

INSTITUTE OF APPLIED SCIENCES
THE UNIVERSITY OF THE SOUTH PACIFIC

Report of the Waste Management Workshop for Bau Island. March
9-10, 2006

IAS ENVIRONMENTAL STUDIES REPORT NUMBER: 185

By

Thaman, B., Dumaru, P

INSTITUTE OF APPLIED SCIENCES
THE UNIVERSITY OF THE SOUTH PACIFIC

REPORT OF THE WASTE MANAGEMENT
WORKSHOP FOR BAU ISLAND
MARCH 9 – 10, 2006
(English Version)

IAS ENVIRONMENT REPORT NO. 185

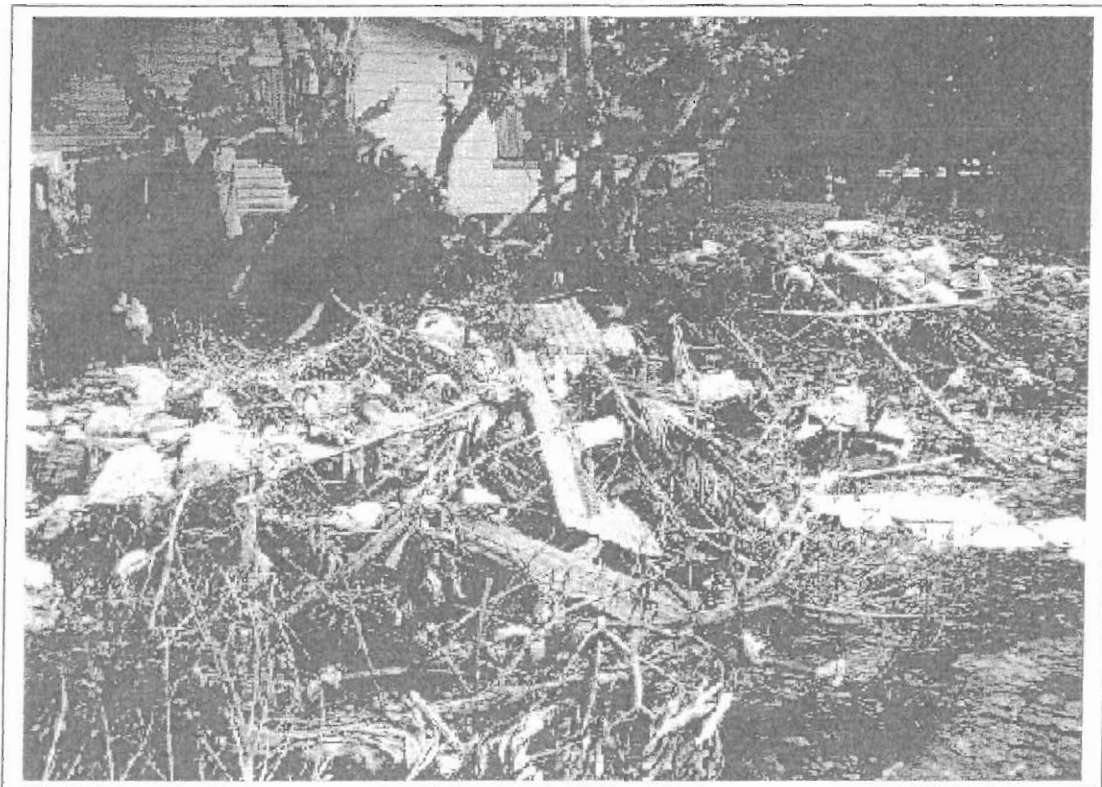
by

Batiri Thaman Hughes
Patrina Dumaru

April, 2006

REPORT OF THE WASTE MANAGEMENT WORKSHOP FOR BAU ISLAND

**March 9-10, 2006
(English Version)**



**By
Batiri Thaman Hughes
Patrina Dumaru**

**INSTITUTE OF APPLIED SCIENCES
THE UNIVERSITY OF THE SOUTH PACIFIC**
April 2006

ACKNOWLEDGEMENTS

Very special thanks to:

- Bau Waste Management Committee for assistance in the organisation
- Turaga ni Koro Bau, Josua Dainiteri for assistance in organising and provision of catering
- Dr. Bill Aalbersberg, Institute of Applied Science and Integrated Coastal Management for contributing to the funding

Presenters:

- Alyson 'Alisi' Venti - Peace Corp Volunteer, Tikina Komave
- Pita Vatucawaqa – Koro Vunisinu, Rewa
- Patrina Dumaru – Institute of Applied Science
- Batiri Thaman Hughes – Institute of Applied Science, Integrated Coastal Management

TABLE OF CONTENTS

- 1.0 INTRODUCTION
- 2.0 WORKSHOP OBJECTIVES
- 3.0 BACKGROUND
- 4.0 OUTLINE OF DAILY PROCEEDINGS

APPENDICES

- Appendix A
- Appendix B
- Appendix C
- Appendix D
- Appendix E
- Appendix F
- Appendix G

1.0 INTRODUCTION

The Bau Island Waste Management Workshop was held on the 9th and 10th March, 2006 in the village of Bau on Bau Island. The workshop was initiated by the Bau Island Waste Management Committee which approached IAS to carry out an awareness and planning workshop. Participants were from the three villages on Bau Island, Loma ni Koro (Bau), Soso and Lasakau. Around 21 participants attended each day of the workshop (Refer to Appendix A for Participants List).

The purpose of the workshop was to enhance the capacity of local community members to better manage waste on Bau Island. Although the aim was to improve waste management on the island in the long-term the focus of the workshop was to improve waste management practices in preparation for the Annual Methodist Conference to be held on Bau Island in August 2006 and to appropriately manage waste produced during the conference. Bau Island is a unique situation in relation to waste management because of its separation from the mainland and lack of land availability on the island which poses challenges for both solid and liquid waste management.

The workshop was planned and carried out by the Institute of Applied Sciences at USP with support and assistance from Alyson Venti a Peace Corps Volunteer from Komave on the Coral Coast Area and Pita Vatucawaqa from Vunisinu Village in Rewa where the IWP project is being carried out. It was conducted in Fijian. The Bau Waste Management Committee provided catering and allowance for community facilitator.

Figure 1. Bau Island



2.0 WORKSHOP OBJECTIVES

The workshop was conducted with the following objectives:

- i. To raise awareness on waste management concerns on the island and how to address them
- ii. To develop an action plan to improve waste management on the island prior to the conference
- iii. To develop an action plan to ensure waste is appropriately managed during the conference

3.0 BACKGROUND

There are 90 households on the island with a total population of 400. A primary school is situated on Bau Island. Transport to the island is by punt and takes approximately 10 minutes. The island is surrounded by a seawall or retaining wall which has gaps where small harbours or *matasawa* have been built. They are used as boat mooring sites and high tide access to individual houses (Siwatibua report?). At low tide there mudflat exist most of the way around the island. Fishing is still a major activity of the local residents. Plantations and gardens exist both on the island and on the mainland. No piggeries were observed to be in use on the island. Water is provided via piped water from the main water supply from the mainland.

4.0 OUTLINE OF DAILY PROCEEDINGS

DAY ONE: THURSDAY 9 MARCH, 2006

4.1 Fijian Protocol

The *sevusevu* was presented by Pita Vatucawaqa on behalf of the workshop team.

4.2 Opening Prayer

The workshop proper began at 9:30 with a prayer which was conducted by the *Turaga ni Koro*, Bau, Mr Josua Dainiteri

4.3 Workshop Introduction

Following introductions by the participants and resource people Pita Vatucawaqa explained the purpose and objectives of the workshop and briefly went through the workshop programme (Appendix B).

4.4 Ecology

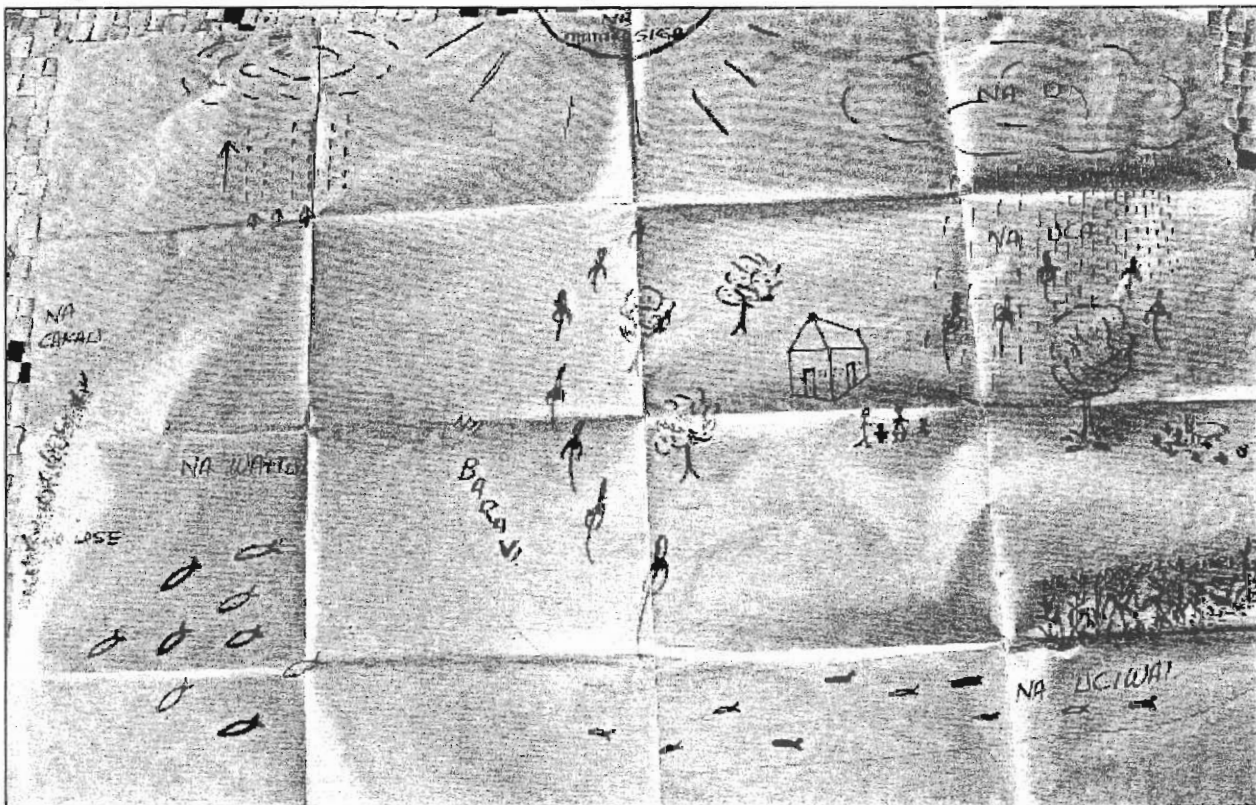
The workshop topics began with a discussion on Ecology carried out by Pita. The concept of ecology was discussed first.

Definition of Ecology: Relationship between living things and their environment.

“Na veiwakani ni veika bula kina veika bula era volivoliti keda.”

This was followed by an explanation on the interrelationships between living things and the physical environment. The poster discussed is shown below as Figure 2. Concepts included the importance and functions of different components such as trees in using up carbon dioxide and mangroves and reefs as nurseries for marine animals. Impacts of development and the provision of the environment by God and the need to look after it was also mentioned.

Figure 2. Poster on Ecology/Interrelationships in the environment



4.5 Waste Management Problems in Fiji

Alyson then presented on waste management issues in general and impacts of waste. She requested the participants to put forward problems related to waste on Bau Island.

These were recorded and were:

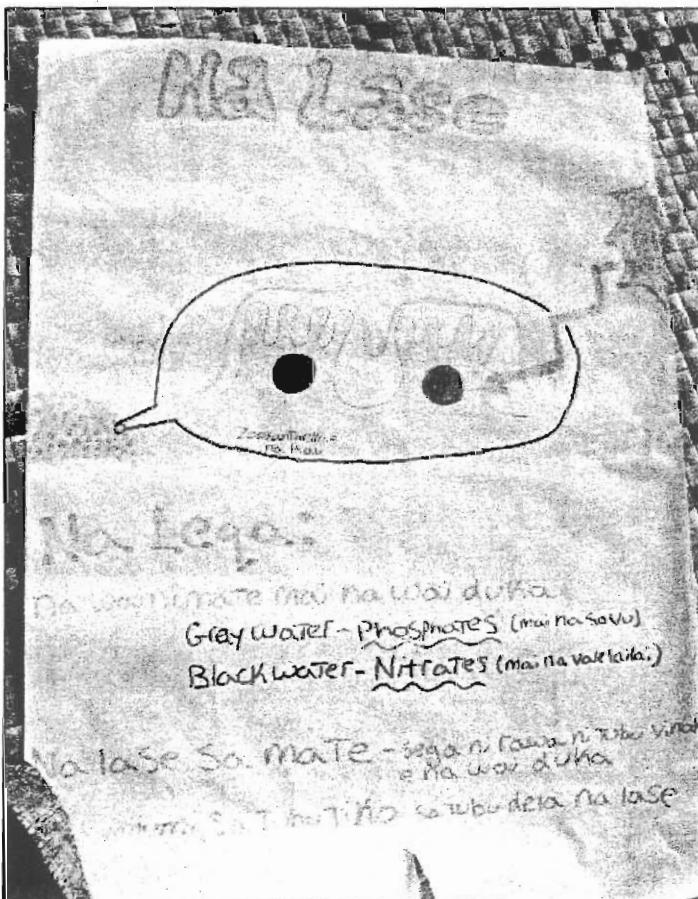
- Biuvaka ca ni benu
- Benu e waitui (benu kece)
- Wai duka e waitui
- Vakamakama
- Cagi ca

She then asked the participants why these were problems i.e impacts of the problems. Replies included:

- Youth get hurt when they swim in the ocean
- Destroys marine life

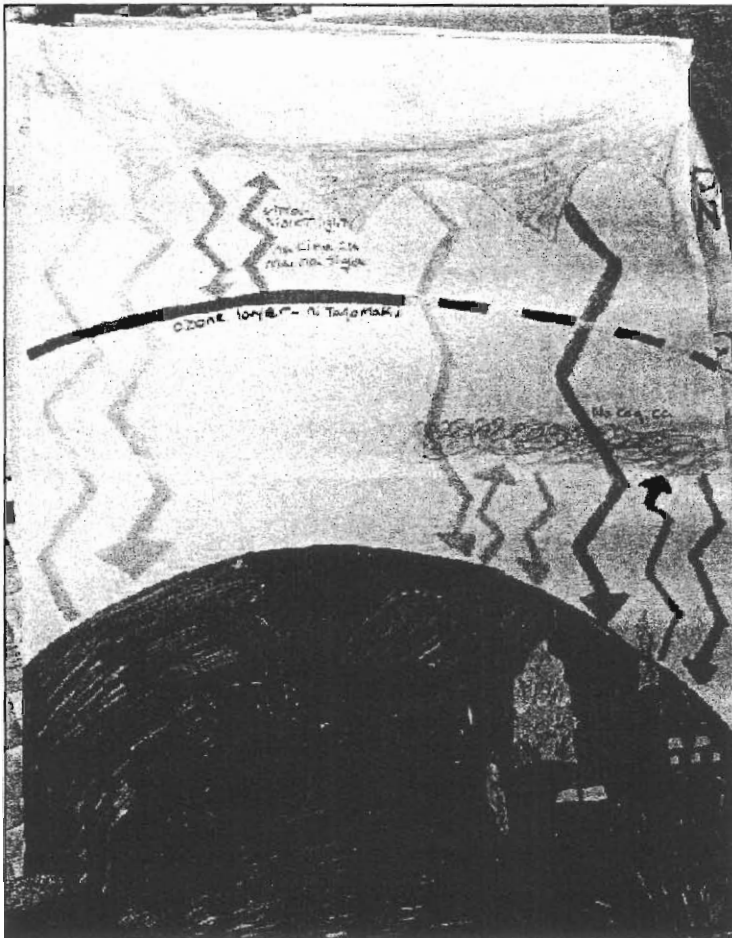
Aly then described the impact of wastewater discharged into the ocean on coral and coral reefs. A poster was used to describe this (Figure 3). Greywater has phosphate and blackwater nitrates which when discharged into the ocean these nutrient levels increase which is not good for animal in corals causing them to die and algae to grow.

Figure 3. Poster showing coral and impact of wastewater on coral reefs



She then described the impacts of burning plastics which are the destruction of the ozone layer and increase in global warming and health impacts (Figure 4). When plastics are burnt CFC's are produced that destroy the ozone layer which protects the earth. This allows more of the sun's energy to enter warming up the earth's atmosphere more. CFCs also can cause cancer if humans inhale the fumes when burning plastic. A question was put forward on what to do with old plastic bags. Options include burying or recycling but not burning.

Figure 4. Poster on Ozone Layer



Aly then described the three types of dumps that can be used for waste disposal. These were – dumps, landfills and sanitary landfills (Figure 5). The following points were made on the three waste disposal site types:

- Dump:*
- current waste disposal method in Fiji
 - waste is dumped above ground level, visible and releases bad smell
 - leachate seeps through the ground

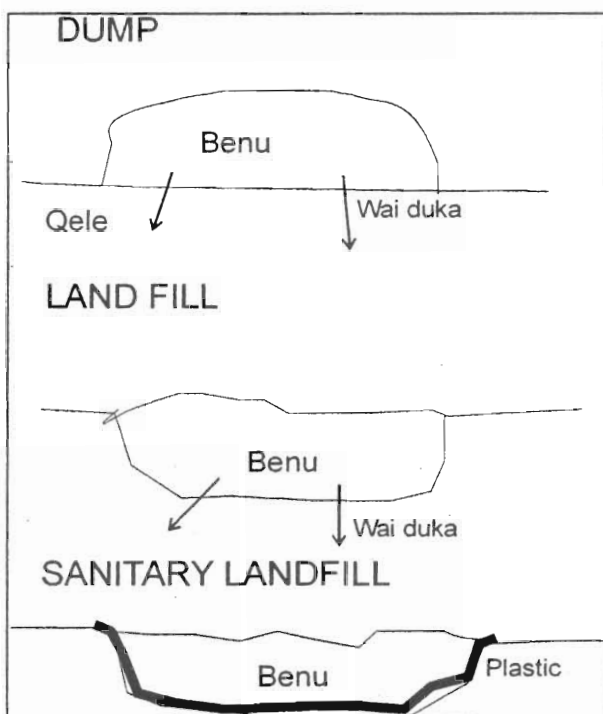
Landfill:

- waste disposal in a hole below ground level
- not visible and bad smell is contained
- leachate seeps through ground

Sanitary Landfill

- waste disposal in a hole area below ground level
- not visible and bad smell contained
- the bottom of hole is covered with lining to stop leachate seeping into the environment
- the best of the three types of waste disposal methods, but is expensive to construct and operate.

Figure 5. Types of Waste Disposal Sites



Lastly photos on waste management problems from other parts of Fiji were shown using powerpoint. Because of lighting these were not very clear.

4.6 Groupwork: Waste characterization for 3 villages on Bau Island

Patrina then introduced the groupwork to discuss waste types present on Bau Island. Participants were split into 3 groups (Bau, Lasakau and Soso) and discussed the following:

1. Mataqali Benu (Types of Waste)
2. Method of Disposal

A map of Bau Island was also drawn to show locations of waste disposal. Following tea break, each group presented on their findings.

1. Soso Village

<i>Mataqali Benu</i>	<i>Disposal</i>
1. Pepa	Kama
2. Tavaya lala, kava	Bulu, waitui
3. Benu ni kakana	Kena na vuaka
4. Civicivi ni tavioka, dalo	Biu ena veibele me manure
5. Draunikau	Kama, biu e waitui
6. Taba ni kau	Maroroi me buka
7. Tavaya lase (kakavorovoro)	Buluti, biu e waitui
8. Taba ni bele	Teivaki e na gele
9. Taba ni rourou	Saqa tale me laukana
10. Plastic bags	Vakawaqa ni buka, ubu kina na kakana qai saqa, kama, biu e waitui
11. Sulu sega ni vakayagataki	Kama, biu e waitui
12. Daiper	waitui

2. Lasakau Village

<i>Mataqali Benu</i>	<i>Disposal</i>
Plastic bag/bottle	Vakawaqa ni buka, viritaki I wai, biu ena loma ni bai ni ua
Kava (tini ika)	Bulu, viritaki tu ga vakaveitalia (wai, vanua)
Benu ni kakana	Biu ena loga ni senikau, kau me kena na vuaka, biu e waitui, loma ni bai ni ua
Tavaya (lase)	Viritaki tu ga vakaveitalia (waitui, vanua mamaca)
Diaper	Viritaki e matasawa, benubenu e lomani bai ni ua
Benu ni vale lailai	Waitui
Drau ni kau, taba ni kau, co	Loma ni bai ni ua, waitui
Qa ni bulu, qa ni bilo	Biu ga ena vanua e sua kina na niu Vakayagataki me buka
Kaukamea	Bai ni ua, waitui

3. Bau Village

<i>Mataqali Benu</i>	<i>Disposal</i>
Plastic, tavaya, taga	Kama, biu ki wai
Drauni kau, co, taba ni kau	Kama, compost, biu ki wai, land fill
Kava, ijini, misini, kaukamea	Biu ki wai
Tavaya iloilo, yaya ni kana	Biu ki wai
Kakana civi, kakana buta	Biu e na veisenikau, land fill, kena na vuaka, biu ki wai
Wai ni savasava/sovu	Biu ki wai
Wai ni valelailai	Septik tank, biu ki wai
Qa ni bulu	Mulching, buka, wai

Following the presentations, Patrina briefly presented on outcomes of a waste audit report undertaken in 2007 by Mrs Siwatibau. See Appendix C for full report. The main findings were:

- i. The majority of Bau Island residents dispose of their everyday household waste directly into the sea. Organic waste made up a large component of household waste followed by plastic then paper. Tin cans were few.
- ii. The shoreline and immediate mudflats below the surrounding sea wall is littered with tins and other rubbish. It appears that most of the plastic and paper waste drifts away from the island.
- iii. There seems to be little marine life in the mud surrounding the island.
- iv. Most fishing is done offshore and there is little gathering of marine resources from the mudflats.
- v. The Bau Island residents are heavily dependant on boats to travel to and from the island, and also for fishing. The majority of boat owners dispose of waste oil and grease into the sea.

4.7 Solid Waste Management

Alyson then presented on the options to manage solid waste.

4.7.1 Composting

A way of managing organic waste (food waste) is using composting. A poster showing how nutrients are recycled was used to explain the cycle (Figure 6). The concept of composting and how to do it was then explained using posters and a handout (Appendix D). The types of waste that may be composted include vegetable peelings, green waste, used tea bags, egg shells. Dry waste is required to alternate with wet waste. Dry waste includes grass clippings, leaves and coconut husks. Waste types that should not be put into a compost included meat, fish, seafood, cheese, milk, oil metals, glass, plastic and diapers. The compost pile should also be turned over often to let air get in. Composting bins may be made out of what ever materials are available such as sticks, old roofing, old fence etc. Photos of composting bins in Komave were also shown (Figure 7).

Figure 6. Poster with trees and cycle of organic matter

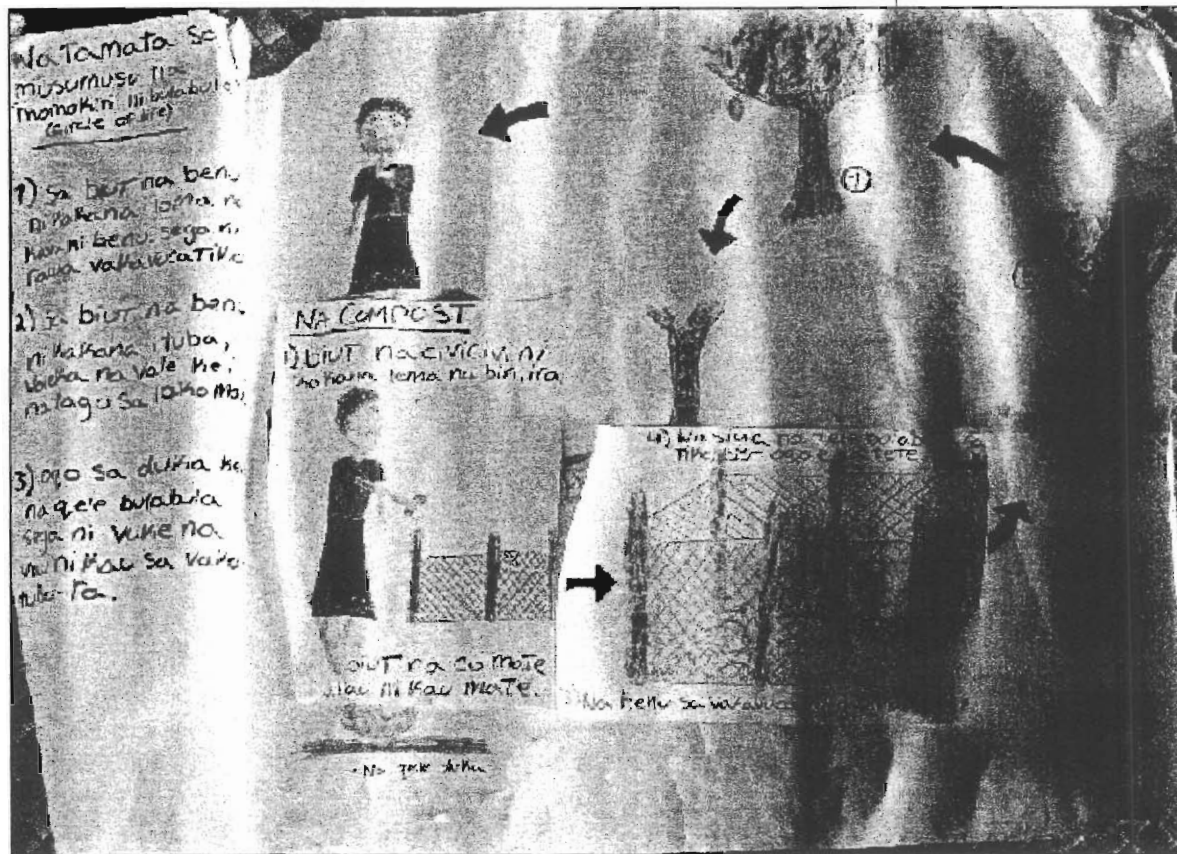
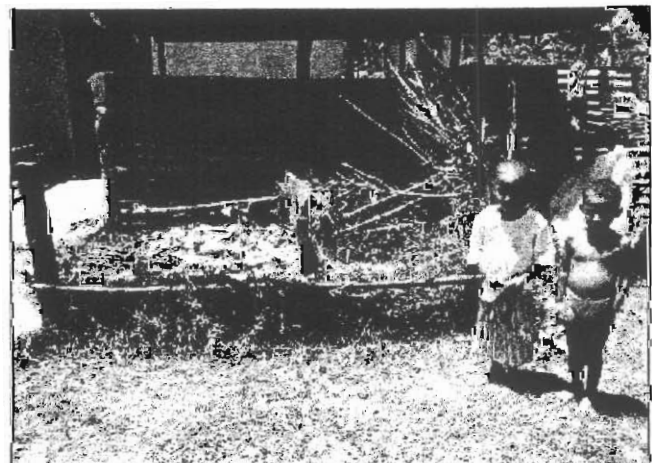


Figure 7. Photos of composting bins in Komave Tikina



4.7.2 Reduce, Reuse & Recycle

Alyson then discussed ways of improving solid waste management by introducing and describing the concepts of reducing, reusing and recycling waste (3Rs). The discussion included meanings of the concepts and types of wastes that may be managed in each way.

Reduce – Na vakalailaitaki

- Plastik
- Daipa
- Tini kakana
- Tavaya ni juice
- Valeti veva
- Tissue

Voli vakalevu (buy in bulk)

Reuse – Na vakayagatakitala

- Tavaya
- Plastik
- Veleti plastik
- Container ni ice cream, bata
- Vokete ni plastik

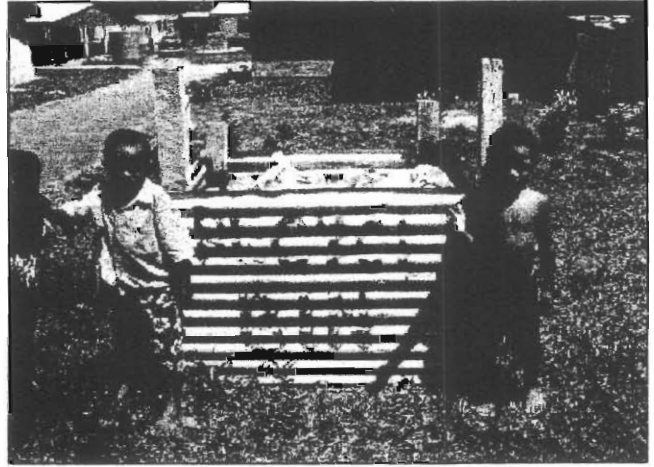
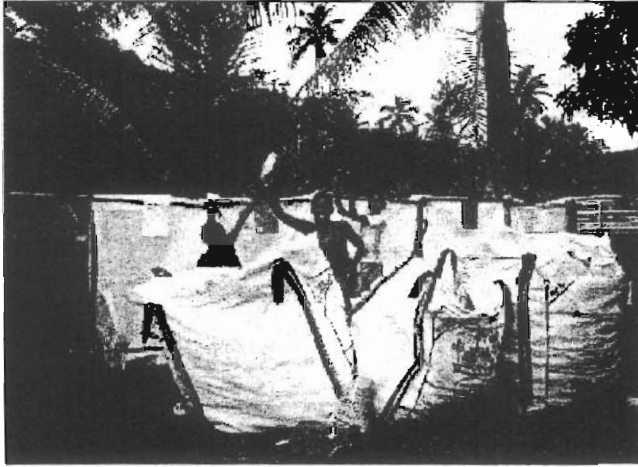
Recycle - Na vakavoutakatala

- Tavaya ni coke
- Veva
- Kava
- Benu kakana (compost)

A question was raised on styrofoam, what it is and how to dispose of it. It is a type of plastic that also contains CFCs and so shouldn't be burnt.

Alyson then described all the types of rubbish that may be recycled in Fiji. They included aluminium cans, PET bottles such as coke or Fiji Water, other types of PET bottles, and tin cans such as corn beef and tin fish cans. Amount paid out and the companies to call to collect the rubbish were also provided in a handout (Appendix E). The method of separation of rubbish, collecting in large sacks which are provided by Coca Cola and which should be labelled with types of rubbish to be put in them was also discussed. Photos of recycling in Komave Tikina were then shown (Figure 8).

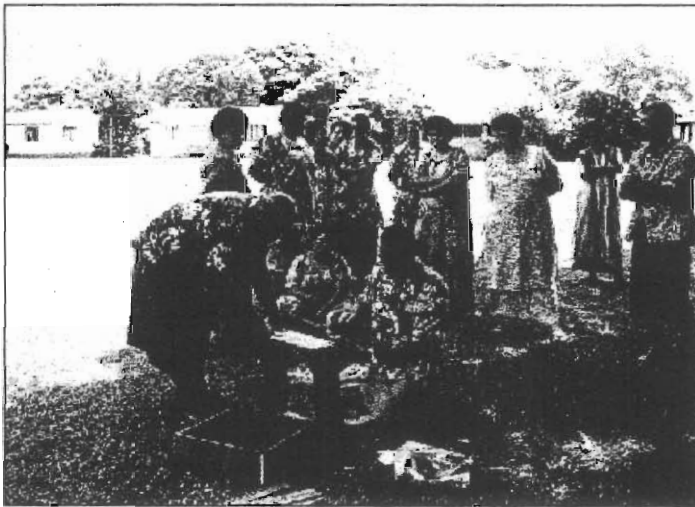
Figure 8. Photos of Recycling in Komave Tikina



4.7.3 Compost Pile Demonstration

Participants were then led outside where Pita demonstrated how to construct and maintain a household compost. This was followed by lunch.

Figure 9. Pita constructing a compost bin



4.8 Liquid Waste (Na Wai Duka) & Wetlands

The nature and source of greywater and black water were then discussed as a large group.

Types: Na wai duka sa lako mai vei?

- Siqi
- Wai ni savasava
- Vale vo
- Vale ni kakana
- Vale ni sili
- Bai ni vuaka

Graywater:

- Wai ni savasava
- Vale ni kakana
- Vale ni sili

Blackwater:

- Vale vo
- Bai ni vuaka

Sewage contains bacteria and pathogens that may cause disease and nutrients that impact on the reefs.

Na cava kedataou rawa sa cakava me maroroi kina na waiduka?

Proper management of wastewater and ways of avoiding its flow into the ocean were discussed. The concept of a wetland for greywater and blackwater discharge was presented including the steps in setting up a wetland (Figure 10). Photos of wetlands were also shown (Figure 11).

Figure 10. How to build a wetland

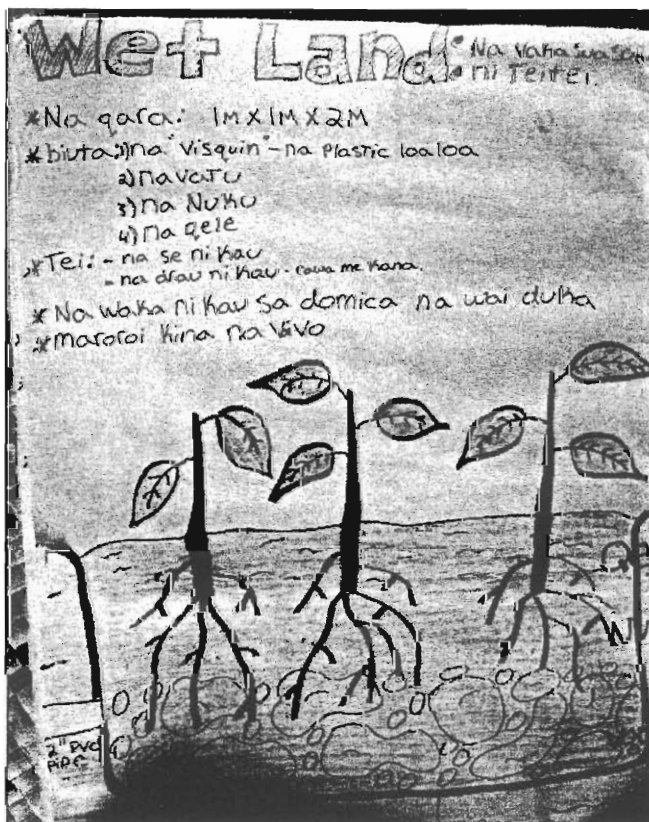
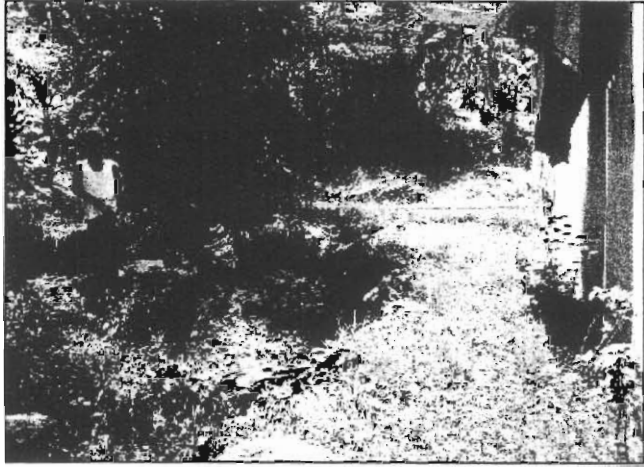


Figure 11. Photo of building a wetland in Komave Tikina



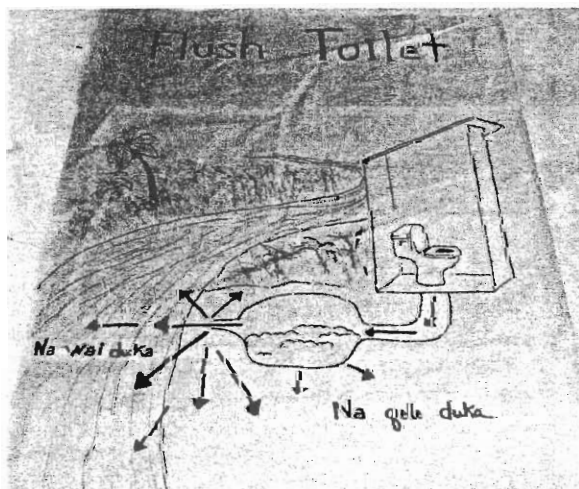
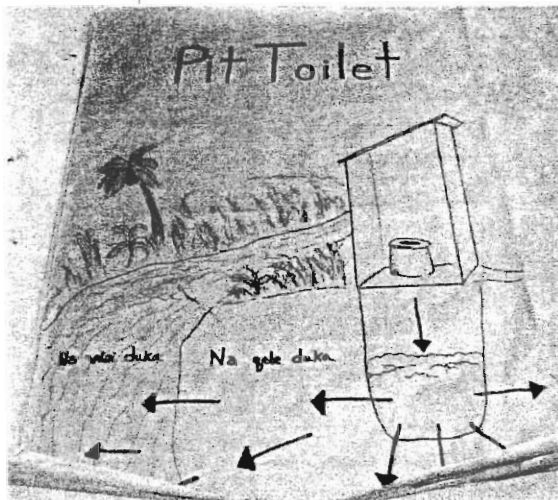
A short village tour was then conducted with participants to look at sources of greywater and blackwater that were being discharged into the environment on Bau island and possible sites identified where wetlands may be built.

4.9 Toilets & Composting Toilets

Pita then discussed the different types of toilets and disadvantages/advantages of each (Figure 12). Both pit and waterseal toilets allow wastewater to leach out into the soil and water polluting the environment.

- Pit Toilet
- Water Seal Toilet
- Flush Toilet

Figure 12. Toilet Types



Pita then described the composting toilet option, the benefits of its use as well as the construction of his wheelie bin design in Vunisinu. (Figure 13). The toilet consists of a shelter, ventilation pipe, wheelie bin where liquid and solid is separated out, and a wetland that is lined with visquin plastic where the liquid goes into. Benefit of composting toilet is that no wastewater goes into the environment polluting the soil and water. The full handout on the construction is included in Appendix F.

Figure 13. Wheelie Bin Composting Toilet

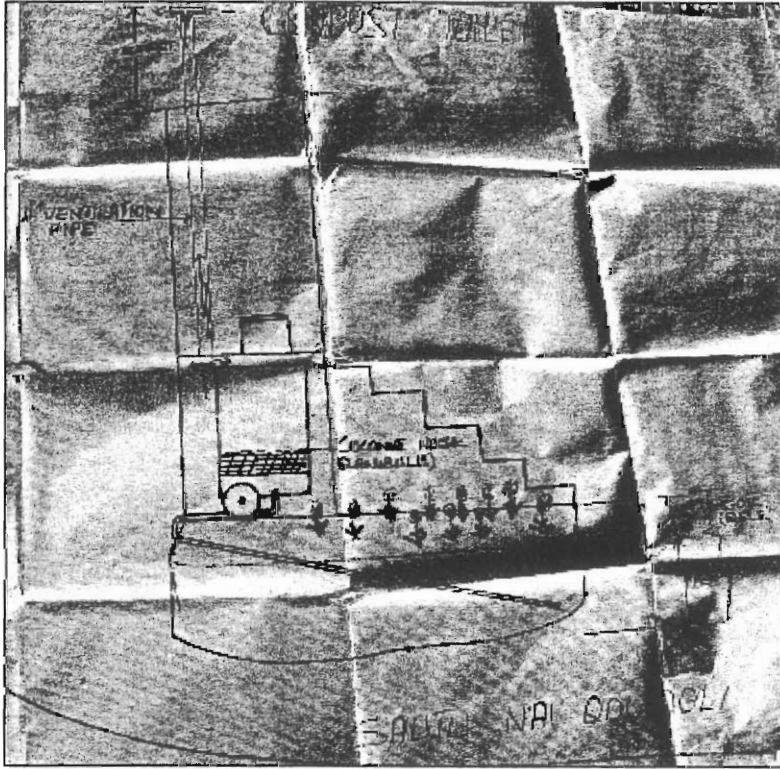
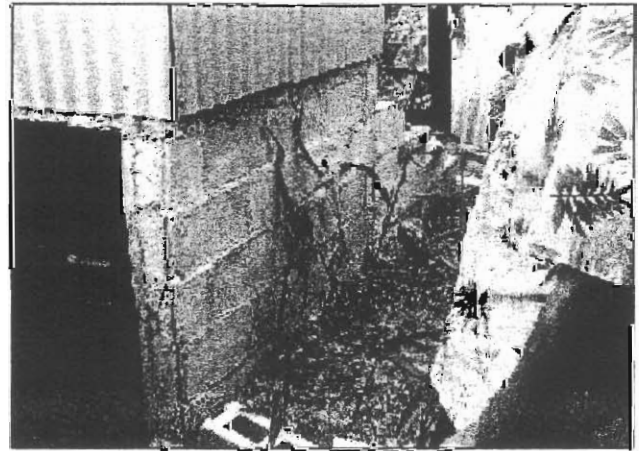


Figure 14. Photos of the composting toilet at Vunisinu village



Alyson then presented more information on composting toilets in general. (Figure 15) Two types of composting toilets have been tried in Fiji, the wheelie bin design and the double vault. Ally then described the double vault system which is used in Komave village where two compartments are used instead of a wheelie bin and when one is full the other is used whilst the first is left to compost (Figure 16).

Figure 15. Details of compost toilet

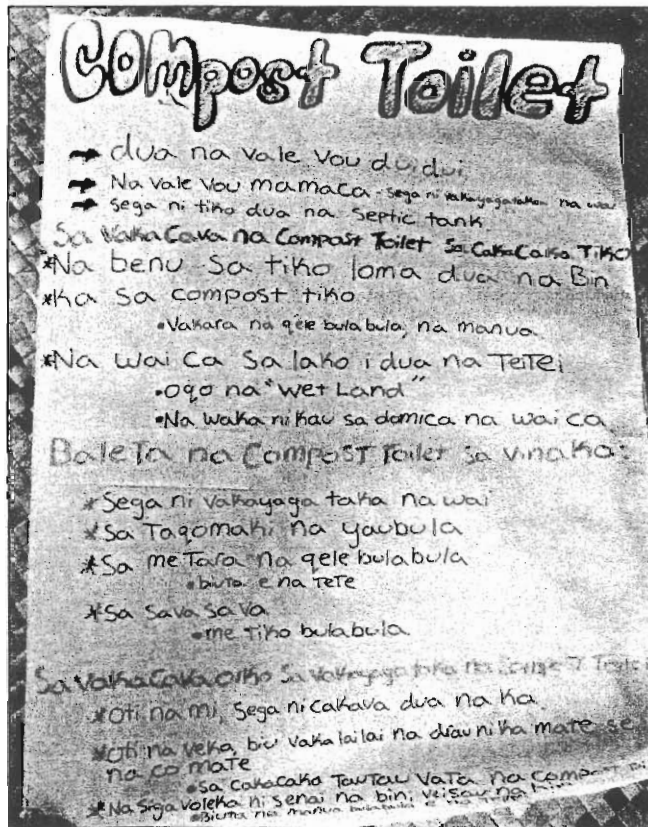
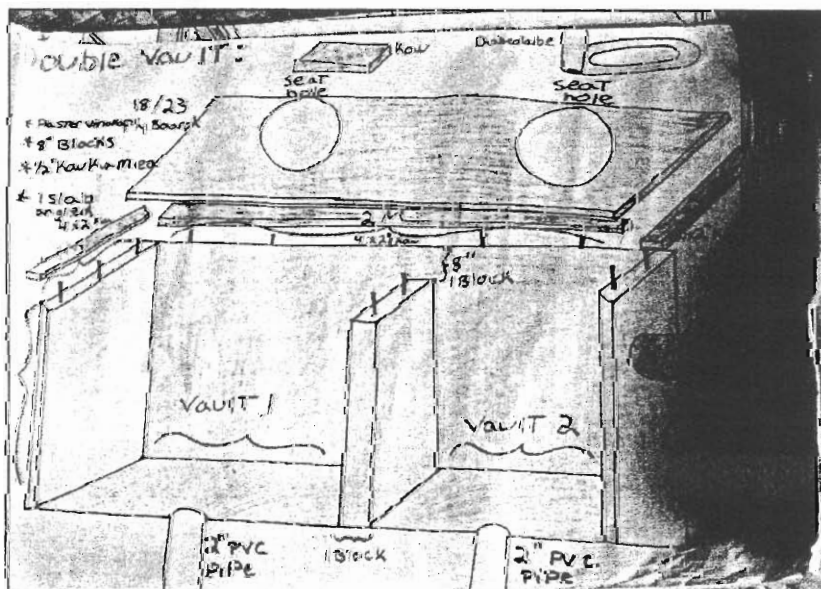


Figure 16. The double vault composting toilet



She also described the insides of the vault and bins and how it is important for the solids and liquid to be separated. (Figure 17).

Figure 17. Inside the double vault and wheelie bin toilets

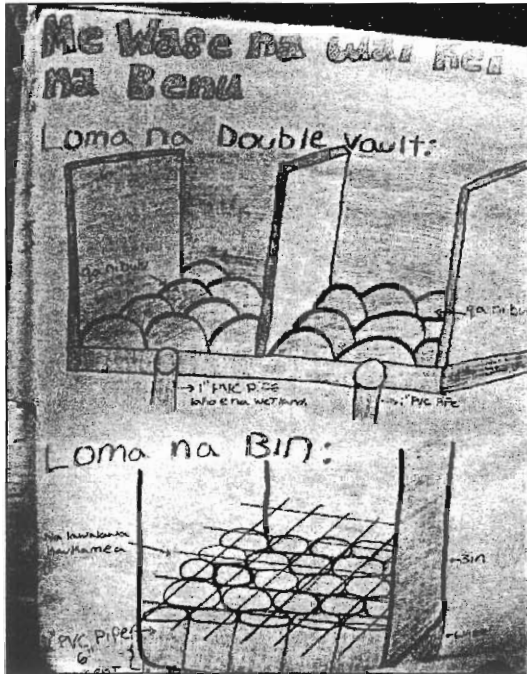
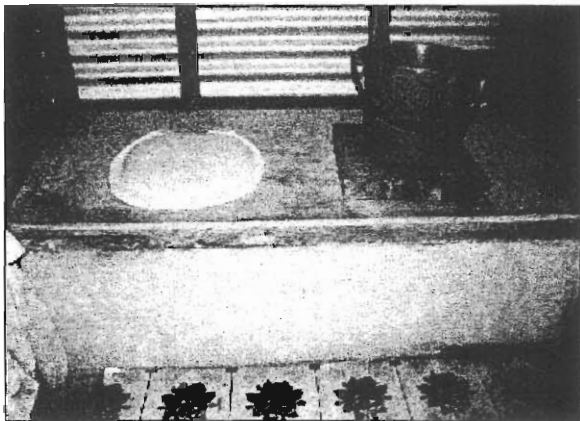


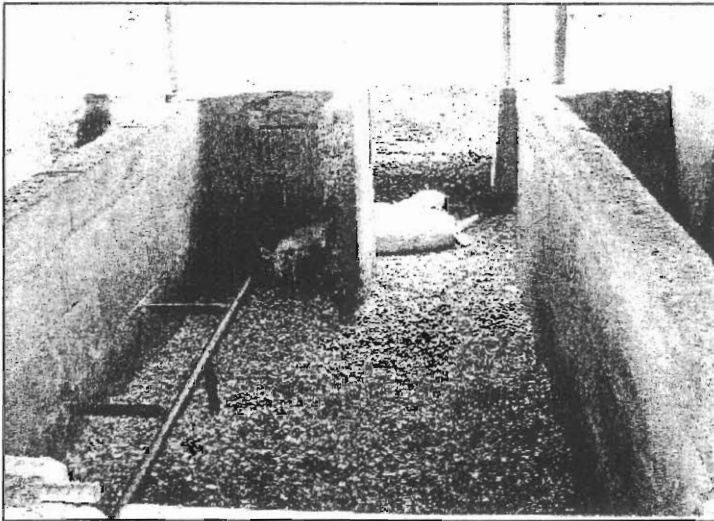
Figure 18. Photos of double vault compost toilet



4.10 Piggery Waste

Pita then discussed piggery waste and the option of composting piggeries to improve the management of wastewater from piggeries. This involves spreading sawdust (2 blocks high) over the pen floor. The sawdust must also be mixed every 3 days to enhance the composting process. The sawdust should be kept dry. After a period of 3 to 6 months sawdust is then scraped out and kept to compost then used as fertiliser. Other material such as coconut leaves and husks and other dry leaves can also be used instead of sawdust (Appendix G for handout).

Figure 19. Photo of sawdust piggery at Nasau Youth Camp (Sigatoka)



DAY TWO: FRIDAY 10 MARCH, 2006

4.11 Opening Prayer

The second day of the workshop began with a hymn and a prayer.

4.12 Review Exercise

Pita then briefly reviewed the sessions of Day 1 followed by Alyson who led a review activity on solid waste separation. This consisted of a review of identifying the different types of solid waste and what to do with each type. Different types of waste were shown to the overall group and they identified it and indicated the most appropriate method to use/manage/or dispose of it (rubbish bin, reuse, recycling, composting) etc. The options were shown on vanguard at the front of the room. The aim of the exercise was to get participants to think about the best method of disposing different waste types.

Output

<u>Kava ni Benu</u>	<u>Reuse</u>	<u>Recycle</u>	<u>Composting</u>
Deoderant spray	Tyres	Cans	Benu kakana
Twisties bag	Plastic bags	Aluminum cans	Pepa
Moisturizer		PET bottles	
Kitchen appliances		kaukamea	
Batteries			

4.13 Development of Waste Management Action Plans

To introduce the development of waste management action plans, Alyson and Pita described how waste management plans were developed in their own villages.

Komave Tikina

Ally talked on action plans of Komave Tikina which included:

- Establishment of a committee ni Yaubula which included the Turaga ni Koro from each village of Komave Tikina
- Meetings once a month of committee
- Set 1 year goals which were
 1. Composting pile for each household
 2. One composting toilet for each village
 3. 5 piggeries use sawdust as compost
 4. Recycling undertaken in each village
 5. Rubbish bins in each village to keep area clean
 6. Have an environment day each year
 7. Have a few wetlands in each village.

In Komave Tikina, all the villages now recycle, 9 piggeries use sawdust, 9 wetlands are being used, they just had an environment day and have got funding to build the composting toilets.

Vunisinu Village

In Vunisinu they have also have an environment management committee. Waste management activities undertaken include:

1. Two houses now share a 44 gallon drum to collect their rubbish and this is put in a large waste management bin which is collected and the rubbish taken to Naboro dump. Households contribute for payment of collection of bin.
2. They have a recycling centre for the koro.
3. Two composting toilets in the village.
4. About to start composting piggeries but it is hard to get the sawdust.

Next an overall discussion of the entire group was carried out on the issues related to waste on Bau Island, what they were going to do about it, who was going to be involved, how it would be done and when. It was decided that one action plan would be developed for the island of Bau.

Output:

Bau Island Waste Management Action Plan

Leqa	Wali	Tavi nei cei	Cakavaka cava	Gauna
1. Benu ni tavaya platik, kava, aluminium	Recycling (vakavoutaki)	Coca cola (taga) Lewe ni vanua (tabagone, mothers club)	Recycling centre veikoro (3 na taga e veikoro)	13 March
2. Tavaya waiwai, iloilo benu vaka ca	Kava ni benu (waste management)	IAS	Biu e na landing	
3. Benu vakaca	Kava ni benu I loma ni koro	Committee ni yaubula	6 (rua I vei koro : 44 gallon drum)	Dua na macawa
4. Benu ca e gaunisala	Biu na saini	Turaga ni vanua		Macawa mai oqo
5. Taba ni kau, draunikau	Kama, biu ena matasawa	Lewe ni koro	Compost	Siga ni sasamaki
6. Greywater (vale ni sili, vale kakana)	Wetland (vakasuasua ni teitei)	Na vuvale ocei sa tiko na qele	Voli mai na nomu visquin me tara na wetland	Se bera ni conference
7. Black water	Wetland	Ocei sa tiko na septik tank	Voli mai na nomu visquin me tara na wetland	Se bera ni conference
	Flush toilet	Ocei sa tiko na water seal	Na vuval	Se bera ni conference

Alyson then facilitated the development of a waste management committee for Bau Island. This was followed by morning tea.

Bau Island Waste Management Committee

Lewe ni Komiti

- Chair: Ratu Eperisa Cakobau
- Secretary: Talei Solimaibau
- Treasurer: Sakiusa B.

- Turaga ni Koro
- Tabagone
- Nasi n Koro
- Marama

Gauna ni Bose – Vei 2 na macawa

Matai ni Bose – Moniti 13/3/06 yakavi ena vale ni sogo

4.14 Planning a Waste Management System for the Methodist Conference

Following tea, a planning session to plan a management system for waste produced during the proposed conference was carried out. Firstly the group discussed details of the one week conference. Approximately 1000 people are to attend each day with 200-300 on the island for breakfast and dinner that will be billeted on the island and another 700-800 for morning tea, lunch and afternoon tea. There will be one kitchen. Main activities to be undertaken during the conference week include bese, lotu ni veivakatikori, veiqaravi vakavanua, vakasigalevu and yaqona. PWD will provide water source by June. 30 women will be involved in food preparation from the island including 8 from waste management committee. Next the main types of waste that would be produced during the proposed conference in August were identified.

Waste Produced During the Conference

1. Vale ni kuro (8 marama mai WM komiti)
2. Nai cili (housing of participants) (veivale kece)
3. Vanua ni gunu yaqona (kosa, pakete tavako, mase, olo ni loli)
4. Vale lailai (tara 12 valelailai 4 na veikoro, 6 septik tanks, 12 na vale ni sisili).

The participants then split into 4 groups to discuss in detail how to deal with these types of waste. This included identifying the types of waste, management actions, who will carry out this actions. Each group then presented back their action plan.

1. Nai cili (veivale kece)

<i>Mataqali benu</i>	<i>Kena maroroi na benu</i>	<i>O cei ena qarauna na kena maroroi</i>
Benu ni kakana	Compost Piggery	Era maroroya se qarauna ga na taukei ni vale
Benu ni yaqona (kosa, tavako, drega, kava ni pinati, masese, taga ni yaqona)	Compost Reuse na taga ni yaqona, kava pinati (ashtray) Waste Care Bin – olo ni loli, masese	Era maroroya se qarauna ga na taukei ni vale
Plastic bags	Waste Care Bin	
Benu ni vale ni sili/vale ni vo (olo ni soyu ni sili, ka ni toilet paper, pad, diaper, pakete ni toothpaste)	Waste Care Bin	Era maroroya se qarauna ga na taukei ni vale

- composting for each household
- rubbish taken to waste care bin at landing

2. Vale ni kuro

<i>Na veigau eso ni kana</i>	<i>Mataqali Benu</i>	<i>Kena maroroi</i>	<i>Ocei e qarava</i>
Katalau, morning tea & afternoon tea	Pakete ni sucu, tea, kosa ni tea, plastic ni suka tavaya ni kofi kava ni jamu container/pepa ni bata benu ni vuanikau kava – tomato sauce	Compost Kava ni benu Vakayagataki tale Vakayagataki tale Compost	Komiti ni waste management
Vakasigalevu	Civicivi ni kakana – dalo etc. Voov ni kakana Wainimoli Wai vakasavasava taki ni ika Lewe ni manumanu Wai ni masimasi yaya	Kana na vuaka, compost Kana na vuaka Vakayagataki tale Mulching Kana na vuaka Wetland and mulching	Komiti ni waste management
Vakayakavi	Plastic ni toa Taba ni rourou Vovo ni kakana Civicivi ni darunikau, dalo etc	Kava ni benu Compost Kana na vuaka Compost	Komiti ni waste management
Lovo	Drau ni kau	Compost	Komiti ni waste management/Youtfi/ Turaga ni Koro

- composting (ladies in waste management committee)
- rubbish bins
- very little tin cans and PET bottles as little canned food so not much need for recycling

3. Guru Yaqona

<i>Benu</i>	<i>Kena maroroi</i>	<i>Ocei me qarava</i>
Kosa	Biu na compost	Ko ira na cauravou kei Turaga ni Koro
Benu ni tavako	Waste bin	
Benu ni wase (loli, bean, drega)	Waste bin	
Olo ni yaqona	Waste bin	

In summary the main waste management actions identified to be undertaken during the conference were:

1. Rubbish bins on the island and rubbish to be barged to mainland and put in waste bins to be taken to Suva.
2. Composting on the island
3. Recycling bins to be provided and used

Other issues discussed were:

- What to do with bones: was decided to bury or feed to dogs
- Decided that the locations of the proposed septic tanks for liquid waste management during the conference would be determined to check if it was possible to have wetlands with outlets attached to them (if land is available).

4.15 Closing and I Tatau

Pita said a few words to close the workshop followed by a closing prayer and the presentation of the I tatau.

Appendix A – Participant List

DAY 1 – THURSDAY

NAME	VILLAGE
1. Viniana Tikomaikoro	Soso
2. Tirisa Qocatabua	Soso
3. Takela Lesumailepanoni	Soso
4. Tevita V.	Lasakau
5. Seruwaia Bainivanua	Soso
6. Dite Dausoko	Lasakau
7. Kevueli Ratumaitavuki	Lasakau
8. Ruci Naua	Lasakau
9. Laisa Bainivanua	Soso
10. Josua Dainiteri	Bau
11. Samuela Bainivanua	Soso
12. Kaliveti Radrotaki	Bau
13. Mereani Komaitai	Bau
14. Raijieli Mucunabitu	Bau
15. Talei Solimaibau	Bau
16. Kelera Marama	Bau
17. Tevita Vakalalabure	Soso
18. Litia Dulakibau	Lasakau
19. Sakiusa B.	Bau
20. Jope Naucabalau	Bau
21. Sake Mateilevuka	Bau

DAY 2 - FRIDAY

NAME	VILLAGE
1. Viniana Tikomaikoro	Soso
2. Takela Lesumailepanoni	Soso
3. Seruwaia Bainivanua	Soso
4. Dite Dausoko	Lasakau
5. Kevueli Ratumaitavuki	Lasakau
6. Ruci Naua	Lasakau
7. Laisa Bainivanua	Soso
8. Josua Dainiteri	Bau
9. Samuela Bainivanua	Soso
10. Kaliveti Radrotaki	Bau
11. Mereani Komaitai	Bau
12. Raijieli Mucunabitu	Bau
13. Talei Solimaibau	Bau
14. Kelera Marama	Bau
15. Tevita Vakalalabure	Soso
16. Litia Dulakibau	Lasakau
17. Sakiusa B.	Bau
18. Jope Naucabalau	Bau
19. Peni Seniloli	Bau
20. Ratu Epenisa Cakobau	Bau
21. Sokiveta	Bau

Appendix B – Workshop Programme

Workshop Purpose: Enhance the capacity of local community members to better manage waste on Bau Island.

DAY 1

- 8:30 Sevusevu
Prayer
- 9:00 Introduction of participants and resource people
- 9:15 Introduce workshop
- 10:00 Introduction to the Ecology concept
- 10:15 Waste management problems in Fiji
- 10:30 MORNING TEA BREAK
- 11:00 Group Activity (Groups to be divided according to the three villages):
- 11:30 Group presentation and open discussion
- 11:45 Presentation of Siwatibau study
- 12:00 Waste Minimisation
- 12:30 Compost building demonstration
- 1:00 LUNCH
- 2:00 Liquid Waste and Wetlands
- 3:00 Liquid waste tour (grey water)
- 3:30 AFTERNOON TEA
- 4:00 Compost Toilets
- 4:30 Piggery waste
- 5:00 End of Day

DAY 2

- 9:00 Prayer
- 9:10 Group activity on solid waste separation
- 9:45 Planning a new village waste management system
Group Work: Development of Bau Island Waste Management Plan
Presentation, discussion and finalisation Waste Management System Plan for Bau Island
- 10:30 MORNING TEA
- 11:00 Planning a Waste Management System for the Conference
- 11:30 Group Work: Waste Management Plan for Conference
Presentation, discussion and finalization of waste management system for Conference
- 1:00 Closing & I tatau
- 1:30 LUNCH

Appendix C. Waste Audit Report

Waste Audit – Bau Island

Introduction:

The Bau Island Development group discussed the issue of rubbish disposal and realised that it was a problem on the island. To begin the process of addressing this issue a week long waste audit was carried out, focusing on the disposal of household waste and also looking at fuel and oil disposal. This report presents the results of this survey.

Background:

Bau Island consists of three village communities: Loma ni koro (Bau), Soso and Lasakau. There are 61 permanently occupied households on the island with a total population of The villagers have gardens and plantations both on the mainland and also on a separate island. The local school is situated on Bau Island and a number of school children and some teachers travel by boat each day from surrounding islands and the mainland.

Bau Island is surrounded by a seawall or retaining wall. There are frequent gaps in the wall where small harbours or *matasawa* have been built. There are 25 of these *matasawa* in total, and they are used as boat mooring sites and high tide access to individual houses. At high tide the water reaches within half a metre of the top of the seawall. At low tide there is 1 – 10 m of exposed mudflat most of the way around the island, with two exceptions being near the jetty where the water is deeper and over the side closest to the mainland where the mudflats extend most of the way across the channel.

Summary of Main Findings:

Five main findings were established from this waste audit:

1. The majority of Bau Island residents dispose of their everyday household waste directly into the sea.
2. The shoreline and immediate mudflats below the surrounding sea wall is littered with tins and other rubbish. It appears that most of the plastic and paper waste drifts away from the island.
3. There seems to be little marine life in the mud surrounding the island.
4. Most fishing is done offshore and there is little gathering of marine resources from the mudflats.
5. The Bau Island residents are heavily dependant on boats to travel to and from the island, and also for fishing. The majority of boat owners dispose of waste oil and grease into the sea.

In conclusion, it was found that waste disposal is a problem on Bau Island and should be addressed.

Materials:

Equipment used to survey household waste included 100 garbage bags, paper, sticky tape, balance/scales, a map of houses on the island, recording book. Materials used for interviews with fishermen and women and boat owners included a map of the island, interview questions, recording book. For surveys done in the area, a map, measuring tape and a recording book were used. Some photographs were also taken.

Method:

1. Household waste:

The surveyors went to the local school and introduced the household survey to the head teacher. Students in year five to eight were briefly spoken to about rubbish and the household rubbish survey. The names of year seven and eight students living on Bau Island were recorded to take part in the survey.

The number of permanently occupied households in each of the three villages on Bau Island was found by talking to key village people. A 30% sample of the households was identified. The houses of the school

students involved were identified and the rest of the sample was selected randomly with a representative number from each village.

Each household in the survey was given five garbage bags labeled with each rubbish category: plastics; paper; food and peelings; metal, tin and glass; and other. The household members were asked to sort out their everyday household rubbish into these separate categories. The surveyors then returned to each household twice during the week to weigh the rubbish. A member of the household was interviewed on rubbish disposal.

2. Waste dumped in the sea:

A shoreline survey was carried out at low tide. The type, distribution, quantity and approximate age of the rubbish observed was recorded. Due to the timing of the tides, this survey could only be completed once.

The areas used for waste disposal were identified and marked on the map. The currents surrounding these sites were mapped by observing the direction in which a small object drifted.

Four belt transects were carried out at low tide to observe the movement of rubbish out to sea. The transects were taken approximately 90° from the shoreline, for 70m or until the water was too deep to make accurate observations, noting the distribution of rubbish and the general state of the habitat.

3. Fuel and oil:

The locations of boats on the island were mapped. Boat owners were interviewed to gauge the level of boat use, the amount of fuel being used and the current practices for oil and grease disposal. General observations on boat use were also made.

4. Fishing:

Observations of fishermen/women were made. Interviews were conducted to identify common fishing areas, fish caught and any changes observed comparing now to five or ten years ago.

Results and Discussion of Results:

1. Household Waste:

The household waste survey and the sorting out of rubbish was met by the majority of residents with enthusiasm.

Items included in the "Paper" category were newspapers, cardboard boxes and scrap paper. The "Plastics" category included mostly plastic shopping bags and food wrappers. In general, approximately half a garbage sack of plastic had a mass of 300g. "Food and Peelings" contained mostly food peelings and several households indicated that these were usually fed to the pigs. Where "Metal, tins and glass" were weighed, the contents consisted of one to five food tins from each household (with one exception: see note 7). It was also observed that a few houses kept glass bottles to obtain the refund. There was some confusion in a few households on what items to include in the "Other" category. In general the most common type of rubbish included were leaves (swept from in and around the house) as well as some material/cloths and in a few households, disposable nappies.

It seemed that some households felt that they should fill all five bags. In addition some people saw the survey as a means of throwing away broken items which had previously been kept. It was stressed after the first weighing session that only the usual rubbish needed to be sorted. It is possible that in some cases this could account for the higher weights in the first day of weighing.

Table 1: Household waste survey results

House number	No. people in House	Weight (g)										
		Paper		Plastics		Food and peelings		Metal, tins and glass		Other		Composition
		Wed.	Fri.	Wed.	Fri.	Wed.	Fri.	Wed.	Fri.	Wed.	Fri.	
1	4	500	100	200	50	8580 ¹	3000	0	0	0	0	
2	10	500	200	250	750	2000	4800	200	0	1300	75	Leaves, orange/onion peelings
3	4	100	400	125	50	1000	1000	825	0	475	500	Nappy, leaves, cloth
4	3	500	120	200	25	2000	1500	125	10	0	50	Leaves
5	15	350	100	150	80	2800	4500	450	0	0	0	
6	4	475	125	175	300	4000	1000	300	150	160	300	Plastic bottles/containers, sponge, corn peelings
7	9	0	100	100	125	600	550	100	5	0	0	
8	6	100	75	250	50	2000	1100	0	0	0	0	
9	10	125	0	500	150	1600	3000	275	0	425	0	Cloth, leaves
10	8	125	125	100	100	4000	4500	0	0	130	150	Plastic bottles
11	6	50	50	160	275	1500	2000	0	0	580	550	Nappy, leaves
12 ²	5	100		100		5250		200		500		School bag
13	7	100	200	300	250	3200	850	160	175	125	125	Part of a sasa broom, leaves, cloth
14 ³	3	200	-	300	-	4750	-	400	-	3200	-	Rourou stems
15 ⁴	4	-	-	-	-	-	-	-	-	-	-	
16 ³	8	600	-	0	-	700	-	600	-	1000	-	Bele stems, leaves
17	10	25	75	150	100	⁵	⁵	0	0	200	150	Paper plates, mostly plastic
18 ⁶	1	0	0	0	0	0	0	0	0	0	0	
19	5	100	275	525	250	500	450	1750 ⁷	325	600	150	Leaves, wood, plywood
20	9	500	100	100	75	800	1100	300	0	0	0	

Notes on results table:

¹ Consisted mostly of grated coconut from preparing *kokoda* for people attending a conference.

² On the second weighing day, the household rubbish had not been separated. The combined weight of the rubbish was 1.3kg.

³ The second weighing of rubbish could not be completed in these households as their occupants were not present.

⁴ Rubbish was not kept for weighing

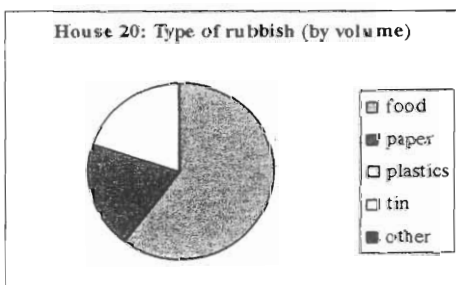
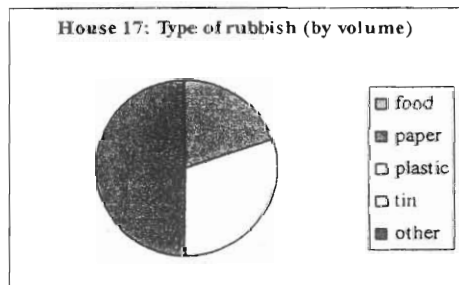
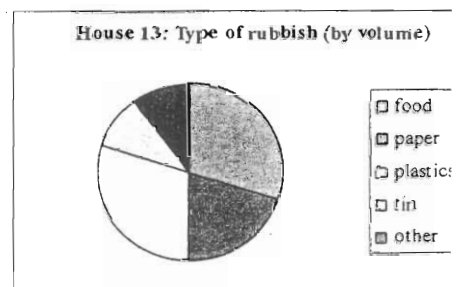
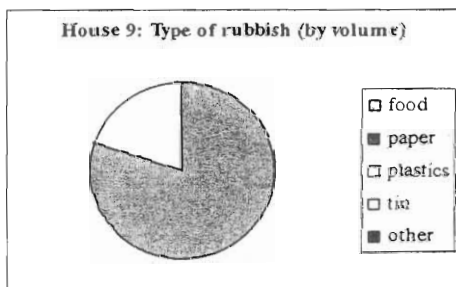
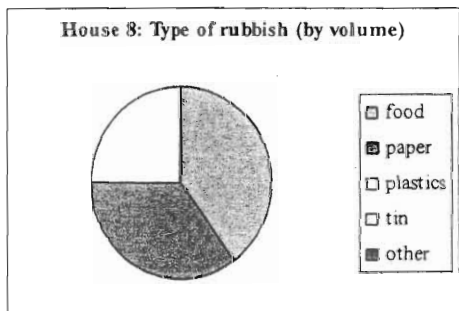
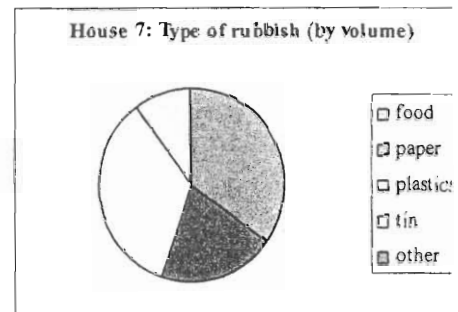
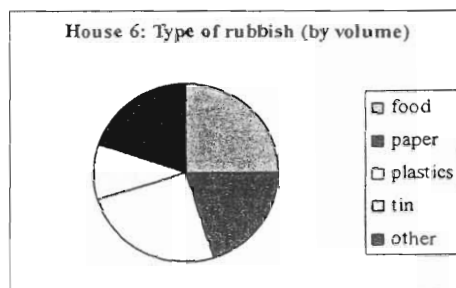
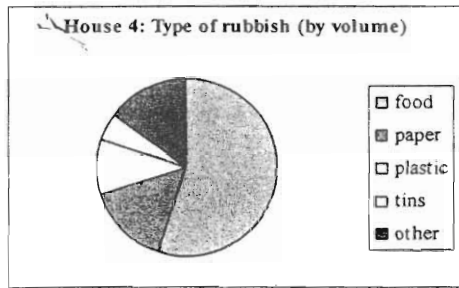
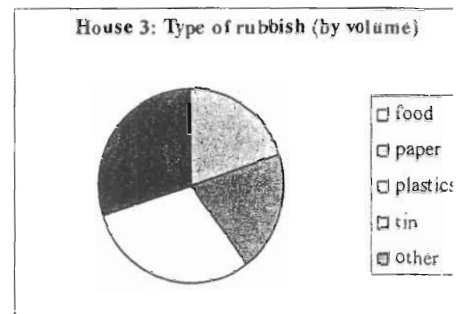
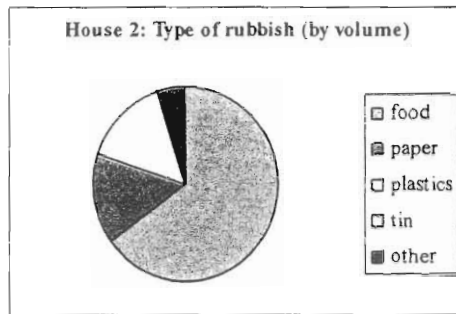
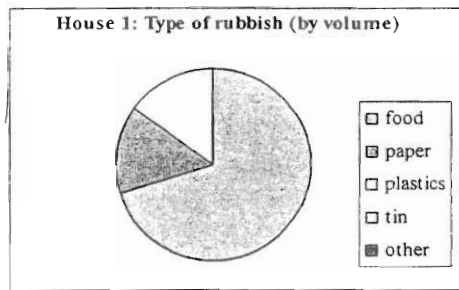
⁵ Food and peelings were not kept for weighing

⁶ There was no rubbish from this household as it consisted of an older lady who often ate with relatives

⁷ Consisted of glass bottles (whereas others only consisted of tins)

Rubbish category	average per person (g) (per 1 ½ days)
Food and peelings	353.4
Other	57.28
Paper	31.28
Metal, tin and glass	29.94
Plastics	27.65

Due to some types of rubbish weighing more than others, an additional activity was carried out at the second weighing session. The relative percentage of each rubbish type by approximate number of items was estimated and drawn in the form of a pie chart.



As it can be seen from these pie charts, in the majority of households, a large percentage of household waste consists of food and peelings. In general, households produced slightly more plastics than paper, and the smallest percentage of waste was made up of tins. This method of recording household waste is probably a more accurate way of looking at the make up of household waste than comparing the distribution according to weight.

From interviewing household members on waste disposal practices, it was established that the majority of residents throw all rubbish into the sea. Several households separated food and peelings to feed them to the pigs or put them on the garden, while a few mentioned that they burn plastics and paper. Some households throw their waste in the waste disposal dumps on shore.

2. Waste dumped in the sea:

In many instances during the shoreline survey it was not practically possible to count the actual number of pieces of rubbish as there was simply too much rubbish present.

The survey of the shoreline surrounding the island indicated the presence of heavy items of rubbish all around the island. As shown by the belt transects completed, there is little movement of the heavy items of rubbish from where they are disposed. However there is little plastic and paper present on the shoreline in relation to the quantities being thrown away each day. According to one resident, the disposal of rubbish is timed with the outgoing tide. This means that the lighter items of rubbish which float, drift away from the island and hence there are relatively few of these items on the shoreline. One result of this is that residents are not directly affected by their actions. Once the plastics are disposed of, the issue no longer affects the residents. There are no unpleasant odours of rubbish on the island and as one resident mentioned, there are very few flies. It is possible however, that this practice is having an adverse impact elsewhere.

From the type of rubbish observed around the island, it appears that almost any item which may be found in and around the house is disposed into the sea when it becomes broken or old. These items range from everyday rubbish such as food wrappers and tins, to household appliances such as stove parts, old irons and outboard motors. The approximate age of these items indicates that this practice has been followed for many years and is still continuing today.

There appears to be very little marine life on the mudflats around the island. The habitat consists of fine, silty mud with the occasional patch of sea grass or seaweed. There are some small fish around the island (successful fishing off the island was observed), as well as an oyster like organism known as *cevare*. Several small sponges were observed around 30m from the shore as well as a few small pieces of hard coral. One sea cucumber was found approximately 70m off shore. It must be noted however, that this survey did not extensively cover marine life in the area and the notes taken were just general observations.

Twelve waste disposal sites on the island were identified. Most of these sites were above the high tide mark and situated on top of, or just behind the seawall. However there were some which were located on the top of the shore sloping down towards the sea. There appeared to be little current around these dumps at the time of survey. The most influence of rubbish movement was from the wind blowing drifting items towards the mangroves on the mainland.

3. Fuel and Oil:

The residents on Bau Island are heavily dependant on boats to travel to and from the island, the mainland and their plantations, as well as for fishing. A total of 14 boats with outboard motors were observed in the water around the island. Most of these boats were moored in the *matasawa*, or just off the seawall when not in use. Several boats on the island operate as passenger boats and charge \$4.00 per boat load or trip. All boat owners interviewed, used premix fuel and spent an average of \$**** on fuel per week (see Appendix). This equated to an average of ****L per week.

The majority of boat owners interviewed disposed of waste oil, grease and fuel directly into the sea. However one mentioned that it was kept for cleaning tools and lighting fires.

4. Fishing:

Fish is a main source of food for many of the villagers. Most fishing is done far off shore in the waters between Bau Island, Toberua and Ovalau. However people were also observed fishing around the island (mostly to the windward side). The interviews conducted were not conclusive on whether there had been any changes in fishing. It was interesting to note that there is little if any gathering of marine resources

from surrounding mudflats. Apparently the villagers used to collect *civare* and *totoyava* for the chiefs to eat as well as *lumi*, *nama* etc. One woman mentioned that the amount of *nama* around the island had declined. Sometimes *kaikoso* is collected but this is used mostly bait. Possible reasons for this lack of marine resource gathering could include lack of resources to collect, other sources of food, lack of time, laziness etc. This issue is linked closely to the problem of rubbish disposal. As the villagers are not dependant on the mudflats for food, the impact of rubbish and pollution of resources has less of an impact on day to day life.

Conclusion:

In conclusion, this assessment clearly shows that rubbish and rubbish disposal is a problem on Bau Island. The impact of this problem on the villagers themselves is not great, because much of the rubbish appears to drift away from the island and also as they are not dependent on the mudflats for food. However, the current practices of rubbish disposal have adverse impacts on the aesthetics of the area particularly at low tide, the marine environment surrounding the island and possibly have serious negative consequences elsewhere. The issue of rubbish disposal on Bau Island should be addressed.

Na I Vakamacala Rawarawa Ni Compost

Na composting na kena cakacakataki me veisautaki na nomuni benu me qele bulabula

▪ Na benu ni kakana e gadrevi kina:

“Na benu drokadroka”

Na benu drokadroka e benu bulabula ka suasua

- Na I civicivi ni kakana draudrau
- Na I civicivi ni kakana dina
- Na qani yaloka
- Na I civicivi ni vuanikau
- Na co drokadroka
- Na draunikau drokadroka
- Na lewe ni niu

“Na benu dravu”

Na benu dravu e benu mate ka mamaca

- Na co mate
- Na draunikau mate
- Na qanibulu
- Na I kotikoti ni niusiveva

▪ Veika e vakatabui:

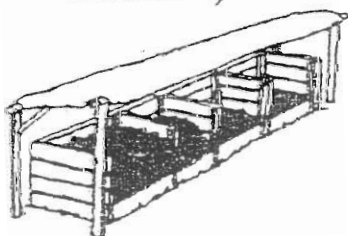
- Na lewe ni bulumakau
- Na lewe ni ika
- Na sasalu ni waitui
- Na cheese
- Na sucu
- Na uro ni kakana
- Na kaukamea
- Na iloilo
- Na tini
- Plastic
- Diapers

Step 1: Biuta na “benu drokadroka” I liu

Step 2: Qai ubia ena “benu dravu”

Step 3: Tomana na cakacaka Step 1 kei Step 2

Step 4: Biuta e so na qele ka cukia vakawasoma (vakadua e na veimacawa)



Appendix E. Recycling Handout

Na saumi ni tavaya:

Aluminium cans (na tini ni juice): 80 na sede dua na kilo
\$20 dua na taga

Na Tavaya ni coke kei na Fiji Water: 30 na sede dua na kilo
\$10 dua na taga

Na tavaya drokadroka ni Sprite: 30 na sede dua na kilo
\$10 dua na taga

Na Tavaya P.E.T.: 20 na sede dua na kilo
\$6 dua na taga

Na Kava: Sega ni rawa ni saumi na kava, baleta oqo
dua na ka bibi ni taqomaki na yaubula kei na tiko savasava
ni koro.

Step 1) Wasewasei vinaka na tavaya, na tini, kei na kava

Step 2) Na lori rawa ni lako mai kei vaka 10 na taga sa e
na tikina sa senai tiko.

Step 3) Qiri vei Coke cola me kauta na tavaya ni Coke,
na tavaya drokadroka ni Sprite
SUVA- 3394333

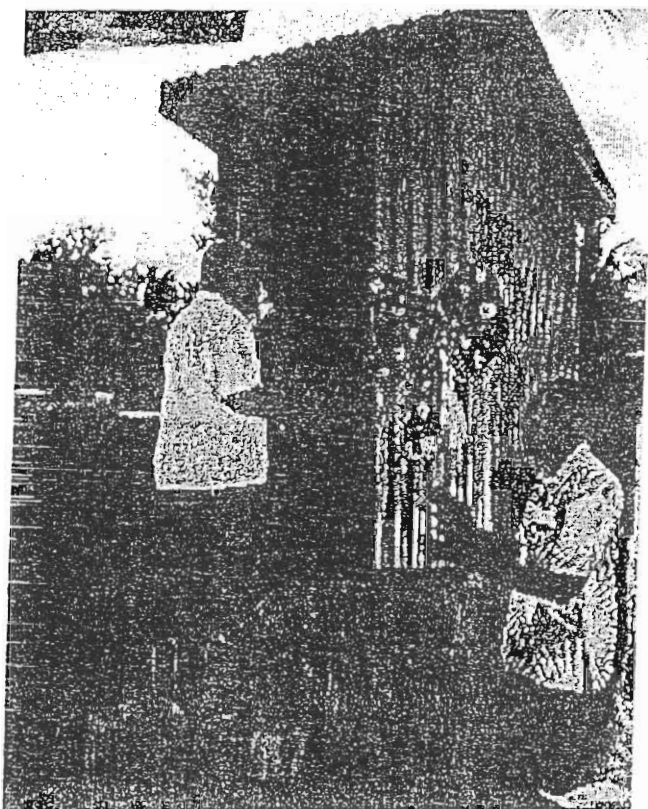
Step 4) Qiri vei Tai Tusi me kauta na kava kei na
aluminium cans (na tini ni juice)
3314321

Appendix F. Composting Toilet Instructions

DRAFT

**Composting Toilet System
Construction Guidelines and Drawings**

Suitable for Fiji and Other Pacific Island Communities



Design adapted by:

Professor William G.L. Aalbersberg, Director
Institute of Applied Sciences, University of the South Pacific
Mary A. Ackley, United States Peace Corps
Pita Vatucawaqa, Vunisinu Village

Introduction

This booklet is intended to serve as a guideline for Pacific Island communities interested in the construction of a composting toilet system. This toilet is ideal for the Pacific community because it is affordable, easy to maintain, and helps protect the health of the people of Fiji and its precious natural environment. The toilet uses composting to transform human waste into a valuable fertilizer, while preventing the harmful pollution that pit toilets, water-seal toilets, and flush toilets with inadequate septic tanks often cause. This toilet does not require any water and does not produce the foul odor that is often associated with a pit or water-seal latrine. The design can be adapted for use inside or outside of any home. The toilet pictured in this booklet was constructed in 2004 by the community of Vunisinu in the Fiji Islands as a pilot project to help protect the health of local marine resources.

I Vakamacala

E a vakarautaki na i vola oqo, ena vakanuinui, me na vukei kemuni na lewe i Viti ka wili talega kina na veiyatu yanuyanu ena Pasifika, ko ni gadreva tiko mo ni tara na valelailai ka vakatokai na Composting Toilet. Na valelailai oqo e rauti keda vakavinaka na lewe ni Pasifika, baleta ni sau rawarawa, rawarawa na kena qaravi ka vakabibi ni vukea sara vakalevu na kena taqomaki na veikabula, vakamareqeti era wavoliti keda. Na valelailai oqo ena veisautaka na benu ni valelailai me i vakabulabula ni qele totoka sara, ka taqomaka na leqa ni benu vakaca ka ra dau solia na vei valelailai tale eso. E sega ni vakayagataki kina na wai ka sega tale ga ni boi. Na valelailai e rawa ni tara e tuba ka vaka tale ga kina e loma ni vale. Na valelailai ka taba tiko ena i vola oqo, e a tara me vukea na kena taqomaki na noda i qoliqoli. Era a tara na lewe ni koro O Vunisinu kei Nalase, ena tikina O Dreketi, Yasana O Rewa ena vula O Sepiteba, 2004. Na cakacaka oqo e vakatokai tiko me "pilot project."

Helpful Guidelines for Toilet Construction and Use

Basic Idea:

The key idea is that human waste combines with plant matter in the presence of air to produce clean manure. If too much liquid matter stays in the container, there is no air and bad smells develop. Therefore, it is probably necessary to drain off any excess liquid. This is done by having a plastic tube coming out of the bottom of the bin which goes into a small wetland. To ensure the exit hole does not get blocked, a filter described in step 1a is prepared. This tube goes to an area bordered by cement blocks and is covered with gravel and planted with things like sledge and kuta that absorbs water.

- 1) It is important to initiate the composting process before you begin using your new composting toilet. Complete the following steps:
 - a. Place a thin layer of coconut husks on top of the wire mesh to prevent large particles from falling into the bottom portion of the wheelie bin.
 - b. Place a layer of soil (or completed compost from a previously used bin) on top of the coconut husks. (2-3 inches of soil should be sufficient)
 - c. Place a handful of dried grass or leaves on top of the soil.
- 2) Paint the exposed ventilation pipe black above the roof-line to facilitate the ventilation of the vault. The pipe needs to be at least 6 inch diameter.
- 3) It is important that the vault is completely sealed to prevent flies and other pests from entering the composting chamber. This can be accomplished by lining any openings in the door with a used tire tube.
- 4) The concrete toilet seat construction is not addressed in these plans. At the time of this publication, a concrete seat with attached floor could be obtained from the Ministry of Health for a \$15 fee.
- 5) You must place a small handful of dry leaves or grass into the toilet each day when the toilet is in use. It is convenient to keep a basket or bag of dry material inside the toilet house for easy maintenance.
- 6) When the bin is full, remove it from the vault; close it, and keep it in a dry ventilated location for approximately two to three months. Replace the full bin with a second empty bin (a total of two bins are necessary for the continued use of your toilet). After two to three months, spread the composted material in the wheelie bin widely in the plantation. The compost should be dark, crumbly, and have a slightly musty or sweet odor when ready.
- 7) The composting toilet should not emit a foul odor. If you detect a strong odor, check to make sure the vault is sufficiently ventilated. Also confirm that you are adding at least one full handful of dry leaves or grass everyday.
- 8) It is important that the outlet for the leachate drain be completely sealed to prevent leakage of urine and any associated odor. It may be helpful to test the drain outlet using water before you begin using the toilet.

Eso na ka e Dodonu me Nanumi ena kena Tara na Valelailai

Na uto ni Vakasama

Na uto ni vakasama eke oya na nodratou cakcakavata na veicurumaki na benu ni valelailai (human waste) kei na co madu kei na cagi, me basika kina nai vakabulabula ni qele (manua). Kevaka e na sivia na suasua ena loma ni "container", ena sogota na cagi, ka na basika kina na boica. Sa ka bibi kina na kena vagolei na wai ki na "wetland", mai na boto ni "container", ka vakayagataki kina na 1.5" PCV pipe.

Mena biu e dua na lawalawa ena boto ni "container" (dabe e na 4 na duru-ya 6") tauvulona na benu mai valelailai, ka me na galala tiko na sala ni wai ki tuba.

Me na tei na cevuga se kuta ena "wet land" me rawa ni gunuva tiko na wai.

Me qai tuva na buloko (block) me baita na "wet land."

- 1) E dodonu me sa tekivutaki na "Compost" ena dua na tutu ni loma ni qiqi ni valelailai ni bera na kena vakayagataki.

Na kena i cakacaka:

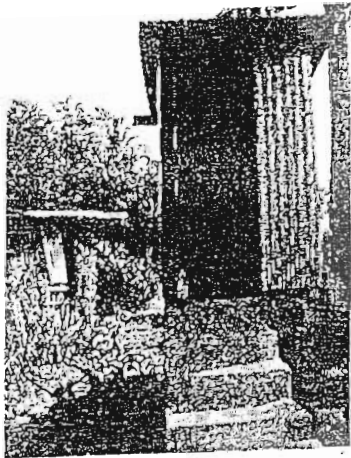
- a. Biu eso na qele ena dela ni magimagi, me rauta toka e tolu nai luku.
- b. Me qai ubi vaka mamare sara ena co mamaca (rauta vinaka na co ni koti matanivale) se draunikau madu mamaca.
- c. Mo biuta tiko vakalailai na co vakayadua ena veisiga me yacova na gauna mo raraga kina na ligamu ena dela ni co, o sa vakila na katakata.
- d. Na katakata ogo ena toso cake tiko ena veisiga; kevaka osa vakali nisa toso cake tiko na katakata ena tolu na siga veitarataravi, mo cega sara na co. E dodonu mo raica ni sa levu sara nai wiliwili ni baca ni qele se ulo. Kevaka e sa vakakina e sa dodonu mo sa vakayagataka na valelailai.

- 2) Sa rui bibi sara na kena sogolati na "vault" ena kena tara na valelailai ogo. Na katuba ni "vault" e muri, me wavoki na rubber (tube ni motoka) ena tutu ni katuba, me tarova na veimanumanu, vakabibi na lago me curu e loma. Na i sogo ni dabedabe ni valelailai e dodonu me dau sogo tu ga ena veigauna taucoko e dega tu kina ni vakayagataki.

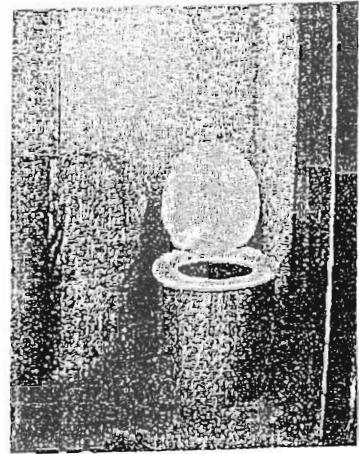
- 3) Na i dabedabe ni valelailai ogo, me vakayagataki ga kina na kena ka dau vakayagataki ena valelailai sovawai na simece ogo. Ia na palasitika ka dau tiko e loma, ka dau taura tiko na wai, mena musu laivi, me rawa ni gote vakadodonu sobu ga na valelailai. Se, e rawa talega me sa kua ga ni vakayagataki na palasitika oya. Me qai voli ga mai, ena "hardware store" na kena i dabedabe, ka dau vaka i sogo.

- 4) Me boro waloa na "ventilation pipe" (o koya ga ka tiko e dela ni vale) me vukea na kena cakacakataki na cagi.
- 5) Na simede ka dabe kinda nai dabedabe ni valelailai e volitaki tu ena Minisiti ni Bula ka dau ya \$15 (vata kei na kena "slab").
- 6) Na kena vakayagataki:
 - a. Me qai dau biu sobu, e rauta e dua nai luku na co mamaca, ena veigauna kece e vakayagataki kina (sega ni wili kina na vakasuasua).
 - b. Ni bera ni cava e dua na siga, ke rawa ni dau sikovi na valelailai, me vakadeitaki na kena tuvi tiko na ka taucoko e tiko ena "Wheelie Bin" ena co mamaca.

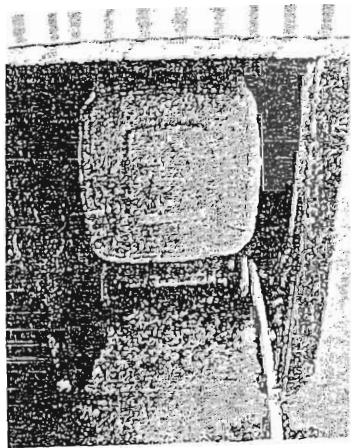
Photographs



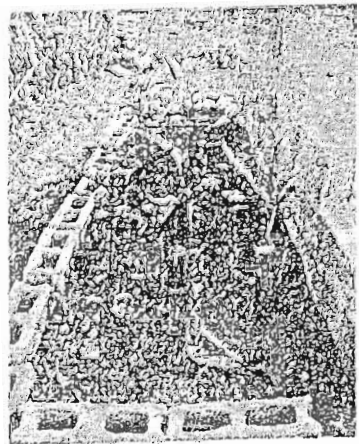
Front View



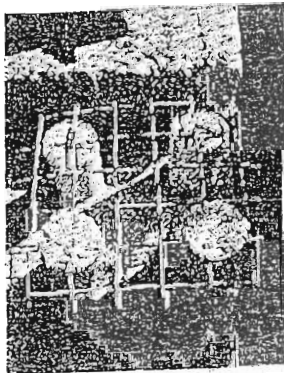
Inside View



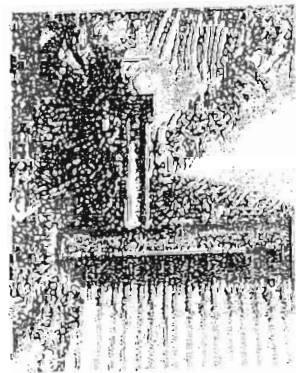
Inside Vault



Wetland



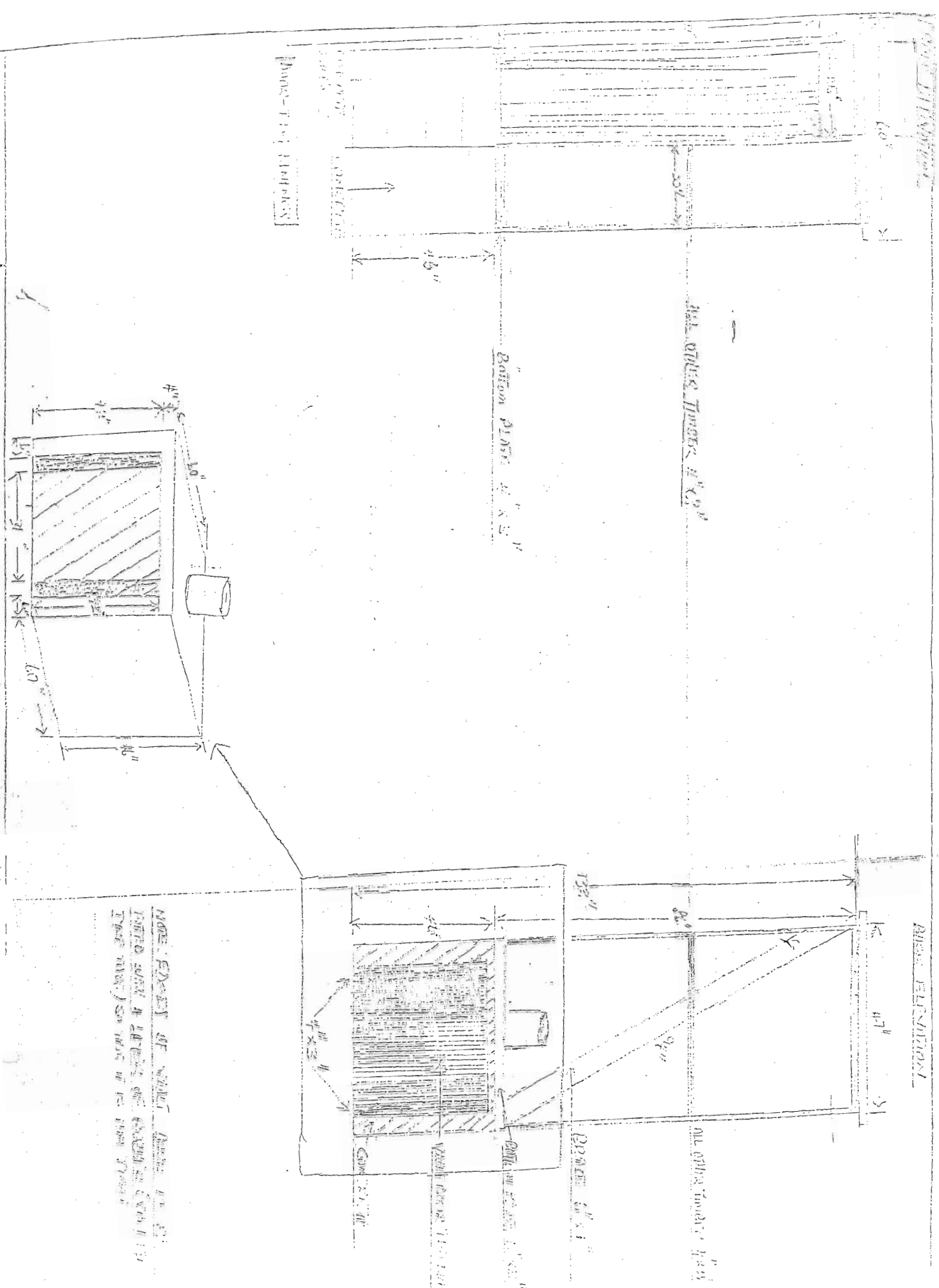
Wire Mesh (Place Inside Vault)



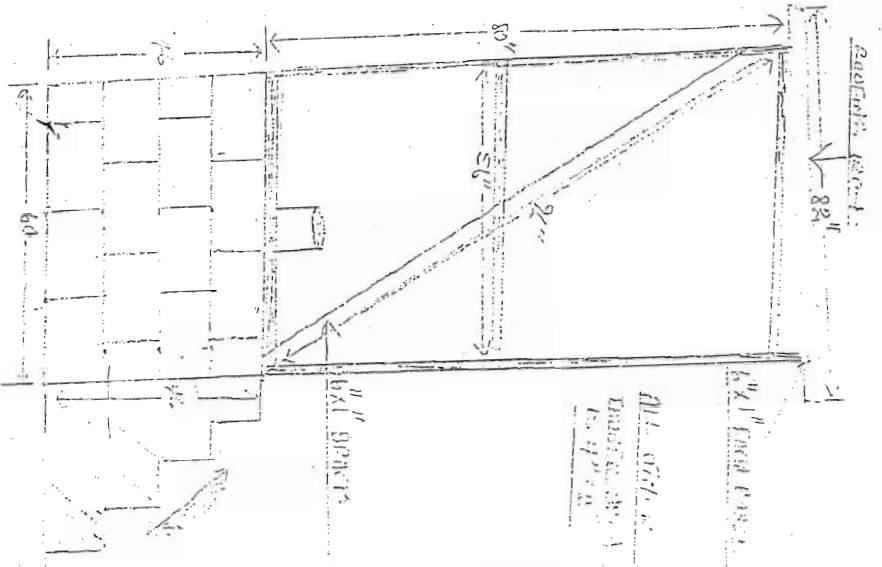
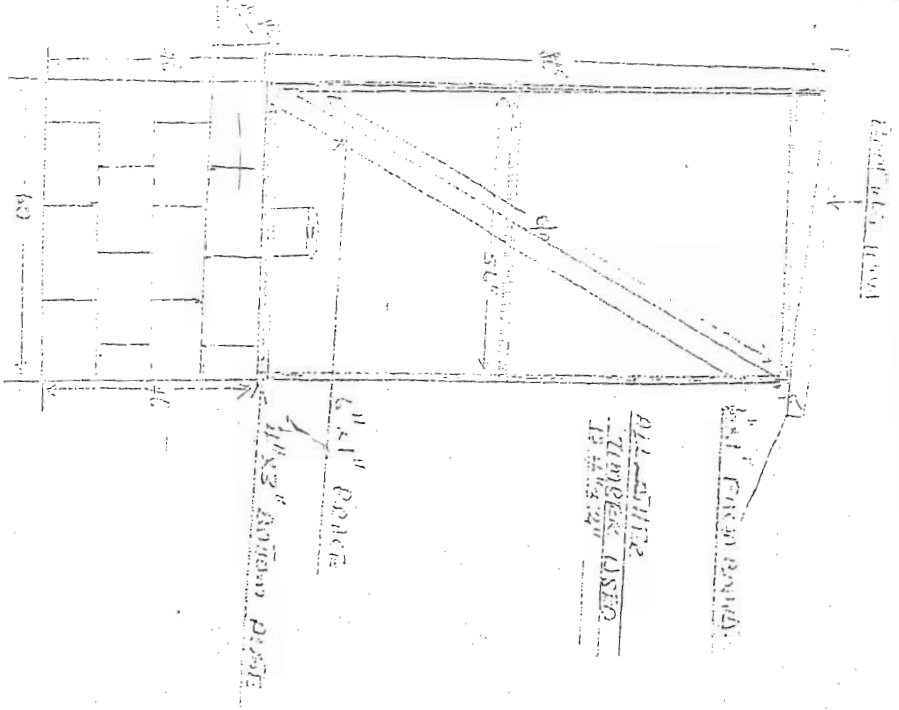
Ventilation Pipe (Paint Black)

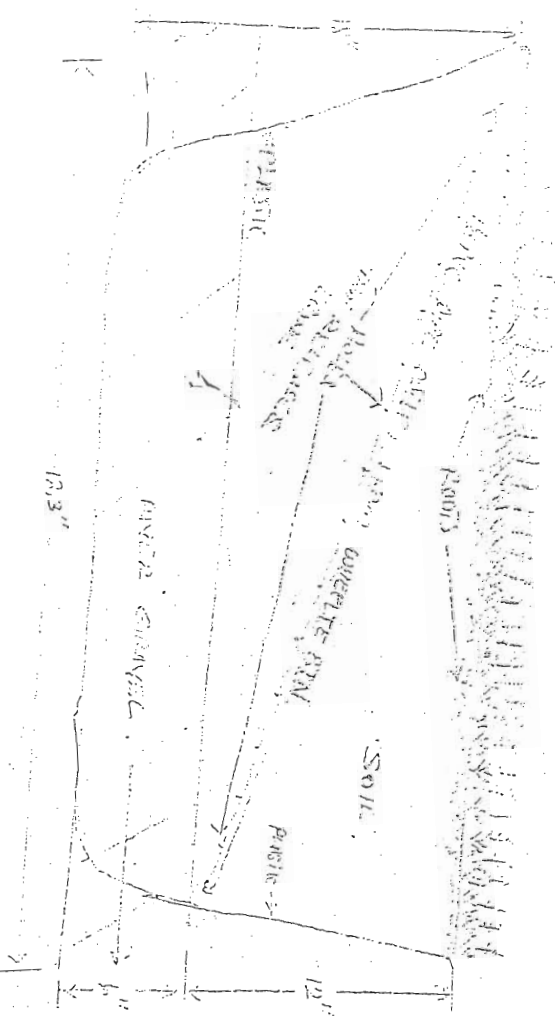
PLAN SECTION 1

PLAN SECTION 2

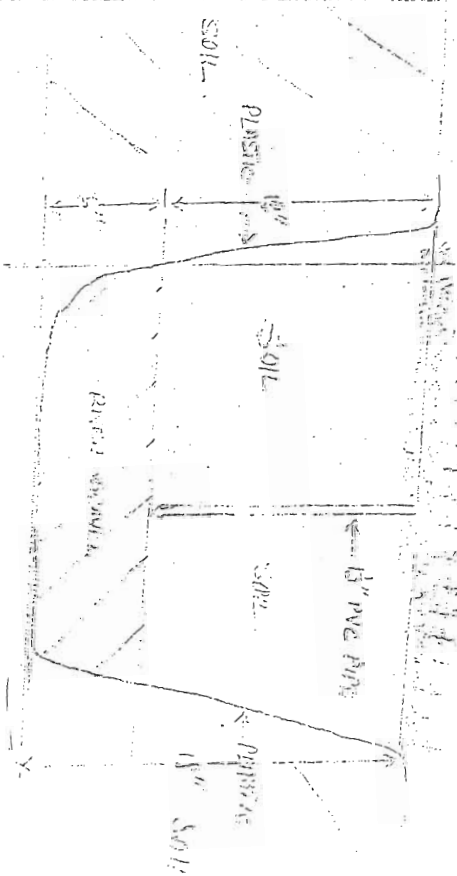


NOTE: EDGES OF WHOLE AREA TO BE
 FINISHED WITH A LAYER OF FINISH
 (SEE PLAN) SEE PLAN OF THE HOUSE

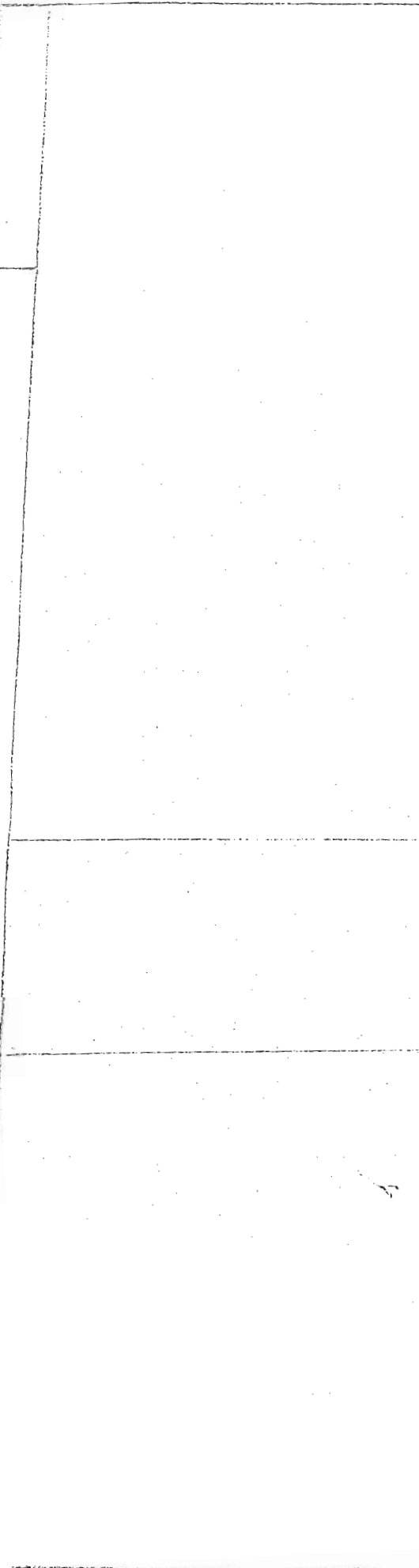




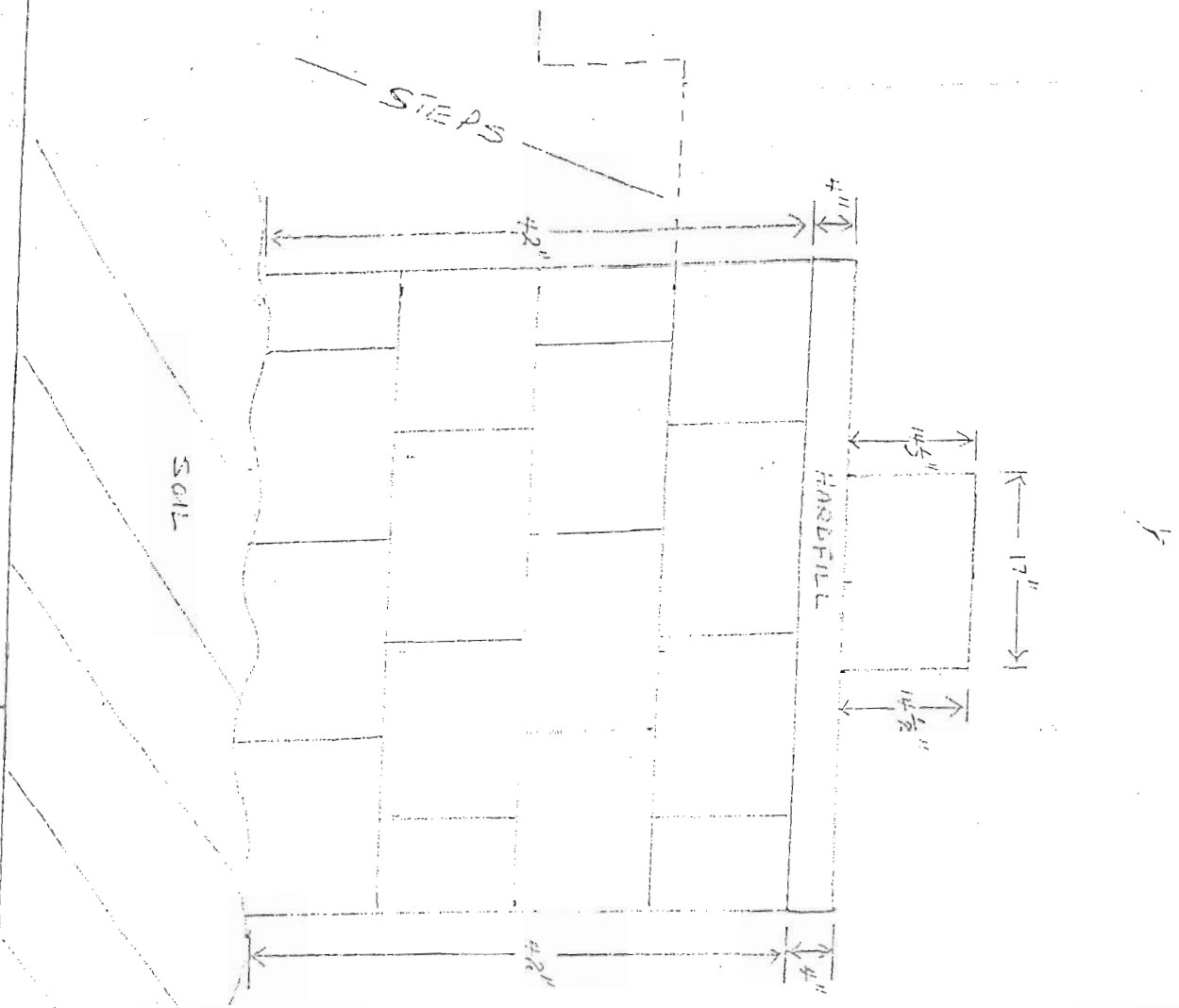
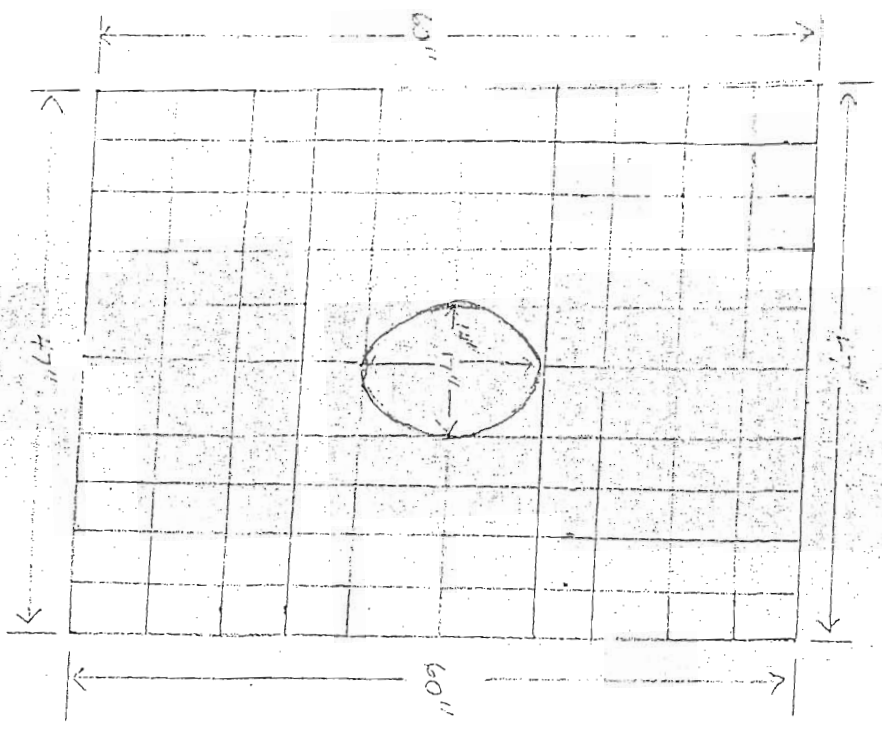
SHOWER ENCLOSURE



SHOWER ENCLOSURE



Scale: 1" = 20'



SHALLOW-BED COMPOSTING IN PIGGERIES

What is shallow-bed composting?

Shallow-bed composting is a method of piggery waste management in which the pig wastes are changed into useful fertilizer. The pigs are housed on beds of sawdust and live on top of this material in the pens. The wastes of the pigs are NOT removed from the pens but are mixed into the bed every 3-7 days. The waste composts in the pen and can eventually be used as a fertilizer for flowers or crops.

Why should I use shallow-bed composting in my piggery?

- It conserves water since water is not used to wash out the pens.
- It is environmentally friendly.
- It prevents water pollution since the wastes are not washed into a stream, river or ocean.
- It produces useful fertilizer for gardens.
- It reduces piggery odors.
- It is EASY TO DO!!

How do I do shallow-bed composting?

The pens:

The pens can be of a simple design and most old piggeries can easily be converted to a composting system. The major difference in the pen is that food and water must be kept separate from the bed. This is usually done by a raised trough or separate feeding and watering area.

Beginning a composting pen:

- Arrange for food and water to be separate from the bed.
- Add a bed of compostable material (untreated sawdust) to the pen about 16" (40cm) deep.
- Put pigs in pen.

Maintaining a composting pen:

- Mix the bed using a garden fork or other tool every 3-7 days to evenly spread the wastes over the entire pen, as the pigs tend to waste in only one corner of the pen. Mix the bed more often for more crowded pens.
- Add more sawdust as needed to the bed to maintain the depth at about 16" (40cm).
- Remove the entire bed in 6-8 months. At this point the material is unfinished compost. To finish the compost, place it in a pile (separate from the pen) and

mix it once a week for 2 months. Add a small amount of water if the pile gets dusty. The compost will then be ready to use as a fertilizer.

- Place a new bed of sawdust in the pen to begin the composting again.

Troubleshooting – Possible problems and how to fix them:

- The bed is too hot, the pigs are uncomfortable.
The bed will heat up as the composting process takes place. This is needed to kill disease organisms in the pig's wastes. If it is so hot that the pigs are uncomfortable, try mixing the bed more often but remember that you do not want to cool the bed down too much.
- The bed is too wet.
The bed should be slightly moist but not wet. Usually, the liquid waste (urine) of the pigs provides the right amount of wetness. If the bed is too wet check the depth of the bed and add more sawdust to get the bed back up to 16" (40cm) if needed. Also, check to see that the drinking water is not being spilled into the bed. If the bed is still too wet there may be too many pigs on the bed (making too much liquid waste) so remove some of the pigs to another pen. Another cause of the bed being too wet could be if rain is getting into the pen so you may need to check the roof.
- The bed is too dry.
Add more pigs to the pen to make more liquid waste or add a small amount of water (not too much).
- The pen smells badly of waste.
A composting pen should not give off a foul odor. It should eliminate most odors and make a piggery smell much better than most other methods. If there is a foul odor, check for the following things:
 - Is the bed too cold? The heat of the composting bed kills the bacteria that cause odor, so the hotter the bed is the less odor there will be. If the bed is too cold, try mixing the bed less often.
 - Is the bed too shallow? Add more compostable material (sawdust or grass clippings and crumbled leaves) to restore depth to 16" (40cm).
 - Are there a lot of visible wastes on the top of the bed? Try mixing the bed more often or there may be too many pigs on the bed making more wastes than the bed can compost.
- The bed is turning dark brown and crumbly.
That is a wonderful thing! It means that the bed is composting well. The finished compost should look like soil.

Frequently Asked Questions

- I only have one pig; can I still use shallow-bed composting?
Yes, shallow-bed composting can be used with piggeries of all sizes. For only 1 or 2 pigs just make sure the bed isn't too large or you may have to add water sometimes to keep the bed moist.
- Where can I get the sawdust?
Try going to furniture manufacturers and lumber factories. These places will usually give sawdust away at no charge and all you have to do is pick it up. Be sure to ask if the sawdust is from treated or untreated wood! Only **untreated sawdust** can be used in a composting pen. Treated sawdust does not compost as quickly and can release harmful chemicals, causing sickness in the pigs or damage to crops when it is used as a fertilizer.
To use grass clippings and crumbled leaves simply collect this material after weeding and keep it in a dry place until you are ready to use it in your pens.
- Why do I need to compost the bed material another 2 months before using it as a fertilizer?
When you remove the bed after 6-8 months it is unfinished compost. That means that not all of the wastes have completed composting because new waste from the pigs was constantly added. It must be composted another 2 months out of the pen to make sure that all of the wastes have completely composted. Unfinished compost still contains harmful disease organisms that can infect crops and the people who eat those crops, causing sickness.
- I can't get sawdust, is there anything else I can use?
Although sawdust has been seen to work the best, any compostable material could possibly be used. If sawdust is not available, try using grass clippings and crumbled leaves. Simply collect this material after grass cutting or weeding and keep it in a dry place until you are ready to use it. Cut the material up into the smallest pieces possible before putting it in the piggpens.

Written - February 2006

Appendix H. Photos of Workshop

