The Republic of Fiji

Waste Minimization and Recycling Promotion Project in The Republic of Fiji

Project Completion Report

March 2012

JAPAN INTERNATIONAL COOPERATION AGENCY（JICA）
Kokusai Kogyo Co., Ltd.
EX Corporation

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JR
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Annex

Abbreviation

AP	Action Plan
CP	Counterpart Personnel
CA	Capacity Assessment
DOE	Department of Environment
EIA	Environmental Impact Assessment
IC/R	Inception Report
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MLGUDH	Ministry of Local Government, Urban Development and Housing
MOE	Ministry of Environment
M/M	Minutes of Meeting
MOH	Ministry of Health
MRF	Material Recovery Facility
NGO	Non-Government Organization
OJT	On-the-Job Training
POS	Public Opinion Survey
PP	Pilot Project
R/D	Record of Discussions
SPREP	South Pacific Regional Environment Programme
SWM	Solid Waste Management
3R	3R (Reduce, Reuse, Recycle/Return)
3RPP	3R Pilot Project
W/S	Workshop

1 Introduction

The waste minimization and recycling promotion project (hereinafter referred to as "the Project"), with an aim to strengthen the capacity on Solid Waste Management for Department of Environment (DOE), Lautoka City Council (LCC) and Nadi Town Council (NTC) through establishment of a 3R model which consists of development of a SWM master plan, executing 3R pilot projects, awareness raising in the target areas, and educational activities for 3R promotion matched with Fijian characteristics, was implemented from October 2008 to March 2012.

In the first year of the Project (October 2008 ~ March 2009), the waste flows of LCC and NTC were developed base on the results of the baseline surveys and the framework of the waste minimization centric SWM master plans were prepared. And the preparatory works for the pilot projects for verifying a practicability of 3Rs were carried out.

In the second year of the Project (April 2009 ~ March 2010), the pilot projects consisting of home composting, market waste composting and recycling of chips of green waste for minimizing organic waste which accounts for about 70% of total discharged waste and separate collection for recyclables were implemented and the practicability of these was verified. Furthermore, the SWM master plans targeting 2017 for LCC and NTC were developed respectively considering the lessons learnt from the pilot projects.

In the third year of the Project (April 2010 ~ March 2011), to promote waste minimization in the whole council area, the pilot project for separate collection of recyclables in the business area and expansion of the 3R promotion in the residential area was conducted in the third year of the Project (April 2010 ~ March 2011). On the other hand, DOE has started to develop the guideline and manual for promoting the waste minimization and recycling project that succeeded in Lautoka and Nadi as a model for other areas, and held workshop on February 2011 targeting the nationwide officials in charge of SWM.

In the forth year of the Project, both councils expanded 3R activities. The separate collection of recyclables is being carried out in the whole jurisdiction area in Nadi and about one third in Lautoka. DOE has finalized 3R Guideline and 3R Promotion Manual based on the experience of the pilot project in Lautoka and Nadi and held the seminar on November 2nd and 3rd 2011 to explain the contents of these and national policy on 3Rs.

This report, the Project Completion Report, summarizes the activities conducted in the Project from October 2008 to February 2012. Therefore, the report of the activities in Lautoka City Council (LCC) and Nadi Town Council (NTC) and Department of Environment (DOE) in Chapter 3, sections A, B, and C, has been prepared by each counterpart.

1.1 Overall Goal, Project Purpose and Output

Overall Goal

3R is progressed in Fiji, mainly in the Western Division.

Project Purpose

Capacity of 3Rs of the Department of Environment (DOE), Lautoka City and Nadi Town is increased through developing a 3R model for Fiji.

Outputs of the Project

Output 1: Solid Waste Management Plans focusing on the 3Rs are developed in Lautoka City and Nadi Town respectively.

Output 2: Lautoka City and Nadi Town obtain the capacity for proper Solid Waste Management (SWM) through the implementation of Pilot Projects.

Output 3: Lautoka City and Nadi Town obtain the capacity for 3R promotion activities in the whole area of Lautoka City and Nadi Town.

Output 4: Awareness of residents in Lautoka City and Nadi Town is raised through implementation of environmental education activities on 3R promotion.

Output 5: 3R model for Fiji is developed and recommended.

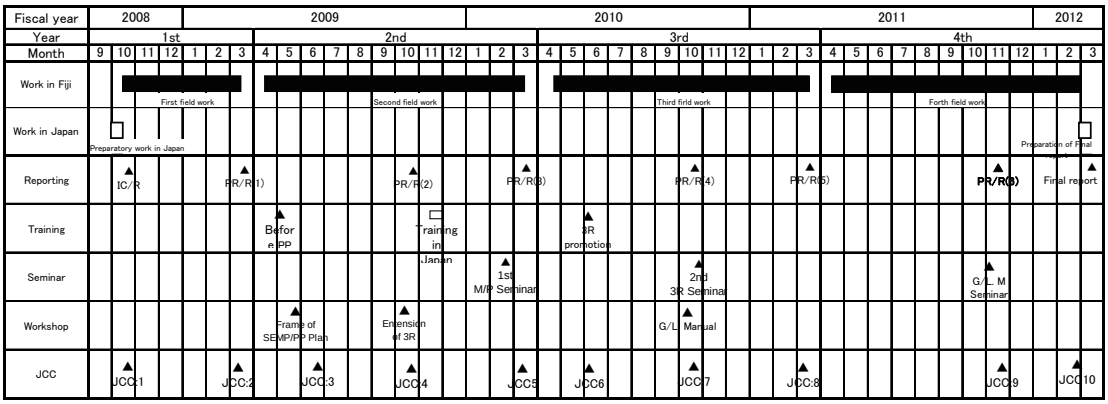
1.2 Project Area

Lautoka City Council and Nadi Town Council in the Western Division of Fiji

1.3 Target Waste of the Project

The project has targeted the household and commercial waste in Lautoka and Nadi, which were collected and transported by both sides. The Project also took into consideration all the waste--including industrial waste--which was transported and landfilled in the Lautoka landfill site.

1.4 Project Schedule



2 Input

2.1 Input of JICA

a. Dispatch of Experts

1st Year of the Project

Field of Expertise	Name (First LAST)	2008 Oct	Nov	Dec	2009 Jan	Feb	Mar	Fiji	JPN
Chief Advisor/Solid Waste Management	Mr. Junji ANAI							4.00	0.50
Waste minimization/recycling(1)/Financial, institutional and organizational aspects	Mr. Susumu SHIMURA							1.43	0.50
Waste minimization/recycling (2)	Mr. Koji KUSUNOKI							2.00	0.00
Solid waste education and awareness raising (1)	Ms. Keiko KANI							0.00	0.00
Solid waste education and awareness raising (2)	Ms. Kaoru OKA							0.00	0.00
Final disposal (planning, construction and operation of sanitary landfill)	Mr. Tamotsu SUZUKI							2.80	0.00
3R Promotion/Project Coordinator (1)	Ms. Yurie KAWABATA							0.50	0.00
Environment and Social Consideration/Capacity Assessment	Mr. Masayuki TAKAZAWA							1.50	0.00
Project Coordinator (2)	Ms.Y. KAWABATA								
								12.23	1.00
								13.23	

2nd Year of the Project

Field of Expertise	Name (First LAST)	2009 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2010 Jan	Feb	Mar	平成21年度 現地	国内
Chief Advisor/Solid Waste Management	Mr. Junji ANAI													5.37	
Waste minimization/recycling(1)/Financial, institutional and organizational aspects	Mr. Susumu SHIMURA													0.70	
Waste minimization/recycling (2)	Mr. Koji KUSUNOKI													4.33	
Solid waste education and awareness raising (1)	Ms. Keiko KANI													3.10	
Solid waste education and awareness raising (2)	Ms. Kaoru OKA													0.43	
Final disposal (planning, construction and operation of sanitary landfill)	Mr. Tamotsu SUZUKI													0.70	
3R Promotion/Project Coordinator (1)	Ms. Yurie KAWABATA													4.07	
Environment and Social Consideration/Capacity Assessment	Mr. Masayuki TAKAZAWA													1.70	
Project Coordinator (2)	Ms.Y. KAWABATA														
														20.40	0.00
														20.40	

3rd Year of the Project

Field of Expertise	Name (First LAST)	2010									2011			平成22年度	
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	現地	国内
Chief Advisor/Solid Waste Management	Mr. Junji ANAI													3.50	
Waste minimization/recycling(1)/Financial, institutional and organizational aspects	Mr. Susumu SHIMURA													0.50	
Waste minimization/recycling (2)	Mr. Koji KUSUNOKI													3.00	
Solid waste education and awareness raising (1)	Ms. Keiko KANI													1.50	
Solid waste education and awareness raising (2)	Ms. Kaoru OKA													0.00	
Final disposal (planning, construction and operation of sanitary landfill)	Mr. Tamotsu SUZUKI													0.00	
3R Promotion/Project Coordinator (1)	Ms. Yurie KAWABATA													4.00	
Environment and Social Consideration/Capacity Assessment	Mr. Masayuki TAKAZAWA													1.10	
Project Coordinator (2)	Ms.Y. KAWABATA														
														13.60	0.00
														13.60	

4th Year of the Project

Field of Expertise	Name (First LAST)	2011									2012			平成23年度	
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	現地	国内
Chief Advisor/Solid Waste Management	Mr. Junji ANAI													3.47	0.50
Waste minimization/recycling(1)/Financial, institutional and organizational aspects	Mr. Susumu SHIMURA													0.50	0.00
Waste minimization/recycling (2)	Mr. Koji KUSUNOKI													1.53	0.00
Solid waste education and awareness raising (1)	Ms. Keiko KANI													0.83	0.00
Solid waste education and awareness raising (2)	Ms. Kaoru OKA													0.00	0.00
Final disposal (planning, construction and operation of sanitary landfill)	Mr. Tamotsu SUZUKI													0.00	0.00
3R Promotion/Project Coordinator (1)	Ms. Yurie KAWABATA													1.50	0.00
Environment and Social Consideration/Capacity Assessment	Mr. Masayuki TAKAZAWA													0.70	0.00
Project Coordinator (2)	Ms.Y. KAWABATA														
														8.53	0.50
														9.03	

Total input of JICA Experts

Field of Expertise	Name (First LAST)	1st Yeat		2nd Year		3rd Year		4th Year		Total	
		Fiji	JPN	Fiji	JPN	Fiji	JPN	Fiji	JPN	Fiji	JPN
Chief Advisor/Solid Waste Management	Mr. Junji ANAI	4.00	0.50	5.37		3.50		3.47	0.50	16.34	1.00
Waste minimization/recycling(1)/Financial, institutional and organizational aspects	Mr. Susumu SHIMURA	1.43	0.50	0.70		0.50		0.50	0.00	3.13	0.50
Waste minimization/recycling (2)	Mr. Koji KUSUNOKI	2.00	0.00	4.33		3.00		1.53	0.00	10.86	0.00
Solid waste education and awareness raising (1)	Ms. Keiko KANI	0.00	0.00	3.10		1.50		0.83	0.00	5.43	0.00
Solid waste education and awareness raising (2)	Ms. Kaoru OKA	0.00	0.00	0.43		0.00		0.00	0.00	0.43	0.00
Final disposal (planning, construction and operation of sanitary landfill)	Mr. Tamotsu SUZUKI	2.80	0.00	0.70		0.00		0.00	0.00	3.50	0.00
3R Promotion/Project Coordinator (1)	Ms. Yurie KAWABATA	0.50	0.00	4.07		4.00		1.50	0.00	10.07	0.00
Environment and Social Consideration/Capacity Assessment	Mr. Masayuki TAKAZAWA	1.50	0.00	1.70		1.10		0.70	0.00	5.00	0.00
Project Coordinator (2)	Mr. Steven SUNDSTROM/ Ms.Y. KAWABATA	(1.0)		(2.0)		(2.0)		(2.0)		(7.0)	(0.00)
		12.23	1.00	20.40	0.00	13.60	0.00	8.53	0.50	54.76	1.50
		13.23		20.40		13.60		9.03		56.26	

b. Procurement of equipment/instruments

	Item	Maker/model/specification	unit	Qnt.	Note
1st Year	Copy machine	RICHO / Aficio MP2000	Unit	1	LCC（JET）
	Desktop PC	Toshiba // Memory 2GB, HH120GB	Unit	1	Incl. UPS：Nova 600 UPS
	Desk for PC	Vinod Patel	Unit	1	LCC（JET）
	Laptop PC	Toshiba/ L300 / Memory 4GB, HH:	Unit	2	LCC, NTC
	Printer	RICOH / SP 3300 DN / Printing speed: 28ppm	Unit	3	LCC, NTC
	Software	Microsoft / Windows WP	Set	3	1 Desktop, 2 Laptops
	Software	Microsoft / Office	Set	3	1 Desktop, 2 Laptops
	Software	Adobe Creative Suite 4.0 Design Premium	Set	1	HP, image processing
	Video camera	Sony DCR-SR220E	Unit	2	LCC, NTC
	Projector	Toshiba / TDP SP1 Multimedia Projector / 23.9～300	Unit	2	LCC, NTC
2nd Year	Weighbridge	Avery Scale 20kg - 80ton	Unit	1	Procured by JICA Fiji Office, LCC
	Excavator	KATO HD-512III	Unit	1	Procured by JICA Fiji Office, LCC
	Multi Purpose Truck	HINO WU422R-HKMRB3	Unit	1	LCC
	Shredder	Vermeer BC1000XL	Unit	1	LCC
	Grass cutter	Kawasaki TH-34/BC320HK	Unit	20	LCC、NTC
	Compost bin	Rotomould Fiji Ltd.	No.	100	3R promotion, LCC, NTC
	Concrete slab	Avery scale	Unit	50	VDS partial improvement, LCC
	Soil etc.				VDS partial improvement, LCC
3rd Year	Multi Purpose Truck	HINO WU422R-HKMRB3	Unit	1	Procured by JICA Fiji Office, NTC

c. Others

JET has contracted out the following works to PASIFIKA Communications, a local consultant.

c.1 Production of multi-media educational materials

Following video materials were created:

- How to sort, store and discharge recyclables (a few minutes)
- How to start home composting (3-5 minutes)

This work included all necessary works such as script, design, storyboard, shooting (videotaping), editing to produce campaign videos.

The video files which were shot during the pilot project in the second year were used as much as possible.

c.2 Production for mass media campaign tool (radio ad)

The purpose of radio program was to show the details of separate collection service and home composting. The duration of the radio program was 1 minute and it was aired for one month.

c.3 Production of poster

Posters were displayed at public spaces such as government offices, schools, and shopping facilities and it showed the following:

- Waste collection system and recycling program in Nadi or Lautoka
- Way of sorting, storing and discharging waste and recyclables with illustrations or cartoons

The number of posters produced was 500. The size was A2.

c.4 Modification of 3R promotion web site

3R promotion web site was modified by creating a new page of “download”, where people could download various educational materials. Several sub-pages of “How to promote 3Rs” were also created to show case the 3Rs.

c.5 Modification of 3R promotion videos

3R promotion pilot project has been expanded to commercial areas, targeting shops, offices, restaurants, and so on in the third year. 3R promotion video produced in the second year of the project was modified by adding new footages of 3R activities by commercial sectors.

Two types of video, a summary video of around 5 minutes and a longer version of around 15 minutes were prepared.

2.2 Input of Fiji side

a. Input of LCC

a.1 Personnel

LCC involved all the staff of Department of Health to the Project as long as time permitted. The names of the staff are listed in the following table.

Table 1: List of the Staff of Department of Health, LCC

Name	Position
Mr. Gyneshwar RAO	Director Health Services, Dept. of Health
Mr. Rouhit Karan SINGH	Manager Health Services, Dept. of Health
Mr. Shalend Prem SINGH	Senior Health Inspector/ Co-Project Manager
Mr. Wally ATALIFO	Health Inspector
Mr. Jeremaia MARAWA	Health Inspector
Mr. Mithun PRASAD	Health Inspector
Ms. Lonika MISHRA	Health Inspector
Mr. Rajendra PRATAP	Ex Director of Dept. of Health
Mr. Prem SUNDAR	Ex Executive Director of Dept. of Health

a.2 Expenses

Table 2: LCC's budgetary expenditure on the Project from Oct. 2008 to Mar. 2010

No.	Major Budget Item	Amount in F$
1.	Office and Materials	750.00
2.	Machinery Fuel (landfill bulldozer)	4,080.00
3.	Gravel and Soil (for maintaining access road)	2100.00
4.	Open Shed & concrete slab/Renovation of office at VDS/new gate for VDS	8,229.65
5.	3 labourers (MPT driver/handyman/wood chipper operator	15,048.00
6.	Compost box and sieve	185.00
7.	EMP- water analysis and monitoring	1,200.00
8.	VDS boundary survey /redefinition works by surveyor	1,650.00
9.	Environmental symbol and slogan competition, media awareness and prize money for winners.	565.83
10.	Opening and handing over ceremony for weighbridge and machinery at VDS and 3R PP launching at Field 40	2,215.90
11.	Transportation/travelling (Recyclable collection, market waste collection, JCC and JWM)	4,075.00
12.	Backup generator for VDS	4,000.00
13.	Home composter for expansion	4,455.00
14.	Landscaping at VDS entrance	100.00
15.	Separate bins for market waste composting project	500.00
16.	Counterpart staff assigned to project	10,334.00
	Total	F$59,488.38

Source: JICA mid-term evaluation report

Table 3: LCC's budgetary expenditure on the Project from May 2010 to Oct. 2011

No.	Major Budget Item	Amount in F$
1	Office and Materials	$100.00
2	Machinery Fuel (landfill bulldozer) improvement works.	$9,362.66
3	Machinery Fuel (Excavator) improvement works	$6,237.59
4	3 labours (MPT driver/handyman/wood chipper operator	$30,492.00
5	Transportation/travelling (Recyclable collection, market waste collection,)	$2,188.40
6	Transportation/travelling (JCC and JWM)	$805.00
7	Home composter for expansion	$5,500.00
8	Landscaping at VDS entrance	$200.00
9	Separate bins for market waste composting project	$1,780.00
10	Counter part staffs assigned to project	$17,201.00
11	Purchase of Submersible pump for VDS	$1,800.00
12	Purchase of Water Blaster for VDS	$1,890.00
13	Purchase of Water tank and pump for VDS	$1,000.00
14	Access improvement for VDS	$80,000.00
15	Gravel for VDS	$4,600.00
16	weighbridge calibration - 2010	$4,250.00
17	Weighbridge calibration - 2011	$13,128.50
18	Miscellaneous expenses for 3R Project (meetings, hosting visitors etc)	$2,000.00
19	Water Blaster for VDS	$1,890.00
	Total	$184,425.15

Source: JICA Terminal evaluation report

b. Input of NTC

b.1 Personnel

NTC has involved all the staff of Department of Health to the Project as long as time permitted. The names of the staff are listed in the following table.

Table 4: List of the Staff of Department of Health, NTC

Name	Position
Mr. Sakaraia SERAU	Senior Health Inspector, Dept. of Health
Ms. Premila CHANDRA	Senior Assistant Health Inspector
Mr. Rajeshwar RAJ	Assistant Health Inspector /Co-Project Manager
Ms. Nafiza ALI	Assistant Health Inspector, Dept of Health

Mr. Taniela SATURY	Litter Prevention Officer
Mr. Sakenasa NAMISI	Environmental Officer

b.2 Expenses

Table 5: NTC's budgetary expenditure on the Project from Oct. 2008 to Mar. 2010

No.	Major Budget Item	Amount in F$
1	Meeting Expenses	F$1,200.00
2	Office Materials	F$300.00
3	Labour used for Recyclable collection	F$7,600.00
4	Launching of 3RPP in Matavolivoli	F$1,800.00
5	Transport and travelling	F$2,550.00
6	Purchase of home composters	F$5,500.00
7	Counterpart involved	F$8,900.00
8	Machinery operations	F$3,013.00
	Total	F$30,863.00

Source: JICA mid-term evaluation report

Table 6: NTC's budgetary expenditure on the Project from May 2010 to Oct. 2011

No.	Major Budget Item	Amount in F$
1	Composter bin purchased (200)	F$11,000.00
2	Counter involvement (salary)	F$12,988.80
3	Labour for Recyclables Collection	F$6,877.92
4	Market launching (banner/lunch)	F$400.00
5	Cost involved in market waste Composting	F$6,200.00
6	Compost yard labour	F$2,000.00
7	clean school program (workshop, lunch, prizes)	F$2,000.00
8	Shibushi Mayor Visit and the team - Dinner@ port denarau	F$1,000.00
9	Transportation/travelling/MPT announcement and Collection/JWM in Lautoka (LCC/DoE) and Suva -JCC	F$4,100.00
10	3R Expansion to Namaka, Martintaar, Town meeting cost/drinks/circular	F$700.00
11	Office materials -printing/ supply paper of JET/meeting paper in office	F$260.00
12	Machinery - Digger for compost turning, collection by MPT, compost yard maintenance, fuel and wear and tear cost	F$5,000.00
13	Matavolivoli meeting only – drinks, meeting papers	F$1,050.00
14	Counterparts training allowance in Japan- sep 2010,2011(for 8 staffs)	F$9,800.00

	Total	F$63,376.72

Source: JICA Terminal evaluation report

c. Input of DOE

c.1 Personnel

The staffs of DOE involved the Project are listed in the following table.

Table 7: List of the Staff of Department of Environment

Name	Position
Mr. Jope DAVETANIVALU	Project Director / Director of Dept. of Health
Mr. Aminiasi QAREQARE	Project Manager Acting Principal Environment Officer, DOE
Ms. Senivasa WAQARAIMASI	Senior Environment Officer, Western Division, DOE
Ms. Laisani LEWANAVANUA	Environmental Officer
Mr. Epeli NASOME	Ex Director of Dept. of Environment
Ms. Lusiana RALOGAIVAU	Environmental Officer

c.2 Expenses

Table 8: DOE's budgetary expenditure on the Project from Oct. 2008 to Mar. 2010

No.	Major Budget Item	Amount in F$
1.	Meeting Expenses	F$2,000.00
2.	Transport / Travel Costs	F$1,000.00
3.	Accommodation for CPs to attend JCC	F$1,600.00
	Total	F$4,600.00

Source: JICA mid-term evaluation report

3 Activities

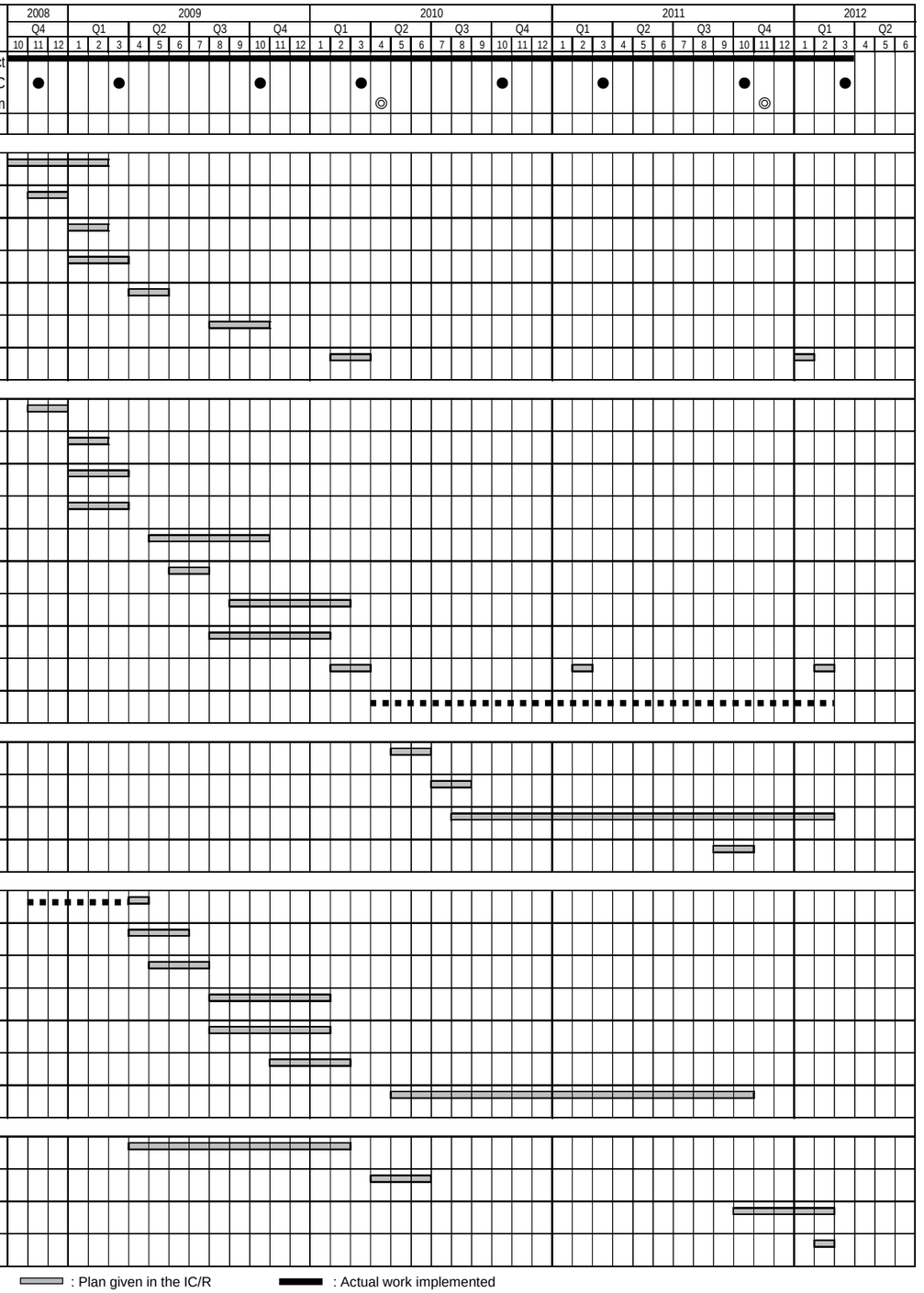
According to the amendment of PDM, Plan of Operation (PO) and Work Flow have also changed. The PO and Work Flow are shown below.

The details of each activity are summarized based on the mid-term evaluation report and terminal evaluation report.

3.1 Plan of Operation (PO)

(1) Plan of Operation at the beginning of the Project

Name of Project: Waste Minimization and Recycling Promotion Project		
Term of Cooperation: Three years and six months		Period of the Project
Project Area: Lautoka City and Nadi Town		JCC
Target Group: Dept. of Environment, Municipal Gov. and Communities in Lautoka and Nadi Town		Joint Evaluation
Outputs and Activities		Results of Activities
Output 1: Solid Waste Management Plan focusing respectively in Lautoka City and Nadi Town		
1-1	Survey the current status of SWM	Results of baseline survey, Waste survey, Capacity assessment, etc.
1-2	Conduct a field survey on Lautoka landfill site	Survey report on Lautoka landfill
1-3	Trace the current waste flow from generation to final disposal and identify issues to be adressed	Waste flow, waste analysis report
1-4	Develop frameworks of SWM	Framework document of SWM
1-5	Build a consensus on the frameworks of SWM among stakeholders	M/M of stakeholder meeting
1-6	Develop draft SWM plans based on the frameworks of SWM	Draft SWM plan
1-7	Finalize SWM plans	SWM plan
Output 2: Pilot Projects are implemented		
2-1	Conduct a community survey	Community survey report
2-2	Select pilot areas on the basis of the community survey	Map for pilot project areas
2-3	Develop a pilot project plan on 3R	Pilot project plan on 3R
2-4	Develop a pilot project plan on a partial improvement of Lautoka landfill	- Pilot project plan on a partial improvement of Lautoka landfill - Environment Management plan
2-5	Conduct training, on the job training, etc. for the staff of Lautoka city council and Nadi town council to implement pilot project	Materials for capacity development
2-6	Complete the Environmental Impact Assessment (EIA) process required for the pilot project on a partial improvement of Lautoka landfill	Necessary documents for EIA process
2-7	Conduct the pilot project on 3R at project areas	Progress report
2-8	Conduct the pilot project on a partial improvement of Lautoka landfill	Progress report
2-9	Review and evaluate the pilot projects	Evaluation report
2-10	Conduct OJT for operation and maintenance of Lautoka landfill	Progress report
Output 3: 3R is implemented at whole area of Lautoka City and Nadi Town		
3-1	Develop a 3R promotion action plan at whole area of Lautoka sity and Nadi town	3R promotion action plan
3-2	Conduct training, on the job training, etc. for the staff of Lautoka city council and Nadi town council to implement 3R promotion	Materials for capacity development
3-3	Implement 3R promotion	Prograss report
3-4	Review and evaluate 3R promotion	Evaluation report
Output 4: Awareness of residents in Lautoka City and Nadi Town is raised through implementation of environmental education activities on 3R promotion		
4-1	Review on environmental education tools/programs in Fiji, Japan and other countries	Review report
4-2	Develop effective educational tools/programes	Educational tools/programmes
4-3	Conduct training, on the job training, etc. for the groups and personnel concerned on 3R promotion in Lautoka and Nadi	Training report
4-4	Introduce the educational tools/programmes in the pilot project areas	Progress report
4-5	Evaluate the educational tools/programmes	Evaluation report
4-6	Improve the educational tools/programmes	Improved educational tools/programmes
4-7	Implement activities to raise awareness through using the educational tools/programmes in Lautoka city and Nadi town	Progress report
Output 5: 3R model for Fiji is developed and recommended		
5-1	Review all the process & results of the activities for 3R promotion by the project and extract findings	Outputs review report
5-2	Develop draft guidelines, manuals on 3R model for Fiji, etc. for its promotion	Draft guidelines, manuals, etc.
5-3	Finalize the guidelines, manuals, etc.	Guidelines, manuals, etc.
5-4	Conduct seminars to present other municipalities the guidelines and manuals	Seminar reports

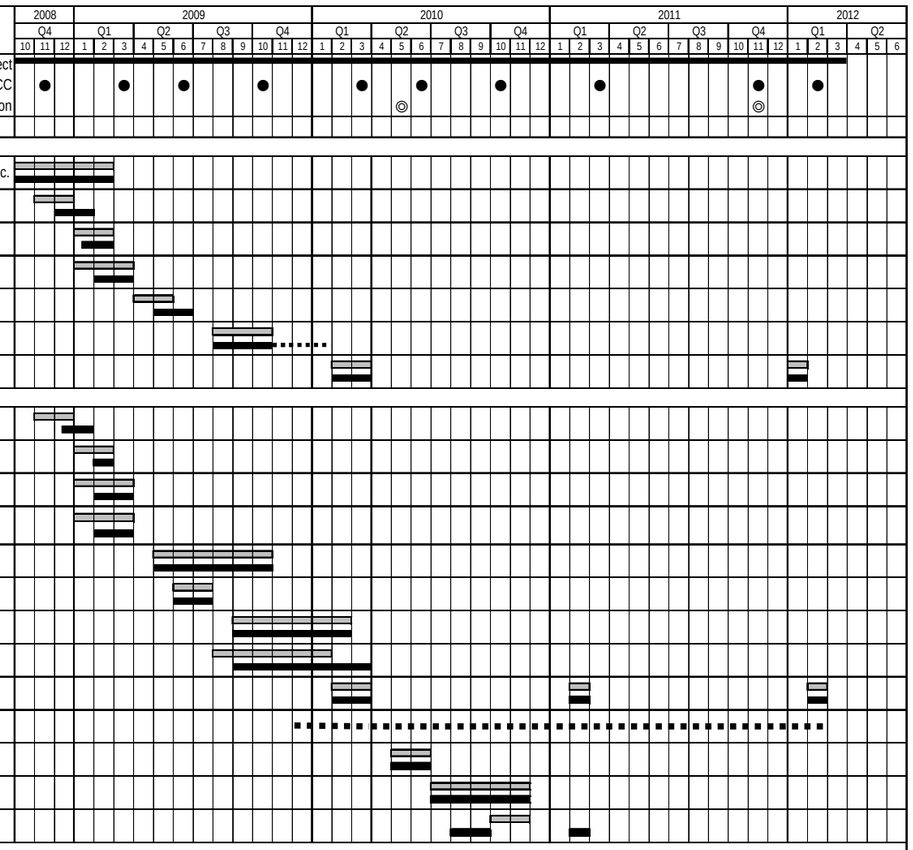


(2) Plan of Operation at the End of the Project

Name of Project: Waste Minimization and Recycling Promotion Project

Term of Cooperation: Three years and six months
Project Area: Lautoka City and Nadi Town
Target Group: Dept. of Environment, Municipal Gov. and Communities in Lautoka and Nadi Town

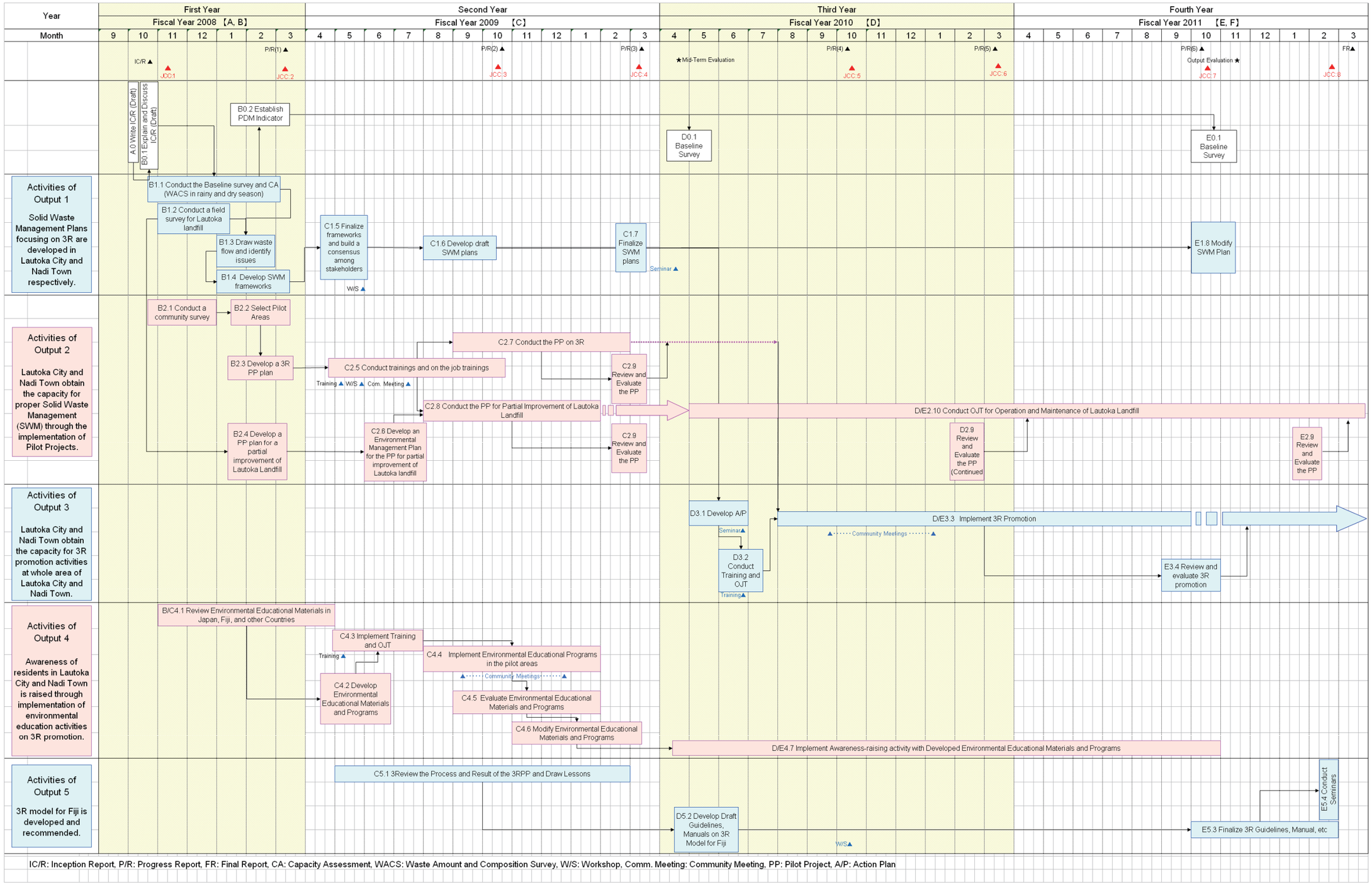
	Outputs and Activities	Results of Activities
	Output 1: Solid Waste Management Plan focusing respectively in Lautoka City and Nadi Town	
1-1	Survey the current status of SWM	Results of baseline survey, Waste survey, Capacity assessment, etc.
1-2	Conduct a field survey on Lautoka landfill site	Survey report on Lautoka landfill
1-3	Trace the current waste flow from generation to final disposal and identify issues to be adressed	Waste flow, waste analysis report
1-4	Develop frameworks of SWM	Framework document of SWM
1-5	Build a consensus on the frameworks of SWM among stakeholders	M/M of stakeholder meeting
1-6	Develop draft SWM plans based on the frameworks of SWM	Draft SWM plan
1-7	Finalize SWM plans	SWM plan
	Output 2: Pilot Projects are implemented	
2-1	Conduct a community survey	Community survey report
2-2	Select pilot areas on the basis of the community survey	Map for pilot project areas
2-3	Develop a pilot project plan on 3R	Pilot project plan on 3R
2-4	Develop a pilot project plan on a partial improvement of Lautoka landfill	- Pilot project plan on a partial improvement of Lautoka landfill - Environment Management plan
2-5	Conduct training, on the job training, etc. for the staff of Lautoka city council and Nadi town council to implement pilot project	Materials for capacity development
2-6	Complete the Environmental Impact Assessment (EIA) process required for the pilot project on a partial improvement of Lautoka landfill	Necessary documents for EIA process
2-7	Conduct the pilot project on 3R at project areas	Progress report
2-8	Conduct the pilot project on a partial improvement of Lautoka landfill	Progress report
2-9	Review and evaluate the pilot projects	Evaluation report
2-10	Review and evaluate the Pilot Project for landfill operation	Progress report
2-11	Preparation of 3R-PP separate collection for recyclables in commercial area	Progress report
2-12	Conduct Pilot Project on separate collection for recyclables in commercial area	Progress report
2-13	Conduct OJT for operation and maintenance of Lautoka landfill	Progress report
	Output 3: 3R is implemented at whole area of Lautoka City and Nadi Town	
3-1	Develop a 3R promotion action plan at whole area of Lautoka sity and Nadi town	3R promotion action plan
3-2	Conduct training, on the job training, etc. for the staff of Lautoka city council and Nadi town council to implement 3R promotion	Materials for capacity development
3-3	Implement 3R promotion	Prograss report
3-4	Review and evaluate 3R promotion	Evaluation report
3-5	Monitor the progress of communities' perception, behavior change of the people by conducting the Public Opinion Survey	Progress report
	Output 4: Awareness of residents in Lautoka City and Nadi Town is raised through implementation of environmental education activities on 3R promotion	
4-1	Review on environmental education tools/programs in Fiji, Japan and other countries	Review report
4-2	Develop effective educational tools/programes	Educational tools/programmes
4-3	Conduct training, on the job training, etc. for the groups and personnel concerned on 3R promotion in Lautoka and Nadi	Training report
4-4	Introduce the educational tools/programmes in the pilot project areas	Progress report
4-5	Evaluate the educational tools/programmes	Evaluation report
4-6	Improve the educational tools/programmes	Improved educational tools/programmes
4-7	Implement activities to raise awareness through using the educational tools/programmes in Lautoka city and Nadi town	Progress report
	Output 5: 3R model for Fiji is developed and recommended	
5-1	Review all the process & results of the activities for 3R promotion by the project and extract findings	Outputs review report
5-2	Develop draft guidelines, manuals on 3R model for Fiji, etc. for its promotion	Draft guidelines, manuals, etc.
5-3	Finalize the guidelines, manuals, etc.	Guidelines, manuals, etc.
5-4	Conduct seminars to present other municipalities the guidelines and manuals	Seminar reports



: Original Plan : Actual work implemented

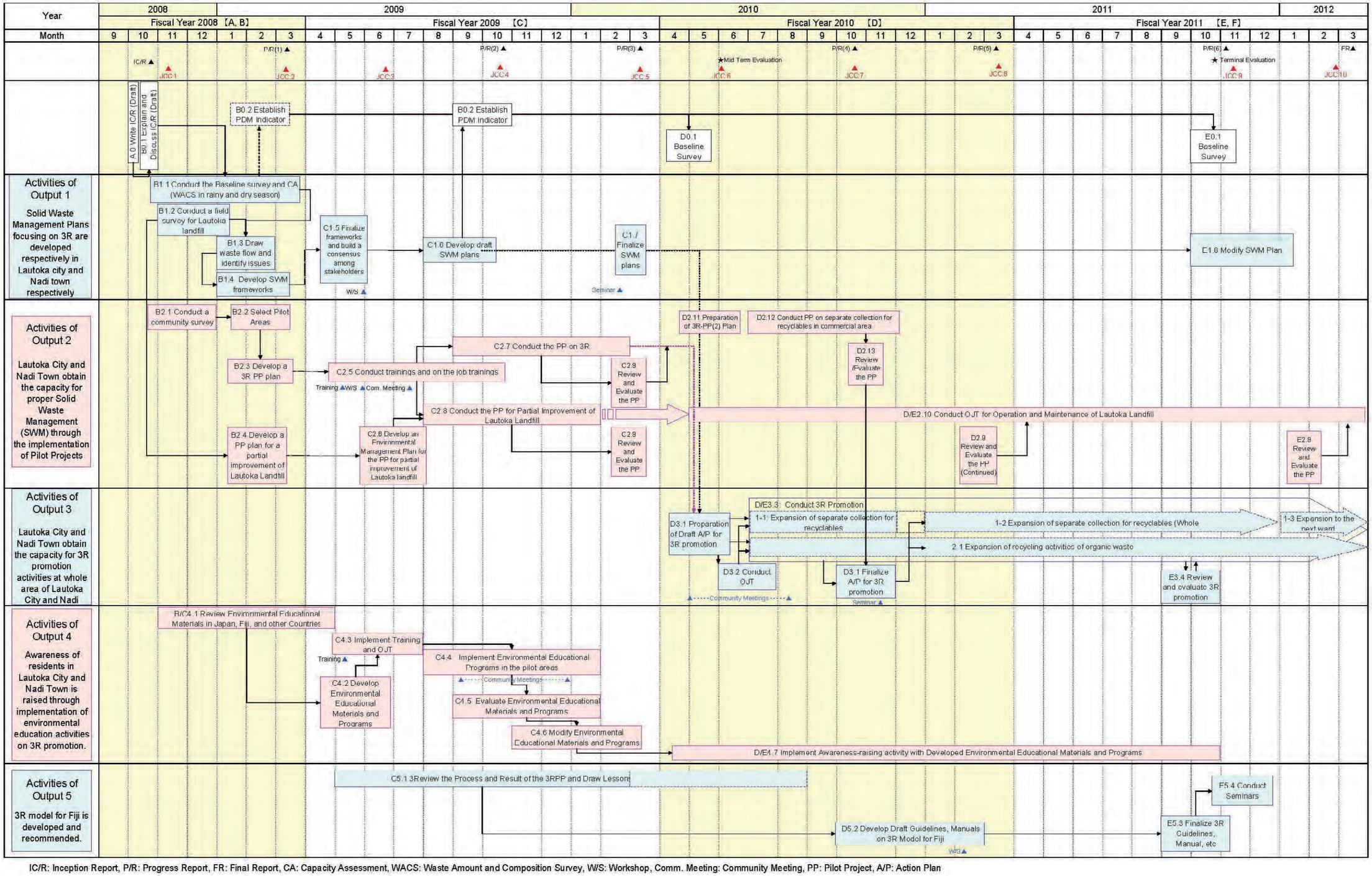
3.2 Work Flow Chart

(1) Work Flow Chart at the Beginning of the Project



IC/R: Inception Report, P/R: Progress Report, FR: Final Report, CA: Capacity Assessment, WACS: Waste Amount and Composition Survey, W/S: Workshop, Comm. Meeting: Community Meeting, PP: Pilot Project, A/P: Action Plan

(2) Work Flow Chart at the end of the Project



IC/R: Inception Report, P/R: Progress Report, FR: Final Report, CA: Capacity Assessment, WACS: Waste Amount and Composition Survey, W/S: Workshop, Comm. Meeting: Community Meeting, PP: Pilot Project, A/P: Action Plan

3.3 Summary of Activities

3.3.1 Activities for Output 1

1-1 Survey the current status of SWM

JET conducted waste amount composition survey (WACS), final disposal amount survey, time and motion survey, public opinion survey, compost market survey and recycling activity survey by contracting them out to local consultants.

1-2 Conduct field survey on Lautoka City Vunato Landfill site (Lautoka Landfill)

JET contracted out local surveyor for the topographical survey of Vunato disposal site and inspected the site with the counterparts of LCC.

1-3 Assess the current waste flow from generation to final disposal and identify issues to be addressed

JET developed the waste flow for Lautoka City and Nadi Town respectively.

1-4 Develop frameworks of SWM

The draft framework of the SWM master plan was explained in the second JCC and the framework was finalized by May 2009.

1-5 Build consensus on framework of SWM among stakeholders

LCC held the first workshop on the 1st of June 2009 to build consensus on the draft framework of SWM among the stakeholders, while a workshop was held by NTC on the 2nd of June 2009.

To share the lessons learnt through the pilot project, LCC and NTC held the 2nd workshop on the 3rd of October 2009. And they explained the draft SWM master plan developed based on the framework and obtained the agreement of the stakeholders.

1-6 Develop draft SWM plans based on the framework of SWM

The CP of LCC and NTC and JET developed the SWM master plan. LCC and NTC explained it to the stakeholders and obtained their agreement on the 24th February and 26th of February 2010 respectively. This SWM master plan was explained in the 5th JCC and approved as a final plan.

1-7 Finalize SWM plans

LCC and NTC had reviewed the SWM master plan as scheduled and presented their policy on 3R promotion in the JCC. However, JET recognized that the council policy to continue 3R

promotion after the completion of the Project, and decided to discuss about the continuity of 3R promotion with the CP including the CEO because there were problems found during the 3R activities. Therefore, the revised SWM master plan was prepared in January 2012.

3.3.2 Activities for Output 2

2-1 Conduct a community survey

Community survey was conducted by the local consultant contracted out by JET.

2-2 Select pilot areas on the basis of the community survey

LCC selected Field 40 and NTC selected Matavolivoli for the pilot project based on the community survey and site inspection.

2-3 Develop a pilot project plan on 3R

Plans for the 3R pilot project for LCC and NTC were developed by JET and CP.

2-4 Develop a pilot project plan on the partial improvement of Lautoka Landfill

Plan of the partial improvement of Vunato disposal site was developed by JET in cooperation with the CP of LCC.

2-5 Conduct training, on the job training, etc. for Lautoka and Nadi council staff to implement the pilot projects

2-6 Complete the Environmental Impact Assessment (EIA) process required for the pilot project on the partial improvement of Lautoka Landfill

It was suggested by DOE that the pilot project for partial improvement of Vunato disposal site required Environmental Management Plan (EMP) instead of EIA because the project was to improve the existing disposal site in the preparatory meeting with DOE.

Therefore, LCC submitted the EMP to DOE and approved on the 26th of August 2009.

2-7 Conduct pilot project on 3Rs at pilot areas

LCC launched the 3R pilot project on the 4th of September 2009 and NTC's launching was 5th of September 2009.

2-8 Conduct pilot project on partial improvement of Lautoka landfill

LCC has commenced the partial improvement under supervision of the staff of engineering department of the council. However, engineering staff had to engage recovery works of the damage of the cyclone attached on the 14th December 2009, the improvement work was

delayed almost one month. Therefore, the improvement work was completed by the end of February 2010.

2-9 Review and evaluate 3R pilot projects

JET analyzed monitoring data of the 3R activities as of April 2010 and made it as a base of action plan.

2-10 Review and evaluate Pilot Project for landfill improvement

JET evaluated the improvement works of Vunato disposal site in October 2010 and summarized the issues to be solved and prepared the Vunato Disposal Site Landfill Management. Subsequently, JET and CP of LCC discussed about the cause of the problems and reflected the results of the meeting in the revised SWM master plan.

2-11 Preparation of 3R-PP separate collection of recyclables in commercial area

The preparation works were carried out from April to June 2010 for introducing separate collection of recyclables in the Central Business District (CBD) in LCC. NTC also prepared several things for expansion of the separate collection of recyclables in Namaka Lane at the same period.

2-12 Conduct Pilot Project on separate collection of recyclables in commercial area

LCC started separate collection of recyclables in CBD from July 2010 and NTC started it at the same time.

2-13 Conduct OJT for operation and maintenance of Lautoka landfill

JET has conducted the following OJT to strengthen the capacity of landfill operation.

(1) Development of landfill section: JET constructed the landfill section 6. Subsequently, LCC started construction of section 1 from August 2010 and completed in October.
(2) Analysis of weighbridge data: JET analyzed the weighbridge data with CP at the beginning. Then the CP of LCC were able to calculate the disposal amount of waste and tipping fee by themselves.
(3) Emergency operation (recovery works): The rainy season started in October 2010, and there was abnormally high rainfall. The collection vehicles could not approach the working face due to the damage of the access road so that the waste was unloaded on the access road and out of landfill section. The reason of the damage of access road was a lack of maintenance of the disposal site. Because none of the budget requested by the CP was allocated under the new Special Administrator (SA) who was appointed from October 2010. JET and CP negotiated with SA to approve the necessary budget for rehabilitation of the access road, and finally SA agree to allocate it in May 2011. The

rehabilitation works including installation of pipe culverts and excavation of the drain and rehabilitation of the access road were carried out by department of Health and engineering section under the supervision of JET.

3.3.3 Activities for Output 3

3-1 Develop a 3R promotion action plan for the whole area of Lautoka City and Nadi Town

LCC prepared 3R action plan by the end of September 2010 and explained the plan to the stakeholders and requested their cooperation for implementation of the action plan. At the same time, NTC also developed the 3R action plan and obtained the agreement to support implementation of 3R action plan from the stakeholders.

3-2 Conduct training, on the job training, etc. for Lautoka and Nadi council staff to promote 3Rs

By the expansion of separate collection of recyclables carried out in July 2010, service population became 5,000 from 513 in LCC and 2,914 from 914 in NTC. As the recycler offered to collect recyclables on a voluntary basis because the service area included business area in both councils, LCC and NTC decided to supervise their activities. Therefore, both councils prepared the detailed plan of actual works such as collection route, unloading place and time. However, the recycler's collection vehicle were not equipped with a loudspeaker which announce the collection service to the citizens, LCC dispatched Multi Purpose Truck (MPT) procured in the Project to lead the recycler's truck with announcing service with music. NTC, did not have MPT, attached loudspeaker to the municipal pickup truck and led the recycler's truck.

3-3 Implement 3R promotion

(1) Separate collection of recyclables

As of November 2011, separate collection of recyclables was provided to 17,000 residents, corresponding to 37.4% of total population in LCC. In NTC, the separate collection of recyclables was being provided in the whole council area (total population is 12,181) except a part of commercial area (Town ward).

(2) Home composting

Based on the results of the Pilot Project, LCC and NTC both promoted home composting. As of November 2011, LCC had installed 160 compost bins and 166 in NTC. Therefore, 50 compost bins in each council were procured for the Pilot Project by JET in 2009.

(3) Market waste Compost

LCC has started market waste composting from September 2009. As of the end October 2011, LCC composted 193.6 ton of vegetable waste generated in the market. On the other

hand, NTC has started collection of vegetable waste generated from two markets from the end of July of 2011 based on the actual performance of LCC and 69 tons of vegetable waste was collected by the end of October 2011.

(4) Collection and Chipping of Green Waste (GW)

LCC is chipping the pruned trees by using shredder procured in this project in September 2009 and utilizing chips for mulching material, selling chips to Fiji Sugar Corporation (FSC) as a fuel. NTC is also chipping the pruned trees by using a shredder donated through grass roots grant aid scheme and utilizing the chips as a mulching material.

3-4 Review and evaluate 3R promotion

JET analyzed the results of monitoring of 3R activities, which were home composting, market waste composting, collection and chipping service of GW and school program,as reported by the counterparts from technical and financial view points and summarized as a "Progress and matters to be discussed on 3R promotion activities" in October 2011. In this summary, JET has revealed the challenges of 3R activities. JET explained these challenges to the CP of LCC and NTC and discussed how to continue 3R activities after completion of the Project. Each council's policy for continuing 3R promotion which was formulated through the discussions was presented in the 9th LCC held on the 17th of November 2011.

3-5 Monitor the progress of communities' perception, behavior change of the people by conducting the Public Opinion Survey

From the social capacity assessment point of view, JET conducted a public awareness survey to confirm the changes of awareness and behavior of the residents living in Field 40 in LCC and Matavolivoli in NTC, where pilot projects commenced at the beginning of September 2009, and again in September 2009, May 2010 and March 2011 and October 2011.

3.3.4 Activities for Output 4

4-1 Review on environmental educational tools/programmes in Fiji, Japan and other countries

This was carried out from the last half of the first year to the first half of the second year of the Project.

4-2 Develop effective educational tools/programmes

JET has developed advertising leaflets, manuals for recyclables separation, guidance of green waste collection, poster of market waste separation and billboard of the pilot project in cooperation with the CP.

4-3 Conduct training, on the job training, etc. for groups & personnel concerned on 3R

promotion in Lautoka and Nadi Town.

JET explained the above education materials and programs to the CP in the weekly meeting and individual meetings. In addition to this training, CP obtained skills and know-how of public awareness raising through the community meetings and door-to-door visits.

4-4 Introduce educational tools/programmes in the pilot project areas

CP and JET distributed education materials and conducted activities on awareness raising in Field 40 in LCC and Matavolivoli in NTC before and after of the commencement of the Pilot Project. For general public, radio campaign was conducted considering expansion of the pilot area.

4-5 Evaluate the educational tools/programmes

JET has conducted interview survey targeting the residents living in the pilot site to verify effectiveness of the education materials and programs used, and extracted the matters to be improved in February 2010.

JET and CP evaluated the education materials which were used based on the monitoring results of separate collection of recyclables in commercial area and examined its contents according to the expansion policy indicated in the 3R Action plan.

4-6 Improve the educational tools/programmes

Based on the results of above survey, JET and CP prepared the education materials, posters and banners which were amended for expansion of the pilot project. JET has also prepared education materials for commercial area. CP implemented the public awareness with the contractors employed by JET. And JET and CP increased the promotion of educational activities such as campaign using media for the general public.

JET has revised several education materials adjusting the expansion of separate collection of recyclables in June 2010. In addition to these, JET has created a video of home composting and separate collection of recyclables for the purpose of dissemination to other councils.

4-7 Implement activities to raise awareness through using the educational tools/programmes in Lautoka City and Nadi Town

During preparation of the expansion of 3Rs, 3R promoters who were employed by JET visited residents living in the target area individually and raised their awareness using education materials improved through the activities abovementioned.

3.3.5 Activities for Output 5

5-1 Review all the process & results of the activities for 3R promotion by the project and extract findings

JET prepared "Review of environmental educational programs and their materials" referring to Beaverton Oregon in USA, Halifax in Canada, 3R program in Shibushi City in Japan and community based recycling in Mitaka City in Japan which were selected among the local governments having well functioning systems of separate collection of recyclables and green waste collection.

5-2 Develop draft guidelines, manuals on 3R model for Fiji, etc. for its promotion

JET and DOE has developed draft 3R Guideline as a national basic policy for 3R promotion and draft 3R Promotion Manual as a guidance to support specific 3R promotion activities in October 2010. DOE held a 3 day workshop in February 2011 in Lautoka and invited officials of all local governments in charge of waste management and explained those draft documents and exchanged the opinions.

5-3 Finalize the guidelines, manuals, etc.

3R Guideline and 3R Promotion Manual have been finalized at the end of October 2011 based on the results of discussions mentioned in Activity 5-2 and the monitoring results obtained after February 2011.

5-4 Conduct seminars to present to other municipalities the guidelines and manuals

DOE held 3R seminars in Lautoka inviting officials of all local governments in charge of waste management and central government concerned on the 2nd of November 2011 to propose 3R Guideline and 3R Promotion Manual to the cabinet.

A Lautoka City Council

ACTIVITY 1: DEVELOPMENT OF SWM PLAN FOCUSING ON 3RS

Activity 1-1 Survey the current status of SWM

Baseline Survey

Eight kinds of baseline surveys were conducted by contracting out to private sectors in Fiji. Some of the surveys were put together and contracted out as one package because they were considered better to be conducted by one contractor judging from the survey timing and methods.

Table 9: List of Baseline Survey and Contractors

Baseline Surveys	Contractors
Waste Amount and Composition Survey (WACS)	WesEng Consulting
Final Disposal Amount Survey (FDAS)	
Time and Motion Survey (T&M)	WesEng Consulting
Public Opinion Survey (POS)	Environment Consultants Fiji (ECF)
Compost Demand and Market Survey (CDMS)	
Recycling Activity Survey (RAS)	
Community Survey	WesEng Consulting
Topographic Survey in Lautoka Landfill	Cadastral Solutions Ltd.

Most of the surveys mentioned above were completed by the end of January 2009, and basic data for a waste flow chart was also collected.

a. Waste Amount and Composition Survey (WACS)

a.1 Objective

In order to prepare sustainable solid waste management plans for LCC it is necessary to properly grasp the current waste flows. WACS was conducted in order to grasp the amount of waste generation and its composition in LCC.

a.2 Contents

In WACS, 43 samples from 13 generation sources were taken from LCC with the waste amount survey being conducted over 8 days. This survey was to be conducted in both dry and rainy seasons, and waste generation rate was to be surveyed at 13 generation sources in LCC. Waste composition of the 13 generation sources was also surveyed. WACS was conducted for dry and wet seasons.

	
Sample Collection in LCC	Waste Analysis at the Vunato Landfill

Figure 1: Scene of WACS

b. Final disposal Amount Survey (FDAS)

b.1 Objective

To grasp how much waste generated in Lautoka is disposed at the final disposal sites

b.2 Content

Number of collection trucks bringing in waste from Lautoka to the final disposal sites and their weights were surveyed using a truck scale hired from a private company over a week.

b.3 Implementation of Survey

FDAS was conducted over the term from 17 to 21 November. A truck scale hired from South Pacific Fertilizer Ltd. in Lautoka was used for this survey.

	
Checking of the Collection Vehicle at Vunato (Lautoka) Landfill	SPFs' Truck Scale, used in FDAS

Figure 2: Scene of Final Disposal Amount Survey (FDAS)

c. Time and Motion Survey

c.1 Objective

To understand current conditions of waste discharge, collection and haulage in Lautoka.

c.2 Content

Follow-up survey of the collection trucks in Lautoka and interviews with the collection workers were conducted. This was conducted in the household area (two trucks) and in the commercial area (one truck), and details of the collection service were recorded. Route map was also prepared. In this follow-up survey, two people recorded the collection route and the work details.

c.3 Implementation

It was conducted over the term from 10 to 12 of February in Lautoka.

d. Public Opinion Survey (POS)

d.1 Objective

To grasp to what extent the public and business establishments are satisfied with the current solid waste management, and their needs, manners during storage and discharge, and opinions on waste collection fee

d.2 Content

Inquiry items for questionnaire survey were defined and interviews to 300 samples taken from households and business establishments in Lautoka and Nadi were conducted. Analysis of survey results, as well as preparation of a database was conducted.

d.3 Implementation

In the household survey, interviews were undertaken in the commercial, residential, and Border (or Peri-urban) areas in Lautoka and Nadi. In the business establishment survey, the business establishments within each council were categorized into six types to select a survey sample, and interviews were held with 56 businesses in Lautoka and 47 in Nadi.

Table 10: Number of Samples for Household Survey

	Lautoka	Nadi	Total
Business area	10	30	40
Residential area	90	50	140
Border area	10	10	20
Total	110	90	200

Table 11: Number of Samples for Business Establishment Survey

Types of business surveyed	Lautoka	Nadi
Shop	14	9
Restaurant	10	10
Office	16	10
Hotel	5	10
Market	1	1
Other (Supermarket)	10	7
Total	56	47

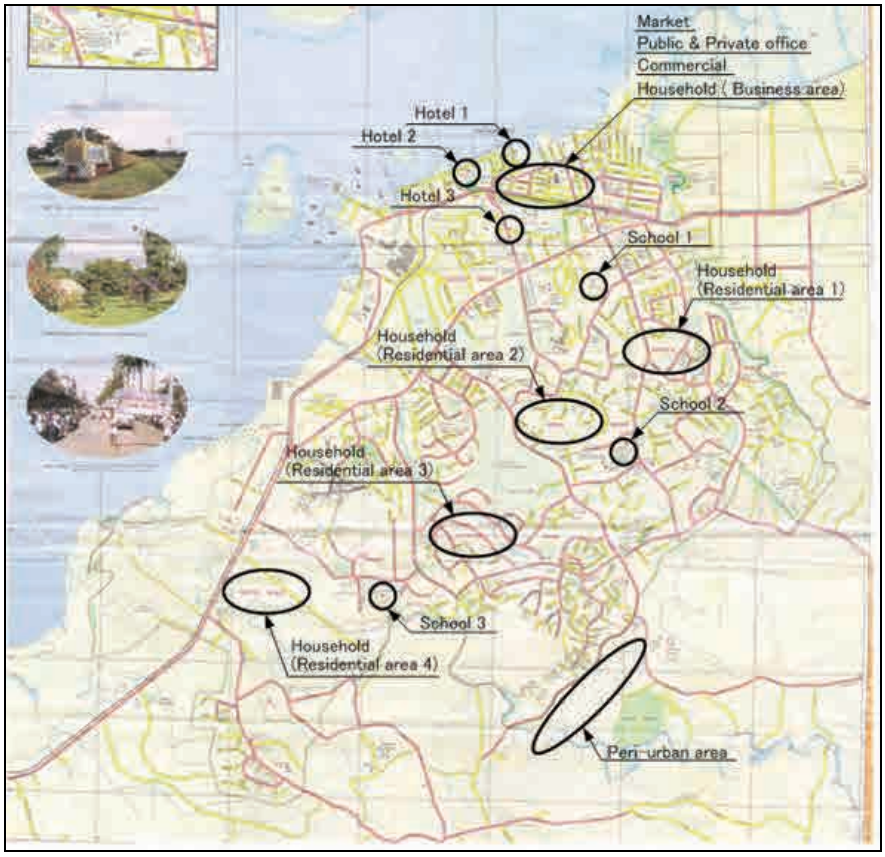


Figure 1: Location of Samples in LCC

e. Compost Demand and Market Survey (CDMS)

e.1 Objective

In order to promote waste reduction and recycling, it is effective to compost organic waste, which accounts for about 70 percent of total amount of waste discharged in Lautoka. However, in order to establish a system in which composting is sustainable, it is necessary to learn how the compost produced would be used. This survey was conducted in order to grasp demand of compost and its marketability in Western division.

e.2 Content

A survey was conducted using the latest statistics in the Western Division of the type and amount of agricultural goods being produced and the location of farms. Moreover, interviews with 50 farmers around Lautoka and Nadi were conducted and prices of the products, cost and amount of fertilizer used, and opinions on compost were summarized. Then, compost demand and marketability were studied.

e.3 Implementation

Interviews with 50 farmers in and around Lautoka and Nadi were conducted. This survey started in February, as its progress was affected by the flooding following a cyclone in January. The data collected were then processed and analysed.

f. Recycling Activity Survey (RAS)

f.1 Objective

To collect data on recyclable waste and its amount in Lautoka and Nadi, to draw waste flow based on the data, and then to use it for establishing an appropriate solid waste management system for the Lautoka and Nadi sides

f.2 Content

Interviews with 60 stakeholders concerned in recycling activities in Lautoka, Nadi, Sigatoka, and Suva were conducted, and data processing was also conducted.

f.3 Implementation

Interviews were requested with 60 representatives of various groups, as shown below, but some did not accept. So interviews were held with 45 people.

Activity 1-2 Conduct a field survey on Lautoka City Vunato Landfill site (Lautoka Landfill)

This survey included interviews of staff from Department of Health, LCC, field survey, and topographic survey. The results of the survey are as described below.

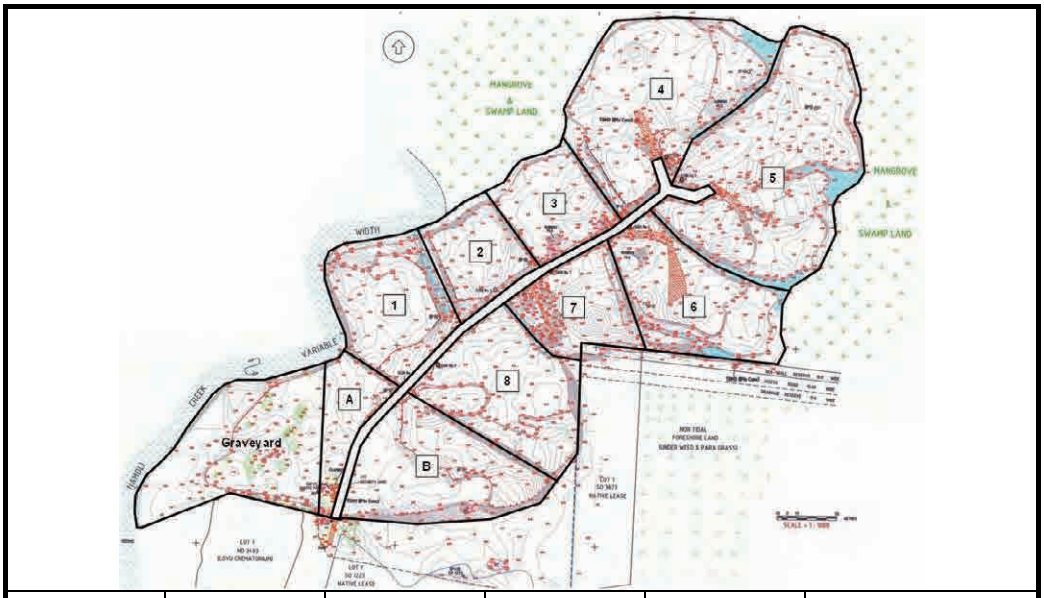
a. Responsible Organization

Department of Health, LCC takes responsibility for doing operation and maintenance work for Vunato (Lautoka) Landfill.

Department of Health, LCC	• Operation and maintenance work for Vunato Landfill
Engineering Department, LCC	• Management of waste brought to Vunato Landfill and collection of the fees charged for waste directly brought to the landfill (one person) • Rolling of the landfilled waste (one person) • Security (four persons: two shifts, two persons each shift)

b. Outline of the Lautoka Landfill (area, location and its facilities)

LCC was given the right to use an area of 50 acres (20 ha) in the mangrove forest of Vunato area for landfill by NLTB (Native Land Trust Board), and it started landfill in 1968. Vunato Landfill has 8 sections. Area of every section is as shown below.



Section	Area (ha)	Section	Area (ha)	Section	Area (ha)
A	0.683	3	8.945	7	0.981
B	1.677	4	2.527	8	1.692
1	1.433	5	3.321		
2	7.852	6	1.654	Total	15.650
Graveyard: 1.837ha (Not included in the 50 acres authorized)					

Figure 3: Outline of Vunato (Lautoka) Landfill Site

c. Landfill method, soil covering, leachate, septic tank, sludge management, etc.

Vunato (Lautoka) Landfill has 8 sections, area of which ranges 0.8 - 3.3 ha. The waste brought in to the site is unloaded in a section and it is rolled by bulldozer. When the rolled waste is piled up to 50 cm in thickness, the section to be landfilled is switched to another section. The waste piled up to 50 cm in thickness is left for about six months. In the waste left, organic substances in it are decomposed (aerobic decomposition) and water content is evaporated. Soil covering is not done at present as it is expensive.

As far as the field survey could ascertain, leachate flow to the outside was not found as there are a lot of creatures such as fish, frogs, crabs, and so on living in the creek and mangrove forest of the landfill's outer peripheral area; therefore, the effect of leachate may be limited.

d. Environment in and around landfill (surface water, groundwater, traffic volume, etc.)

The landfill is in swamp of the mangrove forest. There are 9 waterways for fire protection in the site. The waterway in Section No.1 is connected with Namoli Creek, but the other ones are blocked off, being filled when sea level rises where the water remains to stagnate. The rain water in the landfill is infiltrated into waste and drained vertically. If it rains severely, it flows to the drain along the access road in the site.

The landfill site and its surroundings are affected by sea water, and ground water is not used in this area.

e. Waste pickers (number, age, sex, race, income, residential area, children's school attendance, etc.)

LCC gives permission for entry to Vunato Landfill to waste pickers. The entry rate is FJ$20/month. Each agent can have a maximum of seven waste pickers to enter the landfill site. The waste picker pays FJ$5/week to the agent.

There is almost the same number of male and female waste pickers. There are seven waste pickers. One worker was Indian, and others were Fijians. No children worked. Their income is around FJ$100/week.

They visit the landfill every day. Most workers reside around the landfill site.

f. Future plan for landfill site (Schedule to be used, landfill management plan, termination plan, redevelopment plan after termination, etc.)

The future plan of the landfill, including scheduled use, landfill management plan, termination plan, and redevelopment plan after termination could not be confirmed. Only the landfill area: 50 acres (20 ha) was confirmed.

g. Landfilling equipment (number, specification, years of use, lease, etc.)

LCC retains one bulldozer (Caterpillar D6) at the landfill site. How many years it had been used was not confirmed.

h. Maintenance (maintenance program, equipment for repair, number of maintenance workers, capacity of the workers, contents of the work, etc.)

The maintenance work for equipment is contracted out to private sector. Cleaning and inspection work for the equipment were not done on a daily basis.

i. Topographic Survey

Topographic survey on the existing landfill area (about 20 ha) was conducted. A

topographical map (1/1,000) for the landfill site was prepared.

Activity 1-3 Trace the current waste flow from generation to final disposal and identify issues to be addressed

a. Designing of Waste Flow Chart

Waste amount was estimated based on the WACS, and final disposal amount was estimated based on the FDAS. And the waste flow, including the items of self-disposal, recycling, illegal dumping, etc. was to be estimated based on the POS and RAS.

A cyclone hit the West Division in the beginning of January, affecting the progress of the POS and RAS interviews. Therefore the start of these interviews was delayed for half a month. It was in the middle of February when necessary data was obtained. The waste flow was designed based on the results of the POS and RAS.

b. Identification of the Waste Issues

The waste issues of LCC were identified based on the results of the above-mentioned baseline surveys, waste flow, and other field surveys.

LCC
1. Characteristics of waste that can be seen in Fiji
2. Scattered waste
3. Green waste disposed by households.
4. High cost for public area cleaning service
5. Unfair fee collection system adopted at the landfill site
6. Some waste disposed inappropriately
7. Merit and demerit of the landfill method in which aerobic decomposition and evaporation work
8. Medical waste disposal

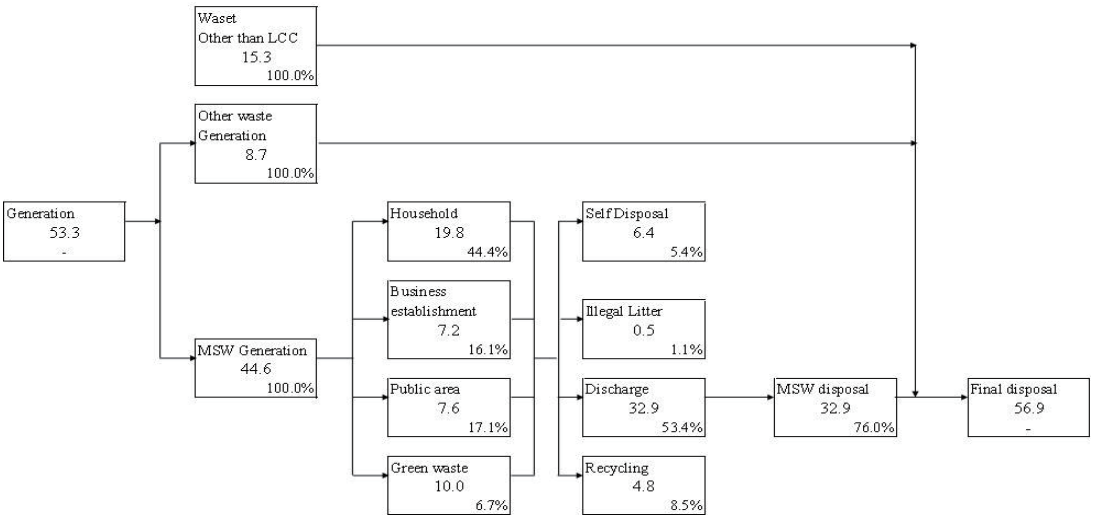


Figure 4: Waste Flow in Lautoka City

Activity 1-4 Develop frameworks of SWM

JET in consultation with the CPs developed the frameworks of the SWM master plan including the fundamental goal and target year of the master plan, forecasted the future population and GDP growth rate as factors to estimate future waste amount and composition.

The numerical target of the master plan was set based on the waste flow which was finalized considering the results of baseline surveys and data forecasted using the factors mentioned above.

Two workshops were held with the key stakeholders who are involved with solid waste management for the purpose of consensus building. These workshops were in addition to the initial workshop that was held on June 1, 2009 in LCC chambers.

Activity 1-5 Build a consensus on the frameworks of SWM among stakeholders

In order to build a consensus among stakeholders on the framework of the SMW master plan, which was prepared in the first fiscal year, the Project held a series of workshops with relevant stakeholders. Counterpart staff from Lautoka City Council were assigned tasks to present each session to the stakeholders based on the programs with the assistance of JET.

During the workshop, the CP reported the results of baseline surveys, and they explained the current status in the LCC's waste management based on the results and the issues addressed. The framework of the SWM master plan targeting year 2017 was also discussed.

Following this, the Project proposed the plans for the 3R pilot projects. This was proposed in order for the Project to examine the possibility of the SWM master plan from the aspects of feasibility, continuity and expandability.

Finally, the participants were also given time to share their views and provide constructive suggestions regarding the SWM master plan.

The stakeholders who attended the workshop included representatives from NGO's, FSC, Field Forty and Andhra 3R PP Committee/members of community, DOE, recycling companies, Rural Local Authority, market vendors association, Councils, cleansing contractors, JOCV Volunteer, Lautoka Chamber of Commerce, Lautoka Retailers Association and JET.

	
The Special Administrator of LCC, MR Josefa Vucago deliberating the opening address.	DHS of LCC, Mr Gyneshwar Rao making presentation

Activity 1-6 Develop draft SWM plans based on the frameworks of SWM

JET and CP discussed the results of the pilot projects including preparation, implementation etc. They discussed how the draft SWM master plan should be prepared in accordance with the framework of SWM which was agreed to at the first stakeholders workshop. They held meetings to discuss these matters three times.

The issues addressed in the 3R promotion pilot projects were shared through the three meetings. They were recognized to be significant issues. Then, the second workshop was held jointly by the two councils to discuss ways of cooperating on envisaged strategies for the expansion of the project. This was an opportunity for various stakeholders, including those from the pilot area, to exchange opinions on these matters.

Activity 1-7 Finalize SWM plans

The Japanese Expert Team (JET) after mutual consultation with the Counterparts has reviewed the Solid Waste Master Plan (SWM M/P) which was adopted in March 2010. It shall be noted that the original SWM M/P was initially formulated based on the results of the baseline survey conducted by JET, planning framework confirmed among the stakeholder in the first workshop held on June 2009 and the 3R expansion plan agreed by the stakeholders in the 2nd workshop held in October 2009. The SWM M/Ps which was prepared by the JET was finalized through the series of mutual meetings with the counterparts and JET. The finalized SWM M/P was explained to the stakeholders in the seminar held on 24th and 26th February, 2010 in LCC and NTC respectively.

However, data retrieved from the computerized weighbridge highlight differing Final Disposal Amount (FDA) compared to the initial data which was estimated during the FDA Survey. Also, some lessons and challenges were experienced during the 3R Expansion to whole of Veitari Ward since July 2010 for instance the expected number of composter sales was not achieved. Furthermore, it has been noted that the amount of recyclables collected from VDS is now measured. Hence, there was need to review the SWM M/P by analyzing and incorporating these findings.

The reviewed SWM M/P now shows a slight decrease in MSW amount generation and target recycling rate.

ACTIVITY 2: CAPACITY DEVELOPMENT FOR SWM THROUGH PILOT PROJECT

Activity 2-1 Conduct a community survey

a. Objective

The objective of this survey was to collect the following materials:

- Basic materials necessary for selecting 3R pilot project site.

- Basic materials necessary for studying about how the 3R activities will be promoted and disseminated throughout the whole of Lautoka and Nadi

b. Content

Main works included community survey and preparation of maps of the areas.

b.1 Community Survey

The 10 communities shown below were surveyed. The community names, location of the activities, the activities' areas, number of participants in the activities, and the community leaders were surveyed. These items surveyed were plotted on the area maps.

Table 12: Community Activities in LCC and NTC

Community	LCC	NTC
1. Primary school zone	16	9
2. Secondary school zone	16	2
3. Church	43	13
4. Temple	10	3
5. Mosque	4	4
6. Mothers' club	11	4
7. Mandali (Hindu)	57	7
8. Neighborhood watch zone	11	-
9. Mataquali	11	8
10. Sub-Division	133	63

b.2 Preparation of Area Maps

Locations of the following wards were plotted on a topographical map, and population and number of households were surveyed by ward.

Ward	Area
Vetari Ward:	Natabua, Natabua Sea Side, Field 40, Rifle Range, Balawa Estate, Vunato, Navutu, CBA
TavakubuWard:	Topline, Banaras, Natokowaqa, Golf Link Crescent, Tavakubu Stage.1 Kermode, Tavakuvu Stage 2 Kashimir
Simla Ward:	Drasa Vitogo, Simula
Waiyavi Ward:	Namoli Village, Waiyavi Stage 1, Waiyavi Stage 2, Waiyavi Stage 5, Waiyavi Stage 6

Activity 2-2 Select pilot areas on the basis of the community survey

The 3R pilot project sites were to be selected based on the results of community surveys, any information about the community, and on hearings with the community leaders.

In Lautoka, at first 6 NWZs (Neighborhood Watch Zone) were selected from the viewpoints of area characteristics, income level, number of households, etc. Then, it was confirmed whether the leaders in each zone have interest in the 3R pilot project as well as any conditions in the site.

As a result, the following sites were selected as candidate sites. From these candidate sites, Field Forty area was selected as 3R PP site.

Table 13: 3R Pilot Project Site

	Names of the Pilot Project Sites	Population	Number of Households
LCC	1. Field Forty Road	850	170
	2. Golf Link Crescent	500	100
	3. Howrah Crescent	550	110

Activity 2-3 Develop a pilot project plan on 3Rs

a. Target of 3R Pilot Project

- LCC gains further capacity to do solid waste management (SWM) appropriately through the 3R pilot project (hereinafter, PP). (PDM Output 2)
- LCC gains further capacity for promoting 3R activities in the whole area of Lautoka City through 3R PP. (PDM Output 3)
- Awareness of residents in Lautoka City is raised through environmental education activities on 3R promotion. (PDM Output 4)
- The 3R model adapted to the characteristics of Fiji is established and suggested. (PDM Output 5)

b. Concept

b.1 Practicability

- Stakeholders such as residents, community, LCC, collection companies, recycling companies accept implementation of PP.
- A new system is developed based as much as possible on the experiences of existing and successful recycling systems.
- Get residents participating as much as possible by employing the support of existing community groups.

b.2 Sustainability

- The system needs to contribute to reduction of waste amount and preservation of the environment.
- Has little impact on current waste management in terms of financial and institutional aspects.
- There needs to be an incentive for the stakeholders

b.3 Expandability

- PP needs to be a model of 3R activities and to be expanded to the whole area of LCC.
- 3R activity is disseminated to the whole area of Fiji through this model.

c. Current Status on 3R and Problems addressed

In order to plan 3R Pilot Projects, particular consideration needs to be given to current status of recyclable materials and organic waste. The Project studied such matters, with the following results.

c.1 Recycling of Recyclable materials

(1) Recyclable items and recycling activities are limited.

- The waste recycled at present include plastic (PET) and glass bottles, and metal. Total generated amount of these three items is estimated at 1.6t/d (3.8%). It is too small.
- Main recycling activities include recycling at the disposal site by waste pickers and collection of recyclable materials by the collection company.
- And, in order to separate, a new collection system for recyclable materials needs to be established. This leads to rise of current SWM cost.
- Capacity of the existing collection companies is not high.

⇒ Therefore, it is expected to be difficult to introduce the system in which residents do separation and the LCC side collects the recyclable materials separated, judging from the basic concept of 3R PP.

(2) However, aggregation of recyclable materials at the levels of community, school, etc. and establishment of a system to collect recyclable materials, may make the current recycling activities more active.

c.2 Recycling of organic waste

The main organic waste in Lautoka includes kitchen waste generated from households, market, restaurants, hotels, etc., green waste, and grass and wood generated by road sweeping, park cleaning and drain and grass cuttings. Table 8 describes current status on disposal of these waste and possibility of recycling.

c.3 The LCC side's Roles in 3R PP

The items of 3R PP candidate activities and the Lautoka side's roles in 3R PP are as

described in the below Table.

Table: The LCC side's Roles in 3R PP

	Candidate Activity for 3R PP	Activity Items	LCC	JICA
On-site (Community)	Recycling Materials (pet and glass bottle, metals)	To coordinate with residents and community in the pilot site	◎	○
		To study on how to discharge and collect	◎	◎
		To provide collection vehicle		◎
		To send a driver, procure fuel, do maintenance work	◎	
		To consider how to transact profit on sale	◎	○
	Making fuel and compost using Green Waste	To coordinate with residents and community in the pilot site	◎	○
		To establish a system to lend shredder	◎	◎
		To provide shredder		◎
		To procure fuel and do maintenance work	◎	
	Making compost using Kitchen Waste	To coordinate with residents and community in the pilot site	◎	○
		To instruct about how to make compost and how to use	◎	○
		To design composter	◎	◎
		To provide composter		◎
	Area Cleansing by Participatory Approach	To coordinate with residents and community in the pilot site	◎	○
		To do environmental education activity	◎	○
		To develop environmental education tool	◎	○
		To prepare environmental education materials and tool	◎	◎
On-site (Cleaning-site)	Public Waste Chipping at site	To provide collection vehicle and shredder		◎
		To send a driver and procure fuel	◎	
		To do maintenance work for collection vehicle and shredder	◎	
	Green Waste Chipping at site	To prepare collection vehicle and shredder		◎
		To send a driver and procure fuel	◎	
		To do maintenance work for collection vehicle and shredder	◎	
OFF-site (Green Waste)	Potential to make compost using bagasse and mill-mud generated through sugar manufacture	To discuss with FSC and SPF on the conditions of woodchip (amount, potential timing to use, how to share expenditure)	◎	○
		To do demonstration	◎	○
	Potential to make compost by mixing sewage sludge and woodchip	To do combination of sewage sludge and chip, demonstrate composting	◎	○
	Potential to make compost by mixing market waste and woodchips	To discuss with the market place side (separation of oragnic waste, etc.)	◎	○
		To transport organic waste to the dump site	◎	○
		To mix organic waste generated at market place and woodchip and demonstrate composting	◎	○
	To use woodchips for fuel (to use woodchips for fuel of boiler operated by wood fuel and used by the business establishments in LCC)	To discuss with business establishment on the conditions of woodchip (amount, potential timing to use, how to share expenditure)	◎	○
	Potentials to use woodchips for gardening at hotel and to use them as mulching for green zones in the public facility	To discuss with hotel industry on the conditions of woodchip (amount, potential timing to use, how to share expenditure)	◎	○
		To list public areas for woodchip to be used as	◎	○

Activity 2-4 Develop a pilot project plan on the partial improvement of Lautoka Landfill

a. Evaluation of the current landfilling management

a.1 Landfilling management

(1) LCC got permission for using an area of 50 acres (20 ha) as a landfill site. It started landfilling in 1968 and the landfilled area has been expanding. However, its boundary line has not been defined, although its area was defined.

(2) There are 8 landfill sections. If landfill in a section reaches 50 cm thick, the section to be landfilled is switched to another section. The section landfilled to a thickness of 50 cm will be left for about six months. Landfilling in the other section starts after it has been confirmed that the smell, which is generated when the landfilled waste is decomposed, is not emitted.

(3) The waste brought in to the landfill site was unloaded at the entrance area of the section, and it is rolled by bulldozer. However, it is not efficient as it needs rolling more than 50 m in length. Moreover, the waste brought in to the landfill site blocks entry to the section, while the bulldozer is not operated.

(4) Soil covering is not done. There is no soil that can be purchased at a low price. When sanitary landfill at level 2 is adopted and soil covering is done every day, it will need an additional FJ51,800/ year ($2.5/ ton) for operation. As the current management cost is estimated at FJ$255,908, the additional cost accounts for 20 percent of the current cost.

(5) One bulldozer does rolling work. Although its maintenance work is contracted out to the private sector, inspection on a daily basis is not done.

(6) There are six personnel working under the supervision of Department of Health, LCC. One is responsible for management (collection of fees); one is an operator; and other four are guards.

a.2 Management of the waste brought in to the landfill site

- Number of collection trucks and their owners are recorded, but amount is not grasped.
- Food waste, animal corpses, and medical waste are disposed in the landfill site.

a.3 Facility

- There is an administration office, in which electricity and water are supplied. There are no facilities such as peripheral dam for landfilling, drainage, fence protecting from waste disporsal, and buffer zone.

a.4 Surroundings of the landfill

- The landfill site is located in a mangrove forest.
- A lot of creatures such as fish, crabs, etc., live in and around the landfill site

and in the waterways within the site.

- As thickness of landfill is 50 cm, aerobic decomposition may work in the landfill and amount of evapotranspiration may be more. Therefore, amount of leachate may be less. As far as the field survey was conducted, there was no trace of leachate confirmed.

a.5 Evaluation of the current management

(1) The current level of sanitary landfill is categorized in Level 1, because the waste brought in to the landfill site is rolled and compacted constantly and fire control management is done.

(2) The current landfill method is categorized as an aerobic method. Its merits and demerits are:

- Merits: environment-friendly, little odor, less leachate
- Demerits: soil-covering is not done, therefore waste is dispersed and landscape becomes worse.

(3) The landfill site is maintained at a steady level. But, its disposal cost is higher than other disposal sites.

Total operation cost: F$255,908 (2008), Unit Cost: F$12.3/ton

Disposal cost at the Lautoka Landfill will become higher, if it is improved. Contractors may haul the collected waste to other disposal sites, even if the other sites do not appropriately dispose waste. Therefore, other councils may not haul waste to the Lautoka Landfill site. Some guidance and regulations may be needed.

- Lautoka Landfill: 77F$/7ton truck or 231F$/21m^3 truck
- Sigatoka Landfill: 45F$/21$m^3$ truck

b. Setting of the sanitary landfill level

Target Level: 1.5

Adopting the Level 2, in which soil covering is done every day, would be difficult due to its cost. However, improvements to the landfilling have to be made. Therefore, the current method will be improved and a more appropriate method of landfilling will be suggested.

c. Purpose of the improvement:

Appropriate management system for landfilling was established to reduce waste and prolong the operation term of the current landfill, and it was agreed upon among the stakeholders.

(1) **Strengthening of management system**

- Definition of landfill site.
- Establishment of data management system.
- Preparation of an appropriate collection fee schedule.

- Preparation of landfill plan

(2) **Establishment of appropriate management system**

- Improvement of access road.
- Setting of on-site access road.
- Improvement of aerobic and evaporation methods

(3) **Mitigation of negative effect on the surroundings**

- Setting of buffer zone.
- Setting of a section for disposing ash generated form medical waste (apart from the section for general waste).
- Establishment of environmental monitoring system

d. Concept

(1) Practicability

- To be conducted in the existing landfill
- To be conducted by CP

(2) Sustainability

- To be sustainably managed by the facility and system, both of which are improved by CP

(3) Expandability

- To be expanded to the whole area by CP: the landfill method improved in a section is adopted for the whole area of the landfill site.
- To establish appropriate method, in which aerobic decomposition and evapotranspiration work, sanitary conditions are kept at a certain level, and negative effect on the surroundings is mitigated as much as possible.

e. Improvement plan for Lautoka Landfill (draft)

The facilities improvement was planned based on the condition that the LCC will carry out the works directly from the technology transfer point of view. The excavator necessary for this work is recommended to be procured or leased for the pilot project.

Table 14: The LCC side's Roles in the Improvement Plan

Work Items	JICA	LCC
1. Improvement of access road	○	◎
2. Improvement of on-site approach road	◎	○
3. Arrangement of buffer zone (South side)	◎	○
4. Arrangement of the section for disposing ash generated from medical waste	○	◎

f. Operation and Maintenance Plan (draft)

Table 15: The LAA Side's Roles

Work Items	JICA	LCC
1. Introduction of truck scale and establishment of data management system	◎	○
2. Preparation of appropriate fee schedule	○	◎
3. Establishment of the planned landfilling management		
(1) Preparation of landfilling plan	◎	○
(2) Management of on-site road	◎	◎
(3) Improvement of the current landfill method, in which aerobic and evapotranspiration methods are adopted	○	◎
4. Establishment of environmental monitoring system		
(1) Water analysis in and around the site (simplified water analysis kit)	◎	○
(2) Condition of waste dispersion	○	◎
(3) Inspection of leachate	○	◎
(4) Change of habitat environment of creatures	○	◎

Figure 5: Plan of the Improvement of VDS

Activity 2-5 Conduct training, on the job training, etc. for Lautoka and Nadi council staff to implement pilot project

On the job training for CPs of LCC was conducted by JET to implement pilot projects in 3R PP area and starting the pilot market waste composting project. In order to carry out these pilot projects CPs had field visits to other sites to observe and gain the practical aspects of 3R activities. Regular sessions with JET especially in regards to pilot project preparations was also an integral aspect of on the job training for CPs. This ensured capacity building from 3R expansion point of view.

These aspects of OJT are discussed below:

a. Preparation for the 3R pilot project

This included initial planning, basic concept and design, review of the plan and examination of the recyclables collection system (for both the LCC and NTC sides).

JET discussed the recyclables collection system with both the LCC and NTC sides, and confirmed the following:

①. The LCC and NTC sides collect the recyclables in the pilot sites using a multi-purpose truck once a week for the first few months.

②. After having grasped the recyclable items and amount of the recyclables through the pilot project, the frequency and methods of collection are examined. Then, the best system for collecting recyclables will be established.

③. After the system has been well established, the recyclables collection would be contracted out to a recycling company (Recycler). The area of collection will be expanded in this way.

b. Discussion with community representatives

JET and CPs discussed with the representatives from Field 40 and Neighborhood Watch Zone in Andhra on 11th June. Field 40 is a candidate pilot site selected jointly by the JET and CP sides in the first fiscal year. They grasped the status in the communities in detail and obtained information for reviewing the pilot project plan.

	
Committee meeting in Field 40	Committee meeting

Figure 6: Scenes of the Committee Meeting

c. Discussion with recycling companies (for both the LCC and NTC sides)

The Project had a meeting with recycling companies as they are essential organizations for establishing a recyclables collection system. They discussed the recyclable items, price, collection method, etc. The Project visited Waste Recyclers (Fiji) Ltd. and Smorgon Steel Recycling (Fiji) Ltd., both of which were operating in the Western Region, while Coca Cola and Foster's Beer are collecting their own PET bottles and aluminum cans as part of their CSR activities.

As a result of discussion with the recycling companies, it was identified that Waste Recyclers (Fiji) Ltd. (hereinafter, WR) could accept the most recyclable items. The Project decided to request cooperation in the pilot project operation to WR.

The Project had repeated discussions with WR. Then, WR was to accept other plastics, paper, and cloths in addition to PET, metals and bottles. However, it was found they could not receive payment for PET and glass bottles and paper. Also, the Project confirmed that the collected items were delivered to WR's warehouse in LCC. It also confirmed that the collected items were measured in the presence of the committee member and CP.

d. Preparation for the 3R pilot project

The LCC CP and JET had repeated committee meetings with the community representatives from Field 40, the site for the 3R pilot project. They discussed preparation for the 3R pilot project implementation.

d.1 Examination of compost making

d.1.1 Observation of existing facilities for composting

As both the LCC and NTC sides did not have experience in making compost, the CP and JET visited sites making compost. They visited a composting facility operated by OISCA (an NGO in Japan) in Sigatoka on 13 July. They also visited such place in Ba on 17th July.

In Sigatoka composting of vegetable waste was being conducted. Bokashi was made by mixing the produced compost with mill-mud, foul dung, and sawdust. It was identified that they had enough skill for home composting to be expanded. The JET and CP sides requested Mr. Yoshida, an expert in OISCA to do technical guidance, and the request was accepted.

In Ba, organic fertilizer was produced on a large-scale using mill-mud discharged from sugar mill. Useful information on usage (sale) of compost was collected.

	
The LCC and NTC CP, visiting a place of compost making in Sigatoka	The CP and a JET expert, visiting a place of compost making in Ba

d.1.2 Collection and separation of market waste

The Project commenced the composting of vegetable waste generated at a market in Lautoka. This was conducted for the purpose of establishing an off-site recycling system for organic waste. On 20th July the work for collecting waste and separating into vegetable waste and other waste was initiated. As of the end of July, it was identified that quality organic waste was separated out, but very few plastic bags and aluminum cans were mixed in the separated waste. The Project decided to continue awareness-raising activities.

The Project also attempted composting of vegetable waste carried into Vunato Landfill from the market. It did composting on the old waste taken from the landfill. However, it became rotten due to rain as the provisional place for vegetable waste was situated in a low lying area.

The Project decided to continue the work for collecting waste and separating into vegetable waste generated at markets. And, it decided to suspend composting of vegetable waste. JET decided to add the work for establishing a compost yard in the improvement work for Vunato Landfill so that they could get vegetable waste dried and matured in the yard.

	
The LCC CP, announcing to separate waste into vegetable waste at Lautoka market	The LCC CP, observing the status of the collected market waste

	
Vegetable waste carried in Vunato Landfill	Surface of the waste is dried, but odor is generated because it is rotting inside.

Activity 2-6 Complete Environmental Impact Assessment (EIA) process required for pilot project on partial improvement of Lautoka Landfill

LCC with the assistance of JET formulated the Environmental Management Plan (EMP) for the improvement works of the VDS. Environmental Management Plan (EMP) is assessed to be proceeded as the appropriate contingency plan for monitoring the landfill environment and its surroundings before/ during the improvement and after the improvement/ during its operation.

LCC submitted the environmental management plan for the improvement of VDS to DOE on 23rd June. DOE issued a document of approval for the improvement to LCC on 26 August. After this the LCC and JET jointly initiated the improvement.

Activity 2-7 Conduct pilot project on 3R at pilot areas

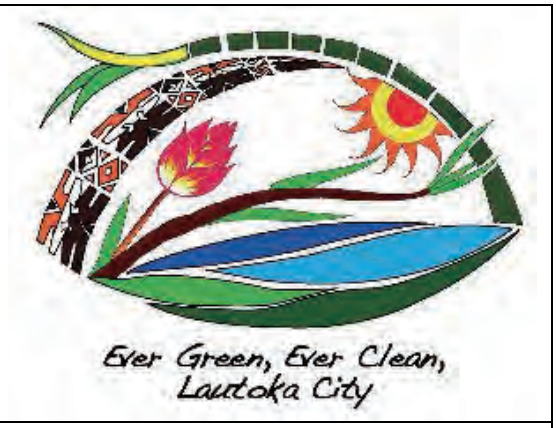
LCC conducted the pilot project on 3R at 3R PP area based on the 3R Pilot project Plans and knowledge gained through OJT for CPs through the assistance of JET. The following activities were conducted as to enable a successful implementation of 3R Pilot Projects:

The following campaigns were conducted for citizens and stakeholders so as to raise their awareness.

a. Environment slogan and logo contest (planned by the JOCV staff, implemented by the CP, and supported by JET)

330 citizens participated in the environment slogan and logo contest, which were planned by the JOCV staff. The JOCV and CP jointly selected the best slogan and the best logo. The Project adopted the selected works for designing T-shirts, signboards, leaflets, etc. They were to be used for promoting the Project. LCC awarded cash to the winner at the launch ceremony for the 3R pilot project.

The CP, selecting the best work of all the works sent by applicants



The selected slogan and logo

Figure 7: Scene of selection of the best environment slogan and logo, and the selected works

b. Installation of the signboards guiding to the pilot sites

At the road entrance of Field 40, signboards guiding to their pilot sites were installed before they were initiated.

c. Distribution of T-shirts

JET prepared two types of T-shirts with the logo selected in the above-mentioned contest. They were distributed to the pilot site residents. On the launch date the residents participated in the ceremony with the T-shirts.

3R PP signboard and Launch ceremony at Field-40: the CP, the minister, the Administrator, and the Resident Representative of JICA Fiji Office participated wearing Project T-shirts

d. Start of the recyclables collection

The collection timing for the recyclables in Field 40 was defined to be at 10:00 to 12:00 every Friday. The first service was provided on 4th September.

52 out of the 122 households (42.3 percent) discharged PET bottles, other plastics, metal, paper, and cloths using the special sack, which was distributed by the CP. The total amount

of the collected recyclables was estimated to be 103 kg.

	
Scene of the recyclables collection	Recycler, measuring amount of the collected recyclables in the presence of CP

e. Market waste composting pilot project

A compost yard was established in Vunato Disposal Site (VDS). The waste generated at market was categorized into two: vegetable waste and other waste. The shopkeeper was requested to separate by that way. The vegetable waste was hauled into VDS on 2nd September, and the composting of the vegetable waste resumed. On this date, the Administrator and CEO declared to separate the waste generated at Lautoka market into vegetable waste and other waste.

	
The CP, requesting shopkeepers to do waste separation at Lautoka market.	
	
On 2nd September the first vegetable waste was carried in VDS from Lautoka market.	

Figure 8: Figure: Scenes of initiation of market waste separation, and composting of the vegetable waste

f. Launch ceremony of the 3R pilot project in Field 40

Launch ceremony of the 3R pilot project was held at a public park in Field 40 at 15:00 on 4th June. The minister and DOE officials from Ministry of Local Government and Urban Development & Housing and Environment, the Special Administrator from NTC, etc. were invited to this ceremony.

After the opening addresses, personnel from the Department of Health in LCC explained the outline of the 3R pilot project as well as the result of the recyclables collection conducted that morning. Following this, a multipurpose truck, grass cutting machines and composters, all of which were procured by JICA, were handed to the Minister of Local Government and Urban Development & Housing and Environment and the Special Administrator.

Lastly, a representative resident from Field 40 declared "we will participate in the 3R promotion project."

Activity 2-8 Conduct pilot project on partial improvement of Lautoka landfill

a. Improvement plan for Vunato Disposal Site (VDS) and establishment of management system

a.1 Finalization of the draft improvement plan for VDS

The JET and CP sides proposed to divide the landfill area into 6 sections and disposal area for special waste. Although the landfill area was divided into 8 sections in its original plan, it was proposed to divide 6 sections in line with the draft improvement plan prepared in the first fiscal year. The 6 sections were to be used as the pilot project site, where buffer zone, divider, access road, and movable road (concrete slab) were established directly by the CP side. In the pilot project, it was also to be examined how leachate generation and management cost would be controlled by landfill volume and soil covering. This was to be conducted for ensuring the sustainable management method for landfill.

a.2 Checking of boundary

VDS is adjacent to native land, but the boundary dividing them was not defined. On 12 August JET discussed the boundary proposed by themselves with the Divisional Manager from Western Native Land Trust Board, the Divisional Surveyor from Western Land Department, Commissioner Western Division, the Special Administrator of Lautoka, and CEO of Lautoka City Council. Then, their proposed boundary was approved. Concrete piles were to be installed on the boundary by the LCC side.

Location survey was conducted on 20th August, and provisional piles were installed. Concrete piles were to be installed later.

	
The CP, checking the provisional pile	The waste, spilled out beyond the boundary (left side of the pile)

a.3 Preparation of the environmental management plan

Before the improvement for VDS was initiated, the LCC side prepared the environmental management plan (EMP) for the improvement of VDS. The LCC side discussed with DOE on how to prepare an EMP. DOE advised that monitoring method should be well described in the EMP. The EMP was submitted to DOE on 23rd June. It describes particularly about how to do monitoring.

a.4 Establishment of system for monitoring water quality

Before the improvement for VDS the LCC side conducted water examination for the purpose of obtaining baseline data. The examination was contracted out to the University of South Pacific (USP). The JET and CP sides fixed five locations of examination. They were instructed about how to take sample by the USP side.

After the water examination by USP, it was to be conducted by the Project. It will conduct the water examination using water test kit procured by JICA. In case that remarkable change in water quality was identified, further examination was to be requested of USP.

b. Establishment of implementation system

b.1 LCC side's implementation system

The CP and JET sides discussed the implementation system for VDS before the improvement started. The following were confirmed:

The improvement for VDS includes rehabilitation of access road, fabrication of movable road (concrete slab), improvement of the area except section six, construction of facility for storing equipment (garage), establishment of rest space with roof and concrete floor for workers. These works were estimated to be FJD 96,925. It was to be procured by the LCC side.

Management of VDS was to be done directly by the Department of Health. The managing organization was transferred from the Department of Engineering to the Department of Health. Figure 7 shows the management system for VDS. Necessary staff will be hired for ensuring the management system.

One building engineer from the Department of Building was to be assigned to the Department of Health for three months and to engage in the improvement of VDS. The engineer will support JET to supervise the improvement.

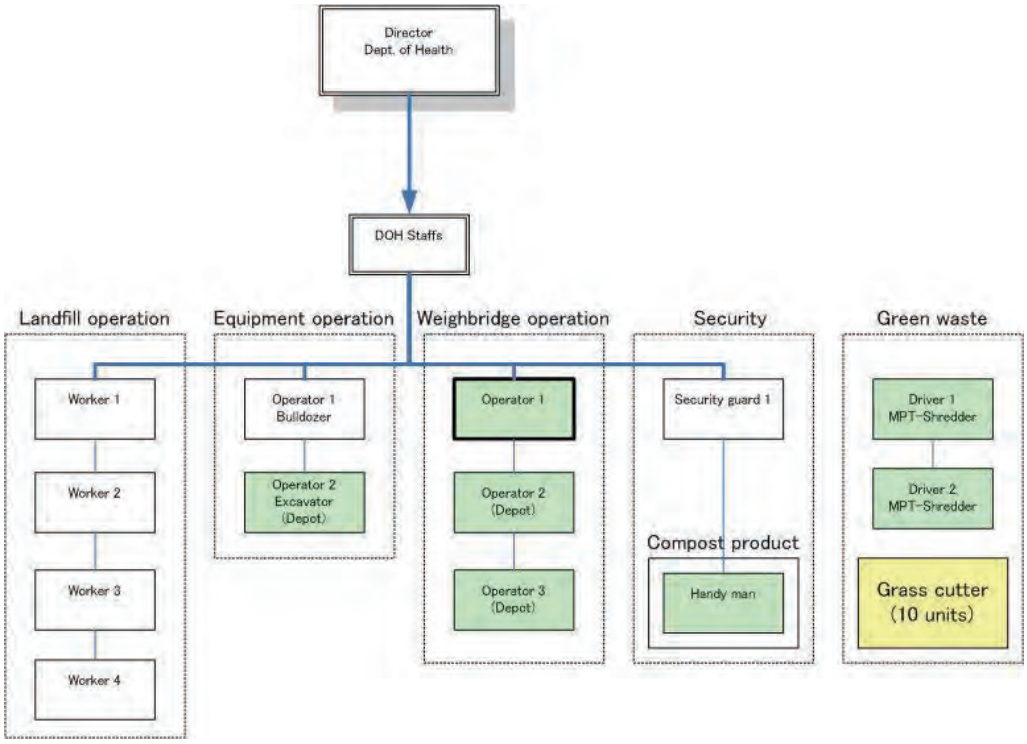


Figure 9: Figure: Management system for the improvement of VDS

b.2 Installation of truck scale

b.2.1 Data collection for data management system

The data to be inputted in the data management system had been collected before the truck scale was operated. The data includes collection vehicle's number, vehicle's owner (local government or company name), vehicle type, vehicle's manufacturer, etc.

b.2.2 Establishment of truck scale

The weighbridge materials were carried in on 16 July and its assembly was completed by 22 July. Following this, indicators, PC and printers were installed. On 12 August it was calibrated using sample weight.

The surrounding area of the landfill was flooded this January, with the water level rising to about 50 cm above ground level. Therefore, the level of the truck scale was set at 1.0 m from the ground level. However, in this case the driver's eye level would be about 3.0 m. It was expected that the driver could not confirm the slope edges. Therefore, safety poles were installed on both sides of the truck scale. Stairs connecting the truck scale to ground was also built.

Although the ceremony for handing over the truck scale was to be held on 4th September, its operation had started about a week before. When the ceremony was held, the CP side was able to completely operate it by themselves.

The weighbridge materials, delivered on 16th July

Scene of the weighbridge assembly

Scene of the installed weighbridge

Figure 10: Shows installation of truck scale

b.3 Ceremony of deliveries of truck scale and excavator

On 4th September, a handing over ceremony of truck scale and excavator, both of which were procured by JICA, was held at VDS. The participants in the ceremony include the minister, DOE's director and DOE manager from the Ministry of Local Government and Urban Development & Housing and Environment, an official from Central Board of Health, the Administrator of NTC, the Resident Representative of JICA Fiji Office, etc. The ceremony was held in grand style.

Scene of the truck scale and excavator handing over ceremony

Scene of tape cut on the truck scale

Figure 11: Scene of the ceremony of deliveries of truck scale and excavator

c. Implementation of the improvement of VDS

The improvement of VDS was initiated from the works for establishment of buffer zone and divider. The establishment work for recycling area, necessary for the 3R promotion pilot project, had been done. All works for improvement were conducted in line with the overall improvement plan shown in Figure 10.

The improvement is currently being carried out directly by the Department of Health in LCC under the instruction of JET.

c.1 Establishment of compost yard for market waste

In the planning stage for the improvement of VDS, the work for establishment of the compost yard was not included. It was added later. This work includes establishment of the composting space and construction of the road to get access to the space.

<table>
<tr><td colspan="2">   </td></tr>
<tr><td colspan="2">Establishment of compost yard started on 25th August. First, the old landfill waste was removed; then, the access road was constructed by leveling three layers of earth.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Compost yard just before its work was completed</td><td>Compost yard (completed on 1st September)</td></tr>
</table>

c.2 Buffer zone and divider

Buffer zone and divider were built using the stabilized landfill.

Establishment of buffer zone started from the north side. It was built using the old landfill and then covered with earth.

Activity 2-9 Review and evaluate the 3R pilot projects

a. Recyclables collection

JET has conducted monitoring to confirm the status in discharge of the recyclables, amount of the collected recyclables, and recyclable items. They visited Field 40 every recyclable collection day (Fridays). The following is the data collected in September, the first month of the pilot project operation.

Field 40 (LCC)

Average rate of the households who participated in the recyclables collection to all the households: 33.7%

Average amount of the recyclables collected: 88.6 kg
Amount of the recyclables discharged: 73 g/person/day

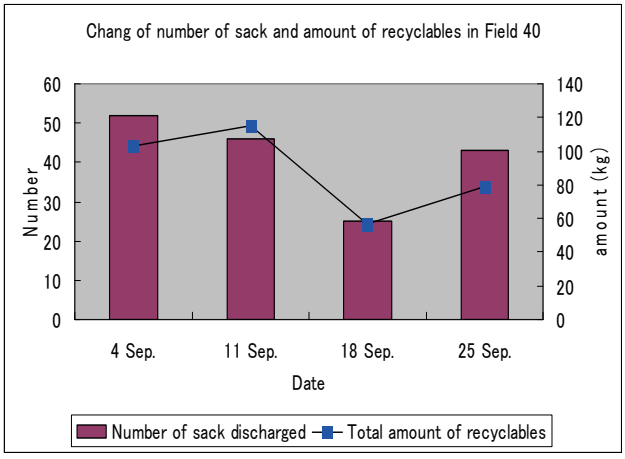


Figure 12: Change of number of sacks discharged and total amount of recyclables (Field 40)

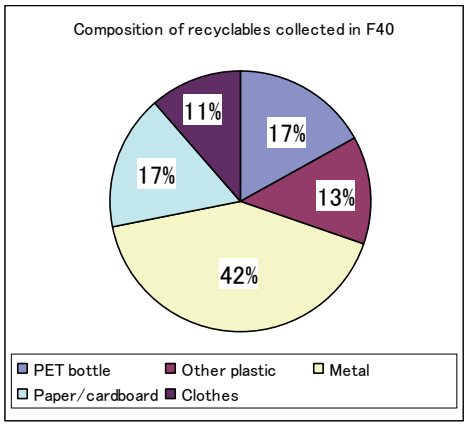


Figure 13: Breakdown of the recyclable items (Field 40)

b. Composting of market waste

Composting of market waste resumed on 2nd September, 2011. Total amount of the waste disposed at composting plant in September was estimated to be about 10 tons. This is expected to contribute to reduction of amount of the organic waste disposed in the landfill. Therefore, it is also expected to contribute to reducing amount of leachate and offensive odor.

	
Vegetable waste carried in by the multipurpose truck, procured by the Project	Compost yard as of 28th September. Volume of vegetable waste is considerably reduced due to evapotranspiration.

Activity 2-10 Review and evaluate the Pilot Project for landfill improvement

Since the installation of the fully computerized weighbridge system, improvements have been made in respect to overall operations and management of the Vunato Disposal Site. These include revision of disposal fees now based on tonnage of waste disposed, computerized printing of weight receipts for customers, on job training of other counterpart staff relating to operation of system, transparent and fair means of charging disposal fees and accountability of income received at VDS. The notable improvement has been the achievement in respect to database of disposal records which is quite exhaustive and detailed. This includes disposal records of waste disposed in accordance to various categories, date, time, vehicle number, weight, customer, origin of waste for daily, monthly, or any time frame.

The weighbridge is also used for weighing purposes by private, commercial vehicle owners for other purposes at rate of $20.00 per weigh. Approximately $2400.00 per month is generated only through the commercial weighing. This income can be used for annual certification and calibration of the weighbridge and also for maintenance work for the computerized system.

Lately, the system has been updated to record separate weight of amount of recyclables taken away from the VDS by waste collectors. An average of 17 tonnes/month of recyclable materials is collected from the VDS by waste collectors for recycling purposes.

All these changes have resulted in significant increase in income from tipping fee. This income is anticipated to be used for VDS improvement works, operation and maintenance costs.

Observations and monitoring has revealed that the operation under the open evaporation method which includes minimum compaction and spread of waste at height of half metre has proven to be very effective particularly in respect to fly and odor nuisance and generation of leachate.

However, since VDS is located over a high water table area and is located near the mangrove swamp, a proper all weather access way is very vital from the attendant's office right up to the last disposal area (section 4). Due to the main access way in the dump section being not maintained on a regular basis, the continuous rain has drastic impact on the operation and condition of the dump.

During such time, trucks faced difficulties transporting waste into the disposal area. Thus, wastes are either disposed at the entrance of the secondary access or even on the main road during worse conditions. Thus, increasing the pushing costs for the council.

It has been also noted that a machine has to present at the end of the secondary access way to keep on making space for trucks to properly dispose wastes at the end. The absence of operator or machine at times results in wastes being disposed on the road, thus making it difficult to be cleared and pushed. Even the special waste like poultry waste which need to be covered immediately cannot all be disposed of properly as the waste trucks is unable to reach the special waste pits. Hence, this results in foul stench being emitted from the VDS.

Therefore, regular maintenance works especially access improvement is of utmost priority for sound landfill operation.

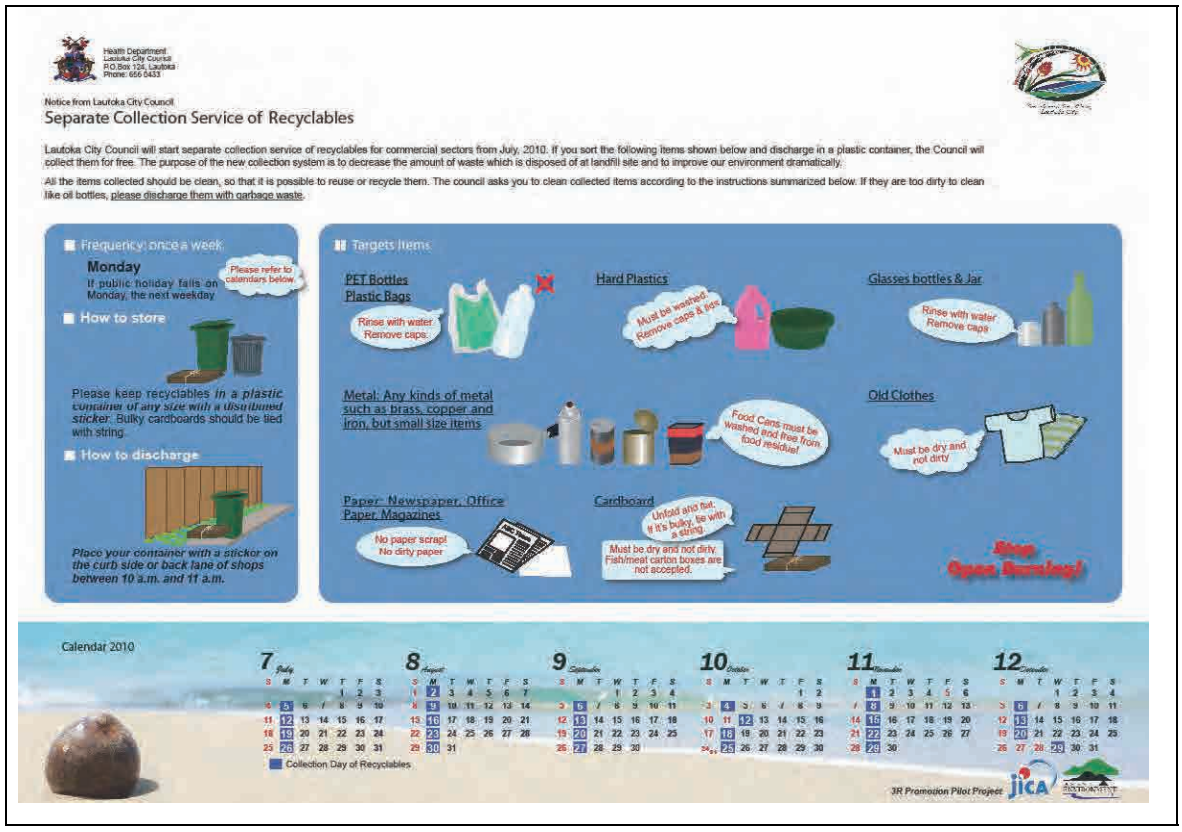
Activity 2-11 Preparation of 3R-PP separate collection for recyclables in commercial area

Following a successful implementation of 3R PP activities at the residential area, it was imperative that a similar pilot project activity be undertaken at the commercial area in particular the separate collection of recyclables. It was necessary to undertake this pilot project since range of recyclables material being generated, suitable storage, discharge and collection system for CBD needed to be experienced or observed before the effective 3R expansion plan could be formulated targeting the expansion of the separate recyclable

collection service to the whole city.

Hence, the following preparatory activities were undertaken for introduction of separate collection service for recyclables in section of CBD area:

1. Meeting with recyclers.
2. Selection of boundary of CBD to implement separate recyclable collection pilot project activity.
3. Meeting with representatives of businesses.
4. Planning and Formulation of plan suitable concept and system of separate recyclable collection in CBD. This outlined the number of business establishments to target recyclables, discharge manner, container, timing, collection and transportation mechanism, and monitoring, etc.
5. Developing educational and awareness raising tools like leaflets, recyclable collection calendar, stickers, posters, circulars etc.



6. Training of 3R promoters for dissemination of information.
7. Conducting awareness raising activities which included:
   a) 3R campaign at Commercial area (Sugar City Mall)
   b) Awareness meeting with women representatives of businesses.
   c) Awareness meeting with representatives of Businesses (Lautoka chamber of commerce and Lautoka retailers Association).
   d) Shop to shop visits for distribution of nylon sacks, stickers, leaflets and circulars.
   e) Development of 3R music with announcement.

Activity 2-12 Conduct Pilot Project on separate collection for recyclables in commercial area

Following the preparations for 3R – PP separate collection for recyclables in commercial area, the council in partnership with Waste Recyclers Fiji) Ltd started actual collection of Recyclables targeting **198 establishments** from the part of the CBD area which commenced from 5th of July, 2010.

a. Plan and Basic Concept of Pilot Project

The Pilot Project on separate collection for recyclables in commercial area was conducted based on the following basic concept and systems:

a.1 Number of business establishment and recyclables collection day at part of CBD implemented PP for separate collection of recyclables

Table 16: Condition PP area for commercial in part of CBD

Area	No. of business establishment	Collection day
Part of CBD	198	Every Monday

a.2 System for Recyclable collection Pilot Project for CBD

Table 17: Basic System for Garbage and Recyclable collection at CBD

Target items	Regular garbage collection	Recyclables collection
Target items	Except recyclables	PET bottle (for beverage), Plastic shopping bag Hard plastic, Metal Paper (newspaper, magazines, office paper) Cardboard, Cloths, Glass bottle
Collection Frequency/collection day of the week	Daily collection except Sunday	Once a week Every Monday
Discharge container	Containers with lid	Any type of containers basically Nylon sack (with 3R logo) distribute only first time Plastic-made container and wheel bin are promoted for discharge of recyclables Bulky cardboards should be discharged by tying it with string
Discharge time	by 9:00 a.m.	10:00-11:00am
Collection time	9:00-10:00 a.m.	11:00am-12:00 pm
Discharge place	Curb side or back lane of the shops	Curb side or back lane of the shops

a.3 Collection Mechanism

Items		Strategy
Collection	Implementation body	The Recycler carried out collection initially for a trial period of 1 month. Since then Council continued with collection work using MPT.
	Workers	One Driver At least two collectors
	Equipment	Collection truck belonging to recycler during trial period and councils MPT afterwards.
	Profits	All profits to be paid to the council.

a.4 Sorting and Storage

Items	Sorting System
Sorting	- Place: Recycler's depot - Staffs: Recycler's staffs

a.5 Monitoring system for separation and collection

Monitoring Items
1) Discharge day of week.
2) Discharge place.
3) Collection crew counts the household discharged recyclables by discharge container.
4) Collection crew refuses the mixed non recyclables and dirty recyclables.
5) CPs monitor the discharge manner at initial stage (at least 2 months)
6) Recyclers submit monitoring sheets with amount of recyclables and profits filled in.
7) Amount of recyclables collected.
8) Other observations regarding the discharge manner.

Activity 2-13 Conduct OJT for operation and maintenance of Lautoka landfill.

LCC has selected 3 workers and trained them regarding the operation of the weighbridge including operation of computerized system of charging dump users, operation system of VDS and market waste composting concepts. CP of health department have also been trained to operate the weighbridge and at times they cover for the weighbridge operator whilst he is on leave.

The workers at the VDS have been given on the job training on market waste composting and operation of landfill equipments. This has been done to ensure that workers are multi skilled and can cover up for other workers whilst they are on leave. This includes operation of heavy machineries, wood chipper and D6 Bulldozer.

LCC CP have also acquired significant level of training in respect to technical issues associated with the improvement works, in particular:

- Formation of buffers, dividers and periphery banks.
- Construction of movable concrete slabs for access.
- Setup of concrete slabs for access into the improvement sections.
- Monitoring of water quality and also monitoring other environmental parameters.
- Operation system of computerized weighbridge and processing and analyzing of weighbridge data.

Co-Project Manager successfully participated and completed the above **Regional Training on Landfill Management held in Port Vila, Vanuatu from October 10 – 14, 2011.** The training was organized and funded by Japan International Cooperation Agency and SPREP under the JPRISM Project. The overall purpose of the training was to train the counterpart staff on semi aerobic method of landfill that is being implemented in Port Vila and share the experiences of other disposal methods around the Pacific Region.

The capacity building training has broadened the CP's knowledge in terms of managing the operations of the landfill and the knowledge gained will be imparted to the fellow colleagues.

	
Trickling filter	OJT for VDS first weighbridge attendant

ACTIVITY 3: OBTAINING THE CAPACITY FOR 3R PROMOTION ACTIVITIES AT WHOLE AREA OF LCC & NTC

Activity 3-1 Develop a 3R promotion action plan for the whole area of Lautoka City and Nadi Town.

The 3R Action Plan was formulated and finalized following the two weeks Group Focused training in Japan on 3R Promotion for 10 CP from Fiji. This 3R action Plan is scheduled to be presented to the Stakeholders on 25th November, 2010. The 3R Action Plan stipulates specific policies for respective 3R activities.

3R Action Plan has been formulated targeting the expansion policy, implementation system, schedule and budget focusing primarily on the following four core components of 3R's:

- Separate Collection of Recyclables.
- Home composting.
- Market waste Composting
- Green waste collection and Chipping Service
- Lautoka Clean Schools Programme

The detailed information is outlined in the copy of the 3R Action Plan

Activity 3-2 Conduct training, on the job training, etc. for the staff of Lautoka and Nadi councils to promote 3Rs

Total of 8 counterparts from the council have so far attained knowledge on 3R promotion as a result of their exposure in Kitakyushu and Shibushi Cities during the 2 weeks group focused training. Other forms of OJT training opportunities have been gained from the JET consultants during the course of the project. The participation of the staff during the Joint Fortnightly meetings also offered opportunity to share and gain knowledge from each other.

CPs have acquired necessary training during the last 2 years of the project and they are now equipped to implement the 3R Expansion Plan to the whole of the city area.

Some basic training gained includes:

- Conducting community meetings.
- Preparation of presentations and conducting presentations to members of public.
- Preparation of educational and awareness raising tools like leaflets, pamphlets, posters, circulars, notices, media awareness materials, tender documents, etc.
- Interpretation of monitoring results of recyclable collection.
- Carry out all monitoring works including home composters, recyclable collection, market waste composting, environmental monitoring at VDS, green waste chipping etc.
- Conduct basic baseline surveys like Public Opinion Surveys, community surveys etc. and interpret results.
- Organise, facilitate and coordinate seminars.
- Prepare manuals.
- Conduct awareness raising of target population especially by house to house visits and announcements.
- Implement Clean schools Programme focusing on 3R's concept.

Activity 3-3 Implement 3R promotion

a. Establishment of Home Compost Subsidy System

LCC is of the view that it is crucial to decrease the amount of organic waste which accounts for around 60% of household waste generated. Therefore, both municipalities established a "Home compost subsidy programme" in July 2010 to encourage their ratepayers to use compost bins which are manufactured locally in Fiji and sold at costs of FJD 55. Council provides a subsidy of FJD 25 when ratepayers purchase a bin from the Councils. Each Council also conducted various advertising and awareness activity to promote this noble initiative.

The Pilot Project proved that home composting using compost bin was very effective. Three hundred and eighty (380) households in LCC are practicing home composting under the pilot programme, and the amount of kitchen waste being recycled is estimated to be **107 g/person/day,** or about 20% of the household wastes being generated. It is also expected that composting will reduce the costs for the municipality because it lessens the amount of garbage going into the waste stream. Thus, LCC positioned the promotion of home composting as a core activity in the Solid Waste Management Master Plan.

		
Booth in the council office	House-to-house visit	Community meeting

b. Lautoka Clean Schools Programme

The aim of the Clean Schools Pilot Programme was to spread the message of good waste management practices to schools, particularly to students who are regarded as effective agents of change and influence, and to create awareness among children about waste minimization in the home and community. This pilot began in July 2010 and participating schools (26 schools in LCC) were required to implement 3R activities through three sets of activities: environmental awareness activities, school composting, and recycling.

Key factor for success was that 3R Project counterparts in LCC monitored the Clean Schools Pilot Programme and also conducted awareness sessions with students during school visits. Competitions were also organized where all participating schools were rewarded with certificates of participation and other awards by the Minister of Environment during a special award ceremony. LCC/NTC are now working with Ministry of Education to expand the concept to all other schools from other municipalities in the Western Region.

		
Winning school representatives with guests and council staffs	Separate bins placed in classroom	Kids practicing compost

c. Expansion of Recyclable collection to whole of Veitari Ward

Separate collection of recyclables was conducted in the residential and commercial areas of Veitari Ward. Target recyclable items for separate collection was limited as it depends on the items which recycling company can accept, including PET beverage bottles, plastic shopping bags, hard plastics, metals including tin cans, paper (newspaper, magazines, office paper), cardboard, cloth (textiles) and glass. Councils provided collection service on a fortnightly basis in residential and on a weekly basis for commercial areas.

Council visited each household and business to provide specific nylon bags with the "3R" logo imprinted, and a recycling leaflet with calendar, which provides guidance on participating in the system. At the same time, people are requested to separate waste into recyclables and non-recyclables at source and to discharge at the curbside on designated times and days, which are indicated in the leaflets.

The Council-owned truck in LCC collects recyclables using unique appealing music announcements to remind the citizens of the collection day. The collection workers monitor the quality of the recyclables being discharged and record the number of households participating in the initiative. Non-recyclables and unclean materials are rejected and the workers provide necessary guidance for the discharger. The recyclables collected are then taken to the recycling company where they are sorted by category, weighed, baled, and exported overseas for recycling.

The results of monitoring of the pilot project implemented in LCC revealed the average discharge rate of recyclables as **6.2 g/person/day** at households and **217 g/BE/day** at business establishments (BE).

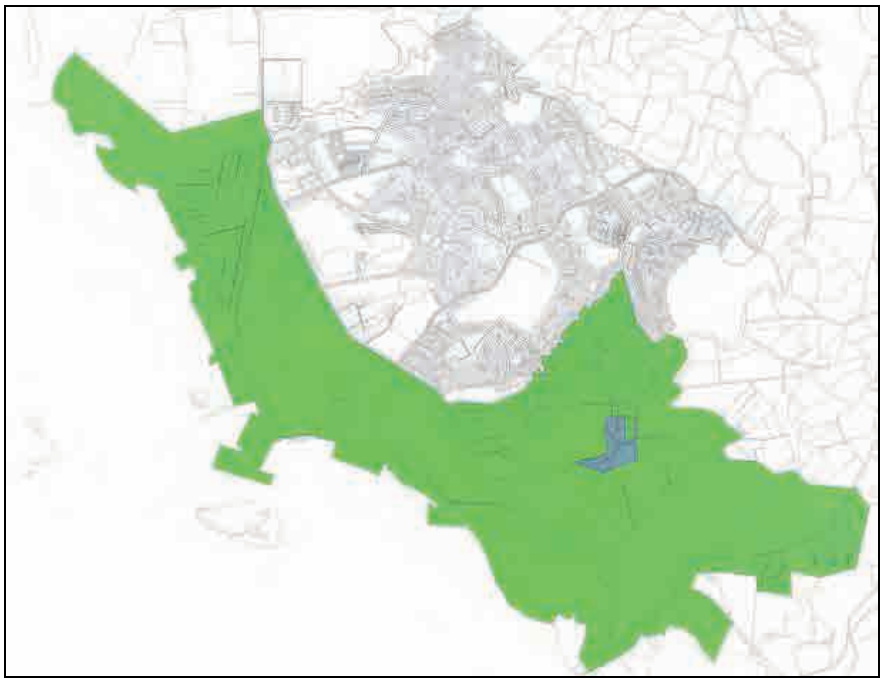
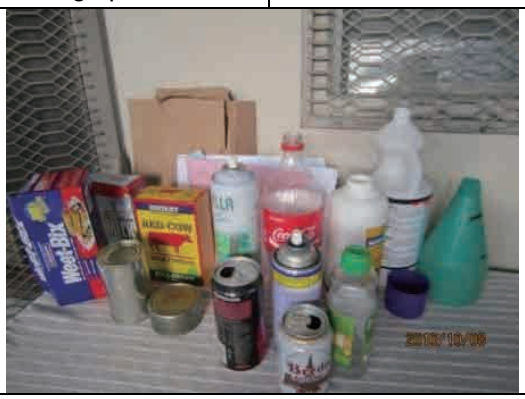


Figure 14: Figure: showing 3R expansion to whole of Veitari Ward

Table 18: showing the basic concept of Recyclable Collection Expansion in stage 2

Target items	Recyclables collection
Target items	PET bottle (for beverage), Plastic shopping bag Hard plastic, Metal Paper (newspaper, magazines, office paper) Cardboard, Cloths
Collection Frequency/collection	Fortnightly collection for residential area (Mondays for Namoli and Fridays for F/40)

day of the week	Weekly for Commercial and schools on Mondays.
Discharge container	Nylon sack (with 3R logo) distributed only first time Bulky cardboards should be discharged by tying it with string
Discharge time	By 8:00 a.m. for residential From 10.00 am to 11.00 am for commercial Request basis for schools.
Collection time	8:30-11:30 a.m. for F/40 11.00 am – 1.00 pm for commercial
Discharge place	Curb side



Recyclable materials

Storage of recyclables at residential area

Residents discharging recyclable sacks on collection day

Recyclable collection and monitoring work

d. Implement Market Waste Composting

Market waste composting pilot projects were undertaken by both LCC and NTC. Both Councils provided separate bins in the Vegetable Markets for discharge of green waste and other waste that cannot be composted. Awareness was also created among the market vendors regarding segregation of compostable waste. In the case of LCC, total market waste generated is 3.3 tons/day. An average of 800 kg/day of compostable waste is segregated and transported to the composting yard located at Vunato Disposal Site (VDS) to be composted.

The “heap method” of composting has been established under the project whereby the dry organic waste (e.g., old wood chips, saw dust) is used for the base material and also for covering which assists in moisture regulation, controlling odors, flies and birds, and introducing microorganism to catalyze the compost. The compost heap is also covered with plastic sheet to retain moisture or protect from excessive moisture during heavy rainfall. The

pile is then left to ferment for 3 weeks and then turned over every week by an excavator. Each compost heap is also monitored for moisture content, temperature and pH.

Once the compost is fully matured (about five to six months), it is sieved, weighed and packed in 10 kg bags for sale at price of FJD3.00 whilst the production cost is FJD2.64/10kg. The compost is purchased by the citizens as flower and vegetable gardening is popular in Lautoka and response from citizens has been encouraging. The analysis of the compost quality revealed nutrient content as Nitrogen: 1.3(%), Phosphorous: 2.1(%), and Potassium: 1.2%, with a carbon to nitrogen ratio of 7.2.

Workers conducting monitoring work

Compost yard

Sieving of final compost

Turning by Excavator

e. Implement Green Waste Chipping Service

The Green Waste Collection and Recycling Pilot commenced in October 2009 as an initiative to prevent the accumulation of such waste in backyards, minimize open burning and littering in public places, reduce the amount of waste going to the dumpsite, and reduce the collection and transportation cost of green waste.

A wood chipper is used to reduce green waste to wood chips which can be effectively recycled as mulching material in gardens, used in market waste composting for moisture control, used as base material for home composting, or sold as fuel for industrial boilers.

Activity 3-4 Review and evaluate 3R promotion

a. Home Compost Subsidy Programme

The position of the council to adopt the gome compost subsidy programme is timely and will yield positive results. It has been noted that the council managed to sell all the composters purchased under the subsidy programme and this highlights that the residents are responding to the awareness activities and have also realized the importance of practicing home composting.

Monitoring results reveal that controlling the moisture is very essential to ensuring effective home composting. Excess moisture in home composters tend to generate foul odor and maggots which at times discourage the residents especially those who are involved in composting for the first time. Therefore, addressing and creating awareness on this issue has been very important.

Council also noted that sometimes the compost bins took a long time to be delivered to residents even after they had paid. Also, some residents kept it for a long time before installing and some did not set up their composter properly. This resulted in council providing the incentive to deliver, setup and supply 1 bag of chips to be used for moisture control.

It can be noted that the gap between the Plan and actual number has increased. Hence, more awareness raising is needed to be conducted. Also alternative method of composting need to be promoted like drum composter and more monitoring work by counterparts need to be done to monitor the progress of newly installed composters.

b. Market Waste Composting

The market waste composting has been implemented since September 2009. The following lessons have been noted in respect to market waste composting:

The use of tarpaulin has been very effective in moisture control both to retain moisture during dry spells and also to prevent excessive moisture entering the heaps during the rain.

The heap method of composting is very effective whereby fermentation progresses well and moisture is retained.

The old stock of wood chips is very useful for composting as it is used as base material and also for covering the newly compost. It supplements additional microorganisms, contributes to balance of C: N ratio and also acts as moisture control.

The demand of compost is not encouraging. Therefore, more awareness is needed.

The change of market cleaning contractors agreement to sort and load market waste has proven to be very effective as only one worker (driver) is enough to transport waste to VDS for composting.

Monitoring work is now conducted by 3R workers.

It can be concluded that market waste composting can be easily implemented by other municipalities provided they have space for composting which is not far from the market.

No major nuisance is observed from market waste composting provided proper procedure is followed.

c. Expansion of 3R Promotion

The expansion of 3R promotion to whole of Veitari ward and all schools has been viewed as successful though the participation rate and engagement by the community has not been up to expectation. Considering the sustainability aspects, it can be concluded that counterparts have acquired extensive experience and the ability to successfully sustain 3R promotion to other areas as per the 3R Promotion Action Plan.

d. Lautoka Clean Schools Programme

Monitoring results reveal that all schools actively participated in the environmental awareness raising activities. The creativty displayed by students was exceptional. Furthermore, most schools have introduced the concept of separate bins at classroom level for papers, plastic, pet bottles, compost or organics, cans and a one bin for non recyclable waste. The schools have established 3R committees involving teachers, leaders and studens who monitor that students dispose of waste seperately in the designated bins. The bins are then emptied in separate bigger storage containers at a common place once a week which is then collected by the council for recycling.

Council is of the view that children are excellent agents of change can easily grasp this new phomenon regarding 3R’s initiative and at the same time influence their parents in the various communities to adopt these environmentally friendly practices.

However, the following lessons were noted from the clean schools programme:

It has been noted that the involvement of the Ministry of education is vital especially engaging the ministry to send circulars to schools.

Monitoring revealed that schools with active 3R teachers performed extremely well

compared to others. Hence, school teachers have a major role to play in order to sustain the programme. Students possess enormous talent and are always eager to explore new experiences. Hence, they need a teachers to guide them and act as a catalyst in propelling this intiative to new heights.

Continous monitoring by council is needed to sustain the interest of the schools and also to tackle challenges with the schools.

Site visits especially to VDS is an eye opener and craetes a positive impact for students to do something about waste generation.

e. Green Waste Collection and chipping Service

It has been noted from the lessons learnt that:

- Request for the shredding service from households has been very limited so far to only 29.54 ton since July 2010.
- Pruning work conducted as part of public area cleansing is undertaken irregularly.
- Therefore, it seems difficult to ensure the stable supply of generated chips to FSC.
- Chips are mainly effectively utilized as mulching materials and for home composting setup and market waste composting.
- Routine green waste collection and chipping work should be established.
- Awareness activity to disseminate the service (newspaper? radio?)
- Implementation should be recorded

Activity 3-5 Monitor the progress of communities' perception, behavior change of the people by conducting the Public Opinion Survey.

The comparison of the four Public Opinion Surveys carried out for the residents of the Field forty Pilot Project Area generally revealed that residents have gradually made positive changes regarding their perceptions towards environmental issues.

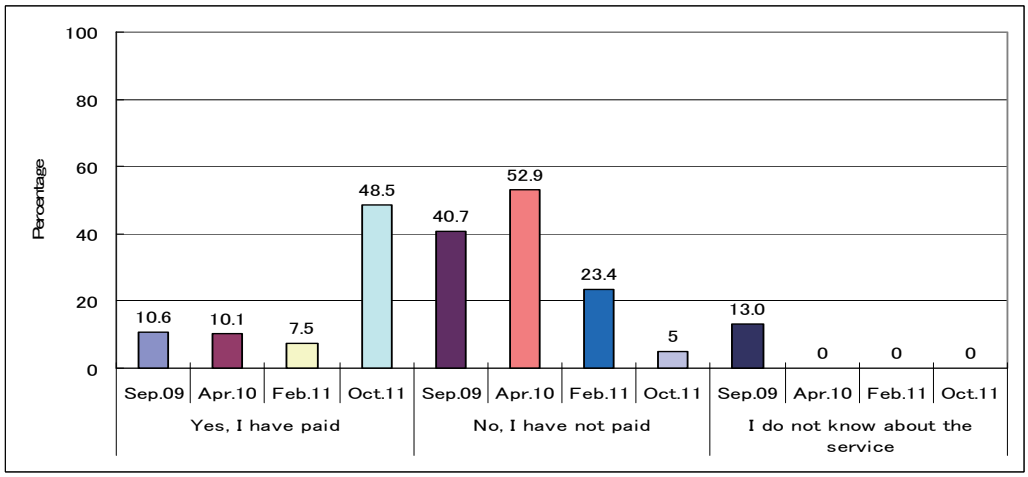
According to the responses to the following questions, some positive behavioral changes have been noted as summarized below:

a. Survey on Current Waste Management

The survey results indicate that generally the citizens tend to reveal contrasting views regarding their knowledge on waste management issues. More positive effect of the pilot project in terms of their perception and knowledge could not be established via the POS.

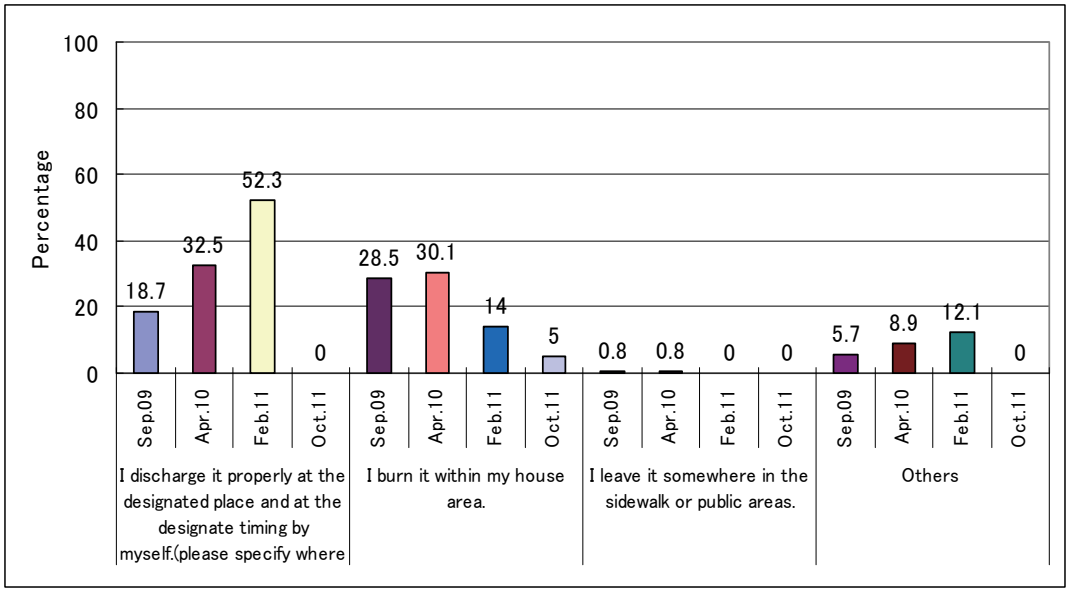
b. Survey on Green Waste Collection and Service

- **Have you ever paid for the green waste collection service?**



The above result indicates the percentage of "yes" responses increased dramatically in F40, which indicates that citizens are aware of the service and are eager to properly dispose their green waste.

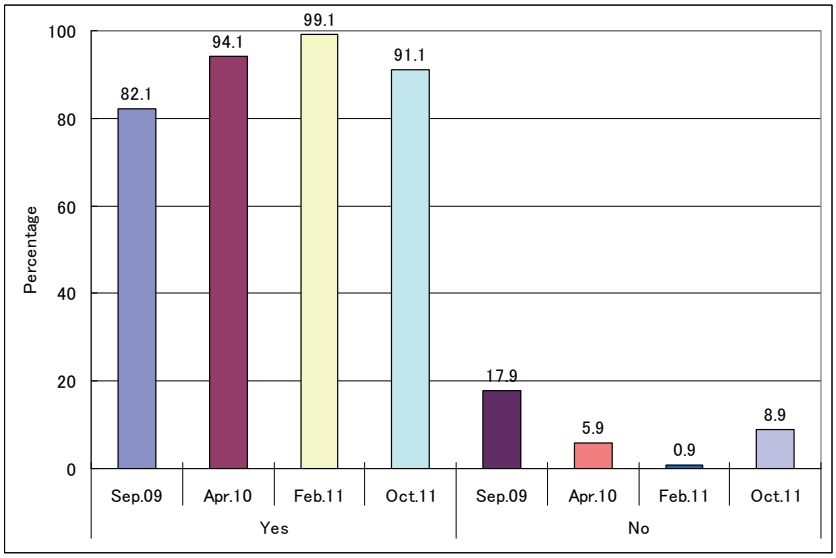
- **How do you discharge green waste?**



The above result indicates that burning of green waste has declined from 28.5% in September 2009 to 5 % in October 2011.

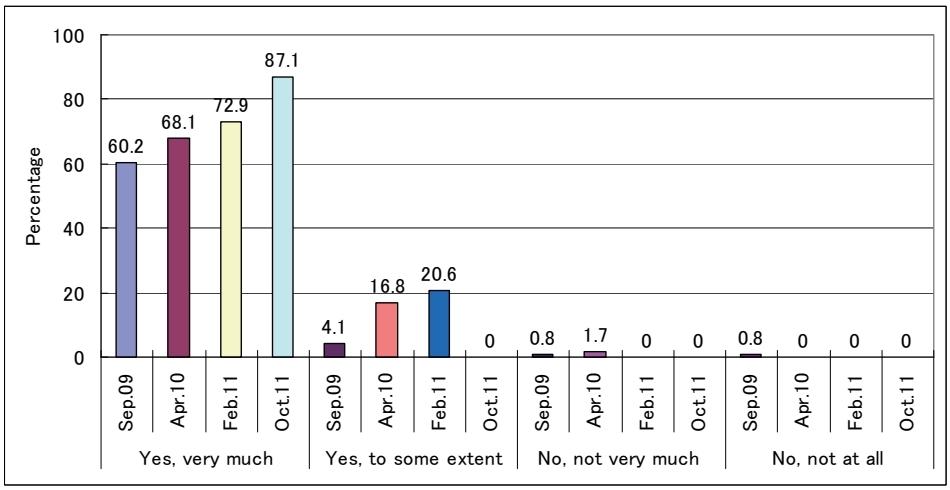
c. Survey on Recyclables Collection Service

- **Do you know the collection service of the recyclables including PET bottles, plastics, tin cans, aluminum & steel cans and spray cans, metal, paper, cardboard, glass bottles and jars, and old clothes, that are collected once a week by Council as a part of the JICA Project?**



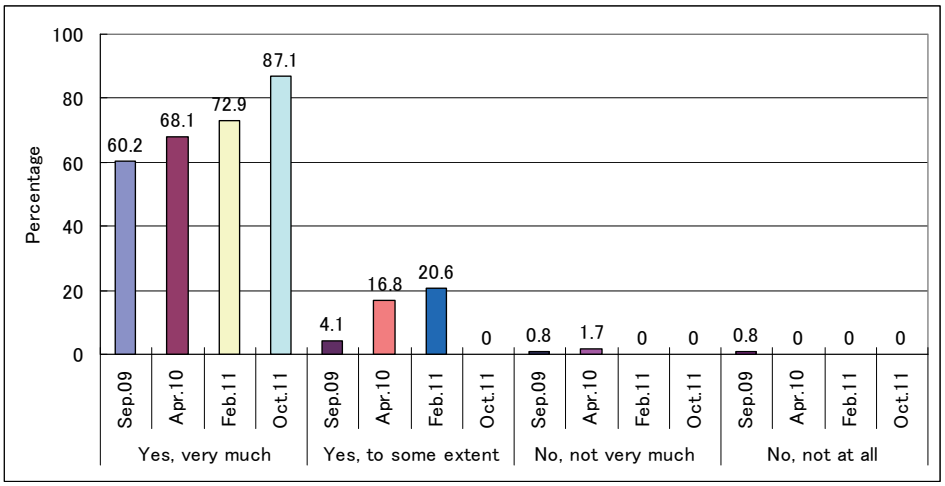
The above indicates that generally, there has been a steady increase in the awareness of the citizens regarding the separate collection service, though a slight decrease has been noted in October 2011. This may be attributed to settlement of new tenants within the 3RPP area.

d. Have you ever used the collection service of the recyclables that are collected once a week by Council as a part of the JICA Project?



The above result is encouraging to note whereby it indicates that percentage of citizens using the separate collection service increased steadily from 60.2% in September 2009 to 87.1 % in October 2011.

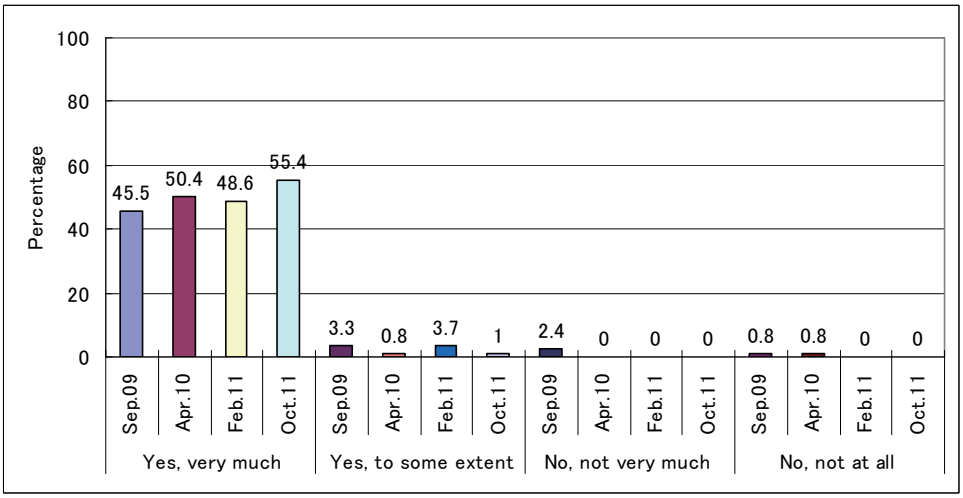
- **Would you like to continue to support in the Recyclables collection service?**



It can be noted that the percentage of response "yes, very much" has increased steadily indicating that the activity can be sustained as the citizens are eager to participate in discharging the recyclable materials.

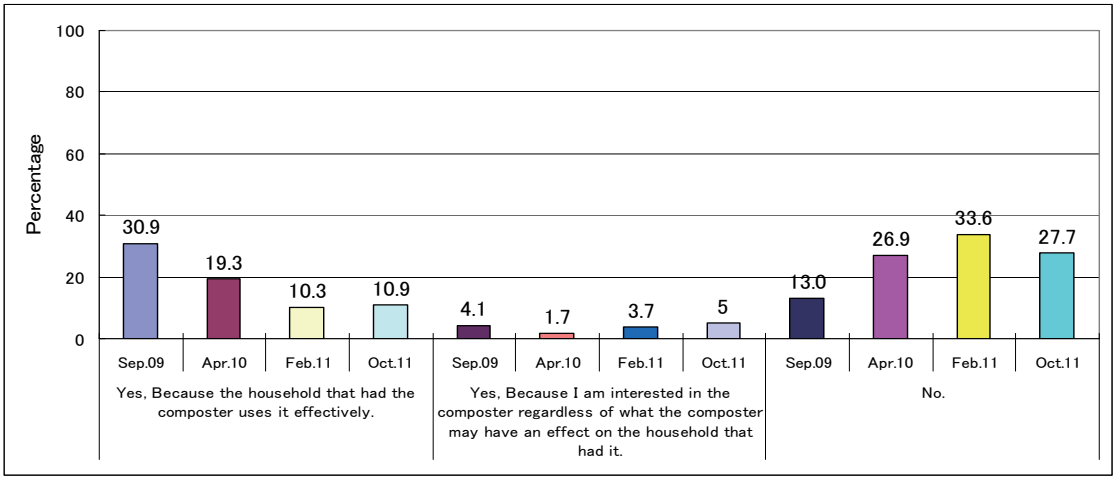
e. Survey on Current Status of Home Composting

- **Would you like to continue to use the composter?**



It can be noted from above results that residents using the composters have the desire to continue to use the home composter as they might have experienced the benefits of composting.

- **Would you like to own a composter?**



It has been noted that the above result indicates that citizens who have yet to own a composter are not keen to own a composter. This may be due to the fact that initially the composters were handed out for only $5.00, whereas the price has increased to $30.00.

ACIVITY 4: AWARENESS RAISING OF RESIDENTS THROUGH ENVIRONMENTAL EDUCATION ACTIVITIES

Activity 4-1 Review on environmental educational tools/programmes in Fiji, Japan and other countries.

Two municipalities, Beaverton (Oregon, US) and Halifax (Canada), which collect recyclables and garden waste separately, were selected, and their recycling systems and educational programs were analyzed together. In addition, container collection of recyclables and garden waste treatment in Guam, 3R programs in Shibushi City and a community-based group collection system in Mitaka City were reviewed as a reference. At the end of the report, the current condition in Lautoka and Nadi were analyzed.

Both Beaverton and Halifax simplified the separate collection and recycling systems as much as possible, so that residents can easily join their systems. Their educational materials, distributed to households and business establishments, make it easier for readers to understand the collection and recycling systems, with a lot of illustrations. On the other hand, in Shibushi, a small city with a traditional village-like community, community groups take critical roles, and the municipality implements a complicated collection system in cooperation with community groups and residents.

Activity 4-2 Develop effective educational tools/programmes

a. Procedures

Since the basic approach of the 3R pilot project is community based, and a community committee is given a critical role, the CP and expert team first tried to provide necessary information through the committee. The committee, however, is not active enough to take a leading role, so Lautoka health department workers conveyed the necessary information at community meetings and by handing out leaflets and other education materials.

Several committee meetings were arranged during the preparation period in order to finalize the pilot project plan, and the community meeting was organized once before the start of the new collection system in order to explain the PP and ask residents for their active cooperation.

The Launching ceremony was organized in order to make the pilot project known widely and increase people’s awareness of solid waste management in Lautoka.

After the new collection systems started, the health department conducts regular monitoring in order to check the number of households who join the new collection activities and their discharge manners.

b. Educational materials

Various educational materials such as leaflets announcing the PP and on recycling and garden waste, and a documentary on the PP that included footage explaining recycling and composting were prepared before the start of the PP, and additional leaflets are made after the PP started based on the result of the monitoring.

Activity 4-3 Conduct training, on the job training, etc. for the groups & personnel concerned on 3R promotion in Lautoka and Nadi.

Total of 8 counterparts from the council have so far attained knowledge on 3R promotion as a result of their exposure in Kitakyushu and Shibushi cities during the 2 weeks group focused training. Other forms of OJT training opportunities have been gained from the JET consultants during the course of the project. The participation of the staff during the Joint Fortnightly meetings also offered an opportunity to share and gain knowledge from each other. CPs have acquired necessary training during the last 2 years of the project and they are now equipped to implement the 3R Expansion Plan to the whole of the city area.

Some of the activities covered by the basic training were:

- Conducting community meetings.
- Preparation of presentations and conducting presentations to members of the public.
- Preparation of educational and awareness raising tools like leaflets, pamphlets, posters, circulars, notices, media awareness materials, tender documents etc.
- Interpretation of monitoring results of recyclable collection.
- Carry out all monitoring works including home composters, recyclable collection, market waste composting, environmental monitoring at VDS, green waste chipping etc.
- Conduct basic baseline surveys like Public Opinion Surveys, community surveys etc. and interpret results.
- Organise, facilitate and coordinate seminars.
- Prepare manuals.
- Conduct awareness raising of target population especially by house to house visits and announcements.
- Implement Clean schools Programme focusing on 3R's concept.

Activity 4-4 Introduce the educational tools/programmes in the pilot project areas

The council was able to make optimal utilization of the various educational tools developed under the project to implement activities to raise the awareness of the residents in Pilot project areas. The educational tools like circulars and leaflets were distributed during house to house visits whilst the presentation materials were utilized during the community meetings. Home composting manual and recycling calendar was particularly effective in disseminating the awareness to the citizens of the 3R PP area.

Activity 4-5 Evaluate the educational tools/programmes

Education materials were prepared by the CPs and JET. The education materials included leaflets for 3R expansion in Andhra Street, home composting manual, council newsletters, circulars for market vendors on waste separation awareness and 2 project newsletters. The CPs also prepared power point presentations for community meetings, joint weekly meetings, and stakeholder's workshop in consultation with the JET.

Therefore, evaluation of the educational materials and program are given as follows:

a) Community Meeting

Community meetings is perceived as idealistic, it has been experienced from pilot project activities that approximately 30 percentage of the community members only turn up for community meetings. Though the information is disseminated and filters into the community at large, not all members receive the awareness. Nonetheless, CP will continue with the community meetings whereby it has been observed that influential members and community leaders are present who are targeted to disseminate the information on behalf of the council.

b) Hose to House Visits

This means of education and awareness has been noted to be most effective whereby the CP have the opportunity to meet the community members face to face and explain the information needed to be disseminated more effectively. Through house to house visits, Council is sure that 100% of the community members are made aware of the target activities and the response from the community is more positive.

c) Announcements and Music (Melody) from MPT (Collection vehicle)

This means of the awareness and notification has been also proven to be very effective in particular prior to collection of recyclables whereby residents respond more positively. The residents get accustomed to the melody in particular and understand that it is meant for discharge of recyclables on road side.

d) Leaflets and Circulars

Significant improvements have been noticed in respect to the standard of leaflets and circulars prepared since the inception of the project. CPs have gained considerable knowledge in respect to formulating such education tools.

Activity 4-6 Improve the educational tools/programmes

The council in cooperation with JET members prepared the following educational tools and programmes for effective awareness and dissemination of information on 3R promotion.

a. Television Commercial Advertisement on Recyclable collection.
b. Television Commercial Advertisement on Home Composting.
c. Green waste collection and recycling circular.
d. 10 minutes Home composting demonstration video.
e. 10 minute recyclable collection video.
f. 6 Volumes of project Newsletters.
g. Updated the 3R information on Department of Environment web site (3R web).
h. Calendar for separate collection service of recyclables for Veitari ward.
i. Green waste collection service circular
j. Home composting manuals
k. Recycling poster

Activity 4-7 Implement activities to raise awareness through using the educational tools/programmes in Lautoka City and Nadi Town

The council was able to make optimal utilization of the various educational tools developed under the project to implement activities to raise the awareness of the residents as follows:

- Community meetings
- 3R Booths and display during various public events.
- Media awareness through Fiji One, Mai TV, City Star and Lautoka Sun.
- 3R Awareness for whole of Veitari Ward through House to House Visits
- 3R Awareness to Special Administrators and Chief Executive officers of All councils during the Local government forum.
- Awareness to school students and teachers visiting Lautoka for educational visits etc.

3R booth display in LCC office

3R Presentation to SA's and CEO's

The table below indicates some of the activities implemented using the educational tools developed under the 3R project:

	Target Group	No. of people
1	Community Meeting at CBD on 1/12/2010	15
2	Community Meeting at Field 40 on 8/12/2010	25
3	Community Meeting at PRB Natabua on 8/02/2011	30
4	Community Meeting at Natabua Primary School on 9/02/2011	40
5	Community Meeting at Navutu Village on 10/02/2011	70
6	Community Meeting at Rifle Range on 16/02/2011	30
7	Community Meeting at Howrah crescent on 17/02/2011	35
8	Community Meeting at Balawa on 18/02/2011	30
9	Community Meeting at Namoli Village on 22/02/2011	15
10	ODA Press tour on 9/12/2010	15
11	JOCV Mission on 04/02/2011	5
12	Stakeholders from Sigatoka Town Council	12

	Target Group	No. of people
13	Lautoka Central Primary School Art display	500
14	Natabua Primary school Annual Prize Giving day	700
15	Golden Age Homes (kitchen hands and Gardeners)	5
16	Natabua Prison (Kitchen hands)	5
17	Special Administrators/CEOs Local Government Forum	40
18	Students of Nasau Training Centre	60
19	3R Guideline and Manual Workshop for all Municipalities	45
20	Andhra Primary School (3R Awareness talk during school assembly)	700
21	3R booth display during PSC week celebrations – 2011	200
22	3R booth display during Fiji Day Celebrations - 2011	500
23	Students of Nasau Training Centre (3R awareness presentation and site visit to VDS) – 2011	60
24	Facilitated 3R Guideline and Manual Workshop for all Municipalities on November 2, 2o11. 3R Presentation and training was also done by CPs of LCC/DOE/NTC	100
25	3R Display Booth organized at Girmit Centre during the Fiji Art and Living Foundation festival on June 24th and 25th, 2011.	300
26	Market Compost sales awareness organized at Sugar City Mall July 2nd, 2011.	200
27	Conducted market waste separation and litter awareness for market masters and all market vendors on July 1, 2011.	300
28	Organized and facilitated visit by Shibushi project Team led by mayor of Shibushi City, Mr Honda on 4/7/2011 to VDS.	10
29	Facilitated visit by NTC CP to market and composting facility to observe market composting practices on June 24, 2011.	3
30	Created awareness on use of home composter during the 1st year anniversary celebration of Rakiraki Township. LCC donated 5 composters to Rakiraki during the celebration and also created awareness to staff of Rakiraki Town Council on Home Composting and Market waste composting.	150
31	3R Display Booth organized at University of Fiji during the Sustainability and Learning Action Forum on July 15th – 16th, 2011.	100
32	3R Awareness to students of all the 26 schools through the Clean Schools Program	13500
33	3R Awareness to Kindergarten students during the Pre School Celebrations	250
34	3R Awareness talk and Site visit of VDS to students of USP (2011)	65
35	3R Presentation (Green Waste Chipping, Home Composting and Market Waste composting) at the International Renewal Energy Forum at USP, Suva.	400
36	3R Awareness talk at the Adi Salusalu Festival on October 28, 2011.	200
37	3R Presentation to Students of Gandhi Bhawan Primary School on October 17, 2011.	65
38	Awareness for staff of Natabua Prison on Heap method of Composting for kitchen, grass and garden waste.	10

	Target Group	No. of people
39	VDS Site Visit by Shibushi City Expert Team on October 31, 2011.	8
40	Community Meeting in Collaboration with Shibushi City Expert Team at Field forty on October 31, 2011	80
41	VDS Site Visit by Okinawa Water Business Team on November 4, 2011	11
42	3R Rap Radio programme from end of October for a month	National level
43	3R Awareness through installation of 3R billboard at Drasa Avenue roundabout.	National level
44	3R media awareness via Fiji sun, Fiji Times and City Star	National level
45	Radio interview on 3Rs on Mix FM (2011)	National level
	Total	18,879 + NL

Note: National Level implies a difficulty in estimating the number of citizens reached during the awareness campaign, however such activities targeted the citizens nationwide.

ACTIVITY 5: DEVELOP AND RECOMMEND A 3R MODEL FOR FIJI

Activity 5-1 Review all the processes & results of the activities for 3R promotion by the project and extract findings

Review of 3R promotion activities were conducted as deliberated in detail under Activity 2-9 and Activity 3-4. The findings of the review of 3R promotion activities was then reflected in the 3R Guideline and 3R manual.

c. Overall Evaluation of 3R Promotion

For instance, review of the 3R promotion activities revealed home compositing is the most practical and applicable 3R initiative followed by market waste composting. Detailed documentation of the review findings can be referred to in the 3R Manual.

Table 19: Overall Evaluation of 3R Promotion

Activity	Technical aspect	People's acceptability	Financial aspect	Waste minimization	Total (order of priority)
Home composting	+1	+2	+1	+1	+5 (1)
Market waste composting	+3	+1	+2	+2	+8 (2)
Green waste chipping and recycling	+2	+3	+3	+3	+11 (3)
Separate collection of recyclables	+4	+4	+4	+4	+16 (4)

Activity 5-2 Develop draft guidelines, manuals on 3R model for Fiji, etc. for its promotion

The JET in mutual consultation with CPs developed the draft framework of the 3R Guideline and 3R Manual. Lessons learnt and challenges faced from implementing 3R promotion was reflected in the 3R Guideline and 3R Manual. The objective of the 3R Guideline is to:

- Reveal the National Policy on 3R promotion to the person in charge of SWM
- The person in charge of SWM (LA) to implement the Guideline in his jurisdiction

3R Guideline consists of the following content.

1. Background and Objectives
2. 3R Targets and Policy of Promotion
3. Basic Accord for 3R Promotion

The objective of the 3R manual is to **provide the technical and practical information which guides Local Authorities to promote the 3Rs** according to the 3R Guideline which serves as the national policy on waste minimization.

Activity 5-3 Finalize the guidelines, manuals, etc.

The JET in mutual consultation with CPs of DOE/LCC/NTC has finalized the 3R Guideline and 3R Manual. This was achieved after a series of discussions with stakeholders and commitment of CPs of DOE/LCC/NTC and JET members.

Activity 5-4 Conduct seminars to present to other municipalities the guidelines and manuals

The 3R Guideline and 3R manual was presented to all the waste management personnel from the respective municipalities including some Chief Executive Officers and Special Administrators on November 2, 2011 at Tanoa Waterfront Hotel, Lautoka.

Since the above documents will serve as the national policy to implement 3R practices to achieve waste minimization nationwide and the driving force for this activity will be waste management personnel working at various local authorities, it is essential that they understand the 3R Guideline and utilize the 3R Promotion Manual.

The Seminar was therefore held by DOE and JET in partnership with CPs of LCC/NTC to explain this proposal to local authority waste management personnel in order to promote 3Rs using 3R Promotion Manual in accordance with 3R Guideline as a national policy on waste minimization in their respective regions.

The 3R Guideline was presented by Doe staff and CPs of LCC, whilst the 3R Manual was presented by the LCC/NTC CPs. Proposed Waste disposal and recycling legislation was also presented and discussed.