close proximity to urban waste collection systems. The report also identifies key strategies that rural areas farther away from urban centres, or on outer islands, could adopt in their effort to better manage solid waste. The study will also help identify key elements of a rural waste management strategy.

The specific objectives of the project are to:

1. Estimate the economic costs of the current liquid and solid waste management systems in the Rewa Province, including health and amenity costs and foregone earnings from not improving the management of this waste (through activities such as composting, recycling and proper disposal).
2. Identify and evaluate alternative waste management options for two categories of villages: (a) those close to urban/peri urban solid waste collection and disposal systems, and (b) more remote villages (areas where it is not financially feasible to link with an urban collection and disposal system).
3. Undertake an analysis of the financial and economic feasibility of extending the IWP-trialed solid waste collection and disposal system for Vunisinu to other rural villages and settlements in the Rewa Province.
4. Contribute practical information to assist the National Solid Waste Management Strategy develop clear waste management tools and targets to improve the management of solid waste in Fiji's rural areas.
5. Assist MOE staff to prepare a well-argued paper Cabinet Discussion Paper on rural solid waste management systems based on the results of the study on Rewa Province, prepared in partnership with rural communities, MOE staff and other stakeholders.
6. Help increase the capacity of the MOE and locally appointed project staff in economic research and analytical skills.

Section 2 describes the methodology used in this study, followed by a description of current waste generation and waste management in Rewa Province. Section 3 addresses waste management options, while Section 4 examines the financial feasibility of a waste collection and disposal system similar to the system used for the IWP pilot project village, Vunisinu. In Section 5, key elements of a rural waste management policy are described, which have been included in the Ministry's Cabinet Discussion Paper.

2 Methodology

A mixed methodology was used to collect the relevant primary and secondary data required to (i) assess the status of waste generation in rural areas, (ii) calculate the financial

and economic cost associated with current level of solid waste management in the Rewa Province, (iii) determine the willingness to pay for a clean environment, and (iv) undertake a financial assessment of a waste collection system linked to the existing urban waste collection and disposal system for Nausori town.

2.1 Household survey: waste generation and disposal survey plus waste-related costs

The primary source of household information was a stratified sample survey of rural households, using a pre-tested questionnaire; 330 households were interviewed out of a total of 4,806 in rural villages and settlements in Rewa Province. Rural Rewa areas included all villages and settlements listed in the 1996 census, excluding households in Greater Suva City, Nausori and Naulu.

The questionnaire was designed in English and then translated into Fijian at the time of the survey. Information was obtained on:

- socioeconomic characteristics of the household;
- the level and types of solid waste generated, recycled (if any), and disposal methods used by households;
- liquid (human and animal) waste generated and liquid waste disposal methods used;
- sources of drinking water, treatment if any, and costs involved;
- incidence of waste-related water and vector borne diseases in the family; and
- costs associated with treatment and/or avoiding the health effects.

The survey was also used to determine the economic value of a “clean” environment associated with a properly functioning waste collection and disposal services. The recall method was relied on to obtain information from communities.

2.2 Household waste audit

A waste audit was carried out in order to update information on household solid waste characteristics and to determine the difference in volume and nature of solid wastes generated by rural Fijian and Indo-Fijian households. For the Indo-Fijian households, six households were selected from Lokia settlement (Lokia is considered to be a “typical” rural Indo-Fijian settlement). Each household was given 50 litre plastic garbage bags to store all their household rubbish each day. Daily bags were collected and the wastes weighed. Waste was then sorted into the different categories, and each category of waste was weighed daily over a period of seven days to determine the amount of different types of wastes generated. For the Fijian rural households, recently completed waste audits for Vunisinu and Nalase villages under the IWP pilot project were used in this study.

2.3 Financial and economic costs of wastes

In order to estimate the financial cost of wastes in the Rewa Province, the volume and nature of waste generated and disposal methods used by the individual households were determined. Information about the direct link between household solid and liquid waste and their environmental and human health effects was then obtained. Costs associated with each direct and indirect effect were estimated and the aggregate financial and economical costs of wastes then determined.

Secondary data

The primary data was supplemented with secondary information obtained from the review of published and unpublished literature on wastes and waste management in Fiji, and interviews with key government staff associated with different aspects of waste management. Much of the background information on wastes in Fiji was obtained from published official census reports, annual reports and other unpublished literature, such as past IWP pilot project and student theses.

The national-level qualitative and quantitative information was collected from government officials involved with wastes and environment management. A semi-structured questionnaire was used to collect primary data from different government stakeholders, including the Ministry of Health and local district nurses, Ministry of Environment, and *Roko Tui Rewa*. Staff of the Rewa Provincial Council, Suva and Nausori Town Council officials, and private waste collectors operating in the Nausori area were also interviewed. Wherever possible, annual reports, special waste reports, etc. were also collected from the relevant ministries.

The Ministry of Health is the primary government source of waste-related health data. Data collected from the Ministry of Health include diseases commonly associated with solid wastes and human and animal wastes, human and solid waste-related preventative measures and costs, and costs associated with outpatient and inpatient treatments. Additional waste-related information and health costs were also obtained from district nurse, local clinics and local hospital. Data gathered from these sources included the number of incidences of waste-related diseases reported in a week, and type, quantity and cost of medicine commonly used to treat each of the diseases. Limited information was also obtained from the Ministry of Environment.

An open-ended interview format in a *talanoa* session, but guided by a questionnaire, is usually found to be most suited when approaching villagers, as it puts them at ease without appearing to be prying. At the village level, information was sought about the nature of the village-based waste collection system (if any), water treatment and supply system (if present), and their respective costs. Financial costs and price information was also collected from villagers, commercial waste collectors, collectors of recyclable material, as well retail prices of medicines from retail chemists in the Nausori area.

Where such official records were not available this research relied on recall information provided by the government officials and/or villagers. Data had to be triangulated wherever possible and as necessary. Differences, when found, were cross-checked and verified using secondary information and or by other stakeholders familiar with wastes in Fiji. In addition to the oral and written information obtained from various stakeholders, some background information on wastes in Fiji was obtained from published official census reports, annual reports and other unpublished literature, such as reports from the IWP Vunisinu and Nalase pilot project villages.

Using the results of these interviews and data collected from other sources, typical impact models associated with different categories of effects were constructed for typical waste categories. These models were then used to estimate the financial costs associated with the impacts of solid and liquid wastes on rural Fiji residents, and the economic costs of inadequate waste management.

3 Waste generation and management in Rewa Province

It is estimated that by the end of 2006, rural residents in Rewa Province would have produced a total of 3514 t of solid waste, amounting to 731 kg of solid waste/HH/year.

Fijian households on average produce about 15 kg/HH/week, compared with 8.58 kg/HH/week by Indo-Fijian households. The main difference is due to the amount of organic waste produced by Fijians households, from the consumption of food items such as taro and tapioca (Table 1). Excluding organic waste material, there was little difference between Fijian and Indo-Fijian households living in the Rewa province.

Table 1: Waste produced in Fijian and Indo-Fijian households in Rewa Province

Waste Type	Fijian		Indo-Fijian	
	kg/ HH/ week		kg/ HH/ week	
Biodegradable	10.51	69.9%	4.53	52.8%
Glass	0.15	1.0%	0.81	9.4%
Hazardous	0.08	0.5%	0	0.0%
Metals	0.62	4.1%	0.48	5.6%
Paper	0.96	6.4%	1.45	16.9%
Plastics	1.13	7.5%	0.81	9.4%
Textiles	0.26	1.7%	0.02	0.2%
Other	1.33	8.8%	0.48	5.6%
Total	15.04		8.58	

Source: Rewa Rural Waste Audit, June 2005

The majority of wastes generated in the rural areas is generally reusable, compostable and or recyclable. For some 10–17% of waste proper disposal would be necessary, assuming all the reusable and recyclable materials were appropriately taken care of. “Other” wastes include construction materials, textiles (fabric), timber and Styrofoam, for which some form of landfill disposal may be necessary.

3.1 Household waste management in Rewa Province

In rural areas, households take care of their own solid wastes; often the visual impact of waste around homes is seen as the main reason for household solid waste management practices. Burning of wastes is the most common waste “disposal” method, with almost all

Table 2: Proportion of households using different methods of waste disposal

Disposal Method	Count	% of HH surveyed
Burn	311	94%
Bury	200	61%
Reuse	93	28%
Rubbish dump	116	35%
Throw anywhere	89	27%
Compost	24	7%
Pig food	30	9%
Other	154	47%
Total no. HH surveyed	330	

(94%) of the households indicating they burn wastes (Table 2). This was followed by yard burial of wastes that cannot be burned. Almost 60% noted that they either threw some or all of their rubbish in mangrove swamps, on coastal foreshores or engaged in indiscriminate dumping elsewhere.

Composting

The concept of composting of wastes is a recent introduction, with about a third of the households noting they understood what composting was and practiced some form of composting (Fig. 1). Only 4% actually practice proper composting, with a further 70% noting they either threw food cuttings and peelings from root crops, grass clippings and other greenery onto vegetable and flower garden beds, or in the bush (possibly as feed for pigs).



Figure 1: Typical village compost heap
(Source: IWP Fiji)

Reuse and recycling

There is some reuse of household wastes, with about a third of the household reporting reusing items such as plastic bottles, glass bottles and cardboard boxes. The concept of recycling is fairly new concept, practiced by less than 10% of households (mainly selling of beer bottles). Those households that did recycle glass earned no more than one dollar in income in a quarter year or about FJD 3 a year from selling mainly beer bottles and PET bottles. Those rural households in the Rewa Province which do not recycle would thus be foregoing an income of about FJD 14,400 per year.



Figure 2: Recycling Centre at Vunisinu Village, Rewa Province
(Source: IWP Fiji)

Human and animal waste

Human and animal wastes are major sources of pollution. Rural villages rely on household-based human waste management. Only about a quarter of the households use septic tanks for human waste disposal, with the majority using pit latrines, most of which are without any flushing system. Even where pit latrines are used, poor maintenance of septic tanks is a major problem. The majority of the septic toilets were never cleaned.

Animal waste is also a source of pollution in rural areas. Given the importance of pigs in the Fijian culture, about 65% of households kept pigs, with households owning an average of about 3.4 pigs; collectively Fijian villages are estimated to have about 16,050 pigs. Most pigs are allowed to roam free, or are put in pigpens that are located near waterways. Households “manage” animal waste by sweeping it into a rubbish heap, dumping it in the nearby bush, or washing it directly into rivers. It is commonly left in the open, and during rainy weather organic matter and bacteria enter the water system. Research conducted in Fiji by the New Zealand National Institute of Water and Atmospheric Research (NIWA)

stated that pollutants in pig waste constitute a threat to human health, as well as to coral reefs (Unpublished data, Department of Environment (S. Singh), October 2005). Pigs can be infected with enteric pathogens and parasites that can be easily passed on to humans through exposure to waste, contaminated soil or ground or surface waters. Most piggeries are located in ecologically sensitive areas such as beaches or rivers. According to the University of the South Pacific Institute of Applied Sciences, the nitrogen load from pig waste is three times higher than from human waste and about 80% reaches the sea untreated (Unpublished data, Department of Environment (S. Singh), October 2005). The NIWA report recommends the immediate mass relocation of piggeries away from streams and channels.

3.2 Residual effect of solid and liquid waste

Solid and liquid waste have some impact on human health as well as on the environment. The aesthetic effects of solid and liquid waste cause the most concern to local villagers, although almost 60% of households reported suffering from waste-related illnesses such as diarrhoea and other gastrointestinal illnesses, dengue fever and skin infections. Of this skin infections followed by diarrhoea and other gastrointestinal-related illness. Only a small percentage of households reported anyone suffering from dengue (Figure 3). This is consistent with reported cases from the Rewa District Nurse (Table 3).

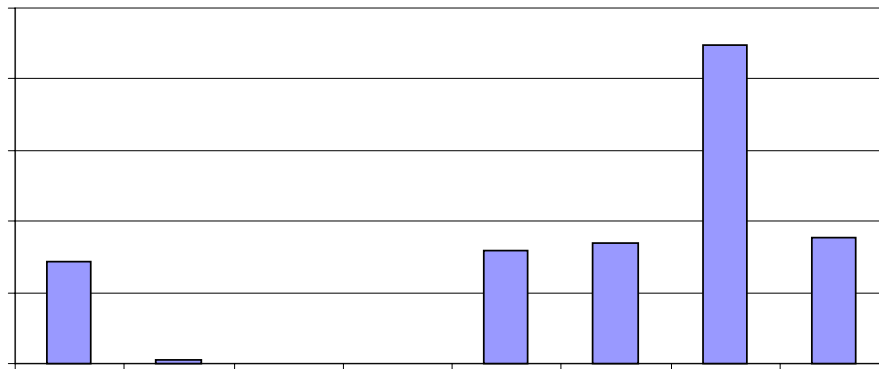


Figure 3: Reported number of cases of human and solid waste-related illnesses by the Nausori Health Centre serving the lower Rewa Province, October-December 2005. Source: Sister Lomanivere, Nausori Health Centre, pers comm 20 February 2006.

Table 3: General Out Patients Department and Accident Emergency Statistics for the Rewa Sub-Division.

Disease	Jan-Dec, 2005	Jan-July, 2006
Diarrhoea	300	267
Dysentery	5	7
Infantile diarrhoea	42	68
Scabies	469	137

Leachate from solid waste “dumps”, along with human and animal waste, also contains high levels of nitrates and phosphates, causing some eutrophication of coastal waters. Depending on the type of waste disposed of in open dumps, the leachate may also contain certain heavy metals. Environmental outcomes of eutrophication include a decrease in

biological diversity, coastal ecosystems, and a decline in water quality. However, local water quality data is almost non-existent and it is difficult to assess the impact of human and animal waste in most of the Rewa province.

3.3 Financial and economic costs associated with liquid and solid waste management

Financial and economic costs associated with poor liquid and solid waste management was difficult to estimate because of the unavailability of relevant base information. If appropriate base data were available¹ it would have been possible to fully estimate the economic and financial costs associated with liquid and solid waste management situation in the Rewa Province, using a ‘*with and without*’ benefit–cost analysis (BCA). The following section is extracted from Lal and Takau (2006).

With and without benefit-cost analysis

A with-and-without analysis refers to the difference between the economic net benefits of the current situation of waste management (the with-waste scenario) and the economic net benefits of the alternative situation of improved management (the without-waste scenario) (see Sinden and Thampapillai 1995 for a discussion on with-and-without analysis).

Solid waste is generated by humans because of their consumption of goods of some type, while liquid waste is a product of human existence. It is assumed that there is no change in their lifestyle and thus the direct benefits (utility) of consuming the goods are constant, regardless of whether waste is managed. A with-and-without BCA in such a situation is, therefore, effectively a with-and-without analysis of costs; that is, the BCA reduces to an analysis of economic costs with waste (i) without improvements in waste management and (ii) with improvement in waste management.

In the with-waste scenario, the direct economic costs of waste include costs associated with human health effects of poor waste management, including hospital costs, the costs of private doctors’ fees and medicine, the value of human life (in the event of deaths), and the cost of human suffering. It also includes the costs of measures taken to prevent health problems, such as the collection of rain water to avoid the use of groundwater, the purchase of bottled water in order to minimise the risk of catching water-borne diseases, and preventative measures taken by the government, such as spraying villages for mosquitoes. The with-waste costs also include the loss in potential earnings from not recycling, indirect costs of the loss in coastal fisheries, loss in tourism earnings and non-market values associated with the loss in environmental amenity.

The without scenario used in the BCA assumes that waste management is improved in a way that makes economic costs negligible. In this case, the economic cost of poor waste management is the sum of :

- private health costs;
- preventative costs;
- economic cost of human life;
- health and preventative government costs;
- aesthetic value of a clean environment;
- cost to fisheries;
- cost to tourism;

¹ As was the case in a similar study done in Tonga; see Lal and Takau 2006.

- foregone earnings from recyclable material sent to the dump; and
- foregone earnings from organic matter not composted.

Table 4: With- and without-costs categories

Costs with current state of waste problems	Costs without waste problems, or negligible or zero impacts
Direct costs	
<ul style="list-style-type: none"> • Treatment of diarrhoea, dengue and skin diseases, including transportation costs to the hospital or private doctors, doctors' fees, if any, and the cost of medicine • Financial costs of health services borne by the government • Economic value of loss of human life attributable to waste • Economic cost of human suffering • Private costs associated with preventative measures: cost of rainwater tanks, filters, and bottled water • Costs of government's preventative actions • Foregone earnings from recyclable waste going to the dump • Potential economic value of composted organic matter 	<ul style="list-style-type: none"> • Nil private costs • Nil government expenditure on waste-related illnesses • no loss of human lives • Loss of human life and human suffering avoided • No preventative measures needed • No recyclable material is sent to the dump • No organic matter going to the dump
Indirect costs	
<ul style="list-style-type: none"> • Economic value of the loss in fisheries • Economic loss of tourism due to reduced number of international tourists • Economic value of aesthetic benefits associated with clean environment 	<ul style="list-style-type: none"> • Loss of fisheries and environment avoided • No loss to the tourism industry • aesthetics restored

To determine the economic cost of waste, it is first important to determine the causal relationship between waste its impact on human health, tourism, fisheries and environmental aesthetics. Market values should then be assigned to these impacts using one of more of the methods in box 1;

Box 1: Valuation techniques used in this study

The value a person places on a good or service reflects the amount that person is willing to pay for it rather than go without it. For example, the household survey results in this study indicated that households were concerned about the aesthetic effects of littering in their villages. The value that people associate with having an aesthetically more pleasing environment — free of litter — would then be reflected in the amount that people would be willing to pay for a waste collection service that eliminated littering. Where markets exist, the market price reflects a person's willingness-to-pay for improved waste management systems, and this can be used to determine the economic costs of waste. Where markets do not exist, a proxy measure has to be determined using one of several valuation methods.

Market valuation

Market valuation methods include the use of market-based cost and price information to determine losses households incur due to health problems, lost production and lost earnings. This economic analysis used the following market valuation methods:

Preventative and mitigating expenditure

The costs incurred by households to reduce the risk of getting sick from drinking contaminated water are used in this study as a proxy for the cost associated with polluted water due to waste contamination. The cost of purchasing bottled water and rainwater tank plus filters, for example, are used as a proxy for the waste-related cost of human health. The government may also incur costs associated with, for example, mosquito control. Market costs are also included in the preventative expenditure estimates. Despite such preventative measures being taken by individual households and the government, a number of cases of water-borne diseases directly attributable to poor waste management are reported, resulting in additional health costs.

Human health cost

The economic cost of getting ill because of poor waste management was estimated using actual costs incurred by the person. The cost associated with coming down with diarrhea from waste-contaminated water includes the cost of transport to the doctor, the doctor's fees, the cost of medicine needed to treat the disease, and any loss in income the person experiences if diarrhea causes the person to stay away from work. The approach was used to estimate the cost of acquiring skin diseases, and dengue caused by mosquitoes that breed in waste that was poorly disposed of.²

In addition to out-of-pocket financial costs, there are also hospital and medication costs borne by the government. In some cases, poor waste management-related dengue resulted in villagers not being able to get to work and, in extreme cases, deaths were also reported. To determine the economic cost of loss in productivity (regardless of whether the person was paid for the time away from work) and loss in lives, the production method was used.

Production method

This method measures the loss in the value of production due to loss in productivity and/or loss of lives. The loss in productive time was estimated as the wage rate and number of days away from work. The value of the loss in human life due to dengue or any other waste-induced illnesses was also estimated using the market pricing method. In this method, the present value of future loss in income from the death of a person is used as a proxy for the value of human life.

The production method was also used to calculate the value of the loss in coastal fisheries due to pollution and eutrophication. Similarly, if poor environmental effects led to a decline in tourist numbers, the loss in gross value of the tourist expenditure was measured using the production method. Market prices and quantities can be used to estimate the impact of waste on the tourist industry and the coastal fisheries, assuming a direct causal relationship between waste and tourist numbers and waste and coastal fisheries is known to exist.

Foregone earnings

Recyclable material that is not recycled is a wasted resource. This is because people may have earned income or produced more goods had they recycled. The value of the economic loss of not recycling can be estimated by calculating the earnings foregone. Ideally, the total gross value of foregone earnings is the export value of the potential volume of recyclable material. It was not possible, however, to obtain this information from exporters because of the confidential nature of this information. Instead, a second-best estimate of the recycling value was made using the value of earnings that the households would have earned had they sold their recyclable material to the local recycling companies.

Non-market valuation

A number of non-market valuation techniques can be used to estimate the economic value of goods and services that are not directly bought and sold in the market. These techniques

² Market price is used in this study as a proxy for economic value. (See Perkins 1994 for further discussion on the relationship between financial and economic values.)

include what is known as revealed preferences methods, such as travel cost and hedonic pricing, and expressed preference methods, such as contingent valuation method and choice modelling. The contingent valuation method was used in this study to estimate household WTP for improved waste management (see Hanemann 1988; Freeman 1991; and Carson et al. 2003 for details on the different methods).

Contingent valuation

This method relies on people's ability to express their WTP for an improved environmental amenity such as waste collection and disposal. Using this method, people are asked to express how much they value a clean environment by directly asking them how much they would be willing to pay for improved management services to achieve it. This can be done using open ended questions such as, 'How much are you willing to pay for [a specified increment of environmental improvement]?' Alternatively, people can be asked discrete questions about whether they are willing to pay a specified amount, and then calculating the average WTP estimate for the improvement (see Box 3). This measure is used as a proxy for the non-market aesthetic value associated with no waste.

Non-market-based techniques, because of their hypothetical nature, can have several sources of bias but all efforts were undertaken in this study to minimise bias through a carefully designed questionnaire (See Freeman 1993; and Carson et al. 2003 for information on non-market valuation and bias).

Human health-related costs

Due to the limited baseline information available in Fiji, only the human health costs could be estimated. Direct human health costs, and associated costs related to illnesses that are directly linked to the effects of poor disposal of solid and liquid wastes in the surveyed rural households in Rewa Province is estimated to be FJD 4,680, excluding the cost of treating boils, which were not reported in the survey conducted under this study. However, the district nurse reported almost 900 incidents of boil in the first quarter of 2006. Assuming that a similar incidence of each type of waste-related disease occurs in other rural areas in the unsurveyed areas of the Rewa Province, the total health-related economic cost associated with poor waste management for the rural areas in the Rewa Province is estimated to be FJD 111,894 a year (see Fig. 4). Of this, only 1% of the cost is directly attributed to mosquito-borne dengue fever associated with solid wastes. Less than 50% of the dengue incidents would have been reported to the doctors or rural health officers. In most cases, households tend to obtain off the counter medicine from local pharmacies.

Recycling

The rural households surveyed in this study earned an average of \$3/year from recycling.³ This suggests that if all rural households in rural Rewa Province were to practice recycling, about FJD 14,418 could have been earned. There are also additional benefits of composting of organic matter, which comprise approximately 56% of the household wastes. On average, a household produces about 3 bags of composted material, with a value of FJD 5/bag, giving a value of FJD 15 per household or a total value of about FJD 72,000.

³ The results differ from the findings of limited household survey data collected during the Vunisinu waste survey in 2004. The Vunisinu survey reported average household recycling income of FJD 1/month, or FJD 12/year.

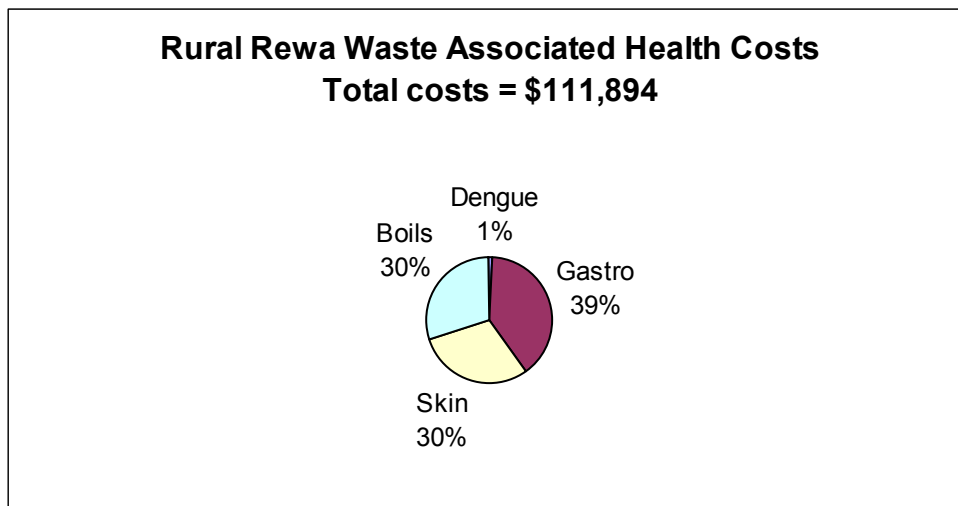


Fig 4: Rural Rewa waste associated health costs

Source: Household Survey Results, 2006.

Total cost

The total “economic” cost of poor waste management practices to rural households in the Rewa Province equals the sum of the human health-related costs of FJD 111,894, the forgone recycling income of FJD 14,418, and the market value of compost of FJD 72,000, which equals a minimum of FJD 198,400.

This suggests that if the rural dwellers of Rewa Province were to practice more responsible waste management, they could expect to ‘save’ an economic loss of FJD 198,400 or about FJD 41 per rural household per year.

3.4 Rural solid waste management

Rural waste management in Fiji is almost non-existent, although Fiji has made international and regional commitments, including by signing the Mauritius Strategy for the Further Implementation of the Barbados Programme of Action; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; the Waigani Convention; and the Stockholm Convention in 2001 (Government of Fiji 2006).

Both urban and rural areas have suffered from a lack of infrastructure, a lack of appropriate legislation and/or financial constraints.

There are at least four laws that specifically address urban waste management, all of which suffer from poor enforcement. They include the Public Health Act, 1936 (1995 Amendment, Cap 111), the litter decree of 1991, the Local Government Act and Environment Management Act (EMA) of 2005. This Ministry of Environment is currently developing regulations that will enable enforcement of the EMA.

The Public Health Act was drafted during the colonial era, with very few amendments since then. It largely deals wastes from a human health and public nuisance perspective, and does not provide for the changing nature of waste. The litter decree deals with waste litter in all areas and stipulates some strong monitoring and enforcement clauses. However, these have not been effective largely because the penalties are very low.

Fijian villages are in any case exempted from these national laws. Fijian villages are administered under the Fijian Affairs Act and through the Fijian Affairs Board. The Fijian Affairs Act does not contain a clause to manage waste or protect the environment. With a

village, the chief can make bylaws relating to waste management and informally manage waste through Village Development Committees.

The Environment Management Act (EMA) was enacted by the Fijian Parliament in 2005. Section 5 of the EMA comprehensively addresses waste management and pollution control, and its implementation and enforcement should result in a marked improvement in the standard of waste management in Fiji. It should be noted that the act is not yet being enforced (regulations must first be drafted). The Act targets commercial facilities only and does not cover individual households located in either rural or urban areas.

Currently almost all villages in rural areas have open dumps, mostly of which are located in mangroves, near riverbanks or along the coast. Many villages who reside near major rivers or the sea use these water bodies for rubbish disposal. Some efforts have been made by the Government and regional organizations (e.g. SPREP) to introduce more responsible rural waste management (Box 2).

Box 2: IWP and rural waste management pilot study

To assist the Government of Fiji develop rural waste systems and pilot best practices in waste management, IWP worked with two pilot communities in the Rewa Province for 3.5 years to find ways to minimize the impacts of solid and liquid waste. Initially, the two communities were dumping all types of waste in the three mini-dumps located in the mangrove areas alongside the village, and into the river. The improper disposal of waste has led to depletion of the marine resources and poor water quality, and has also been a human health hazard, causing high levels of skin diseases among children in the community.

IWP used a bottom-up participatory approach to engage communities and helped them find appropriate ways to manage their environment and natural resources. The best practices in waste management have been documented and are being replicated to other provinces in Fiji through the Ministry of Regional Development and Fijian Affairs and Ministry of Multi-Ethnic Affairs Capacity Building Project, and through the Ministry of Environment. The best-practices were based on the basic principles of recycling, reusing, reducing and refusing waste. Some of the activities that are in keeping with these principles and have been promoted at community level are composting of household waste, and the establishment of recycling centres, together with the engagement of a waste removal company to remove inorganic waste from the area.

Although the composting of household and green waste can be seen by some as an extra daily chore, it is not a new practice for members of the community, as it was practiced by their forebears. However, the recycling of waste is quite a new concept for rural dwellers, but this has easily been taken onboard by most rural communities, without too much need for awareness raising. A waste removal company, Waste Care Fiji Limited, was engaged on a trial basis in December, 2004, to remove inorganic waste or waste that cannot be recycled.

After seeing the success of the IWP pilot communities, other neighbouring villages in the Rewa Province have followed suit: the nearby village of Nadoria Village in the Dreketi Tikina has established a recycling centre and is practicing household composting.

In addition to IWP, some NGOs have also implemented some waste management initiatives in a few villages along the Coral Coast, which is popular with tourists. Visible efforts include establishment of recycling centres, and placement of waste bins and rubbish stands, with inorganic waste removal undertaken with assistance by hotels such as Fijian Resort.

There is only one sanitary landfill in the country (see Box 3), with most of the local authorities operating open dump sites in their own jurisdiction.

Box 3: Naboro Sanitary Landfill Operations

The only sanitary landfill at Naboro started its operation in 2005. The landfill is a joint venture between the Fijian Government and the European Union. The landfill serves the greater Suva area, as well as adjacent peri-urban towns. The councils and rural local authorities that take their waste to Naboro landfill include the Navua Rural Local Authority, Lami Town Council, Suva City Council, Nasinu Town Council and the Nausori Town Council. Wastes generated by squatter settlements within these city and town boundaries are not collected by the councils because they do not pay town rates. Some councils (e.g. the Nasinu Town Council) have asked the government to subsidise the collection, so that they can collect waste from the squatter areas). Villages in these areas do not pay city rates but some pay garbage collection rates and hence their waste is collected. Some villages have engaged private waste collectors to collect waste.

Currently all types of waste go to the landfill. There is no sorting of rubbish, either at household level or at the landfill. Some discussion has taken place between the Ministry of Environment and the Japan International Cooperation Agency (JICA) to establish transfer stations where waste can be sorted. Special clearances must be obtained from the Ministry if hazardous waste or any contaminated soil is to be disposed at the landfill.

The landfill is operated by HG Leach, a private New Zealand contractor engaged by the Fijian Government. The Government has plans to extend the current landfill. Construction of cell 2 of the landfill is scheduled to start later in 2008.

3.5 User pays system

In urban areas in Fiji, waste collection and disposal costs are partially covered by the city or town rates (fees) that residents pay to their respective city or town council or local authority. However, it is unclear what proportion of the city rates reflect the true cost of removal and disposal of solid wastes, as compared with the fee for other services provided by the authorities. In rural areas where there are no town councils, residents do not pay town/city rates, waste collection services are not provided, and residents do resort to burying, burning and or illegal disposal of wastes in nearby mangrove swamps or coastal areas.

Willingness to pay (WTP) for waste removal

The contingent valuation approach was adopted in this study to determine how much rural households in villages and settlements in the Rewa Province were willing to pay for waste removal. The results suggest that on average the WTP of a rural household FJD 1.75/HH/week. WTP ranged from a low of FJD 0.50/ week to a few households willing to pay FJD 3/week; the majority of households surveyed were willing to pay around FJD 2/week for collection and disposal of their solid wastes.

The WTP measured here is greater than the amount paid by the IWP pilot village, Vunisinu in Noco Tikina when pilot project was first established in 2005 by *Waste Care Services*. Vunisinu residents' monthly cost comprised FJD 1.50/day for bin rental and a FJD 65 pick up and disposal charge, or an average of approximately FJD 3.93/HH/month, or about FJD 1/HH/week. More recently, the villagers changed over to another waste collection and disposal company, *Waste Disposal Services*, which collects bi-monthly and charges FJD 95 per removal, an average of FJD 1.7/household/month, or about FJD 0.50/HH/week. The fees are paid by the Village Development Committee through their yearly village fund-raising exercise. Thus, the removal and disposal by a commercial operator is still within the range that some households are willing to pay (see Fig. 5).



Figure 5: Waste bins at the IWP pilot site, Vunisinu Village, Rewa Province (Source: IWP Fiji)

It is important to note that almost half of the households were not willing to pay anything. Reasons given included that they had other priorities, could continue using their usual method of disposal (e.g. burying, throwing in mangroves and along the coast). Thus, for a rural waste management system to be cost effective, a *mandatory* village/settlement-based waste collection and disposal system may be needed.

4 Rural waste management options

Rural waste management options in Fiji are limited because of the small population size, the geographical distribution of households and limited resources.

For villages and settlements close to urban areas, the most logical approach could be to link up with existing waste removal and disposal system operating in nearby urban areas. Rural villages and settlements could collectively negotiate a regular waste management arrangement, for a fee, with a commercial company such as *Waste Disposal Services*, and take advantage of the benefits of economies of scale. As discussed above, the unit cost of commercial charges for collection and disposal is less than the lower limit of WTP by rural households in the Rewa Province. Operationally, at least for the rural areas of the Rewa Province, a regular commercial collection of solid wastes could be financial feasible, according to Waste Care Services (Hafiz Raza, Manager, Waste Care Services, pers comm., February 2006). Thus, either a single pick up fee, as charged by *Waste Disposal Services*, or a two part payment system used by the earlier company, *Waste Care Services*, could be used.

For such a system to be effective, each village and settlement would need to define a central location where the waste bins are kept together with a regular local collection arrangement. Operationally this will be relatively easy in a Fijian village, where the local village administrative setup could be used to establish and operate the waste collection system, such as in Vunisinu (see Box 4).

Box 4: Traditional Village Administration System and Vunisinu Waste Management System

All Fijian villages are linked into the national government structure through their districts or *Tikina* and Provincial Councils and *Roko Tuis*. Under the Fijian Affairs Act, each village has a *Turaga-ni-koro*, who is also a member of District Council; authority then follows upwards to the Provincial Council and the Fijian Affairs Board. *Turaga-ni-koro* regularly calls village meetings, *Bose-ni-koro*, where village-related matters are discussed, and where necessary may also formally pass village bylaws.

A *Bose-ni-koro* also serves as a vehicle through which key policies and strategies are communicated to villagers, and is used as a mechanism for communicating local level concerns and issues to the central government. Through *Bose-ni-koro* villages regularly establish different types of committees to collectively address local management issues (e.g., to manage wastes in Vunisinu village). Similar systems have also been used to manage marine protected areas in Fiji, and the Coral Coast Integrated Coastal Zone Management Project (administered by the USP Institute of Applied Sciences).

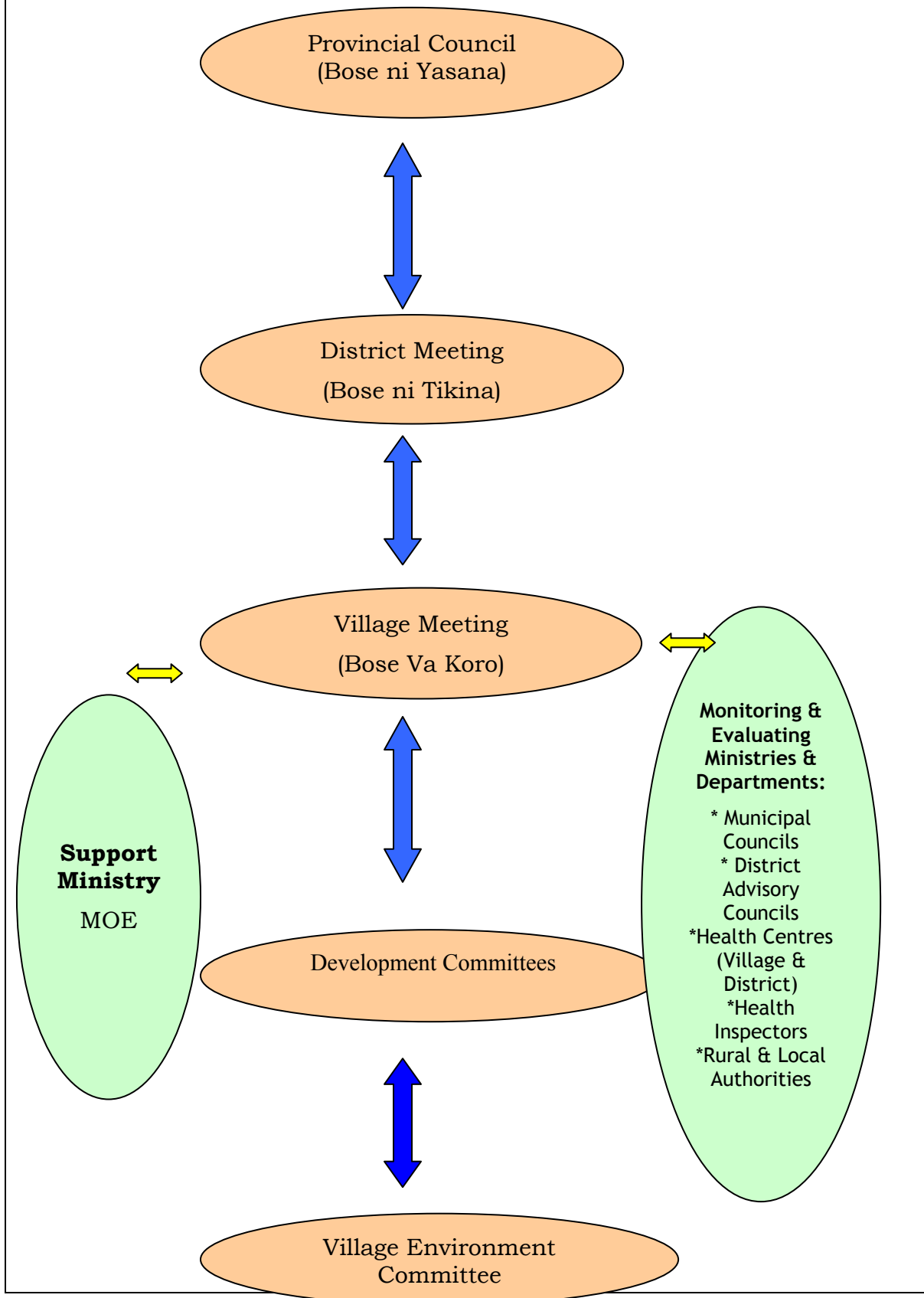
In the village of Vunisinu the Navovula Development Committee deals with all village development and management issues. It established a Village Environment Committee which was tasked with the responsibility of managing wastes and general environmental quality.

The Environment Committee developed and implemented the policy on reuse, recycling and composting of organic matter and the collection and disposal of residual solid wastes for a fee. They developed and conducted an education and awareness campaign on appropriate waste management system, including strategies for reducing, reusing and recycling their wastes.

They approached, with the help of the IWP project, a commercial company operating in the nearby urban town, Nausori, to supply waste bins and to collect and dispose of the residual solid waste. Within the village, the Environment Committee twice weekly collects wastes from each household and dumps them in the waste bins provided by the commercial waste collector. The Environment Committee also monitors household waste disposal behaviour and puts moral pressure on villages to remove all recyclable and compostable material (Sandeep Singh, IWP Coordinator, Department of Environment, pers comm. January 2007).

Without this monitoring and “enforcement” by the Village Environment Committee, such a collection and disposal system is not likely to be very effective, as was experienced in Nalase village, the second IWP pilot project site. Nalase village does not have a Village Development Committee or a Village Environment Committee. There was thus no local level monitoring and enforcement of waste management strategies, resulting in many villagers not putting their wastes in the bins provided; no one collected the rubbish on a regular basis. Some villagers were also not willing to contribute towards the cost of the village based collection system

INSTITUTIONAL REPORTING STRUCTURE FOR VILLAGE SYSTEM



For Indo-Fijian settlements, the logistics of a local collection and disposal system would need to be carefully assessed before such a system is introduced. Indo-Fijian households are scattered over a larger area and settlements generally do not have institutional structures such as development committees or councils; the traditional *panchayat* system have generally disintegrated in most places around Fiji.

A full cost recovery-based household waste management system for villages in remote areas and outer islands is more difficult to introduce for several reasons. The volume of wastes are likely to be small and the distance from urban waste collection system large, making it too costly for existing urban waste collectors to extend their regular services without losing money. Unit cost of collection and disposal per household would most likely to be well beyond their ability and or willingness to pay. Once recyclable materials accumulated at the village level these would also need to be collected, in this case by recycling companies, but here also the volumes are likely to be too small for a financially viable collection by recycling companies. Thus a “formal” waste management system may work only if it is externally subsidized and a local village-level management system is established.

Alternatively, the government may wish to consider localized transfer stations linked to urban waste landfill sites; or a localized mini landfill for a cluster of villages and/or settlements. However, each of these options pose their own administrative, operational and financial feasibility issues for the Government and local communities, which must be carefully considered before a decision is made.

In conclusion, options for rural waste management are:

- full cost recovery-based rural–urban tandem residual waste collection and disposal
- partially subsidized rural–urban tandem residual waste collection and disposal system
- a localized transfer station linked to an urban waste landfill site; and
- a localized mini landfill for a cluster of villages and or settlements.

Regardless of which system is selected, in the design of the system it is important to ensure financial viability and practical considerations of:

- collection and transfer of residual wastes and recyclable material to waste bins under wither the rural–urban tandem system, transfer stations or mini landfill sites;
- local village or settlement-based fee collection and/or payment system; and
- local village or settlement-based monitoring and enforcement of waste separation, recycling and disposal and collection system.

Policy recommendations

Proper waste management in urban and rural areas is one of the priorities listed in the Fiji draft Strategic Development Plan (2007–2011) (Government of Fiji 2006). The Government of Fiji endorsed a National Solid Waste Management Strategy in 2006. It is recommended that the Government of Fiji develop and implement (i) village and settlement-based rural waste management strategies and initiatives, supported by appropriate rural waste management legislation, or amendments to existing legislation that

addresses solid waste management issues, and (ii) village bylaws to encourage

- reuse, reduce, recycle of household wastes;
- composting of household organic matter; and
- removal and disposal of residual wastes.

If implemented the National Liquid Waste Management Strategy and Action Plan developed under IWP (Fiji Ministry of the Environment 2007) could assist with liquid waste pollution problems. The strategy and action plan was endorsed by the Government of Fiji in October of 2006.

Rural waste management strategies

Rural waste management strategies will include:

1. Establishment and implementation of an appropriate rural waste management framework involving Ministry of Environment, Fijian Affairs Board, and the Ministry of Multi-Ethnic Affairs, together with relevant town or city councils or authorities and villages, and settlement-based institutional arrangement for encouraging reuse, reduction, recycling and responsible disposal of residual wastes. Such a system would also build on village/settlement-based development and environmental management decision-making processes where relevant, such as Village Development Committees

2. Development and implementation of an education and awareness campaign by the Ministry of Environment in partnership with the Fijian Affairs Board and the Ministry of Multi-Ethnic Affairs, targeting rural households, to encourage:

- reuse, reduction, and recycling of household wastes;
- composting of household organic matter; and
- removal and disposal of residual wastes.

3(a). Introduction of a full cost recovery-based rural waste management system **only** after assessing the feasibility of introducing a rural waste management arrangement in tandem with an existing urban waste management system;

(b). Where a full cost recovery-based commercial urban–rural tandem system is viable, the development and implementation of integrated solid waste management initiatives in partnership between the community and nearby urban-based waste management company;

(c). Where full cost recovery based tandem urban–rural waste collection and disposal system is not viable, such as for outer islands and or remote rural households, assessment of:

- the feasibility of introducing a partially-subsidised commercial system;
- the feasibility of establishing and operating fee-based transfer stations linked to an urban land fill system; and
- the feasibility of establishing and operating an independent mini landfill-based waste collection and disposal system.

(d). Once a system is selected for remote areas and outer islands, the development and implementation of an operational plan of initiatives in partnership with the community through the assistance of Assistant Roko and RokoTui for:

- reuse, reduction, and recycling of household wastes;

- composting of household organic matter;
 - a partial cost recovery-based residual waste collection and removal system; and
 - local monitoring and enforcement strategies.
4. For Indo-Fijian settlements, a pilot household waste management project will be undertaken to identify appropriate local level waste management arrangement, including detailed operational/administrative arrangements necessary for rural–urban tandem-based waste management.
5. Establishment of regular monitoring, enforcement and reporting of rural waste management efforts using a set of agreed indicators.

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_Draft_Thaman_et_al._for_CD_28.10.03.doc](http://www.sidsnet.org/docshare/other/20031105164530_WASTED_ISLANDS_-_Draft_Thaman_et_al._for_CD_28.10.03.doc).

Annex: Personal communications

CONTACT	COMPANY/ORGANISATION/DEPARTMENT	DATA/INFORMATION COLLECTED.
Merewalesi Raikoti	Bureau of Statistics	Households, Population, No. of villages in the Rewa Province.
Subhash Chand	Graphical Section (Lands Dept.)	Map outlining the provincial boundaries, villages, settlements, islets, roads.
Kusitino Mudanaivalu	Eco-tourism Unit (Ministry of Tourism)	Eco-tourism projects in the Rewa Province
Razia Khan	Waste and Pollution Officer (Ministry of Environment)	Stakeholder analysis from the National Solid Waste Management Strategy
Samisoni	Roads Section (Public Works Department)	Distance by road from villages/settlements to main road (in km).
Savenaca Kamikamica	Roko Tui Rewa	General information on the Rewa Province.
Taniela Tabukarau	Assistant Roko Tui Rewa	
Manasa Masere	Assistant Roko Tui Rewa	
Reshmi Chandra Prakash	Nausori Town Council	Council operations concerning garbage disposal and areas covered for waste collection.
Vijay Chand	Health Inspector (SCC)	SCC operations on waste collection.
Brian McAllister	Waste Management (Fiji) Ltd	Company operations on solid waste collection
Hafiz Raza	Waste Care (Fiji) Ltd	Company operations on solid waste collection
Max Olsson	Transport & Waste Disposal (Carpenters Shipping)	Company operations on solid waste collection
Shalendra Singh	Waste Recyclers (Fiji) Ltd.	Company operations on solid waste collection
Dr. Reddy R K	Dr. Reddys Private Clinic	Information on patients attended to and types of illnesses/disease related to improper solid waste management.
Sister Lomanivere and Staff.	Nausori, Wainibokasi and Naililili Health Centres	Figures on no. of patients from Rewa Province.
Parmod Kumar	Health Inspector-Nausori Health Office	Medical statistics on breakdown of water borne disease by rural/urban areas for the Rewa Sub-Division.
Ramesh	Managing Director-Pacific Batteries	Company Operations.

CONTACT	COMPANY/ORGANISATION/DEPARTMENT	DATA/INFORMATION COLLECTED.
Chauhan		
Vijendra Sharma	FIRCA	Waste Exporters Report for 2005
Sue Yabaki	Eden Nursery	Composting
Mr. Akbar	Gulraaz Nursery	Composting
Mrs. Jamila Akbar	Raiwaqa Nursery	Composting
Sher Singh Horton Young	Kinoya Treatment Plant	Operations at the Kinoya Treatment Plant
May	Cost U Less	Enquiries on compost materials
Arvin	Punja & Sons (Suva Store)	Enquiries on compost materials
Rita	M.H. Flagstaff	Enquiries on compost material
Viney	New World Supermarket	Enquiries on compost materials
Mada	AGCHEM Ltd (Fertilizer Company)	Enquiries on compost materials
Sharma	S.R. Sharma & Sons (Soil Company)	Enquiries on compost materials
Adman Ronald Ram Mizzam	M.H. Home Maker	Enquiries on compost materials
Shailendra Prasad	Coca-Cola Amatil	Company operations dealing with collection of plastic bottles and Coca-Cola Products.
Lusiana Ralogaivau	IWP Assistant	Progress Reports for IWP Project Sites.