

**Lao People's Democratic Republic
Ministry of Natural Resources and Environment
Ministry of Public Works and Transport**

**Laos Pilot Program for
Narrowing the Development Gap
towards ASEAN Integration**

Environmental Management Component

**Project Completion Report
Supplement Book**

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**Japan International Cooperation Agency
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**Laos Pilot Program for
Narrowing the Development Gap towards
ASEAN Integration**

Environmental Management Component

Project Completion Report consists of the following documents.

1. Main Report (Japanese, English and Lao)
2. Supplement Book (Japanese and English)
 - Supplement 1 (Appendices for Vientiane Capital)
 - Supplement 2 (Appendices for Luang Prabang)
 - Supplement 3 (Appendices for Xayabouri)
 - Supplement 4 (Other Appendices)

Supplement Book

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Abbreviations

ASEAN	Association of South - East Asian Nations
AIESC	ASEAN Initiative on Environmentally Sustainable Cities
AP	Action Plan
AWGESC	ASEAN Working Group on Environmentally Sustainable Cities
CA	Capacity Assessment
CD	Capacity Development
C/P	Counterpart
DHHP	Department of Hygiene and Health Promotion (MOH)
DPWT	Department of Public Works and Transport
DOH	Department of Health (Provincial Level)
DONRE	Department of Natural Resources and Environment
EEA	Environmental Education and Awareness
ESC	Environmentally Sustainable Cities
IC/R	Inception Report
JICA	Japan International Cooperation Agency
LNTA	Lao National Tourism Authority
LPB	Luang Prabang District
LPP	Laos Pilot Project
LPPA	Agricultural Component of LPP
LPPE	Environmental Management Component of Laos Pilot Project
LPPO	Laos Pilot Project Office
LPPSC	Laos Pilot Project Steering Committee
M/M	Minutes of Meetings
MAF	Ministry of Agriculture and Forestry
MOFA	Ministry of Foreign Affairs
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MPWT	Ministry of Public Works and Transport
OJT	On-the-job Training
ONRE	Office of Natural Resources and Environment
PCD	Pollution Control Department
PDM	Project Design Matrix
PO	Plan of Operation
PP	Pilot Project
P/R	Progress Report
R/D	Record of Discussion
SJET	Short Term Japanese Expert Team
SWM	Solid Waste Management
T/C	Technical Committee
UDAA	Urban Development Administration Authority
UEM	Urban Environment Management
UNESCO	United Nations Educational, Scientific and Cultural Organization
VTE	Vientiane Capital
VUDAA	Vientiane Urban Development Administration Authority
XYB	Xayabouri District

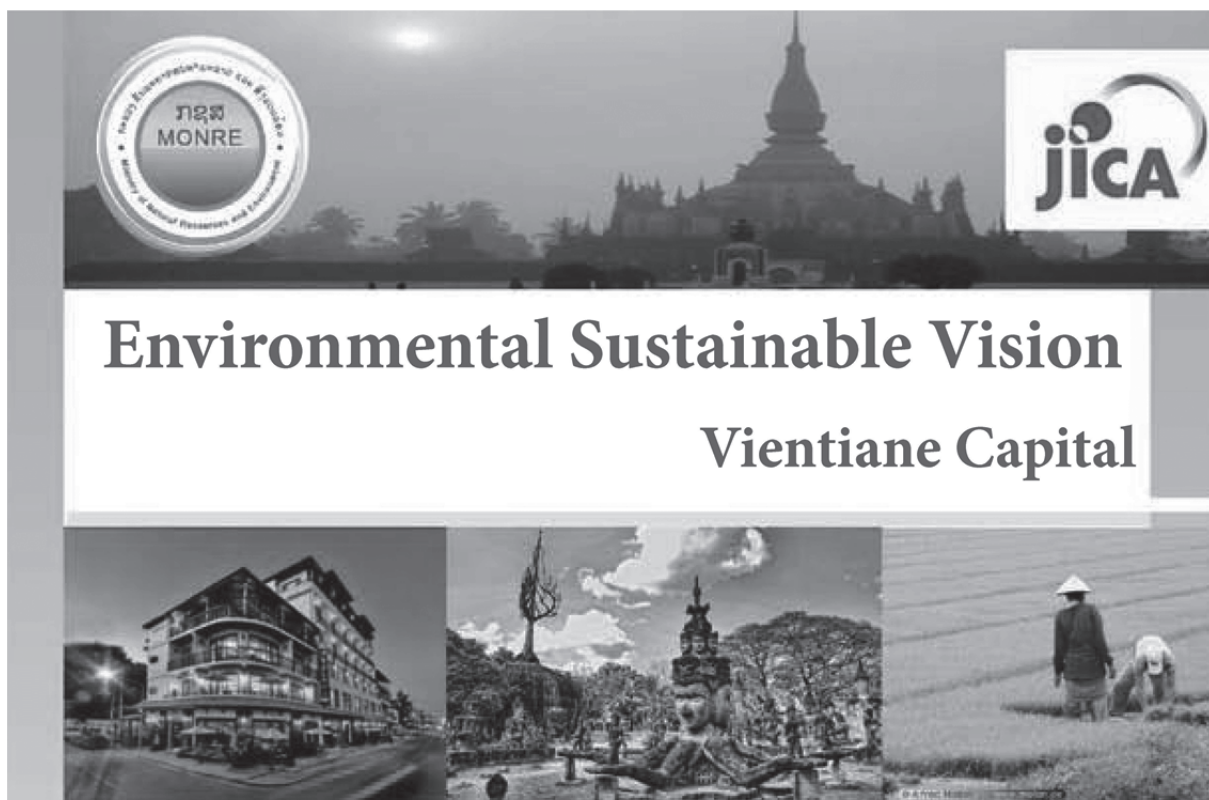
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Appendix 1. ESC Vision

ESC Vision of VTE was printed in a 4-page brochure of A3 size shown as below.



Environmental Sustainable Vision Vientiane Capital

Background

MONRE intends to encourage the cities in Laos to be clean, green and beautiful so that they become environmentally sustainable without compromising the quality of living of the next generation.

Japan International Cooperation Agency (JICA) has commenced the Laos Pilot Program for Narrowing the Development Gap towards ASEAN Integration-Environmental Management Component (LPPE) in August 2011. The LPPE has established the promotion of environmentally sustainable cities (ESC), one of the areas advocated in "Ensuring Environmental Sustainability" in the blueprint for the ASEAN socio-cultural community (ASSC), as the primary objective of the project.

The LPPE has conducted the baseline survey on urban environmental management (UEM) in 3 pilot sites (Vientiane Capital, Luang Prabang and Xayabouri) from the beginning of September 2011 by the short-term JICA expert team (SJET) in cooperation with Lao counterparts (C/P).

Based on the results of the survey, Department of Natural Resources and Environ-

ment (DONRE) and Vientiane Urban Development Administration Authority (VUDAA) of Vientiane Capital has prepared this Vision by supporting from LPPE in March 2012. DONRE and VUDAA have finalized the Vision in March 2013 reflecting the public comments received by the end of 2012.

Environmental Sustainable Vision of Vientiane Capital

Environmental sustainable vision includes an overarching goal, sector-specific goals and strategies with a view of environmental sustainability.

Vientiane Capital is part of the ASEAN Environmentally Sustainable Cities (ESC) Network. As such, the Vientiane Capital is expected to lead the way in environmental activities while ensuring economic and social development for the urban clean, green and beautiful.

This Vision is supported and involved all stakeholders, from both public and private sectors and individuals, in the movement towards and environmentally sustainable Vientiane Capital.

*ກົມຄວບຄຸມມົນລະພິດ
ກະຊວງ ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ*

*www.dopc.monre.gov.la
www.monre.gov.la*



Vision for an Environment

Safe, lighted, clean, green, civil

Sub-sector	Goal 2020	Strategy	
SOCIO-ECONOMIC ENVIRONMENT	1. Local Economy	<ul style="list-style-type: none"> ● Appropriate population management plan is implemented according to the urban development plan. 	<ul style="list-style-type: none"> → Review of population management plan in the urban development plan. → Authorization of the urban development plan
	2. Land Use	<ul style="list-style-type: none"> ● Regulation of land-use is enforced according to the urban development plan and illegal construction is controlled. 	<ul style="list-style-type: none"> → Authorization of the land use plan → Enforcement of land use regulations → Control and revelation of illegal construction
	3. Traffic and Road Condition	<ul style="list-style-type: none"> ● Road network is improved, and public transportation system (buses) and electric vehicles, etc. are introduced to reduce impact on urban environment. 	<ul style="list-style-type: none"> → Review of transport network plan → Promotion of new transport system → Road network is improved according to urban transport network plan and introduction of public transportation system and electric vehicles, etc. is considered.
	4. Urban Environmental Management Policy Implementation	<ul style="list-style-type: none"> ● Effective and practical capacity development is conducted to promote urban environmental management by implementation of 5-year Environmental Management Action Plan. 	<ul style="list-style-type: none"> → 5-year Environmental Management Action Plan is realized. → Capacity development is carried out continuously since capacity development is prioritized in each environmental action plan of MONRE and DONRE of Vientiane Capital.
	5. Poverty	<ul style="list-style-type: none"> ● Millenium Development Goal is achieved according to the poverty eradication program. 	<ul style="list-style-type: none"> → Review of the poverty eradication program → The situation of poverty is studied in rural area of Vientiane Capital.
	6. Landscape	<ul style="list-style-type: none"> ● Current aesthetic urban landscape is conserved according to the urban development plan. 	<ul style="list-style-type: none"> → Review of urban development plan from the viewpoint of landscape conservation.
	7. Cultural Heritage	<ul style="list-style-type: none"> ● MoICT cooperates with DPWT for urban development planning to conserve cultural heritages. 	<ul style="list-style-type: none"> → National and provincial (capital) cultural heritages are designated.
	8. Health	<ul style="list-style-type: none"> ● Health care service can be accessed even in remote rural area in Vientiane Capital. 	<ul style="list-style-type: none"> → The situation of villagers who cannot access to primary health care is surveyed. → Medical kits are provided to the villagers who cannot go to health care center.
	9. Environmental Awareness	<ul style="list-style-type: none"> ● People follows rules and regulations to make the city clean and beautiful. 	<ul style="list-style-type: none"> → Rules and regulations are clearly explained to people. → Useful education tools are developed and utilized.
	10. Stormwater Management	<ul style="list-style-type: none"> ● The frequency of the events of water clogging and stagnation decreases. 	<ul style="list-style-type: none"> → Improvement of drainage system
	11. Biodiversity	<ul style="list-style-type: none"> ● Natural environment abundant in flora and fauna surrounding central area is protected to conserve a green city. 	<ul style="list-style-type: none"> → National, Provincial (Capital) and District Biodiversity Conservation Areas in Vientiane Capital are monitored strictly to prevent illegal cutting.
	12. Forest Resources	<ul style="list-style-type: none"> ● Illegal felling is monitored and controlled regularly. 	<ul style="list-style-type: none"> → Budget allocation and staff training are urgently implemented to monitor and control illegal cutting.
	13. Urban Green Area	<ul style="list-style-type: none"> ● The citizens can enjoy accessible green in the public parks in Vientiane Capital. 	<ul style="list-style-type: none"> → The area of public urban parks is extended so that citizens can enjoy accessible green.

mentally Sustainable Vientiane Capital

lized and charming Vientiane; it is the sustainable city.

Sub-sector	Goal 2020	Strategy
NATURAL ENVIRONMENT	14. Nature Reserve	<ul style="list-style-type: none"> ● That Luang Marsh is conserved for sustainable development of Vientiane Capital. <ul style="list-style-type: none"> → That Luang Marsh is conserved for sustainable development of VTE Capital by making legislative preparation and public information after formulating a wetland management plan. → Field survey is carried out by experts and zoning is conducted. → Wetland management plan is prepared and authorized. → Conservation of the wetland is enforced. → Concrete action plan is prepared and implemented.
	15. Global Warming	<ul style="list-style-type: none"> ● Concrete action plan is implemented.
SOCIO-LIVING ENVIRONMENT	16. Air Quality	<ul style="list-style-type: none"> ● Air quality is maintained at an acceptable level <ul style="list-style-type: none"> → Air quality is regularly monitored. → Vehicle emission is effectively inspected. → The capacity of the government staff in charge of air quality management is strengthened.
	17. Water Quality	<ul style="list-style-type: none"> ● Water quality is ensured by regular monitoring <ul style="list-style-type: none"> → Legal system and guidelines related to water environment are strengthened. → Robust water quality monitoring network is established. → Water monitoring and pollution control system against problematic point sources is established.
	18. Safe Drinking Water	<ul style="list-style-type: none"> ● The 7th Five Year Plan of VTE Capital “the whole area of VTE Capital should be covered by water supply system by 2020” is realized. <ul style="list-style-type: none"> → Practical action plans should be developed and implemented.
	19. Sanitation	<ul style="list-style-type: none"> ● Access to sustainable wastewater facilities and services increase in the urban areas of Vientiane Capital <ul style="list-style-type: none"> → Step-wise wastewater improvement plan is established and implemented in accordance with characteristics of pollution sources.
	20. Soil Contamination	<ul style="list-style-type: none"> ● The system of monitoring and controlling pesticide and chemical fertilizer according to the new regulation is strengthened and proper amount is utilized in agricultural land. <ul style="list-style-type: none"> → Personnel, equipment and budget are prepared to monitor and control pesticide and chemical fertilizer according to the new regulation. → Capacity development of staff → Procurement of equipment → Allocation of government budget
	21. Solid Waste Management	<ul style="list-style-type: none"> ● A sound solid waste management system is established in harmony with the city environment and development <ul style="list-style-type: none"> → “3Rs” are promoted at generation sources. → Waste collection and transportation system is improved to keep the city clean and raise its efficiency. → Final disposal system is improved to mitigate adverse impacts on the surrounding areas. → Healthcare waste management is improved. → An official document that defines the solid waste management system is drafted.
	22. Noise/Vibration	<ul style="list-style-type: none"> ● Noise and vibration problems are suppressed to an acceptable level. <ul style="list-style-type: none"> → Noise is regularly monitored. → The capacity of the government staff in charge of noise control is strengthened.
	23. Accident	<ul style="list-style-type: none"> ● Traffic accidents decrease year by year. <ul style="list-style-type: none"> → Traffic control, vehicle maintenance, safety education and training of drivers and campaign of traffic safety for students are conducted continuously.



You can access this vision on website at <http://bit.ly/zBcoML>.

How the Vision was made

The first step was gaining an overall understanding of the current urban environmental status by baseline survey related to urban environment conservation. During survey period from September to December 2011 by DONRE, VUDAA of Vientiane Capital and experts dispatched by JICA, the information was collected and analyzed to present conditions of urban environment management according to the 29 sector categories as shown below.



Social Environment

1. Local economy
2. Land use
3. Traffic and road condition
4. UEM policy
5. Poverty
6. Ethnic people
7. Landscape
8. Gender
9. Children's rights
10. Cultural heritage
11. Health
12. Environmental awareness

Natural Environment

1. Stormwater Management
2. Biodiversity
3. Forest resources
4. Urban green area
5. Nature reserve
6. Global warming
7. Mineral resources development

Socio-Living Environment

1. Air quality
2. Water quality
3. Safe drinking water
4. Sanitation
5. Soil contamination
6. Solid waste management
7. Noise/vibration
8. Land subsidence
9. Odor
10. Accident

The second step was “scoping” based on the results of the current status assessment of each sector and a checklist for issue finding, 23 sectors were selected as those which require further actions in light of environmental sustainability.

The next step was to define a vision. As mentioned earlier, a vision is a short statement to express the future desired image of the city. The vision must compromise with the slogan of “6S” in the development goal of Vientiane Capital endorsed by the IVth party conference in 2006. All related agencies will build strategies and work plan in order to achieve the goal. DONRE and VUDAA of Vientiane Capital and JICA under LPPE's project will review the plan in all periods systematically.

Procedure Afterward

Submitted comments and our responses through website: <http://bit.ly/zBcoML>.

The vision will serve as a foothold to develop further action plans and projects in Vientiane Capital until year 2015. Although LPPE's projects are mostly for the waste sector, the Vientiane Capital intends to plan and carry out pilot projects for other sectors by making the best lessons learnt from the LPPE.

For details of the LPPE, please contact at: lppepcdteam@hotmail.com

Appendix 2. Action Plan for the Improvement of Solid Waste Management

1 Introduction of Action Plan Formulation

1.1 Formulation Procedure

The national guidelines for environmentally sustainable cities (ESC_GL) states that an action plan (A/P) is to be formulated through the process flow as shown in the figure below.

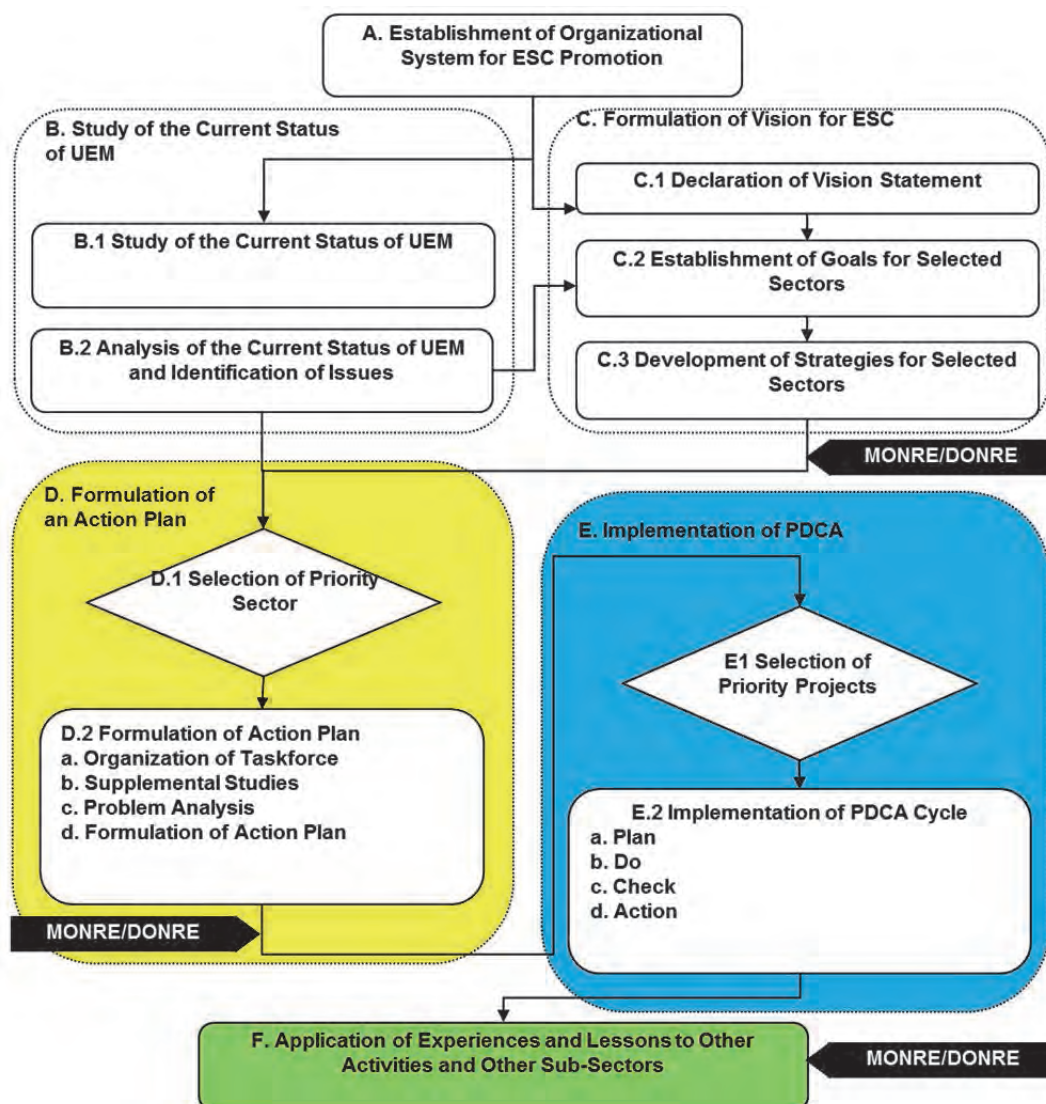


Figure 1: Process Flow for ESC and Action plan

1.2 Structure of the A/P

As shown in the figure above, the A/P is the final output of Process Flow D, and only priority projects in the A/P will proceed to Process Flow E. In other words, the projects in the A/P which are not given priority will be suspended without any clear commitment of implementation. Therefore,

practically speaking, the A/P as an output of Process Flow D can be a simple framework leaving the detailed planning work to Process Flow E.

Accordingly, in case of A/P formulation for VTE by LPPE, the output of Process Flow D is rather a framework of the A/P. On the contrary, taking account of technical and financial input available through the LPPE, most of the activities that were able to start by LPPE were considered to be the priority projects and all their plans were formulated. Consequently, the A/P Framework and a package of plans of individual priority projects compose the A/P (see Figure 2).

Chapter 2 is going to show the A/P Framework after describing how it was formulated according to the Process Flow of D. Chapter 3 is a series of plans of priority projects, for which LPPE's assistance is available by 2015.

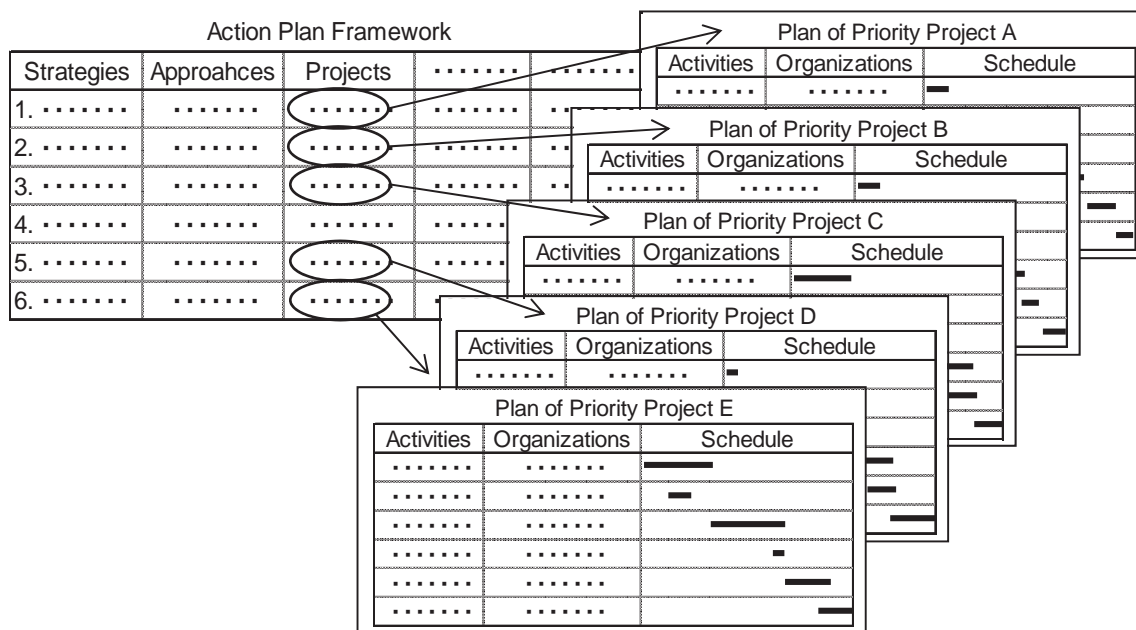


Figure 2. Structure of the Action Plan

2 The Framework of the A/P

2.1 Selection of Priority Sector (D.1 of ESC_GL)

After the formulation of the ESC vision of VTE, the ESC promotion team, which consisted of DONRE, VUDAA and DPWT of VTE, selected SWM as a priority sector for ESC promotion by February 2012.

2.2 Organization of Taskforce (D.2a of ESC_GL)

After the SWM sector was selected as the priority sector of ESC promotion for VTE, the ESC promotion team organized a taskforce for the improvement of SWM in VTE consisting of DONRE, DPWT, VUDAA and SJET, considering their roles and responsibilities in the area of SWM. The taskforce was chaired by the deputy director general of DONRE.

2.3 Implementation of Supplemental Studies (D.2b of ESC_GL)

The taskforce decided to conduct supplemental studies to understand the current SWM for formulation of the A/P. The supplemental studies included waste amount and composition study, waste collection study, final disposal site study, recyclables dealer study and healthcare waste management study.

The main features on SWM identified by the studies are shown below. Further details about the study results were shown in the Supplemental Report of March 2012.

Table 1. Waste Generation in VTE

Area	Waste Generation Amount (g/capita/day)
Urban Area	686
Suburban Area	695
Weighted average	691

Table 2. Waste Composition in VTE

Waste Types	Composition (%)
Kitchen Waste	34
Wood	30
Paper	7
Plastics	12
Glass	7
Textile	5
Metal	1
Leather, rubber	3
Inert (sand and stone)	1
Others	0
Total	100

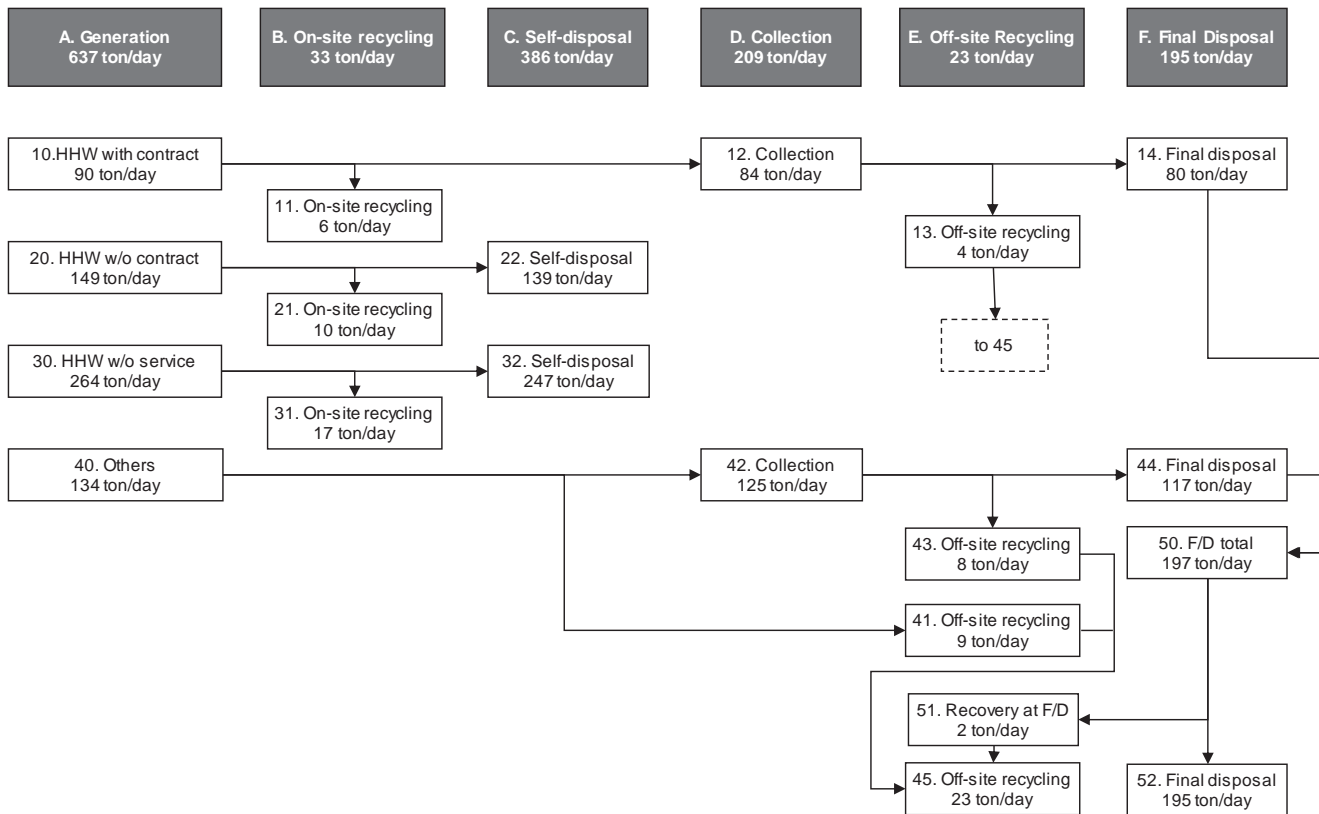


Figure 3. Waste Stream in VTE

2.4 Problem Analysis (D.2c of ESC_GL)

Results of the supplemental studies were analyzed to identify the current problems. Proper understanding of the problems is significantly effective to make a feasible plan. The specific problems related to the Goal of the SWM sector, “A Sound SWM is established in harmony with the city environment”, were identified as shown below.

- ✓ Low recycling rate: 8.8 (56/637) % of the total waste generation was recycled. The waste recycled at households was 5.2 (33/637) %. This could be raised more with the fact that as much as 64% of waste generated at households was kitchen waste and garden waste, which were organic and compostable.
- ✓ Insufficient coverage of waste collection service: The waste collection contract covered only 14,1 (90/637) % of waste generated at households. Even in the served area, contract rate is only 37.7 (90/239) %. As a result, as much as 60.6 (386/637) % of waste was disposed of by households (self-disposal).
- ✓ Costly waste transportation: The KM32 disposal site is far from the city center, as its name implies. Long distance transportation raised the transportation cost and decreased the efficiency of collection vehicle use.
- ✓ Open dumping operation: The final disposal site was almost a simple waste dump without proper management and there was no systematic dumping rule. The site was giving serious adverse impacts on surrounding area and difficult to manage during the rainy seasons. The existing treatment facility for sludge from septic tanks was not functioning well and needed improvement to allow appropriate operation and maintenance.

- ✓ Improper healthcare waste management: Although there was an isolated special pit for infectious waste, yellow bags of infectious waste were often found in the normal disposal area. At the isolated area, there was no any facility to reduce possible risks caused by infectious substances. Considering the volume of infectious waste (about 300 kg/day only from five major hospitals) and the large number of waste pickers, the introduction of infectious waste treatment was required.

2.5 Formulation of Action Plan (D.2d of ESC_GL)

Upon consideration of the results of the supplementary studies and the Goal of SWM sector, the strategies developed in Process Flow C were reviewed and 5 strategies were re-established. Also, the condition of the A/P was set as below.

Goal: A sound solid waste management system is established in harmony with the city environment and development.

Target Year: 2020

In view of these goal and target year, necessary approaches were proposed under the each strategy so as to facilitate the formulation of the specific projects.

Strategy 1: "3Rs" are promoted.

Approach 1.1: "3Rs" are promoted at on-site to reduce waste generation amount.

The methodology to promote 3Rs varies and this approach aims to integrate 3R activities into the daily waste management practices at households. A household is a source of waste, but it has an important role before waste discharging; 3Rs. 3Rs at households are also important as they are essential forms of community-based waste management.

Strategy 2: Waste collection system is improved through the strengthening of collection service capacity and enhancement of public cooperation.

Approach 2.1: Existing collection and discharge system is improved.

Approach 2.2: Waste collection service area is expanded.

Approach 2.3: The efficiency of waste transportation is increased.

In VTE, even with the collection service, it is typically provided only to households along the main streets. Approach 2.1 is going to address this issue by facilitating the dialogue between the service providers (VUDAA or primate companies) and the villages. By doing so, the increase of new collection contracts is also expected, which is in line with Approach 2.2.. Moreover, Approach 2.2 simply aims to provide collection service to new areas. Approach 2.3 focuses on the cost saving of waste transportation.

Strategy 3: Final disposal system is improved to mitigate adverse impacts on the surrounding areas.

Approach 3.1: The final disposal site is managed properly to dispose of waste properly.

Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.

The final disposal site in VTE receives general waste and sludge from septic tanks and those requires respective technical procedures and facility. Two approaches listed above are to improve the management of both kinds of waste.

Strategy 4: Healthcare waste management (HCWM) is improved.

Approach 4.1: Healthcare waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.

Approach 4.2: HCW is disposed of properly to prevent the expansion of infectious pathogen at the disposal site.

Due to the presence of infectious items, HCW must be disposed of in a safe manner and the safe disposal in turn requires appropriate collection and transfer of HCW. In this light, HCWM is considered to have a transfer stage and a disposal stage, both of which are addressed by individual approaches.

Strategy 5: Institutional system to support the above improvements is established.

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

Approach 5.2: Financial system necessary for proper SWM is improved.

SWM involves wide range of stakeholders including governmental organizations, private sectors, and the general public. Approach 5.1 is to ensure their collaboration and to optimize their coordination. Further, Approach 5.2 attempts to strengthen the financial basis for SWM, as any technical solutions of SWM are only effective when they are sustainably operated and maintained with a financial background.

In order to materialize these approaches, specific projects are proposed for each of the approaches. The A/P Framework, consisting of strategies, approaches and projects, is thus produced as shown in Table 3.

Table 3. A/P for the Improvement of SWM in VTE for Year 2020

Strategies	Approaches	Projects	Activities	Local Responsible Organizations	Time Schedule	
1."3Rs" are promoted.	1.1 "3Rs" are promoted at on-site to reduce waste generation amount.	1.1.1. Reduction of kitchen waste and garden waste at households	Project planning	DONRE	By June 2012	
			Planning of PP	DONRE	By June 2013	
			Implementation of PP	DONRE	By October 2015	
			Dissemination of PP	DONRE, (VUDAA)	Nov 2015 to 2020	
		1.1.2. Recyclable waste separation at generation sources	Integrated in the "Primary Collection System Project", 2.1.1 and 2.1.2, Strategy 2			
		1.1.3 Avoidance of the use of excess packages such as plastic shopping bags	Project planning	DONRE	By June 2012	
			Planning of PP	DONRE	By June 2013	
			Implementation of PP	DONRE	By October 2015	
			Dissemination of PP	DONRE, (VUDAA)	Nov 2015 to 2020	
		2. Waste collection system is improved through the strengthening of collection service capacity and enhancement of public cooperation.	2.1 Existing collection and discharge system is improved.	2.1.1 Improvement of exiting collection system	a. Primary collection system project	Project planning
Planning of PP	VUDAA					By March 2014
2.1.2 Improvement of existing waste discharge system	Implementation of PP				VUDAA	By October 2015
	Dissemination of PP				VUDAA	Nov 2015 to 2020
2.2 Waste collection service area is expanded.	2.2.1 Waste collection service planning		Baseline Survey	VUDAA	By December 2012	
			Drafting the Plan	VUDAA	By August 2013	
			Review and Detail Planning	VUDAA	By October 2015	
			Implementation of Plan	VUDAA	Nov 2015 to 2020	
	2.2.2 Increase of collection service contract rate		In connection with the "Primary Collection System Project", 2.1.1 and 2.1.2, Strategy 2			
	2.2.3 Waste collection using collection vehicles		Project planning	VUDAA	By Oct 2015	
			Vehicle procurement	VUDAA	By Nov 2015	
			Contract negotiation	VUDAA	From Oct 2015	
			Collection service provision	VUDAA	From Dec 2015	
	2.3 The efficiency of waste transportation is increased.		2.3.1 Development of waste transfer station	Project concept planning	VUDAA	By June 2012
Planning of Grant Aid Project				JICA, VUDAA, MPWT	By February 2014	
Construction of T/S and procurement of Vehicles				JICA, VUDAA, MPWT	By October 2015	
Operation and Maintenance		VUDAA		Nov 2015 to 2020		

3. Final disposal system is improved to mitigate adverse impacts on the surrounding areas.	3.1 The final disposal site is managed to dispose of waste properly.	3.1.1 Proper management of existing final disposal site.	Project planning	VUDAA, DONRE	By June 2012		
			Planning of PP	VUDAA, DONRE	By December 2012		
			Implementation of PP	VUDAA, DONRE	By October 2015		
		3.1.2. Proper management of waste pickers and improvement of their working conditions	Operation and Maintenance	VUDAA, DONRE	Nov 2015 to 2020		
			Project planning	VUDAA, DONRE	By June 2012		
			Planning of PP	VUDAA, DONRE	By December 2012		
	3.2 Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.	3.2.1. Development and management of the treatment facility for the sludge from septic tanks	Implementation of PP	VUDAA, DONRE	By October 2015		
			Management of waste pickers	VUDAA, DONRE	Nov 2015 to 2020		
			Project planning	VUDAA, DONRE	By June 2012		
		4.1.1. HCW collection system establishment	Planning of PP	VUDAA, DONRE	By December 2012		
			Implementation of PP	VUDAA, DONRE	By October 2015		
			Operation and Maintenance	VUDAA, DONRE	Nov 2015 to 2020		
4. Healthcare waste management (HCW) is improved.	4.1 Health care waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.	4.1.1. HCW collection system establishment	Project planning	VUDAA, MOH, DOH,	By May 2012		
			Planning of PP	VUDAA, MOH, DOH,	By April 2013		
			Implementation of PP	VUDAA, MOH, DOH,	By October 2015		
		4.2 HCW is disposed of properly to prevent the expansion of infectious pathogen at the disposal site.	4.2.1. HCW treatment and disposal system establishment	Dissemination of PP	VUDAA, MOH, DOH,	Nov 2015 to 2020	
				Project planning	VUDAA, MOH, DOH,	By May 2012	
				Planning of PP	VUDAA, MOH, DOH,	By April 2013	
	5. Institutional system to support the above improvements be established	5.1 The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.	5.1.1 Consensus building among stakeholders	Implementation of PP	VUDAA, MOH, DOH,	By October 2015	
				Dissemination of PP	VUDAA, DONRE, MOH, DOH	Nov 2015 to 2020	
				Project planning	VUDAA, DONRE, MOH, DOH	By May 2012	
			5.2 Financial system necessary for proper SWM is improved.	5.2.1 Financial System Improvement	Planning of PP	VUDAA, DONRE, MOH, DOH	By April 2013
					Implementation of PP	VUDAA, DONRE, MOH, DOH	By October 2015
					Dissemination of PP	VUDAA, DONRE, MOH, DOH	Nov 2015 to 2020

PP: Pilot Project

3 Plans of the Priority Projects of the Action Plan

According to the Process Flow, the next process is to select priority projects from the A/P. Taking account of the availability of assistance from LPPE, most of the projects were considered to be the priority projects. The exception were Project 2.2.3 “waste collection by collection vehicles” and “Project 2.3.1 Development of waste transfer station”, as these were only possible with facility and equipment which required excessive input to LPPE in terms of finance and time. Nevertheless, they were put into practice with the grant assistance by the Government of Japan.

The following sections describe the plans of the priority projects, which comprise the A/P together with the A/P Framework.

3.1 Strategy 1: 3Rs Promotion

Approach 1.1: “3Rs” are promoted on-site to reduce waste generation amount.

Project 1.1.1: Reduction of kitchen waste and garden waste at households

Because of the large proportion of organic component, composting is deemed to be a plausible solution to reduce waste to be discharged from the generation sources. Project 1.1.1 is to promote composting at the generation sources and is called **On-site Composting Project**. The plan of the project is shown in the table below and the activities up to 2015 of LPPE are considered to be a PP.

Area of PP: B. Hongsupharp, B. Nonesavanh, B. Amone, B. Nonesavang (65 households, estimated 338 people)

Target of PP: The rate of the households that continue on-site compost to all the households that started on-site compost in all the pilot villages is 60%.

After the completion of the PP by LPPE, DONRE, and VUDAA when appropriate, shall disseminate the PP to other area of VTE based on the lessons learned from the PP.

Table 4. Plan of On-site Composting Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, SJET	■				
	Set up concept	DONRE, SJET	■				
Planning of PP	Study and selection of pilot area	DONRE, SJET	■				
	Study of composting method	SJET		■			
	Procurement of equipment	SJET		■			
	Preparation of education tools	DONRE, SJET		■			
Implementation of PP	Delivery of equipment and instruction of method	DONRE, SJET		■			
	Monitoring and awareness raising	DONRE, SJET			■	■	■
	Evaluation of the PP	DONRE, SJET				■	
	Suggestion for dissemination	SJET				■	
Dissemination of PP	Planning of dissemination	DONRE, (VUDAA)				■	
	Dissemination to other area	DONRE, (VUDAA)					■

Project 1.1.2: Recyclable waste separation at generation sources

Recyclable waste that has trading market can be diverted from waste management provided that it is separated from waste. The project to promote recyclable waste separation at generation sources is called **Waste Separation Project**.

It promotes the separation of recyclable waste at households in connection with the introduction of a primary collection system described in the later section of Strategy 2, waste collection system. Refer to the section of “Primary collection system” for more detail.

After the completion of the PP by LPPE, DONRE and VUDAA shall disseminate the PP to other area of VTE based on the lessons learned from the PP.

Project 1.1.3: Avoidance of the use of excess packages such as plastic shopping bags

The most favorable waste management will be to cut the possibility to generate waste in the first place. This does not require not only waste disposal but also waste reuse or waste recycling. What the general public can do for this is, however, not many, but one approach that is relatively easy to try is to avoid using excess packages such as plastic shopping bags. Project 1.1.3 is therefore selected as a priority project called **Eco-basket Project**.

For the general households, baskets are preferred than bags as the baskets can be washed and cleaned. The plan of the eco-basket project is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Area of PP:	B. Hongsupharp, B. Nonesavanh, B. Amone, B. Nonesavang, Houa Khua Market (1,795 households, about 9,334 people + 500 people in the market + 800 people in other area of phase II)
Target of PP:	The rate of the households that refuse plastic bags as many as possible to all the households in all the pilot villages is 40%.

After the completion of the PP by LPPE, DONRE, and VUDAA when appropriate, shall disseminate the PP to other area of VTE based on the lessons learned from the PP.

Table 5. Plan of Eco-basket Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, SJET	■				
	Set up concept	DONRE, SJET	■				
Planning of PP	Study and selection of pilot area	DONRE, SJET	■				
	Procurement of equipment	SJET		■			
	Preparation of education tools	DONRE, SJET		■			
Implementation of PP	Delivery of equipment and instruction of use	DONRE, SJET		■			
	Monitoring and awareness raising	DONRE, SJET			■		
	Evaluation of the PP	DONRE, SJET				■	
	Suggestion for dissemination	SJET				■	
Dissemination of PP	Planning of dissemination	DONRE, (VUDAA)				■	
	Dissemination to other area	DONRE, (VUDAA)					■

3.2 Strategy 2: Waste Collection System

Approach 2.1: Improvement of existing collection and discharge system

Project 2.1.1: Improvement of existing collection system

Project 2.1.2: Improvement of existing waste discharge system

Approach 2.1 has two projects: one is for waste collectors and the other for waste generators. These two are combined to one priority project called **Primary Collection System Project**, and its activities up to 2015 of LPPE are planned as a PP.

Wheeled waste bins are provided to the groups of households who live along streets inaccessible for the waste collection vehicles. The bins are managed by those households on a rotating basis. The household on duty during a particular period collects waste from other households of the group and brings the bin to the nearest waste discharge point on a collection day.

Besides, a discharge rule which is set up by the project promotes the households to separate recyclable waste in order to minimize the amount of waste to be collected and transported to the disposal site. The residents shall separate the recyclables to sell it to dealers so as not to discharge them on regular waste collection service.

Area of PP: B. Hongsupharp, B. Nonesavanh, B. Amone, B. Nonesavang (160 households, estimated 832 people), in Xaysettha district
2 villages in Sisathanak district

Target of PP: 1. Primary collection system by using collection bins covers 125 households in the inaccessible road of collection vehicles in 4 pilot project villages.

2. Primary collection system by using collection bins for inaccessible road of collection vehicles will be expanded to the two new villages and cover 25 households by the initiative of VUDAA.
3. The rate of the households that separately discharge recyclable waste to all the households covered by primary collection PP: 70%
4. Waste management groups are established in the existing collection improvement pilot villages.
5. The rate of the cooperating households to all the households covered by the primary collection PP: 70%

After the completion of the PP by LPPE, VUDAA shall extend the primary collection system based on the lessons learned from the PP.

Table 6. Plan of Primary Collection System Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	SJET, VUDAA	■				
	Set up concept	SJET, VUDAA		■			
Planning and Preparation PP	Study and selection of pilot area	SJET, VUDAA		■			
	Collection system determination	SJET, VUDAA			■		
	Procurement of equipment	SJET			■		
	Preparation of education tools	SJET, VUDAA			■		
Implementation of PP	Delivery of equipment and instruction of method	SJET, VUDAA			■		
	Monitoring and awareness raising	SJET, VUDAA			■	■	
	Pre-dissemination	VUDAA			■	■	
	Evaluation of the PP	VUDAA, DONRE, SJET				■	
	Suggestion for dissemination	SJET				■	
Dissemination of PP	Planning a roadmap to 2020	VUDAA					■
	Dissemination to the priority area	VUDAA					■
	Dissemination to the other area	VUDAA					■

Approach 2.2: Expansion of waste collection service area

Project 2.2.1: Waste collection service planning

Waste collection service plan is indispensable to expand waste collection service from the mid to long term viewpoint. Starting from the analysis of present situation such as the waste collection service coverage status, waste collection amount and others, the project should stipulate the policy regarding where to be covered by the target year. The activities up to 2015 are considered to be a PP of LPPE.

Target Area: Whole Vientiane Capital, about 500 villages (205,406 households 1,074,999 people in 2020 predicted)

Target of PP: A waste collection and transportation plan is formulated

After the completion of the PP by LPPE, VUDAA shall regularly review and update the plan in case on necessity based on the lessons learned from the PP.

Table 7. Plan of Waste Collection Service Planning Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Baseline Survey	The first determination of present waste stream flow-chart	SJET, VUDAA	■				
	Detailed survey	SJET, VUDAA	■				
Drafting the Plan	Sharing the survey result among stake holders	SJET, VUDAA		■			
	Discussion and consideration internally by the local authority	VUDAA		■			
	Drafting the plan in rough scale	SJET, VUDAA,		■			
Review and Updating the Plan	Monitoring and watching the progress concerned about solid waste management	VUDAA			■	■	
	Reviewing and detail planning comparing between the draft and latest situation	VUDAA				■	■

Project 2.2.2: Increase of collection service contract rate

The survey of project revealed that Vientiane capital has been faced to characteristic problem which is lower waste service contract rate compared to other cities. It is approximately less than 40% in central districts where certain amount of people lives and was developed whereas other 2 cities are regarded almost 100% in that similar corresponding area.

Project 2.2.2 therefore aims to expand the collection rate. However, it is tightly connected to the “Primary Collection System”, 2.1.1 and 2.1.2, Strategy 2 since that main portion of people, who has not contracted, is supposed to live in inaccessible street for the collection vehicle. The project basically applied the method to encourage the contract which provides the wheeled waste bins to the only households who contracted so that people would be covered the primary collection system. Or else as more regular way, for the households in accessible street, the private collection company attempted to persuade people to contract in cooperation with VUDAA and village office.

The activities up to 2015 are considered as a PP of LPPE.

Area of PP: B. Hongsupharp, B. Nonesavanh, B. Amone, B. Nonesavang (around 1,800 households, about 9,360 people), in Xaysettha district

- Target of PP:
1. Collection coverage (Contracted) rate of collection service in 4 pilot project villages increases from 33% in November 2013 to 50% in December 2014.
 2. The fee payment rate of the households in 4 pilot project villages that newly make collection service contracts with the collection company maintains 90 %.

After the completion of the PP by LPPE, VUDAA shall disseminate the PP to other area of VTE based on the lessons learned from the PP.

The schedule, refer to the “Primary Collection System”, 2.1.1 and 2.1.2, Strategy 2

3.3 Strategy 3: Final disposal system is improved to mitigate adverse impacts on the surrounding areas

Approach 3.1: The final disposal site is managed to dispose of waste properly.

Project 3.1.1: Proper management of existing final disposal site

The project to conduct the proper management of existing final disposal site is selected as a priority project and its activities up to 2015 is planned as a pilot project.

Target Area: KM32 existing disposal site

- Target of PP:
1. An operation plan of the final disposal site is formulated.
 2. The final disposal site is operated in accordance with the operation plan.
 3. The final disposal site is monitored by the final disposal site monitoring committee once a year.

After the completion of the PP by LPPE, VUDAA shall carry out operation and maintenance of existing final disposal site while DONRE shall continue site monitoring based on the lessons learned from the PP.

Table 8. Plan of the Project for the Proper Management of Existing Final Disposal Site

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET,	■				
	Set up concept	VUDAA, SJET,	■				
Planning of PP	Identify and study the pilot area at KM32 existing final disposal site	VUDAA, SJET,	■				
	Formulation of improvement plan of infrastructure at KM32 existing final disposal site	VUDAA, SJET,	■				
	Formulation of draft operation plan at KM32 existing final disposal site	VUDAA, SJET,		■			
	Formulation of operation plan reflecting the Grant aid project	VUDAA, SJET,		■	■	■	
Implementation of PP	Improvement of KM32 existing final disposal site and procurement of heavy machinery	SJET	■	■			
	Proper operation of KM32 existing final disposal site	VUDAA, SJET		■	■	■	■
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET				■	
	Suggestion for continuation	SJET				■	
Operation and maintenance	Operation and maintenance of existing final disposal site	VUDAA					■
	Site monitoring	DONRE					▲

Project 3.1.2: Proper management of waste pickers and improvement of their working conditions

The project to manage waste pickers and improve their working conditions is selected as a priority project. As they often work nearby the heavy machinery operating at the waste dumping point, the management of their activities is important for their safety and for proper site operation.

The project plan is shown in the table below and the activities up to 2015 were considered to be a PP of LPPE.

Target Area: KM32 existing disposal site

- Target of PP:
1. A management plan of waste pickers is formulated.
 2. The waste pickers working conditions is improved in accordance with the management plan.
 3. The management of waste pickers is monitored by waste pickers meeting.

After the completion of the PP by LPPE, DONRE and VUDAA shall continue the activities of the PP based on the lessons learned from the PP.

Table 9. Plan of the Project for the Proper Management of Waste Pickers and Improvement of their Working Conditions

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET	■				
	Set up concept	VUDAA, SJET	■				
Planning of PP	Identify the waste pickers	VUDAA, SJET	■				
	Formulation of management and improvement plan	VUDAA, SJET	■				
Implementation of PP	Management of Waste Pickers and Improvement of their Working Conditions	VUDAA, SJET	■				
	Waste pickers meeting	VUDAA, DONRE, SJET	▲	▲		▲	
	Evaluation of the PP	SJET				■	
	Suggestion for continuation	SJET				■	
Management of waste pickers	Management of Waste Pickers and Improvement of their Working Conditions	VUDAA					■
	Waste pickers meetings	DONRE, VUDAA					▲ ▲ ▲

Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment

Project 3.2.1: Development and management of the treatment facility for the sludge from septic tanks

The project to introduce and manage the proper treatment facility for the sludge from septic tanks is selected as a PP of LPPE. The project plan is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Area of PP: KM32 existing disposal site

- Target of PP:
1. An operation plan of the treatment facility for the sludge from septic tanks is formulated.
 2. The treatment facility for the sludge from septic tanks is operated in accordance with the operation plan.
 3. The treatment facility for the sludge from septic tanks is monitored by the final disposal site monitoring committee once a year.

After the completion of the PP by LPPE, VUDAA shall carry out operation and maintenance of the sludge from septic tanks while DONRE shall continue site monitoring based on the lessons learned from the PP.

Table 10. Plan of the Project for the Development and Management of the Treatment Facility for the Sludge from Septic Tanks

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET	■				
	Set up concept	VUDAA, SJET	■				
Planning of PP	Identify and study the pilot area at KM32 existing final disposal site	VUDAA, SJET	■				
	Formulation of improvement plan of infrastructure	VUDAA, SJET	■				
	Formulation of draft operation plan of treatment facility for the sludge from septic tanks	VUDAA, SJET		■			
	Formulation of operation plan reflecting the Grant aid project	VUDAA, SJET		■	■	■	
Implementation of PP	Establishment of treatment facility for the sludge from septic tanks	SJET	■	■			
	Proper operation of treatment facility for the sludge from septic tanks	VUDAA, SJET		■	■	■	■
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET				■	
	Suggestion for continuation	SJET				■	
Operation and maintenance	Operation and maintenance of treatment facility for the sludge from septic tanks	VUDAA					■
	Site monitoring	DONRE					▲

3.4 Strategy 4: Improvement of Healthcare Waste Management (HCWM)

Approach 4.1: Healthcare waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.

Project 4.1.1: HCW collection system establishment

The project to establish the collection and transportation system of HCW and monitoring system is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Target hospitals of PP: 7 Main hospitals, namely Mahosot Hospital, Sethathirath Hospital, Friendship Hospital, Military Hospital (103 Hospital), Police Hospital (5 April Hospital)), Mother and Child Hospital, and Child Hospital

- Target of PP:
1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.
 2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.

After the completion of the PP by LPPE, VUDAA, MOH and DOH shall extend the system to receive HCW from other hospitals based on the lessons learned from the PP.

Table 11. HCW Collection System Establishment Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, MOH, DOH, SJET	■				
	Set up concept	SJET, VUDAA, MOH, DOH, ,	■				
Planning of PP	Study and selection of pilot hospitals	VUDAA, SJET, MOH, DOH, ,	■				
	Preparation of collection and transportation PP plan	SJET, VUDAA, MOH, DOH,	■				
Implementation of PP	Preparation of education tools	SJET, DOH, DONRE, VUDAA		■			
	Collection of separated HCW *1	VUDAA, MOH, DOH, SJET			■	■	■
	Monitoring and awareness raising	MOH, DOH, VUDAA, SJET			■	■	
	Evaluation of the PP	SJET, MOH, DOH, VUDAA				■	
	Formulation of collection and transportation plan	SJET, VUDAA, MOH, DOH,			■	■	
	Suggestion for expansion	SJET, VUDAA, MOH, DOH				■	
Dissemination of PP	Instruction to medical institutions	MOH, DOH, VUDAA				■	■
	Implementation of separated HCW collection	VUDAA, MOH, DOH				■	■

Note: *1: Separate HCW collection had been conducted by VUDAA even before the PP. In this table, the separated HCW collection means collection of HCW separated in a manner suitable for incineration from from targeted hospitals.

3.5 Strategy 5: Establishment of Institutional System to Support PPs Implementation

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

Project 5.1.1: Consensus building among stakeholders

The project to codify the responsibilities of each stakeholder and build consensus is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are considered as a pilot project of LPPE, whereby roles and responsibilities in other PPs for Strategies 1 to 4 are clarified.

Area of PP:	VTE
Target Activities:	Codification of the responsibilities of each stakeholder regarding PPs of LPPE for Strategies 1 to 4.
Target of PP:	Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.

After the completion of the PP by LPPE, VUDAA together with DONRE shall apply the lessons learned from the PP to other consensus building activities for the improvement of SWM in VTE.

	Completion of the financial system improvement plan	VUDAA, DONRE, MOH, DOH						
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Appendix 3. Pilot Projects (PPs)

Strategy 1. "3Rs" are promoted.
Approach 1.1 "3Rs" are promoted on-site to reduce waste generation amount.
1.1.1 Reduction of kitchen waste and garden waste at households
1.1.2 Recyclable waste separation at generation sources
1.1.3 Avoidance of the use of excess packages such as plastic shopping bags
Strategy 2. Waste collection system is improved.
Approach 2.1 Improvement of existing collection and discharge system
2.1.1/2.1.2 Primary collection system
Approach 2.2 Expansion of waste collection service area
2.2.1 Waste collection service planning
2.2.2 Increase of collection service contract rate
Strategy 3. Final disposal system is improved.
Approach 3.1 The final disposal site is managed to dispose of waste properly.
3.1.1 Proper management of existing final disposal site
3.1.2 Proper management of waste pickers and improvement of their working conditions
Approach 3.2 Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.
3.2.1 Development and management of the treatment facility for the sludge from septic tanks
Strategy 4. Health care waste management is improved.
Approach 4.1 HCW is collected properly.
4.1.1 HCW collection system establishment
Approach 4.2 HCW is disposed of properly.
4.2.1 HCW treatment and disposal system establishment
Strategy 5. Institutional system to support the above improvements is established.
Approach 5.1 The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.
5.1.1 Consensus building among stakeholders
Approach 5.2 Financial system necessary for proper SWM is improved.
5.2.1 Financial system improvement

Strategy 1. “3Rs” are promoted.

Approach 1.1: “3Rs” are promoted on-site to reduce waste generation amount.

1.1.1 Reduction of kitchen waste and garden waste at households

1. Project Purpose and Summary

The purpose of this PP is to reduce household’s organic waste such as kitchen and garden waste at generation source in Vientiane Capital.

After pilot households were selected from 4 pilot villages, home composting was introduced to the households in order to encourage them to reduce the amount of discharged waste at home.

2. General Concept

DONRE was selected as a main C/P and had discussions with SJET in order to design the project plan. Since the main actor of promotion and expansion of on-site composting should be transferred from SJET to C/P transitionally, project’s phase was decided to be divided into two: Phase I, which is mainly managed by SJET with a purpose of OJT to C/P and Phase II, which is mainly managed by C/P.

Table 3-1. Outline of the Plan for Reduction of kitchen waste and garden waste at households PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, SJET	■				
	Set up concept	DONRE, SJET	■				
Planning of PP	Study and selection of pilot area	DONRE, SJET	■				
	Study of composting method	SJET		■			
	Procurement of equipment	SJET		■			
	Preparation of education tools	DONRE, SJET		■			
Implementation of PP	Delivery of equipment and instruction of method	DONRE, SJET		■			
	Monitoring and awareness raising	DONRE, SJET			■	■	■
	Evaluation of the PP	DONRE, SJET				■	
	Suggestion for dissemination by C/P	SJET				■	

3. Planning

a. Study and selection of pilot area

a.1 Study of kitchen and garden waste at households

According to the Waste Amount and Composition Survey (WACS) conducted in September 2011 in Vientiane Capital, organic waste makes up 64% of the total amount of waste at the households. Details of the survey results are shown as below.

Table 3-2. Waste Generation Rate in VTE

Area	Waste Generation Amount (g/capita/day)
Urban Area	686
Suburban Area	695
Weighted average	691

Table 3-3. Waste Composition in VTE

Waste Types	Composition (%)
Kitchen Waste	34
Wood	30
Paper	7
Plastics	12
Glass	7
Textile	5
Metal	1
Leather, rubber	3
Inert (sand and stone)	1
Others	0
Total	100

Most of the households did not separate their organic waste and discharged them together with other waste. However, some of the households separated their kitchen waste and fed their domestic animals with it.

a.2 Selection of pilot area

For selecting candidate districts, SJET and C/P raised criteria as follows:

1. The district should be provided with waste collection service.
2. Households in the district should have land large enough to place composting containers.
3. Leader of the district should have interest in solid waste management and its organization should have human resources with adequate attention to the environment.

After the consideration, MONRE nominated Sisattanaak district and Xaysettha district as candidates.

For further understandings, SJET, MONRE and DONRE C/Ps visited Sisattanaak district and Xaysettha district and interviewed some representatives from both districts. As a result, Xaysettha district was found to meet the criteria aforementioned.

In order to specify the pilot area, a workshop was held on July 18, 2012, with attendance of 12 village leaders in Xaysettha district. SJET visited 17 villages that were made up of the villages that showed interests in the PP after attending aforementioned workshop or even without attending the workshop. As a result of the site visits, the following four villages were selected as pilot villages.

1. Nonesavang village
2. Hongsupharp village
3. Nonesavanh village
4. Amone village

b. Study of composting method

After SJET considered the pilot households' living environment, life style, discharged waste types, maintenance method of compost and so on, two methods of composting were chosen: one using barrels with holes called "barrel composting" and the other using worms called "worm composting". The chart below shows differences of the two methods.

	Pros	Cons
Barrel composting	<ul style="list-style-type: none"> • Almost all organic waste can be used. • Without special equipment is; it can be easily started. 	<ul style="list-style-type: none"> • As water does not drain well; moisture adjustment is required. • Odor and maggot often occurs. • In order to promote aerobic fermentation, air should be taken into the barrel by mixing inside of the barrel regularly.
Worm composting	<ul style="list-style-type: none"> • Hardly smells. • Worm itself or liquid that comes from the compost can be fed to domestic animals. 	<ul style="list-style-type: none"> • Waste that can be used is limited. • Temperature adjustment and dryness prevention are needed; it cannot be left for a long time. • Once all worms die, it would be difficult to restart composting unless the worms are procured again.

c. Procurement of equipment

In April 2013, SJET procured 58 barrels and 22 worm bins. For good drainage and ventilation, holes were drilled at the side and the bottom of both barrels and bins.

d. Preparation of education tools

In May 2013, SJET made two kinds of composting handbook: barrel composting handbook and worm composting handbook.

4. Implementation

a. Delivery of equipment and instruction of method

In May 2013, composting lessons for the pilot households of four pilot villages were given at Nonesavang village office. After the demonstration of composting was given by SJET and a worm composting expert, equipment and the handbooks of Phase I were delivered to the pilot households.

The handbooks were revised in accordance with the households' opinion and monitoring results. The revision of the barrel composting handbook was completed in February 2014 and the worm one was completed in March 2014.

By using the revised handbooks aforementioned, composting lessons for the pilot households of Phase II were provided at Nonesavang village office in March 2014. C/P acted as the main instructor and conducted a "separation game" which made the pilot households understand clearly what kinds of waste can or cannot be used for the composting. After the lessons, equipment and the handbooks for Phase II were delivered to the pilot households.

b. Monitoring and awareness raising

After the delivery of the equipment, mainly DONRE conducted monitoring regularly. For publicizing and raising people's awareness, households' implementation of the composting was reported and aired by Lao National TV.

In January 2015, a worm composting video was produced so that C/P could continue dissemination activities after the completion of the project.

5. Evaluation and Achievements

Achievement status of the PP is shown in the chart below.

Indicator	Means of Verification	Achievement Status
Indicator 2.1. 3Rs are promoted.		
1. All barrels and bins are	1. LPPE Progress Report and	Achieved. All composting

disseminated by Dec 2014 and kept monitored until the end of the project by C/P.	Monitoring Report	equipment was delivered by December 2014 and has been monitored by C/P continuously.
Indicator 3.2. The residents participate the 3Rs activities.		
1. The rate of the households that continue on-site compost to all the households that started on-site compost in all the pilot villages: 60%	1. MONRE Monitoring Report and Information from the chief of the village	Achieved. As of April 2015, 79% of the households still continue on-site composting.

In addition to the achievements above, some pilot households in Nonesavanh village shared their worms to three new households and instructed them on the composting method without project’s help. Participants themselves disseminated and expanded the composting.

In conclusion, the project purpose was achieved.

6. Suggestion for the Post-Project Activities

a. Characteristics of the households that tend to continue the composting

According to the monitoring results, characteristics of the households that have high opportunity for continuing the composting were considered as follows:

- Barrel composting
 - Households that have gardens.
 - Households that like to grow plants.
 - Households that can easily get some materials for moisture adjustment, such as rice bran, saw dust, dry leaves, etc.

Since the barrel composting doesn’t require any special equipment, people can easily get started. However, some households had to stop the composting because they didn’t control moisture and then maggots appeared inside the barrel. Therefore, it would be necessary for C/P to explain the importance of moisture control to the households and let them drain water out from the waste before putting it into the barrel and put some materials for moisture adjustments properly.

- Worm composting
 - Households that have gardens.
 - Households that like to raise animals.
 - Households that have domestic animals or fishes.
 - Someone in the households likes fishing.

Since the worm itself and the liquid coming from the compost can be fed to animals, households that have domestic animals tend to keep their motivation for composting. Hence, having domestic animals should be considered as one of criteria for the selection of new pilot households.

On the other hand, some households had to stop the composting because they consumed too much worms for feeding their domestic animals or for fishing and the number of worms was drastically decreased. Therefore, it would be necessary for C/P to explain the objectives of the composting clearly during the instruction and even after the implementation, C/P is recommended to remind the households of the objectives again when they go monitoring.

Characteristics of the households that can be applied for both composting methods is that the person who raised his/her hands to join the PP usually stays in the house and has enough time to take care of the compost. In case that the person who is interested in composting is an employee or governmental officer for example, s/he normally is out of his/her house in the daytime and tends to leave the compost for long unless other person looks after it instead. This situation made some households’ composts become too wet or too dry. When C/P selects candidate households,

it should be clear beforehand that who will be in charge of the composting in the family, and whether or not that person has enough time for the composting.

b. Making a monitoring system by households

In order to keep the household composting, it is necessary to monitor regularly and give right advices to the households before or after problems happen. However, as the number of C/P and their budget is limited, it would be very difficult for C/P to visit every pilot household frequently. One of the solutions of this problem is as follows:

1. Several neighboring composting households are grouped.
2. Participant who manages compost very well, or who is very eager in the composting is selected as a group leader.
3. C/P instructs the group leader on the maintenance and monitoring method.
4. The group leader checks the condition of other members' compost and instructs them directly if there is any problem.

1.1.2 Recyclable waste separation at generation sources

This PP was carried out as part of the PP “**2.1.1/2.1.2 Primary collection system**”, thus described together with it.

1.1.3 Avoidance of the use of excess packages such as plastic shopping bags (Eco-basket)

1. Project Purpose and Summary

The objectives of this project is to encourage households and stalls in VTE to refuse unnecessary use of plastic bags in order to reduce the number of plastic bags discharged as waste.

Four villages were selected as a pilot village. Project delivered eco-baskets to every household in the four villages. The objectives of the PP and instructions on the use of the baskets were explained to the households. The eco-baskets were also delivered to some of the shoppers and sellers in the pilot market. Awareness raising activity was also carried out in order to facilitate the attention of the basket users on reducing the use of excess plastic bags.

2. General Concept

DONRE was selected as a main counterpart and had discussions with SJET to design the project plan. Since the main actor of promotion and expansion of eco-basket PP should be transferred from SJET to C/P transitionally, project's phase was decided to be divided into two; Phase I, which is mainly managed by SJET with a purpose of OJT to C/P and Phase II, which is mainly managed by C/P.

Table 3-4. Outline of the Plan for Eco-basket PP

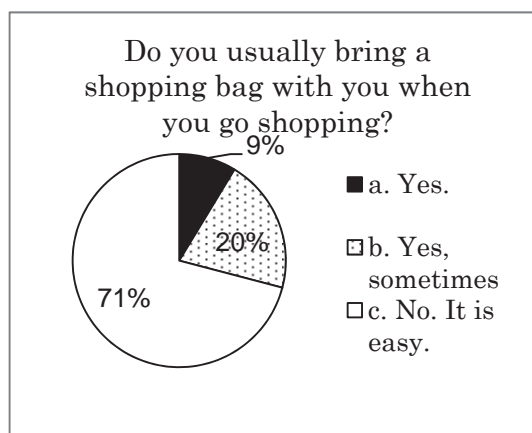
Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, SJET	■				
	Set up concept	DONRE, SJET	■				
Planning of PP	Study and selection of pilot area	DONRE, SJET	■				
	Procurement of equipment	SJET		■			
	Preparation of education tools	DONRE, SJET		■			
Implementation of PP	Delivery of equipment and instruction of use	DONRE, SJET		■	■		
	Monitoring and awareness raising	DONRE, SJET				■	■
	Evaluation of the PP	DONRE, SJET					■
	Suggestion for dissemination by C/P	SJET					■
Dissemination of PP	Planning of dissemination	DONRE					■
	Dissemination to other area	DONRE					■

3. Planning

a. Study and selection of pilot area

a.1 Study of current situation of plastic shopping bag

According to the Public Opinion Survey (POS) conducted before the implementation of the PP, in May 2013, 12% of interviewees answered “Yes, often” to the question of “Have you ever refused plastic shopping bags at shops?”, and 9 % of interviewees answered “Yes” to the question of “Do you usually bring a shopping bag with you when you go shopping?”. The details are shown in the chart below.



a.2 Selection of pilot area

Four pilot villages of the “PP for Reduction of kitchen waste and garden waste at households” were selected as the pilot villages for the same reason. As for the pilot market, criteria for the selection were as follows:

1. Market which is located near the four pilot villages
2. Market which is comparatively big.
3. Market's owner is cooperative for the reduction of plastic bag use.

After the consideration, Houakhua Market was selected to be a pilot market as it met the criteria above.

b. Procurement of equipment

SJET was supposed to promote eco-bags as a substitution of plastic shopping bags, but "eco-baskets" instead of eco-bags were chosen as a tool for reducing plastic bags, because most of the participants preferred eco-baskets rather than eco-bags for its convenience to put wetty fresh foods.

In May 2013, SJET delivered 3,095 eco-baskets. Each basket was tagged with logos of LPPE and JICA.

c. Preparation of education tools

In May 2013, SJET made a leaflet for explaining the objectives and the methods of plastic bag reduction.

4. Implementation

a. Delivery of equipment and instruction of use

Since June 2013, instruction and awareness raising activity for plastic bag reduction were given in the four pilot villages. The eco-baskets and leaflets were delivered to every household.

In September 2013, opening ceremony for the awareness-raising signboard at the pilot market was held. The eco-baskets and leaflets were delivered to some of the shoppers and the sellers in the market at the same time. For explaining the objectives of the eco-basket, a picture-story flip chart which was made by SJET was used in order to catch participants' attentions.

As for Phase II, a total of 800 eco-baskets were delivered at 9 new places by C/P. C/P also gave instructions and carried out awareness raising activities to the participants.

b. Monitoring and awareness raising

Since the delivery of equipment, DONRE together with the Office of Natural Resources and Environment of Xaysettha district had conducted monitoring regularly. As a tool for raising awareness, publicizing stickers were produced and script for broadcasting through the market's public-address system was prepared. In addition, the delivery of eco-baskets and the awareness raising activity were reported and aired by Lao National TV.

5. Evaluation and Achievements

Achievement status of the PP is shown in the chart below.

Indicator	Means of Verification	Achievement Status
Indicator 2.1. 3Rs are promoted.		
1. Plastic shopping bag reduction activities are started at one or more new places under the instruction of the C/P.	1. LPPE Progress Report	Achieved. C/P delivered eco-baskets at 9 new places with giving instructions and raising awareness.
Indicator 3.2. The residents participate the 3Rs activities.		
1. The rate of the households	1. MONRE Monitoring Report	Achieved. As of March 2015,

that refuse plastic bags as many as possible to all the households in all the pilot villages: 40%	and Information from the chief of the village	79% of the households try to refuse plastic bags.
1. The rate of the stalls that cooperate plastic bag reduction to all the stalls in all the pilot markets: 40%	2. Information from the stalls	Achieved. As of March 2015, 67% of the stalls cooperate plastic bag reduction.

In conclusion, the project purpose was achieved.

6. Suggestion for the Post-Project Activities

a. Importance of raising stalls' awareness

According to an informal interview with the participants, it was found that some stalls automatically put their goods into plastic bags before the participants refuse, even though the participants bring their eco-baskets. It shows that the reduction of plastic bag will not succeed if there is no cooperation not only from the shoppers but also from the sellers. Therefore, it is important to raise stall's awareness enough to enable the shoppers to avoid using unnecessary plastic bags.

b. Continuous awareness raising

The participants who said "I rarely use the eco-basket" explained their reasons as follows:

- I always forget to take the eco-basket when I go shopping.
- I usually go to market directly from my office after I finish work, but I don't take the eco-basket to my office when I go to work in the morning.

Though they don't use their eco-baskets, they replied that they understand the importance of the plastic bag reduction. It shows that many people "understand but do not make action". Since changing people's behavior would take time, it is important for C/P to raise people's awareness continuously.

c. Priority stores for post-project activities

During the planning of the PP, SJET introduced some examples of plastic bag reduction in Japan: Shops charge their customer for the plastic bags, shoppers can get some rewards or discounts from the store when they refuse plastic bags, etc. However, the owner of the pilot market refused to make those trials because he said it would be very difficult to control stalls as the market is made up of more than 100 of the stalls and the turnover of the stalls is quite high. Therefore, this PP only carry out awareness-raising activities for the shoppers and the sellers. If C/P would like to attempt the new approach rather than simple awareness raising, it might be effective to start from the stores as follows:

- Shops of imported goods and foods, souvenir shops, because foreign customers are relatively many and they tend to be environmentally conscious.
- Convenience stores because most of their goods are those which are already packaged and do not need to be put into plastic bags.

If the new method for reducing the plastic bags is successfully established at the stores above, it can be applied to other shops.

Strategy 2. Waste collection system is improved.

Approach 2.1: Improvement of existing collection and discharge system

2.1.1/2.1.2 Primary collection system

1. Project Purpose and Summary

This PP aims to improve a discharge and collection system for general waste which generates from households in VTE.

The PP, after 4 pilot villages were selected, introduced a primary collection system, using wheeled waste bins, to households who lived on inaccessible streets for waste collection vehicles, so that it could lead 1) To make waste collection service more efficient, 2) To make a waste discharge rule more convenient for people, and 3) To keep the collection points clean. Moreover, it made an opportunity to encourage people who did not have waste collection contract to make contract.

Also the project aimed to promote the separation of recyclables so that they were diverted from the waste collection system as much as possible.

2. General Concept

VUDAA had been concerned about the low contract rate in the area where VUDAA or private collection companies provided the collection service. The increase of the contract rate was regarded as the priority issue in the pilot project. Four villages in the Xaysettha district, where a private company provides collection service, were selected as target areas in the pilot project. VUDAA were primarily responsible for the establishment of a pilot project committee which consisted of DONRE, Xaysettha district, villages, the private company and others. SJET took the initiative in the beginning period, and gradually it was taken over to VUDAA, which also led the committee.

Table 3-5 Outline of the Plan for Introduction of Primary Collection System PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule			
			2012	2013	2014	2015
Project Planning	Set up project management system	SJET, VUDAA	██████████	██████		
	Set up concept	SJET, VUDAA	██████████			
Planning and Preparation PP	Study and selection of pilot area	SJET, VUDAA		██████		
	Collection system determination	SJET, VUDAA			██████	
	Procurement of equipment	SJET			██████	
	Preparation of education tools	SJET, VUDAA			██████	
Implementation of PP	Delivery of equipment and instruction of method	SJET, VUDAA			██████	
	Monitoring and awareness raising	SJET, VUDAA			██████████	
	Pre-dissemination by C/P	VUDAA			██████████	
	Evaluation of the PP	VUDAA, DONRE, SJET				██████
	Suggestion for dissemination by C/P	SJET				██████

3. Planning

a. Study and Selectin of Pilot Area

a.1 Baseline Survey and Selection

Basically the project selected the same pilot area as another PP on “Reduction of organic waste at households PP” under the strategy of 3Rs promotion. The primary reasons for this are:

- VTE is composed of 9 districts while other 2 project target cities (LPB and XYB) are composed of single district each. Therefore, the Vientiane capital is physically wide and each district has different administrative institution.
- Some of the selection criteria of pilot areas of 3Rs PP such as “The district should be provided with waste collection service” and “The leader of the district should have interest in solid waste management and its organization should have human resources with adequate attention to the environment.” consistent with the criteria for this PP.

As a result of considering those conditions, it was decided to select the same pilot area with 3Rs PP to make survey and implementation efficient avoiding the dispersion of relevant resources

a.2 Implementation survey

Through the above selection, the project conducted a fact finding survey on pilot villages. It found the following items.

- Only part of households was provided with collection service. Especially, households along alleys inaccessible for collection trucks often lacked the collection service contracts.
- Even in the area covered with collection service, people living in alleys inaccessible for the collection trucks had inconvenience as they needed to bring their garbage from their houses to the nearest collection points.
- Garbage was often piled up and littered at certain waste collection points. They impaired the view of the streets and made waste collection work difficult.

The each village were requested to identify the streets which faced problems and needed particular improvement because of the existence of many households without contract or inaccessibility for collection vehicles. The information was summarized in the table below.

Table 3-6 List of streets for the target of implementation survey in pilot villages in Xaysetta district

	street #	Number of HH	HH with contract	Priority
Amone	3	11		Yes
	4	4		
	6	7	2	Yes
	7	21	19	
Hongsouphap	4	6		Yes
	9	16		
	10	18		
	12	39		Yes
	15	5		
	17.1	14		
Nonesavang	20	13		Yes
	1	5		
	2	14	6	
	3.1	8	7	
	3.2	4	1	
	3.3	5	2	

	3.4	4	4	
	5	6		
	6	11	11	
	8.1	5	5	
	8.2	4	4	
	8.3	14	13	
	8.4	6	5	
	9	25	24	Yes
	13.1	2	2	
	13.2	7		
Nonsavanh	2	58		Yes
	5	4		
	7	9		
	8	6		
	9	15		
	10	45		Yes
	11	3		
	Total	414	105	

b. Determination of waste collection method

In order to solve the existing problem, solution below was figured out for the improvement.

- Wheeled waste bins are provided to the groups of households who live along streets inaccessible for the waste collection vehicles. The bins are managed by those households on a rotating basis. The household on duty during a particular period collects waste from other households of the group and brings the bin to the nearest waste discharge point on a collection day.
- Besides, a discharge rule which is set up by the project promotes the households to separate recyclable waste in order to minimize the amount of waste to be collected and transported to the disposal site. The residents shall separate the recyclables to sell them to dealers so as not to discharge them on regular waste collection service.

c. Procurement of Material

80 wheeled waste bins with 120L capacity were procured based on the abovementioned fact finding survey.

d. Leaflet for discharging rule

Table 3-7 Discharging rule described in leaflet which is distributed for primary collection

Collected	1.	General Waste	To be discharged at specified collection point on the collection date being put in the garbage bin provided by the project
	2.	Green Waste	Large trees must be cut into separate pieces and be tied up to discharge at specified collection point on the collection date
	3.	Fragment of Glass or Ceramic	To be discharged at specified collection point on the collection date being put in a plastic bag
Not collected	4.	Recyclables (Glass-Bottle, Can or Pet-bottle)	To be stored for certain period at home to sell it to recycling dealers who periodically visit around villages.
	5.	Construction Waste (Brick or Block)	Not collected by the ordinary waste collection service. They must be discarded with extra service charge or be individually carried to the disposal site.

* Garbage of #1. to #3. is be collected in the same schedule, and #4. and #5. are basically not collected.

Table 3-8 Primary items described in leaflet

1.	Name of group leader	4.	Waste collection point
2.	Contact number of the leader	5.	List of group member
3.	Location and method for managing the garbage bin	6.	How to separate and discharge the waste

As shown above, VUDAA showed its policy not to collect the recyclables and to encourage the households to sell them to the dealers. It aims to raise the public awareness of 3Rs.

4. Implementation

a. Dissemination of the rule, public meeting

In June 2014, after the public meetings for each target household, wheeled waste bins and leaflet were distributed to commence the primary collection.

b. Monitoring

After the introduction of the primary collection, the private company which is engaged in waste collection service in the pilot villages was assigned to regularly monitor the pilot project and report to VUDAA when it is necessary. Monitoring was also conducted by MONRE and the third parties such as a project evaluation team and the PP workshop members.

c. Result of implementation

During the planning period, 80 waste containers were planned to cover 150 households, but it changed to 63 containers to 125 households. It was because, firstly, the effect of the primary collection appeared before distributing all the 80 containers and secondly, VUDAA had an intention to see the effect of the primary collection not only in suburban area (e.g. Xaysettha district) but also in the center of the capital. Consequently, 17 containers were supposed to be used for 25 households of 2 villages in Sisatthanak district.

However, eventually PP could not get cooperation from villages and residents in two villages in Sisatthanak district so that it was implemented in Hongsoupab village in Xaysetta district instead of them.

The result of the introduction of primary collection is illustrated in the following table.

Table 3-9 Outline of introduction of primary collection in Xaysetta district

Village	street	Number of HH	Number of Groups	Number of garbage bins distributed
Amon	3	6	1	2
	7	11	4	4
	1	2	1	1
	4	2	1	1
	Unit 5	4	2	2
	Unit 16	9	2	2
	5	6	2	2
Nonsavang	8.3	13	3	6
	9	21	5	10
	4	2	1	1

	5	5	1	1
	6	12	2	2
Nonsavanh	3	6	3	3
	10	1	1	1
	1	3	1	1
	1.1	3	3	3
	8	3	1	1
Hongsouphap	4	6	1	2
	10	10	2	4
	17	7	2	4
	12	24	11	11
	20	14	5	5
	14	8	4	4
	15	10	5	5
Total		188	64	78

5. Evaluation and Achievements

Table 3-10 Evaluation and Achievements of PP for Introduction of Primary Collection System in VTE

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. Primary collection system by using collection bins covers 125 households on the inaccessible road of collection vehicles in 4 pilot project villages.	1. Information from the collection company	Achieved. Primary collection service was introduced to 125 households in the 4 villages. The remaining bins could not
2. Primary collection system by using collection bins for inaccessible road of collection vehicles will be expanded to the two new villages and cover 25 households by the initiative of VUDAA.	2. Information from the VUDAA	Not achieved. Without cooperation from village people and residents of the planned villages, VUDAA expanded the system to new households in the existing 4 villages in Xaysetta because the PP could not get cooperation from village people and residents in those new 2 villages.
Indicator 3.2. The residents participate the 3Rs activities.		
1. The rate of the households that separately discharge recyclable waste to all the households covered by primary collection PP: 70%	1. MONRE Monitoring Report and Information from the chief of the village	Achieved. It reached 93%.
Indicator 3.3. The residents cooperate with the waste collection system.		
1. Waste management groups are established in the existing	1. Group member list	Achieved. The groups which share the primary collection were

collection improvement pilot villages.		established in the 4 villages in the Xaysettha district.
2. The rate of the cooperating households to all the households covered by the primary collection PP: 70%	2. MONRE Monitoring Report and Information from the chief of the village	Achieved. It reached 93%

6. Suggestion for the Post-Project Activities

Although the primary collection is an effective way to increase the waste collection contract, it necessitates initial investment as it requires waste containers.

It is expected that VUDAA and private companies properly introduce primary collection system considering its revenue from new collection contracts from a long term viewpoint regardless of initial expense.

Approach 2.2: Expansion of waste collection service area

2.2.1 Waste collection service planning

1. Project Purpose and Summary

This PP aims to formulate a waste collection service plan in VTE in order to expand the waste collection service area.

The plan is formulated based on the situation in 2013 for whole Vientiane capital with 9 districts and around 480 villages toward target year 2020.

2. General Concept

VUDAA had been concerned about the low contract rate in VTE, and intended to expand waste collection service to improve it in future. While it was indispensable to formulate a plan from a long-term point of view, it was difficult to do so since information was not organized quantitatively and visually.

Therefore, firstly the situation of collection service in 2013 was studied. This information was visualized by using GIS application. Based on the situation in 2013 and visualized data, VUDAA set the target figure about contract rate in 2020. This was also visualized by GIS.

Table 3-11 Outline of Waste Collection Service Planning

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Baseline Survey	The first determination of present waste stream flow-chart	SJET, VUDAA	■				
	Detailed survey	SJET, VUDAA	■				
Drafting the Plan	Sharing the survey result among stake holders	SJET, VUDAA		■			

	Discussion and consideration internally by the local authority	VUDAA		■			
	Drafting the plan in rough scale	SJET, VUDAA,		■			
Review and Updating the Plan	Monitoring and watching the progress concerned about solid waste management	VUDAA			■■■■■■■■■■		
	Reviewing and detail planning comparing between the draft and latest situation	VUDAA				■■■■■■■■■■	

3. Current situation survey

a. Calculation and prediction of population and household

Since proper statistical population data of 2013 was not available, population of 2013 was estimated based on the annual population growth rate at 3.93% which was figured out from the existing information of 2010 population and 2020 predicted population used in the VTE master plan.

It was assumed that the ratio of population in each village would not change even though population increased. This means that the population of each village would increase in proportion to total population increase. 2006 census value was applied as basic information for population ratio of each village.

As for the number of households, the information of average size of household was obtained from census 2006, and it was also assumed not to change until 2020.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population	731118	759853	789717	820755	853013	886539	921382	957595	995231	1034347	1074999

Source: 2010 population: VTN Capital Information and Culture Division, 2010 Population Data from 9 Districts
2020 population: The Project for Urban Development Master Plan Study in Vientiane Capital

b. Situation of waste collection contract in 2013

SJET and VUDAA cooperated to summarize the situation in 2013 into the table below.

Table 3-12 Waste collection situation of each district in 2013

	District	Population	Household	Contract	Rate
Urban Center		164,229	31,610	13,249	41.9%
	Chanthabuly	81,575	15,610	7,078	45.3%
	Sisattanak	82,654	16,000	6,171	38.6%
Sub Urban		505,331	96,258	17,865	18.6%
	Sikhottabong	118,360	22,041	5,474	24.8%
	Xaysetha	115,523	22,301	7,353	33.0%
	Xaythany	178,642	33,153	3,479	10.5%
	Hadxaifong	92,806	18,762	1,559	8.3%
Rural		151,194	28,957	994	3.4%
	Naxaithong	69,148	13,268	994	7.5%
	Sangthong	28,687	5,784	0	0.0%

	Mayparkngum	53,359	9,906	0	0.0%
Total		820,755	156,826	32,108	20.5%

Table 3-13 Waste collection situation of each service provider in 2013

		Population	Household	Contract	Rate
VUDAA		239,427	45,381	13,242	29.2%
	Chanthabuly	61,022	11,548	4,690	40.6%
	Sikhottabong	59,049	10,934	3,919	35.8%
	Sisattanak	11,507	2,214	619	28.0%
	Naxaithong	5,535	1,103	152	13.8%
	Xaythany	90,139	17,213	3,479	20.2%
	Hadxaifong	12,175	2,369	383	16.2%
Private company		341,942	66,048	18,866	28.6%
	Chanthabuly	20,553	4,062	2,388	58.8%
	Sikhottabong	50,093	9,303	1,555	16.7%
	Xaysetha	100,258	19,154	7,353	38.4%
	Sisattanak	71,147	13,787	5,552	40.3%
	Naxaithong	41,085	7,913	842	10.6%
	Hadxaifong	58,805	11,828	1,176	9.9%
No Contract		239,386	45,397	0	0.0%
	Sikhottabong	9,217	1,804	0	0.0%
	Xaysetha	15,266	3,147	0	0.0%
	Naxaithong	22,528	4,252	0	0.0%
	Xaythany	88,503	15,941	0	0.0%
	Hadxaifong	21,825	4,564	0	0.0%
	Sangthong	28,687	5,784	0	0.0%
	Mayparkngum	53,359	9,906	0	0.0%
Total		820,755	156,826	32,108	20.5%

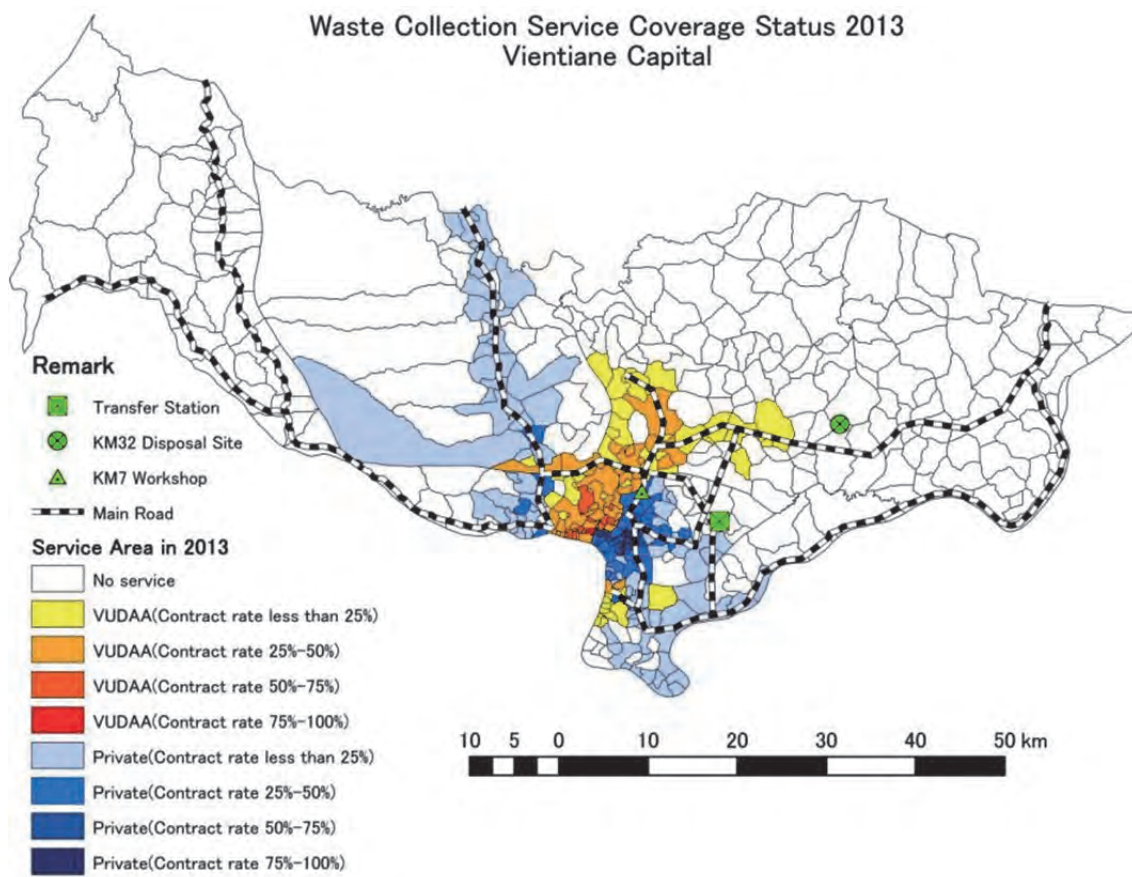


Figure 3-1 the map indicating the contract situation of waste collection coverage in 2013

4. Implementation (Determination of waste collection service plan)

a. Target of waste collection contract in 2020

Table 3-14 Target of waste collection contract of each district in 2020

	District	Population	Household	Contract	Rate
Urban Center		215,103	41,402	38,160	92.2%
	Chanthabuly	106,845	20,446	19,689	96.3%
	Sisattanak	108,258	20,957	18,471	88.1%
Sub Urban		661,867	126,076	41,764	33.1%
	Sikhottabong	155,024	28,869	15,221	52.7%
	Xaysetha	151,309	29,210	15,285	52.3%
	Xaythany	233,980	43,423	7,849	18.1%
	Hadxaifong	121,554	24,574	3,410	13.9%
Rural		198,030	37,928	2,586	6.8%
	Naxaithong	90,568	17,378	2,220	12.8%
	Sangthong	37,574	7,576	0	0.0%
	Mayparkngum	69,889	12,974	366	2.8%
Total		1,074,999	205,406	82,511	40.2%

Table 3-15 Target of waste collection contract of each service provider in 2020

		Population	Household	Contract	Rate
VUDAA		342,232	64,865	37,655	58.1%
	Chanthabuly	79,925	15,125	14,369	95.0%

	Sikhottabong	78,691	14,585	11,679	80.1%
	Sisattanak	15,071	2,899	2,208	76.1%
	Naxaithong	8,134	1,616	345	21.4%
	Xaythany	127,072	24,335	7,849	32.3%
	Hadxaifong	15,946	3,103	839	27.0%
	Mayparkngum	17,393	3,202	366	11.4%
Private company		456,439	88,232	44,856	50.8%
	Chanthabuly	26,920	5,321	5,321	100.0%
	Sikhottabong	69,237	12,957	3,542	27.3%
	Xaysetha	137,541	26,295	15,285	58.1%
	Sisattanak	93,187	18,057	16,263	90.1%
	Naxaithong	53,812	10,365	1,874	18.1%
	Hadxaifong	75,743	15,238	2,570	16.9%
No Contract		276,328	52,308	0	0.0%
	Sikhottabong	7,096	1,327	0	0.0%
	Xaysetha	13,768	2,915	0	0.0%
	Naxaithong	28,622	5,398	0	0.0%
	Xaythany	106,908	19,088	0	0.0%
	Hadxaifong	29,865	6,233	0	0.0%
	Sangthong	37,574	7,576	0	0.0%
	Mayparkngum	52,496	9,772	0	0.0%
Total		1,074,999	205,406	82,511	40.2%

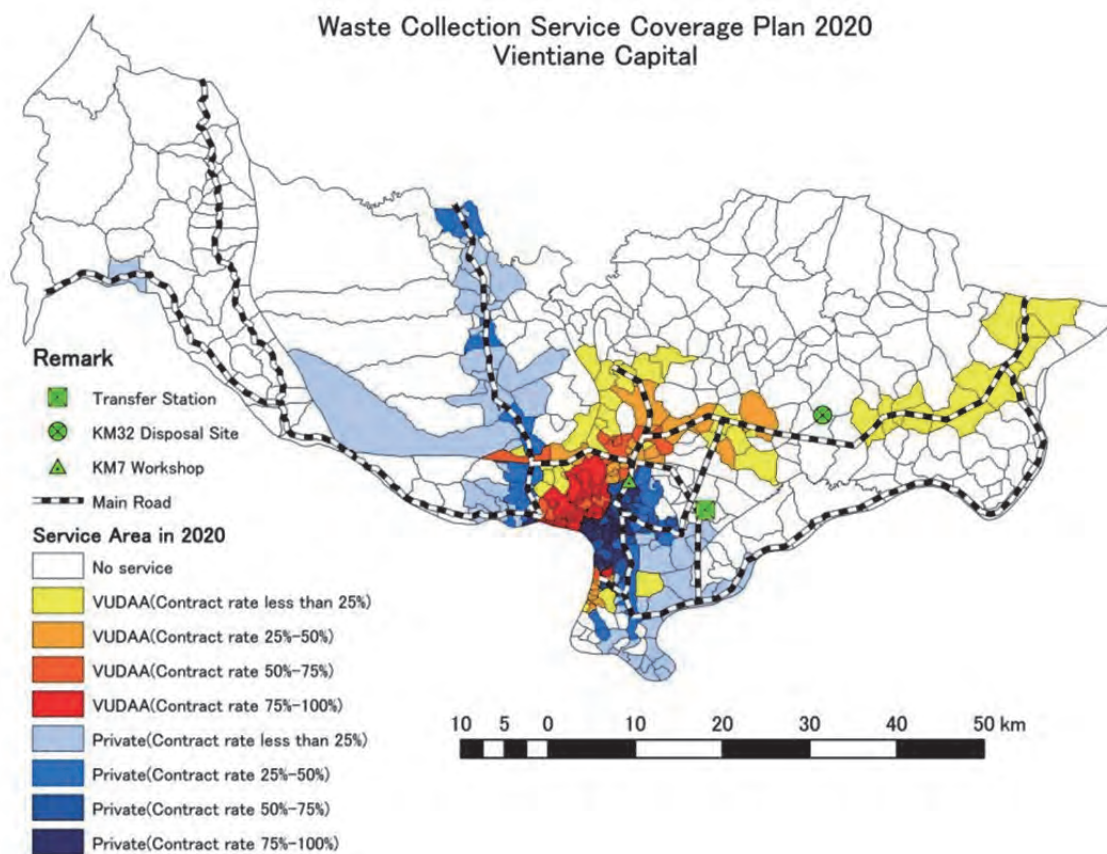


Figure 3-2 the map indicating the contract situation of waste collection coverage in 2020

b. Situation in 2015

As of July 2015, households with contract were considerably increased by 8000 since 2013. The contract rate, however, was raised up only 3% considering the increase of total number of households.

The number of contract in both of villages ,where VUDAAand the private companies are respectively responsible, increased to a certain extent. Moreover, VUDAA intends to accomplish the plan to significantly expand waste collection area, once new collection vehicles, which are supposed to be provided by the grant aid project in Dec 2015, become available.

Table 3-16 Situation of contracted households

	2013	2015	2020
Population	820,755	886,539	1,074,999
Household	156,826	169,396	205,406
Household with Contract (VUDAA)	13,242	15,958	37,655
Household with Contract (Private)	18,866	24,042	44,856
Household with Contract (Total)	32,108	40,000	82,511
Contract Rate	20.5%	23.6%	40.2%

* 2013 and 2015 are actual figure (Source;VUDAA information May2013 and Jul2015), planned value for 2020

5. Evaluation and Achievements

Table 3-17 Evaluation and Achievements of Waste Collection Service Planning in VTE

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. A waste collection and transportation plan is formulated.	1. Waste collection and transportation plan	Achieved. The plan for waste collection was formulated in March 2014

In addition to the abovementioned achievement of PP indicator, PP implementation resulted in following outcomes.

- The draft future plan proposed in this PP was used as basic data in the grant aid project to make a plan for the provision of equipment for waste collection.
- A GIS software called “QGIS” was used. As this is free, it can be downloaded to the computers of VUDAA. Therefore, some VUDAA staff is willing to learn more about GIS.

6. Suggestion for the Post-Project Activities

According to VUDAA’s information, there are 8 private companies which provide waste collection service in VTE as of Jun 2014. It is not easy for the private companies alone to persuade residents or village office to sign service contracts. However, based on the experience of PP in Xaysetta district, it will be possible to increase the contract if VUDAA took initiative to interconnect the private companies and village officers.

The review in 2015 shown above tells that the private companies ought to obtain 20,000 new contracts in the next 5 years in order to accomplish the plan. It means 4,000 households should

make contracts per year.

Therefore, the achievement of 2020 target depends on how VUDAA directs the private companies to coordinate with villages. At the same time, VUDAA is supposed to strive to expand its waste collection service using waste collection vehicles provided by grant aid project into the villages where VUDAA is responsible.

2.2.2 Increase of collection service contract rate

1. Project Purpose and Summary

This PP aims to expand waste collection service and increase the number of households with service contracts in VTE.

The PP selected 4 pilot villages, and specified the households who did not have waste collection contract in those 4 villages so as to encourage them to make a waste collection contract. It attempted to raise the contract rate.

For such a purpose, the PP introduced primary collection when necessary to the residents on inaccessible alleys for collection vehicles. Thus this PP is strongly linked with above-mentioned "Introduction of primary collection PP".

2. General Concept

Same as "Introduction of primary collection PP".

3. Planning

a. Study and Selectin of Pilot Area

a.1 Baseline Survey and Selection

Same as "Introduction of primary collection PP".

a.2 Implementation survey

Through the selection process above, the project conducted a fact finding survey in the pilot villages. It found the items below.

- Only part of households was provided with collection service. Especially, households along alleys inaccessible for collection trucks often lacked the collection service contracts.
- The household contract rate in 4 villages was 33.4% overall. Among them, 55% of Amone was the highest rate, and 13.9% of None Savanh the lowest.
- In those 4 villages, a private company is authorized to conduct waste collection service business. The company was affordable to mobilize more waste collection vehicles in order to increase the number of household contracts and expand its business size. However, they had faced difficulty in direct negotiation and communication with the village office, since the company is not an governmental or official organization and they are not empowered.
- On the other hand, such residents were unwillingly considered as illegal dischargers. They would like to discharge confidently with proper contracts but they had no choice but to discharge their waste without contracts since they had little opportunity to contact directly the collection service provider to make contracts.

Table 3-18 Contract status of pilot villages in Xaysetta district

	None Savang	Hong Sourpharp	None Savanh	Amone	Total
Total Households	517	616	252	411	1796
With contract	240	99	35	226	600
Without contract	277	517	217	185	1196
Contract rate	46.4%	16.1%	13.9%	55.0%	33.4%

b. Determination of a method for improving contract rate

In order to solve the existing problem, solution below was figured out for improvement.

- The PP considered that living on alleys inaccessible for collection vehicles is a possible indirect reason for not making contracts. The PP encourages those households to sign service contracts by providing the wheeled waste bins. Only households who sign contracts will be covered by the primary collection system.
- As for other households, a conventional method for the collection company is to persuade people to sign contracts in cooperation with VUDAA and village office. In the PP, the company carries out this method.

c. Procurement of Material

Same as “Introduction of primary collection PP”.

4. Implementation

a. Procedure such as raising public awareness

Same as “Introduction of primary collection PP”. The opportunities of meetings among VUDAA, Village headman and private companies were arranged intentionally. Within the framework of project, a large public meeting (together with 3Rs PP) was held to persuade people to sign the contract. After that, the private company repeatedly organized meetings of a smaller scale, and attempted to increase the contract.

b. Monitoring

Basically updated information was obtained on every time of each progress report and official evaluation to monitor the progress in the increase of number of contracts.

c. Result of implementation

Transition status of the number of contracts in target villages is illustrated in the following table.

Table 3-19 Transition of number of contracted household in Xaysetta district

		Amone	Hong Sourpharp	None Savang	None Savanh	Total
	Total Households	411	616	517	252	1796
Baseline (Jun 2013)	With contract	226	99	240	35	600
	Contract rate	55.0%	16.1%	46.4%	13.9%	33.4%
Project Achievement (Jul 2015)	With contract	244	374	304	91	1,013
	Contract rate	59.4%	60.7%	58.8%	56.4%	56.4%

※Created by SJET based on interview survey from relevant people such as villages, private company

5. Evaluation and Achievements

Table 3-20 Evaluation and Achievements of PP for Increase of collection service contract in VTE

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. Collection service coverage rate in 4 pilot project villages increases from 33% in November 2013 to 50% in December 2014.	1. Information from the collection company	Achieved. It was 56.4%.
2. The fee payment rate of the households in 4 pilot project villages that newly make collection service contracts with the collection company maintains 90 %.	2. Information from the VUDAA	Achieved. If the fee isn't paid, collection service will not be provided. In the pilot area, the service is provided, which in turn means the fee have been paid.

In addition to the abovementioned achievement of PP targets, PP implementation resulted in following outcomes.

- In this PP, VUDAA acquired some knowhow to increase the contract rate. VUDAA is trying to increase the contract rate in other villages and districts and they succeeded the increase of contract rate to some extent. The knowhow from this PP might have been contributed to such achievement.

6. Suggestion for the Post-Project Activities

The pilot project progress revealed that VUDAA's leadership is important to establish the relationship between the private company and the village even in the area where VUDAA is not providing service.

VUDAA is expected to be responsible for the mediating actively between the private company and the village for further increase of collection contract rate in other villages or districts.

Strategy 3. Final disposal system is improved.

Approach 3.1: The final disposal site is managed to dispose of waste properly.

3.1.1 Proper management of existing final disposal site

1. Project Purpose

The purpose of this PP is to improve the final disposal site, dispose of waste properly, and mitigate adverse impacts on the surrounding area.

2. Concept

The proper operation and maintenance of KM32 existing final disposal site is conducted in

accordance with the formulated operation plan of final disposal site by deputy director and staff of VUDAA to improve the existing final disposal site. The implementation schedule is shown as follows;

Table 3-21. Implementation schedule of Proper management of existing final disposal site PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET,	■				
	Set up concept	VUDAA, SJET,	■				
Planning of PP	Identify and study the pilot area at KM32 existing final disposal site	VUDAA, SJET,	■				
	Formulation of improvement plan of infrastructure at KM32 existing final disposal site	VUDAA, SJET,	■				
	Formulation of draft operation plan at KM32 existing final disposal site	VUDAA, SJET,		■			
	Formulation of operation plan reflecting the Grant aid project	VUDAA, SJET,			■	■	
Implementation of PP	Improvement of KM32 existing final disposal site and procurement of heavy machinery	SJET		■			
	Proper operation of KM32 existing final disposal site	VUDAA, SJET			■	■	
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET				■	
	Suggestion for continuation by C/P	SJET				■	

3. Plan

a. Identify and study the pilot area

A topographic survey was conducted to identify the boundary of pilot area at KM32 existing final disposal site.

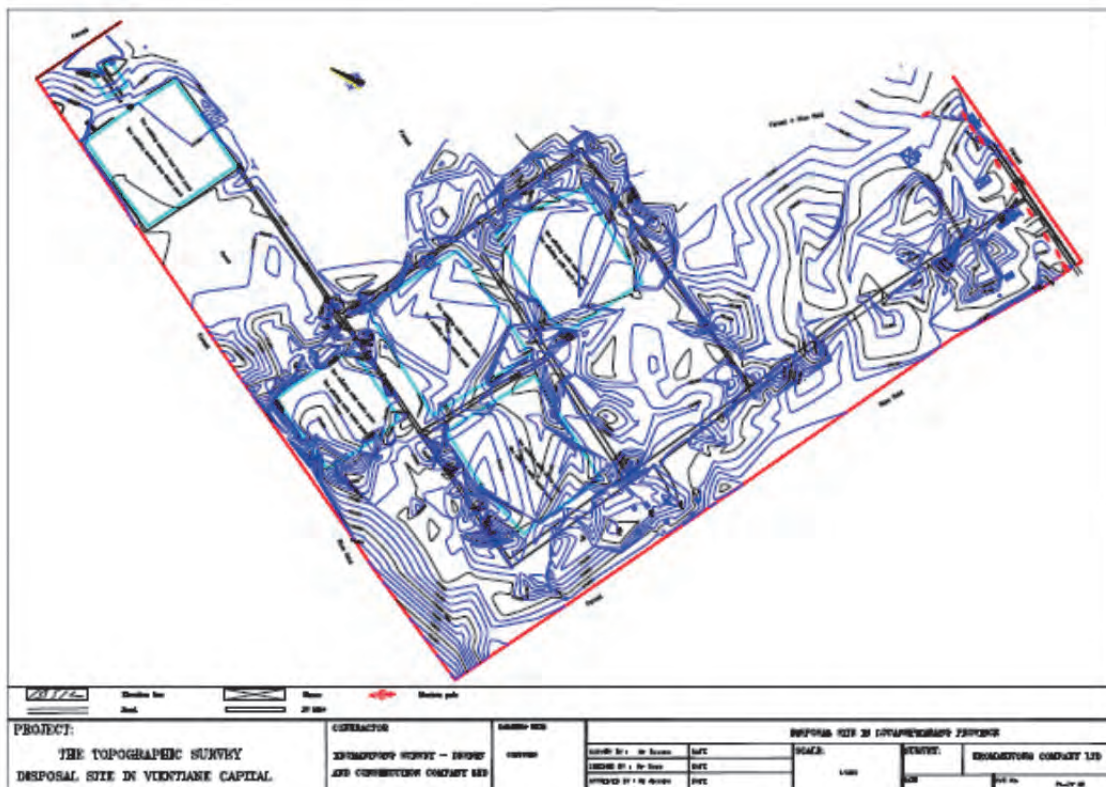


Figure 3-3. The boundary of pilot area at KM32 existing final disposal site

b. Formulation of improvement plan

The improvement plan of infrastructure at KM32 existing final disposal site was formulated in the boundary of project site as shown in the following table and figure.

Table 3-22. Improvement plan of infrastructure at KM32 existing final disposal site

No.	Items	Qty.	Unit
1	Access road	1,200.0	m
2	Pipe drain (dai600mm L=10.0m)	2	Place
3	Buffer zone	200	m
4	Installation of new computer and new software for existing weight bridge	1	unit
5	Concrete Plate	200	no.

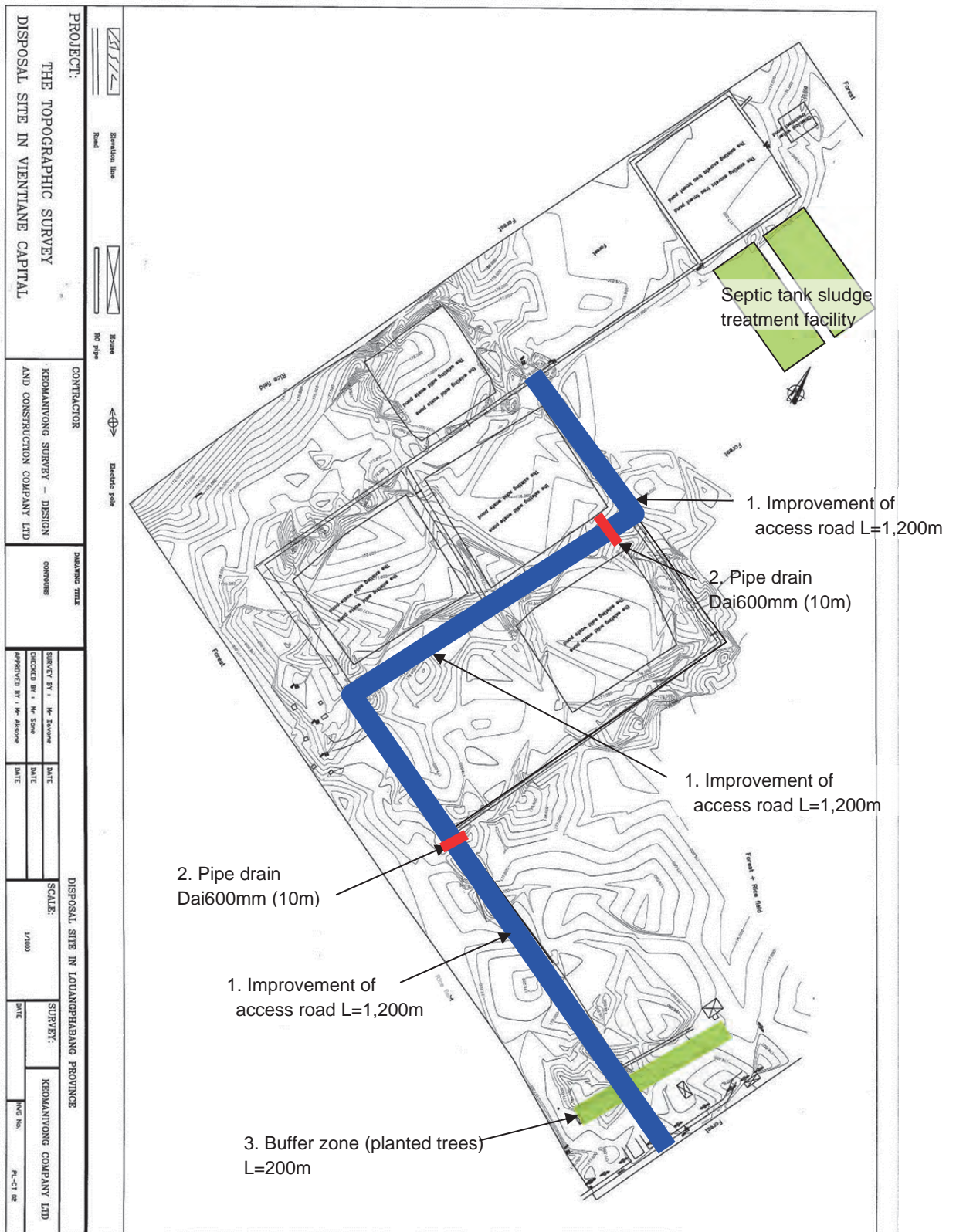
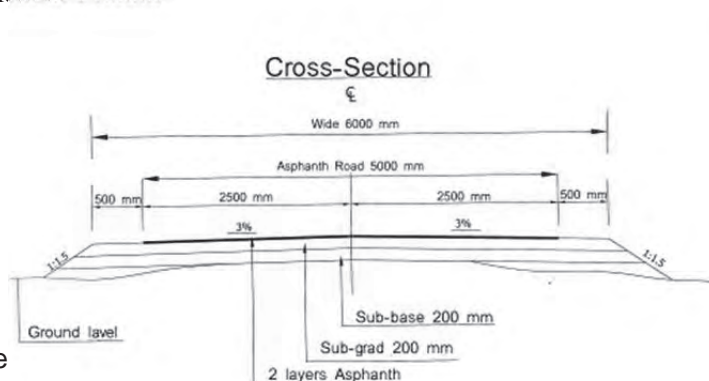


Figure 3-4. Improvement plan of infrastructure at KM32 existing final disposal site

b.1 Access road

The function of the access road is to allow waste trucks to access to active cells from the main road for waste discharging. The structure of the access road consists of two layers asphalt (w=5,000mm), sub-grad (t=200mm) and sub-base (t=200mm) and leveling. The length of access road improvement is 1,200m.



b.2 Pipe

The function of the pipe is to collect and transport waste liquids. The pipe has a diameter of 600mm and a length of 10m.

b.3 Buffer zone

The function of the buffer zone is to prevent the deterioration of landscape due to waste disposal and the diffusion of odor, flies and drifting waste. It consists of plants with 3m intervals.

b.4 Replacement of PC and its software for weighbridge

The PC and its software did not work properly. They are to be replaced with new ones.

b.5 Concrete plates

The concrete plates are used on a muddy access road in order to allow the waste trucks to run in the rainy season. The size of a concrete plate is 2,000mm (length) x 1,000mm (width) x 200mm (height). 200 plates are used.

c. Formulation of draft operation plan

The collected waste is disposed of at the designated disposal area in the improved KM32 final disposal site. The collection vehicles can approach to the designated disposal area on the concrete plate in the rainy season although the access road becomes muddy.

Waste disposal cells Area 1 to Area 11 shown below are used in the alphabetical order.

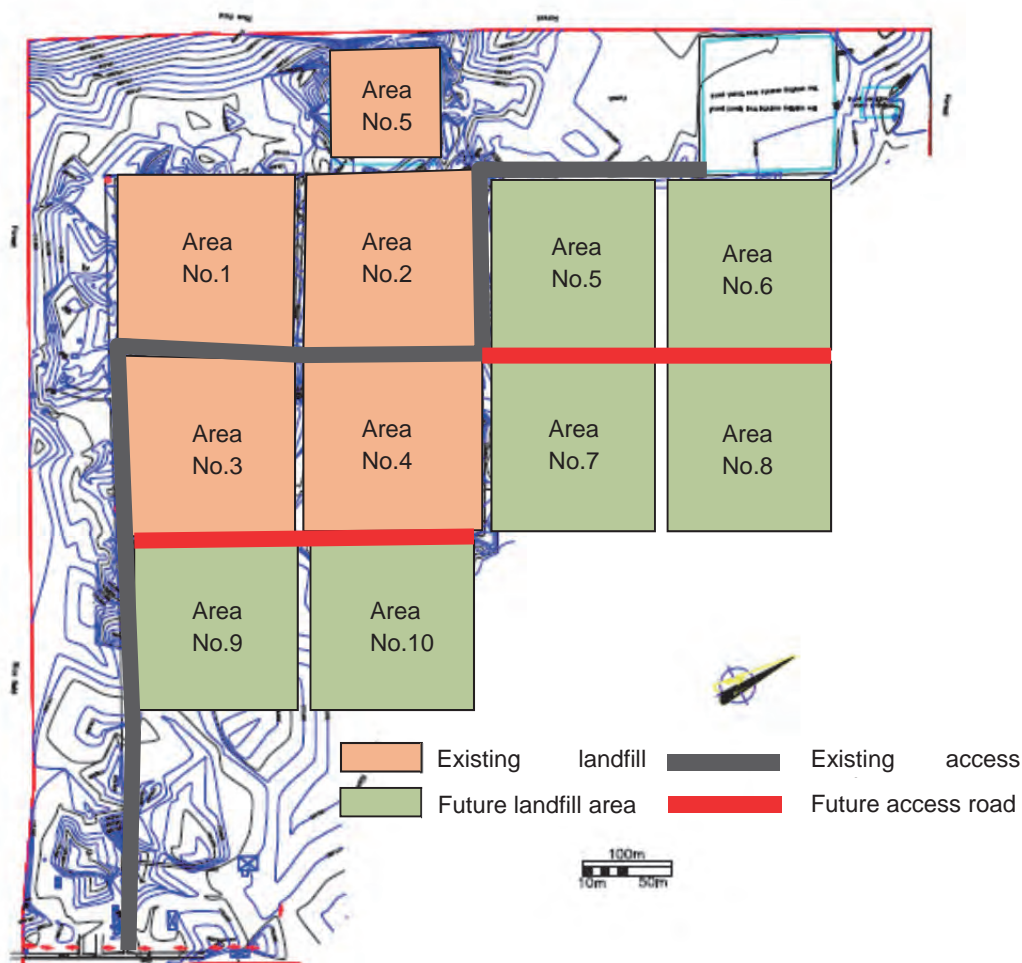


Figure 3-5. The operation plan at KM32 existing final disposal site

d. Formulation of operation plan reflecting the grant aid project

The draft operation plan was continuously implemented and examined at the improved KM32 final disposal site since 2012. And the operation plan was finalized in August 2015 by VUDAA and SJET. Operation plan reflecting the grant aid project by the Japanese Government is described in Appendix 4

4. Implementation

a. Procured equipment and implementation of improved work

a.1 Procured equipment

A bulldozer was procured by JICA in May 2012 to move the disposed waste. Also two dump trucks were provided by JICA for soil covering work.

a.2 Implementation of Improved work

SJET supported JICA to put out the tender for improvement work at existing KM32 disposal site in November 2013. The improvement work started in November 2013, completion inspection was conducted on 5 March and operation started on 9 April 2013.

Table 3-23. Improvement work at existing KM32 disposal site

No.	Items	Qty.	Unit
-----	-------	------	------

1	Access road	1,200.0	m
2	Pipe drain (dai600mm L=10.0m)	2	Place
3	Buffer zone	200	m
4	Installation of new computer and new software for existing weight bridge	1	unit
5	Concrete Plate	200	no.



Figure 3-6. Layout of existing disposal site after improvement

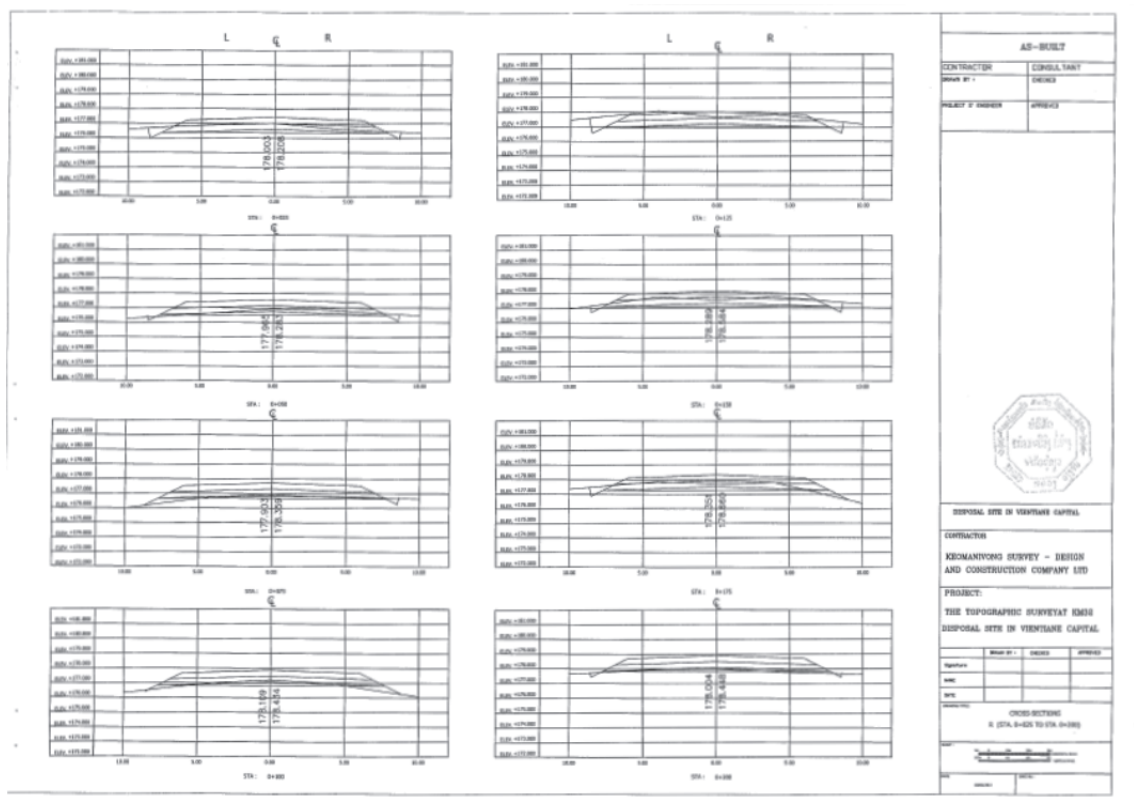


Figure 3-7. As built drawing of access road section

- b. Operation after the improvement work
 - b.1 Incoming waste data

The proper operation of KM32 existing final disposal site stated on 9 April 2013. The incoming amount of collected waste was measured at the weight bridge and is shown in the following table.

Table 3-24. Incoming amount of collected waste

Month	2013 ton/month	2014 ton/month	2015 ton/month
1		7,208	6,978
2		7,151	7,634
3		6,613	4,714
4		7,272	7,287
5		7,426	7,652
6	7,271	8,333	8,352
7	8,119	7,970	8,303
8	7,535	8,295	
9	7,817	8,567	
10	7,816	7,635	
11	5,090	6,964	
12	7,058	7,489	
Total	50,706 ton/year	90,923 ton/year	50,920 ton/year

- b.2 Waste dumping

VUDAA has been using Area No.1-No.5 for waste dumping since the KM32 final disposal site

was established in 2007. VUDAA used to dump collected waste to the dumping areas from the access road before 2012. With an instruction by SJET, it changed this practice and it started to let the trucks into the dumping area and dump waste in the middle of the dumping area. VUDAA then moves and compacts dumped waste using the bulldozer and the excavator.

Area No.6 should be constructed before Area No.1 to No.5 are filled with discharged waste in 2019. The second layer of waste dumping at No.1 to No.11 will be commenced in 2022.

b.3 Access road

The collection vehicles can easily approach to the cell area No.1-No.5 through the improved access road all year around. The trucks further go into the cell area for dumping. This is not a problem in the dry season, but difficult in the rainy season due to the muddy ground. VUDAA lines up the concrete places in the cell area, so that the trucks can go into the cell area even in rainy season.

b.4 Soil coverage

UDAA has regularly applied soil coverage at the cell areas to prevent the problems of fire, smoke, offensive odor and waste scattering. The cover soil is available within the disposal area. Two dump trucks and a bulldozer, provided by JICA, and the VUDAA's existing excavator have been used for soil coverage.

c. Monitoring

After the commencement of the pilot project, on-site monitoring was carried out approximately once a year. The number of participants and date of monitoring were 45 people in May 2012, 37 people in July 2013, 24 people in August 2015 and 33 people in June 2015. The participants were those from governmental agencies at the national, capital and district levels, social organizations (Labor Union, Women's Union and Youth Union) and schools. The participants were given a lecture about the facility and operation of the disposal site, observed the facility operation and answered prepared questionnaires.

The questionnaire had a structure and questions shown below. The questions of Category A were asked every time of the monitoring, while the questions of Category B were asked at the 2nd monitoring and onwards as they were related to the operation of facility developed by the civil works in 2013.

Category A (regarding environmental aspects)	Category B (regarding facility operation)
<ul style="list-style-type: none"> • Offensive odor • Fire and smoke • Waste scattering • Vermin (flies and other small animals) • Wastewater stagnation, etc. 	<ul style="list-style-type: none"> • Access road • Drainage system • Landfill operation • Septage treatment facility • Healthcare waste management, etc.
Three answer options: acceptable, medium, not acceptable	Three answer options: functioning medium, not functioning

The answers were compiled according to the year of monitoring and questions. The results across the years were shown below.

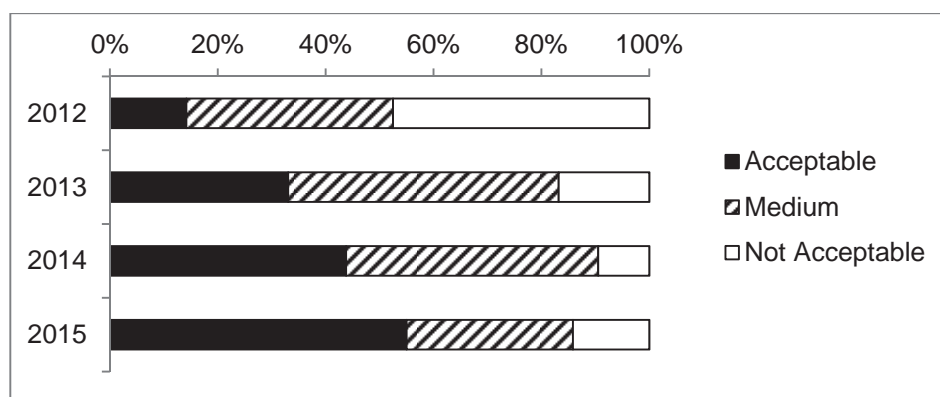


Figure 3-8. Results of Category A

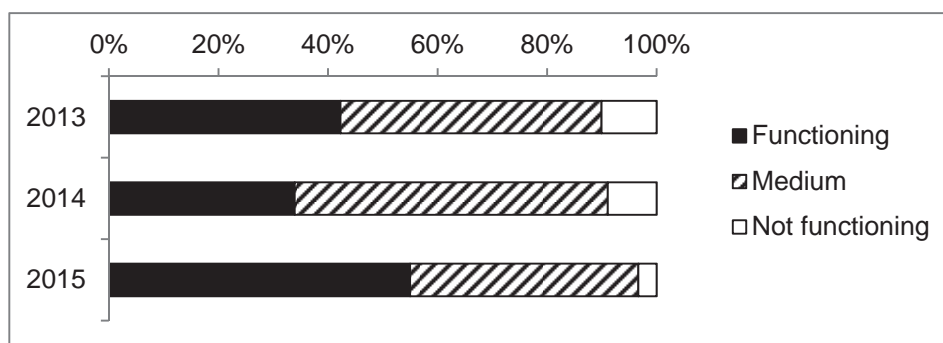


Figure 3-9. Results of Category B

Category A was improved year by year. From the examination of the original questions and answers, improvement is particularly found in the aspects of the flies and smoke problems, rain water and leachate seepage and stagnation and waste pickers.

The monitoring in 2013 was in the next month of the completion of improvement work. Its result in Category B was relatively good probably by reason that the participants were impressed by the newly improved facilities rather than their operation status. One year later in 2014, the operation and maintenance manner was not adequate and the monitoring gave low scores. As the LPPE was reaching its final phase, VUDAA became highly motivated to operate and maintain the disposal site properly, hence monitoring result took an upturn accordingly.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-25. Evaluation of Proper management of existing final disposal site

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. An operation plan of the final disposal site is formulated.	1. Final disposal operation plan	Achieved. An operation plan of the final disposal site was formulated after discussion between VUDAA and SJET.
2. The final disposal site is operated in accordance with the operation plan.	2. Final disposal operation record	Achieved. The final disposal site is operated in accordance with the operation plan and the waste amount of incoming waste was properly

		recorded.
3. The final disposal site is monitored by the final disposal site monitoring committee once a year.	3. The monitoring report of the committee	Achieved. The final disposal site is monitored by the final disposal site monitoring committee once a year.

6. Recommendation

Necessary budget should be secured every year for the adequate operation and maintenance of the final disposal site. After the reception of a bulldozer procured by the grant assistance of the Japanese Government in 2015, the cost for operation and maintenance including the use of the bulldozer is estimated at 1,730,155 thousand kip per year.

The capacity of the present disposal site will be full by 2026. VUDAA is required to prepare an engineering design and construct the landfill by then in the land next to the current site. .

As for the daily operation, the main issue is to keep the site operational and to keep allowing the access of waste trucks in the rainy season by applying the concrete plates. As the concrete plates, however, will be deteriorated with age, VUDAA should produce new concrete plates using formwork provided by the LPPE.

3.1.2 Proper management of waste pickers and improvement of their working conditions

1. Project Purpose

The purpose is to manage the waste pickers properly and to improve their working conditions.

2. Concept

The proper management of waste picker is formulated and conducted to improve their working conditions by VUDAA and SJET. The management of waste pickers is monitored by waste pickers meeting.

Table 3-26. Implementation schedule of Proper management of waste pickers and improvement of their working conditions PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET,	■				
	Set up concept	VUDAA, SJET,	■				
Planning of PP	Identify the waste pickers	VUDAA, SJET,	■				
	Formulation of management and improvement plan	VUDAA, SJET,	■				
Implementation of PP	Management of Waste Pickers and Improvement of their Working Conditions	VUDAA, SJET		■			
	Waste pickers meeting	VUDAA, DONRE, SJET	▲	▲		▲	
	Evaluation of the PP	SJET				■	

	Suggestion for continuation by C/P	for SJET						
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3. Plan

a. Identify the waste pickers

The ID cards of waste pickers are issued to identify and organize the waste pickers.

b. Formulation of management and improvement plan

In order to regulate and control the activities of waste pickers, VUDAA established and issued “Rules and Measures for Km 32 Disposal Site, No 3988/SWCT” in 2012. Furthermore, in order to facilitate control of waste pickers, VUDAA in cooperation with SJET stated the control of waste pickers in the KM32 disposal site operation plan finalized in August 2015 as follows.

- Waste pickers are required to be registered for working at the disposal site.
- Waste pickers are required to bring the issued ID cards when they work at the disposal site.
- Waste pickers are required to put on safety jackets, gloves, masks and long boots.
- Waste pickers are required to have Preventive injection for infection disease supported by LPPE.
- Waste pickers are required not to work at the active disposal area to avoid any accident.

4. Implementation

a. Management of Waste Pickers and Improvement of their Working Conditions

In order to facilitate control of waste pickers VUDAA in cooperation with SJET has conducted the following activities:

- (1) ID cards were issued to organize the waste pickers
- (2) The following equipment was provided to the waste pickers.
 - Preventive injection for infection disease (160 persons)
 - Gloves (160 persons)
 - Long boots (160 persons)
 - Safety Jacket (160 persons)

VUDAA instructed the waste pickers to put on the gloves, boots and safety jackets when they work on waste picking and warned anybody not following this.

The implementation of the KM32 disposal site operation plan contributes the improvement of working condition, such as the prevention of infectious disease, accidents caused by heavy machinery and disputes among waste pickers and so on.

b. Waste picker meeting

Since the 1st waste picker meeting in January 2013, the waste picker meetings have been held a few times every year to repeatedly have the rules understood by the waste pickers.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-27. Evaluation of Proper management of waste pickers and improvement of their

working conditions PP

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. A management plan of waste picker is formulated.	1. Final disposal operation plan	Achieved. A management plan of waste pickers was formulated.
2. The waste pickers working conditions is improved in accordance with the management plan.	2. Progress report	Achieved. The waste pickers' working conditions was improved in accordance with the management plan.
3. The management of waste pickers is monitored by waste pickers meeting	3. Progress report	Achieved The management of waste pickers is monitored by the waste picker meeting.

6. Recommendation

The regular discussion is recommended to manage the waste pickers.

After the reception of a bulldozer by the grant aid of the Japanese Government in November 2015, the operation method of the final disposal will be changed. For example, the frequency of waste movement and soil coverage will increase and the waste disposal work and waste picking work can have conflicts. The waste picker management rule will need a revision and all the waste pickers should understand it. Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.

3.2.1 Development and management of the treatment facility for the sludge from septic tanks

1. Project Purpose

The purpose of this PP is to properly manage the treatment facility for the sludge from septic tanks and to mitigate impacts to the surrounding aquatic environment.

2. Concept

The proper operation and maintenance of the treatment facility for sludge from septic tanks is conducted in accordance with the formulated operation plan. its operation is regularly monitored after improvement.

Table 3-28. Implementation schedule of Development and management of the treatment facility for the sludge from septic tanks PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	VUDAA, SJET,	■				
	Set up concept	VUDAA, SJET,	■				
Planning of PP	Identify and study the pilot area at KM32 existing final disposal site	VUDAA, SJET,	■				
	Formulation of improvement plan of infrastructure at KM32 existing final disposal site	VUDAA, SJET,	■				

	Formulation of draft operation plan at KM32 existing final disposal site	VUDAA, SJET,					
	Finalization of operation plan	VUDAA, SJET,					
Implementation of PP	Improvement of KM32 existing final disposal site and procurement of heavy machinery	SJET					
	Proper operation of KM32 existing final disposal site	VUDAA, SJET					
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET					■
	Suggestion for continuation by C/P	SJET					■

3. Plan

a. Identify and study the pilot area

The topographic survey was conducted to identify the boundary of the pilot area at KM32 existing final disposal site.

b. Formulation of improvement plan of infrastructure

A facility plan for the treatment of the sludge from septic tanks was formulated as follows;

- Excavation of Sedimentation Pit & Treatment Pond
- Wall protection (Reinforced Concrete t= 150mm)
- Open Drainage w= 30 cm
- Receiving tank 3 x 4 m (Reinforced concrete)
- Gate w= 4.0m
- Fence H= 1.8m (RC pole & Wire mesh)
- Gravel pavement t= 150 mm
- Concrete pavement w=5.0 m
- Access road (DBST) w= 5.0m, t= 200mm 300m

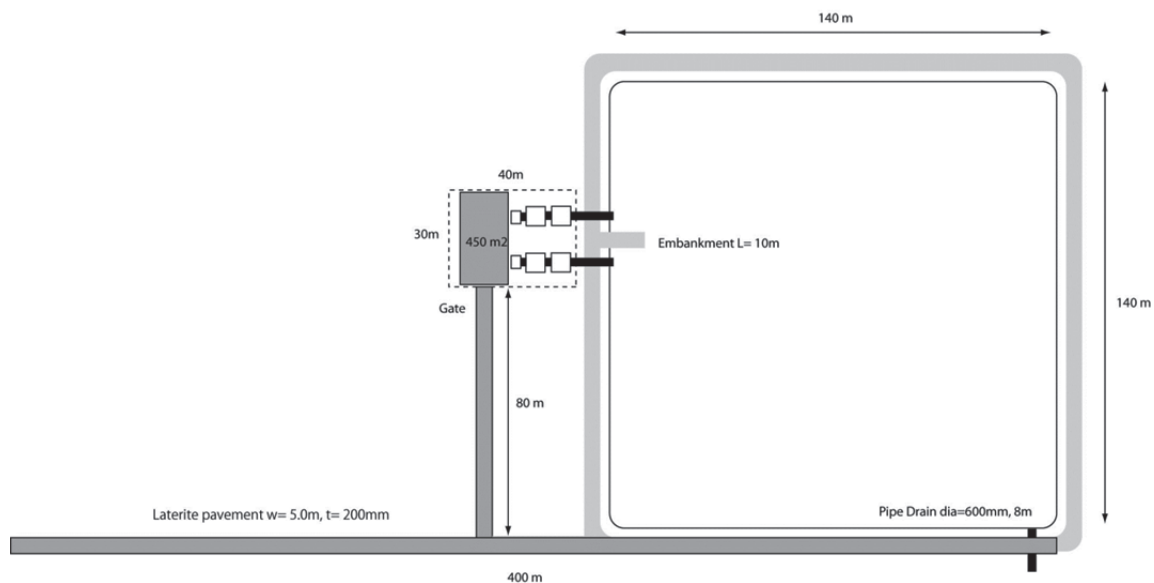


Figure 3-10. Layout of the treatment facility for the sludge from septic tanks

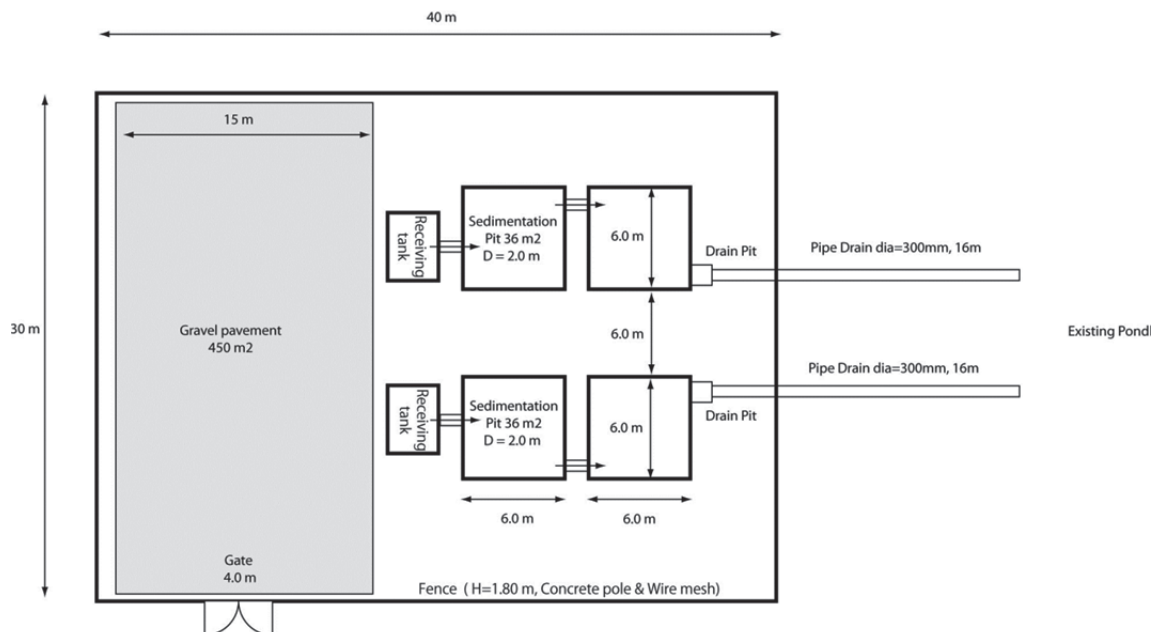


Figure 3-11. Layout of the treatment facility for the sludge from septic tanks

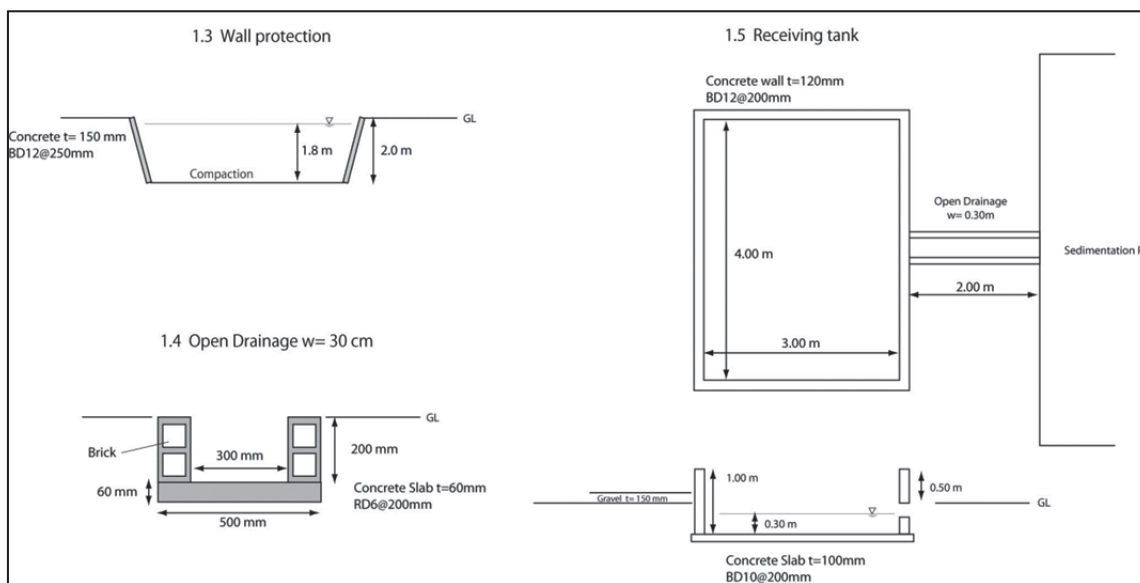


Figure 3-12. Typical section of the treatment facility for the sludge from septic tanks

c. Formulation of draft operation plan of treatment facility for the sludge from septic tanks

The constructed treatment facility for the sludge from septic tanks requires not only proper operation but also proper maintenance. The draft operation plan included following maintenance procedure.

The Use of Septic Sludge Treatment Facility

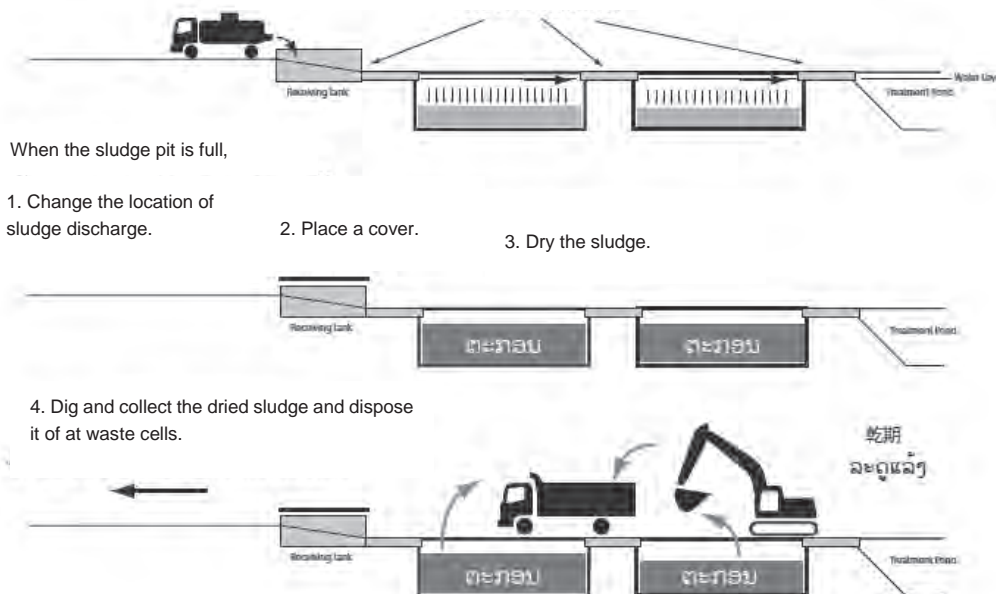


Figure 3-13. Procedure of operation and maintenance of treatment facility for the sludge from septic tanks

d. Finalization of operation plan

The finalized operation and maintenance plan of treatment facility for the sludge from septic tanks is described in Appendix 5.

4. Implementation

a. Implementation of construction of treatment facility for the sludge from septic tanks

The construction started in March 2013 and completed in June 2013. The operation of treatment facility for the sludge from septic tanks started in July 2013.

Table 3-29. Construction of treatment facility for the sludge from septic tanks

	Items	Qty	unit
1	Site clearing	2,100	m ²
2	Excavation of Sedimentation Pit & Treatment Pond	736	m ³
3	Wall protection (Concrete t= 150mm)	192	m ²
4	Open Drainage w= 30 cm	26	m
5	Receiving tank 3 x 4 m	2	place
6	Gate w= 4.0m	1	place
7	Fence H= 1.8m (RC pole & Wire mesh)	196	m
8	Gravel pavement t= 150 mm	250	m ²
9	Concrete pavement w=5.0 m	25	m

Section Plan

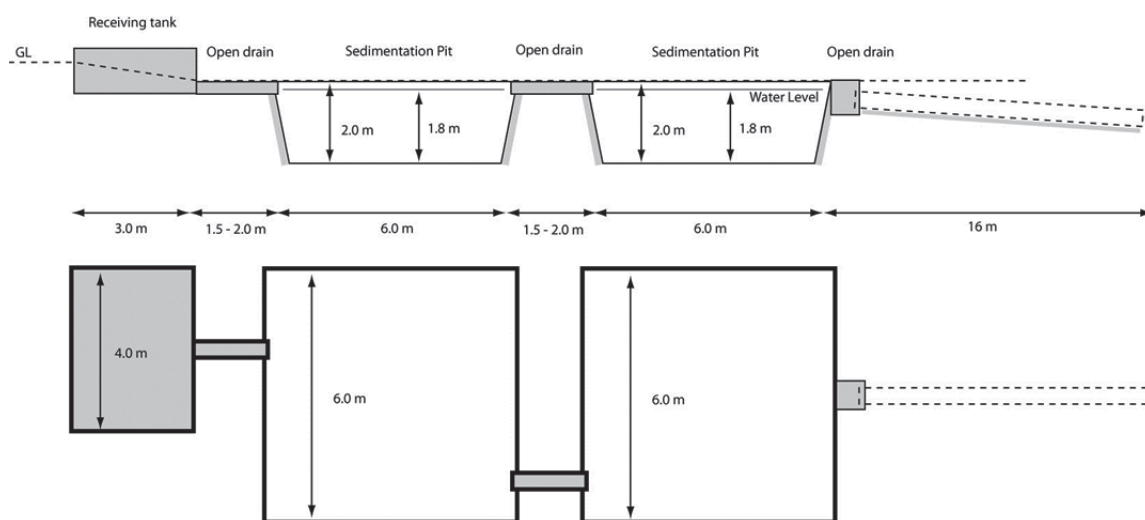


Figure 3-14. As built drawing of treatment facility for the sludge from septic tanks

b. Operation of treatment facility for the sludge from septic tanks

The treatment facility for the sludge from septic tanks started its operation after the improvement works. The data of incoming amount of collected sludge was only available after July 2013, when the computer system of the weighbridge was renewed.

Table 3-30. The incoming amount of collected sludge

Month	2013 m ³ /month	2014 m ³ /month	2015 m ³ /month
1	-	-	80
2	-	-	0
3	-	-	0
4	-	-	0
5	-	252	0
6	-	468	216
7	-	504	446
8	-	636	1,330
9	-	798	
10	-	412	
11	-	470	
12	-	136	
Total	-	3,676	2,072

c. Monitoring

The treatment facility for the sludge from septic tank was monitored by the monitoring committee once a year in the monitoring committee for the proper management of final disposal site. According to the monitoring results from 2013 to 2015, it was evaluated by most of the monitoring participants that the septic tank sludge treatment facility was operating at an acceptable level or a medium level.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-31. Evaluation of treatment facility for the sludge from septic tanks PP

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. An operation plan of the treatment facility for the sludge from septic tanks is formulated.	Final disposal operation plan	Achieved. An operation plan of the treatment facility for the sludge from septic tanks was formulated.
2. The treatment facility for the sludge from septic tanks is operated in accordance with the operation plan.	Final disposal operation record	Achieved. The treatment facility for the sludge from septic tank was operated in accordance with the operation plan.
3. The treatment facility for the sludge from septic tanks is monitored by the final disposal site monitoring committee once a year.	The monitoring report of the committee	Achieved. The treatment facility for the sludge from septic tank was monitored by the final disposal site monitoring committee once a year.

6. Recommendation

So far, VUDAA removed the sludge sediment approximately every six months and the facility keeps functioning well. VUDAA should continue sludge removal at the same frequency as present.

In case that daily receiving amount of septic tank sludge in a month reaches more than 90% (32.4m³) of capacity of treatment pond, the new treatment pond is recommended to design.

Strategy 4. Healthcare waste management (HCW) is improved.

Approach 4.1: HCW is collected properly.

4.1.1 HCW collection system establishment

Approach 4.2: HCW is disposed of properly.

4.2.1 HCW treatment and disposal system establishment

Due to the close linkage of these two PPs, they are described below together.

1. Project Purpose and Summary

The PP for HCW Collection System Establishment aims to establish a separate collection and transportation system for HCW generated in main hospitals in VTE and its monitoring system.

The PP for HCW Treatment and Disposal System Establishment aims to establish a treatment and disposal system for the separately collected HCW generated from main hospitals in VTE and its monitoring system.

Through these projects, infectious HCW discharged from four main hospitals in LPB is separately collected and incinerated.

2. General Concept

To establish the project concept, the PP implementation body, which was chaired by director of Urban Cleaning Supervision Division of VUDAA and consists of members of MOH and DOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

Table 3-32. Outline of the Plan for HCW Collection System Establishment PP and HCW Treatment and Disposal System Establishment PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Concept Planning	Set up project management system	VUDAA, MOH, DOH, SJET	■				
	Set up concept	SJET, VUDAA, MOH, DOH	■				
Planning of PP	Study and selection of pilot hospitals	VUDAA, SJET, MOH, DOH, ,	■				
	Preparation of collection and transportation PP plan	SJET, VUDAA, MOH, DOH,	■	■			
Implementation of PP	Construction of a HCW incinerator	SJET	■				
	Instruction of the incinerator operation	SJET, VUDAA	■				
	Implementation of HCW incineration	VUDAA, DOH, SJET	■	■	■	■	■
	Preparation of education tools	SJET, DOH, DONRE, VUDAA		■	■		
	Collection of separated HCW *1	VUDAA, MOH, DOH, SJET			■	■	■
	Monitoring and awareness raising	MOH, DOH, VUDAA, SJET			■	■	
	Evaluation of the PP	SJET, MOH, DOH, VUDAA				■	
	Formulation of HCWM plan	SJET, VUDAA, MOH, DOH,			■	■	
	Suggestion for expansion	SJET, VUDAA, MOH, DOH				■	

Note: *1: Separate HCW collection had been conducted by VUDAA even before the PP. In this table, the separated HCW collection means collection of HCW separated in a manner suitable for incineration from targeted hospitals.

3. Planning

a. Study and Selection of Pilot Hospitals

a.1 Study on Current HCWM

After literature search until April 2012, an interview survey was carried out in May at Mahosot, Friendship, Police, Sethathirath and Military hospitals to know their waste generation, separation, collection, treatment and disposal practices. The findings are shown below regarding HCW generation in the two hospitals.

Table 3-33. HCW Generation in the Five Hospitals in VTE Capital (2012)

Name of Hospital	Nos of beds	Occupation rate	Total staff	Out-patients/day	In-patients/day	Waste Total (hearing survey)	Infectious + Sharps (hearing survey)	Infectious+ Sharps (Weighing)
		rate	Persons	person	person	kg/d	kg/d	kg/d
Mahosot	450	70%	914	415	43	402	196	137
Friendship	250	60%	482	200	195	600	50	136.2
Police	100	50%	150	100	40	50	5	12
Sethathirath	175	70%	426	200	80	250	20	23.5
Military (103)	250	50%	1018	239	252	250	20	10
Total	1225		2990	1154	610	1552	291	318.7

HCW collection practices for the five hospitals in May 2012 are shown in the table below.

	A	B	C	D
No	Name of Hospitals	Fee for General Waste (kip/month)	Fee for Infectious Waste (kip/month)	Separate Collection
1	Mahosot	10,000,000	LS	Yes
2	Friendship	3,600,000	588,000	Yes
3	Police	1,400,000	LS	Yes
4	Sethathirath	5,500,000	None	No
5	Military (103)	7,500,000	880,000	Yes

LS: Lump sum (fee for general waste collection covers infectious waste collection)

As shown in Column D, four hospitals used separated collection services for general waste and infectious waste, for which VUDAA utilized the vehicle specialized to carry infectious waste provided by JICA in 1998. However, this separate collection service did not have a uniform fee structure (see Column C) and fee was determined for each hospital individually together with general HCW collection and very cheap. Strict separation of infectious HCW, therefore, was not conducted.

Sethathirath hospital did not use the separate collection service, because the hospital was supposed to treat its waste by an incinerator installed at the hospital. When it was interviewed, however, the incinerator had operation troubles and was not used. The hospital was discharging all the waste to the general waste collection service.

a.2 Selection of Pilot Hospitals

Based on the results of the current HCWM study the target hospitals of PP were selected as follow. Also, two project targets were set.

Target hospitals: 7 Main hospitals, namely Mahosot Hospital, Sethathirath Hospital, Friendship Hospital, Military Hospital (103 Hospital), Police Hospital (5 April Hospital), Mother and Child Hospital, and Child Hospital.

Indicator:

1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.

b. Preparation of Collection, Transportation, Treatment and Disposal PP Plan

SJET made a plan to carry infectious HCW from target hospitals by the specialized vehicle provided by JICA in 1998.

Futhermore, infectious HCW separately collected from the target hospitals shall be treated by the HCW incinerator to be installed at the KM32 disposal site and the ashes remaining after incineration shall be disposed of at the disposal site.

Based on the agreement to install the HCW incinerator at the KM32 disposal site, it was planned that VUDAA should separately collect the separated infectious HCW from target hospitals, transport and treat the waste by incineration and disposed of the incinerated ash at the KM32 disposal site.

4. Implementation

a. Construction of Facility for Infectious HCW Incineration

In May 2012 SJET constructed a facility for infectious HCW incineration at the KM32 disposal site and installed an infectious HCW incinerator made in Vietnam, i.e. manufactured by VAST (Vietnamese Academy of Science) and with a capacity of 20 kg/hr). After installation VAST provided an operation training to the operation staffs of VUDAA. Following the training a test operation was conducted and necessary cost for operation was understood. Based on the test operation results, VUDAA set up infectious HCWM fee (collection, transportation and incineration fee) at 10,650 kips/kg and commenced contract negotiation with 7 target hospitals.

In 2013, the incinerator stopped operation twice. The operators of VUDAA made asked for advice from the Vietnamese manufacturer and managed to restart operation. The main cause of malfunction was considered to be a disparity between the facility setting of the incinerator since its installation and the setting which is the precondition of the operation manual provided by the Vietnamese manufacturer. SJET carefully observed the VUDAA's operation manner, and SJET gave some instructions such as the regular cleaning of the bottom part of cyclone of the emission gas treatment devise.

On July 15, 2014, back fire occurred when operation just started and the No.2 burner was damaged. SJET investigated inside of the burner, and the cause was supposed to be the clogged burner nozzle with waste. SJET then ordered spare parts to solve this current problem and to be ready for the forthcoming problems from VAST (Vietnam Academy of Science and Technology). VAST sent the spare parts and a technician and successfully repaired.

Table 3-34. List of Spare Parts for the Incinerator

	Spare-parts	Unit	Quantity	Note
1	Photoelectric eyes	Piece	1	Common to the burners
2	Ignition electrode	Piece	1	Common to the burners
3	Temperature sensor	Piece	1	Common to the No.1 and No.2 chambers
4	Nozzle	Piece	2	One for each burner
5	Solenoid Valve	Piece	1	Used for No.2 burner

b. Implementation of Separate Collection and Incineration of Infectious HCW

Performance of the incinerator operation from May 2012 when the incinerator was installed at the KM32 disposal site to July 2015 is presented in the table below.

Table 3-35. Operational Performance of HCW Incinerator at KM32 Disposal Site

Period	Operation Time (Hours)	Total Incineration
--------	------------------------	--------------------

	Hour	hour/day	kg	Kg/day
May 2012~Dec 2012	25	0.1	420	1.75
Jan 2013~Dec 2013	38	0.1	739	2.02
Jan 2014~June 2014	19	0.1	392	2.15
July 2014~Dec 2014	668	3.7	10,858	59.50
Jan 2015~Apr 2015	1,043	8.6	20,456	168.13
May 2015~July 2015	877	9.5	18,614	202.33
Total	2,670	-	51,479	-

According to the table from May 2012, installation of the incinerator, till June 2014, the average incineration amount is less than **2.2 kg/day** that is very limited and much lower than its maximum capacity of **20 kg/hour**. The reason is only Mahosot hospital and Mother & Child hospital among seven target medical institutions have entrusted their infectious waste separate collection and treatment by incineration until June 2014.

Average daily possible incineration amount is estimated at **76 kg/day** based on the calculation below.

1. Capacity: 20 kg/hour
2. Required operation hours for one batch: 2hours 20 minutes (Two hours operation + 20 minutes cool down)
3. Maximum numbers of batch operation: 3 times/day
4. Maximum incineration amount: 120 kg/day (20 kg/hour x 2 hours x 3 batch)
5. Monthly possible operation days: 21.4 days (30 days x 5/7)
6. Monthly maintenance days: 2 days
7. Yearly maintenance days: 5 days
8. Yearly operation days: 232 days ((365 x 5/7) – (2 x 12) – 5)
9. Yearly incineration amount: 27,840 kg/year (120 kg/day x 232 days)
10. Average daily possible incineration amount: 76 kg/day (27,840kg/365 days)

According to the calculation above, in December 2014 the incineration amount reached almost the same amount as the daily possible amount. As of July 2015 the daily average operation time and amount are 9.5 hours and 202kg respectively. It means the incinerator is being operated far beyond the possible capacity. Overcapacity operation is conducted without holidays and maintenance days, and over 10 hours operation everyday. It is afraid that these overcapacity operation may cause frequent break down of the incinerator.

The Figure below shows the change of monthly incineration amount and it clearly indicates that even after it reached the monthly possible incineration amount capacity (76kg x 30days = **2,280kg**), the incineration amount is increasing a lot and the incinerator is being operated far beyond its capacity.

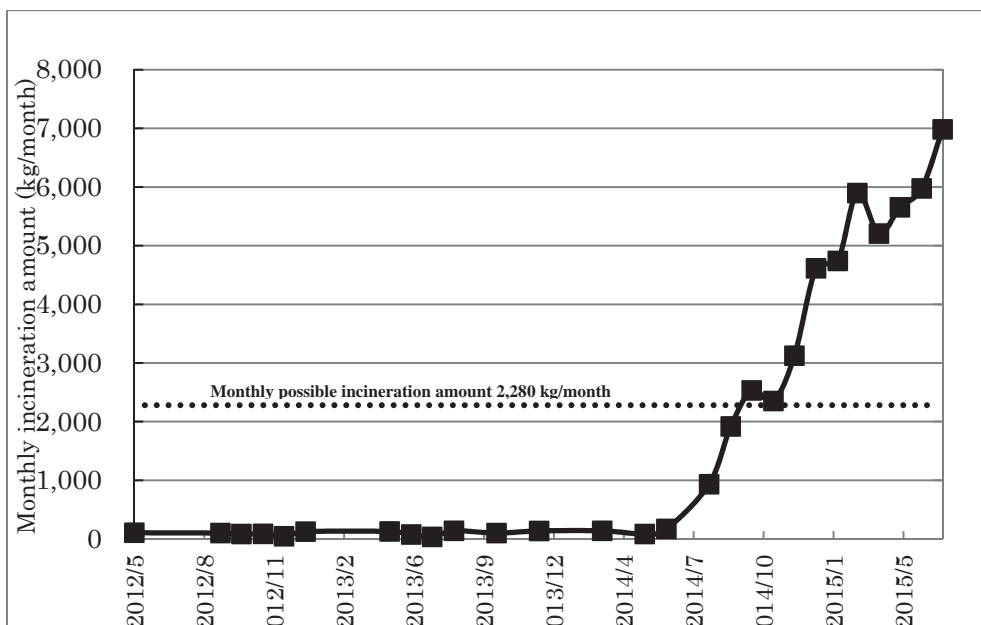


Figure 3-15: Monthly Incineration Amount (Kg/Month)

c. Education, Monitoring and Awareness Raising Activities

As described above, the incinerated amount from May 2012 to June 2014 was very limited and far below its capacity. In order to solve these situations SJET in cooperation with VUDAA, MOH and DOH conducted the following education, monitoring and awareness raising activities. As a result, the separate collection and incineration of infectious HCW from seven main hospitals have been progressed.

Table 3-36. Major Education, Monitoring and Awareness Raising Activities to Improve HCWM in VTE Capital

Date	Events
August 17, 2012	Agreement of the separate collection and treatment fee at 10,656 kip/kg at the HCW Management Committee with 6 medical institutions
September 7, 2012	The HCW incinerator started operation not for 5 target hospitals but only for Pasteur Institute.
February 8, 2013	Agreement at the HCW Management Committee with 6 medical institutions to organize a seminar to promote separate collection and treatment
March 12, 2013	Seminar on the HCW separation in hospitals
June 3, 2013	Petition from VUDAA to MONRE for the proper separate discharge of HCW from the 5 target hospitals.
November 21, 2013	At the meeting room of MOH, the 1st meeting of HCW personnel was held by DHHP (Department of Hygiene and Health Promotion).
December 2013 to January 2014	DHHP implemented a survey to monitor the health care waste separation at the seven major institutions and to observe the operation of the incinerator.
June 12, 2014	DHHP of MOH held the 2nd meeting of HCW personnel with the participants from the 6 target institutions. The output of the meeting, however, was merely comparable to that of the 1st one.
June 19, 2014	DHHP/MOH, VUDAA and LPPE had a meeting. It was agreed that DHHP should instruct the 7 target institutions to separate HCW which should be incinerated and to discharge it separately even in a pilot scale at part of wards or units.
7-9 July 2014	DHHP and other relevant officers formed three training teams and provided instructions to the 7 target institutions.

21-23 2014	July,	DHHP followed up the improvement works at the 7 target institutions.
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d. Formulation of HCWM Plan

A HCWM Plan (draft) was formulated and reviewed several times through the discussion with the C/P before finalization. The finalized HCW flows are shown in the figures below.

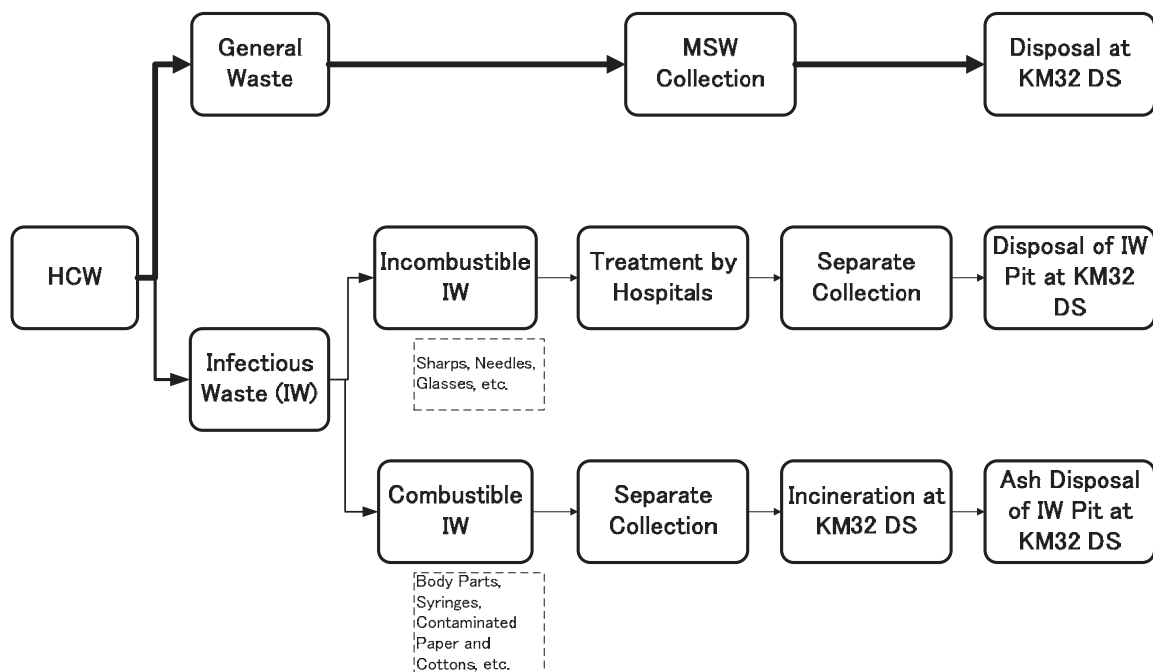


Figure 3-16: HCWM Flow in 2020

The detail of the Plan is shown in the Appendix 6, Supplement 1.

5. Evaluation and Achievements

Achievement of the PP indicators is as follows:

Table 3-37. Evaluation of HCWM Improvement PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.4. Healthcare waste management is improved.		
1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.	1. The healthcare waste collection, treatment and disposal plan	Achieved. HCWM Plan was formulated, reviewed and finalized.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.	2. The record of healthcare waste collection, treatment and disposal.	Achieved. Separate collection, incineration and disposal is conducted for the infectious HCW from all of the target hospitals.

In addition to the above-mentioned indicators, the following outputs were produced through the implementation of the PP:

- In order to improve HCWM in VTE Capital instruction, monitoring and control system by

- MOH/DHHP has been established.
- Legal tools necessary for the improvement of HCWM in VTE Capital is being established with a lead of the MOH/DHHP.
 - In addition to the 7 target medical institutions (MIs) 6 non-target MIs have entrusted separate collection, incineration and disposal of infectious HCW to VUDAA. Consequently PP achieved much more outputs than planned.

6. Suggestion for the Post-Project Activities

As described above the target of the PP is achieved. The target set by the HCWM Plan for the year 2020 is to separately collect, incinerate and dispose of all the infectious waste in VTE Capital. VUDAA in cooperation with MOH and DOH is recommended to take the following improvement measures by continuing and expanding the PP:

1. A reliable list of medical institutions (MIs) in VTE Capital the HCWM plan should be reviewed and modified when necessary using the list.
2. In the review of the HCWM plan, VUDAA should examine the demand of incineration of the incombustible infectious HCW from the medical institutions that do not have its treatment facility for a purpose of intermediate treatment.
3. Based on the revised HCWM plan VUDAA should make a construction plan of the incinerator to treat all of infectious HCW generated in VTE Capital and implement the plan.
4. MOH should issue the Ministerial Order on proper infectious HCWM as soon as possible to establish separate collection, treatment and disposal of all infectious HCW in VTE Capital.
5. Based on the above Ministerial Order MOH in cooperation with DOH and VUDAA should strengthen the monitoring and control system of improper infectious HCWM.
6. VUDAA should operate and maintain the HCW incinerator referring to the manual shown in Appendix 7. Also, it should examine reduction and control of leachate generated in HCW pit in KM32 disposal site.

Strategy 5. Institutional system to support the above improvements be established.

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

5.1.1 Consensus building among stakeholders

1. Project Purpose and Summary

To improve SWM in VTE Capital a lot of pilot projects (PPs) have been conducted based on the strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The purpose of this PP is to codify the responsibilities of each stakeholder regarding PPs for SWM improvement conducted in VTE Capital and build consensus among them.

The PP has clarified the responsibilities of each stakeholder necessary for the implementation of PPs and built consensus among them through mutual discussions. When consensus was made, the PP tried to codify the contents of the consensus as much as possible. The products of codification varied from legal documents to leaflets distributed among the stakeholders according to the nature of the PPs.

2. General Concept

To establish the project concept the PPs implementation body, which is chaired by director of Urban Cleaning Supervision Division of VUDAA and consists of members of DONRE and MOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

As for the PPs for Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and HCWM Improvement, DONRE, VUDAA and MOH formulated the PP execution bodies in consideration of their roles and duties.

Table 3-39: Roles and Responsibilities of Stakeholders of SWM Improvement PPs in VTE Capital

Pilot Project	Stakeholder	Roles and Responsibilities	Method of Codification
Strategy 1: 3Rs Promotion			
1.1.1. Reduction of kitchen waste and garden waste at households (On-site Composting)	DONRE	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	<ul style="list-style-type: none"> On-site composting leaflet Worm composting dissemination video
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
1.1.2.a. Recyclable waste separation project at household	DONRE, VUDAA	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	<ul style="list-style-type: none"> Primary collection leaflet
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
1.1.3. Avoidance of the use of excess packages, Eco-basket project	DONRE	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	<ul style="list-style-type: none"> Eco-basket leaflet
	Village	Public education, awareness raising and instruction	
	Resident, Stalls of the market	Implementation	
	MONRE	Dissemination and Expansion	
Strategy 2: Collection System Improvement			
2.1.1&2 Improvement of exiting collection and discharge system, Primary collection system project	VUDAA	Planning, Preparation of awareness raising tools, Monitoring, Dissemination	<ul style="list-style-type: none"> Primary collection education leaflet
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
2.2.2 Waste collection service expansion	VUDAA	Planning, Preparation of awareness raising tools, Instruction of negotiation between collection company and village, Dissemination	<ul style="list-style-type: none"> Standard contract agreement of collection service
	Collection company	Negotiation with village, Awareness raising and instruction to waste discharger	
	Village Resident	Public education, awareness raising and instruction Implementation	
	MONRE	Dissemination and Expansion	
Strategy 3: Final Disposal System Improvement			

3.1.1. Proper management of existing final disposal site	VUDAA	Establishment of the rule and tipping fee of the disposal site, Education, awareness raising and instruction to users	<ul style="list-style-type: none"> • <u>No.798/SWCT/VUDAA 23/11/2011: Rules and penalty of KM32 disposal site users</u>
	KM32 disposal site	Enforcement and instruction of the rule	
	User of KM32 disposal site	Compliance of rules	
	MONRE	Dissemination and Expansion	
3.1.2. Proper management of waste pickers and improvement of their working conditions	VUDAA	Establishment of the rule, Education, awareness raising and instruction to Waste Picker	<ul style="list-style-type: none"> • <u>No.3988/SWCT/VUDAA 01/08/2012: Rules of and penalty of KM32 disposal site waste pickers</u>
	KM32 disposal site	Enforcement and instruction of the rule, Improvement of working condition of Waste Picker	
	Waste Picker	Compliance of rules	
	MONRE	Dissemination and Expansion	
Strategy 4: HCWM Improvement			
4.1.1. HCW collection system establishment	MOH, DOH, VUDAA	Revision of Ministerial Order on HCWM, Public education, awareness raising and instruction to MIs	<ul style="list-style-type: none"> • Revision of MOH Order No 1707/MOH • Contract agreement of separate collection service with MIs
	VUDAA Medical institution (MIs)	Separate collection of infectious HCW Separate discharge of infectious HCW and payment for service	
4.2.1. HCW treatment and disposal system establishment	MOH, DOH, VUDAA	Revision of Ministerial Order on HCWM, Public education, awareness raising and instruction to MIs	
	VUDAA Medical institution	Incineration and ash disposal of infectious HCW Separate discharge of infectious HCW and payment for service	

5. Evaluation and Achievements

The achievement of the PP indicator (Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.) is as follows:

Strategy 3: Final Disposal System Improvement:

1. **798/SWCT/VUDAA 23/11/2011: Rules and Measures for User of KM32 Disposal Site:**
 - To establish rules for the user of KM32 disposal site and penalty of violator.
2. **3988/SWCT/VUDAA 01/08/2012: Rules and Measures of KM32 Disposal Site:**
 - To establish rules of the waste pickers working at KM32 disposal site and penalty of violator.

Strategy 4: HCWM Improvement:

3. **Revision of No 1706/MOH 20/07/2004: Ministerial Order on HCWM of Healthcare Facilities:**
 - The ministerial order has being revised. For the revision works of the MOH the experience of HCWM PPs in VTE Capital and LPB District is being considered.
 - Especially “No.159/DOH.LPB 05/01/2014: Regulation on HCWM from Healthcare Facilities in LPB District” is one of the important references for revision work.

As mentioned above, 2 legal documents considered as “rule” were established and one considered as “ministerial order” is under discussion for two strategies. For the other strategies of 3Rs Promotion and Improvement of Collection System, the PP activities were carried out in villages and the codification of the responsibilities did not correspond to regulation. Nevertheless, the codification of responsibilities and consensus building, which were the purpose of the PP, were completed and the codified documents could serve for the future regulations at the district or VTE Capital level. Accordingly, the purpose of the PP was achieved.

Table 3-40: Evaluation of Consensus Building among Stakeholders PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.5. The following documents are prepared.		
1. Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.	1.1 VUDAA's regulation on waste discharge, collection and final disposal. 1.2 Draft amendment of LPB District's regulation on SWM or additional implementation rules.	Achieved. 2 legal documents were established and one is under discussion in the PPs and other documents could serve for the future regulations.

In addition to the above-mentioned targets, the following outputs have been achieved through the implementation of the PP:

- The roles and responsibilities of stakeholders on improvement of SWM became clear through the implementation of various PPs.
- Through the implementation of various PPs coordination system among MONRE, MOH and MPWT of central government and VTE Capital, District and Village of local government, and Residents have been established.
- The coordination system among relevant organizations was established to enforce the regulations on the improvement of HCWM.

6. Suggestion for the Post-Project Activities

Although the implementation of various PPs clarified roles and responsibilities of stakeholders for the improvement of SWM, the number of regulations formulated was limited. In order to promote further legislation, relevant organizations are recommended to conduct the following measures:

- “Basic Laws on SWM” should be established as soon as possible by the lead of MONRE.
- Following the “Basic Laws on SWM”, VTE Capital in cooperation with its Districts should establish “Regulation on SWM in VTE Capital” according to the situation of Districts in VTE Capital.
- If “Basic Laws on SWM” of national level delays, VTE Capital may need to establish “Regulation on SWM in VTE Capital” with the cooperation of MONRE.
- For the establishment of “Regulation on SWM in VTE Capital” VTE Capital and its Districts should utilize the experiences of the PPs.

Approach 5.2: Financial system necessary for proper SWM is improved.

5.2.1 Financial System Improvement

1. Project Purpose and Summary

To improve SWM in VTE Capital a lot of pilot projects (PPs) have been conducted based on the strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The purpose of this PP is to improve the financial system for r SWM improvement through the implementation of the above-mentioned PPs.

The financial system to be improved by the PP includes the following.

1. Financial system necessary for the implementation of the PPs for SWM improvement; and
2. Financial system necessary for the continuation, dissemination and expansion of the PPs to be implemented by the Laotian C/Ps after the termination of LPPE.

As for the former system, most of the proposals were regarding the operation and maintenance (O&M) cost shouldered by the Laotian side since the basic investment was born by the Japanese side of LPPE. In addition, most of the proposals were actually implemented because of the necessity of implementation of the PPs for SWM improvement.

As for the latter system, simple proposals are prepared for both O&M cost and investment.

2. General Concept

To establish the project concept the PPs implementation body, which was chaired by director of Urban Cleaning Supervision Division of VUDAA and consists of members of DONRE and MOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

As for the PPs for Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and HCWM Improvement, DONRE, VUDAA and MOH formulated the PP execution bodies in consideration of their roles and duties.

Table 3-42: Results of Financial Burdens for PP Implementation in VTE Capital and Proposal of Financial Burdens for Continuation, Dissemination and Expansion of PPs

Projects	Implementation of PP		Continuation, Dissemination and Expansion of PP	
	Items of Financial Burden	Organization Bore Burden	Items of Financial Burden	Proposed Organization to Bear Burden
Strategy 1: 3Rs Promotion				
1.1.1. Reduction of kitchen waste and garden waste at households (On-site Composting)	Study and planning	SJET	Study and planning	DONRE
	Procurement of equipment	SJET	Procurement of equipment	Resident
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET, DONRE, Ban, MONRE	Awareness raising, education and monitoring	DONRE, Ban
1.1.2. Recyclable waste separation project at household	Study and planning	SJET	Study and planning	DONRE, VUDAA
	Procurement of container for separation	Resident	Procurement of container for separation	Resident
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET, DONRE, VUDAA, Ban, MONRE	Awareness raising, education and monitoring	DONRE, Ban, VUDAA
1.1.3. Avoidance of the use of excess packages, Eco-basket project	Study and planning	SJET	Study and planning	DONRE
	Procurement of Eco-basket	SJET	Procurement of Eco-basket	Resident, Acquisition of subsidies and support from donors and CSR by MONRE/DONRE
	Implementation	Resident, Stalls of market	Implementation	Resident
	Awareness raising, education and monitoring	SJET, DONRE, Ban, MONRE	Awareness raising, education and monitoring	DONRE, Ban
Strategy 2: Collection System Improvement				
2.1.1&2 Improvement of exiting collection and discharge system, Primary collection system project	Study and planning	SJET	Study and planning	VUDAA, Ban
	Procurement of container for primary collection	SJET	Procurement of container for primary collection	Part of collection fee collected from resident by VUDAA and Collection company
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET, VUDAA, Ban, MONRE	Awareness raising, education and monitoring	VUDAA, Ban, Collection company
2.2.2 Waste collection service	Study and planning	SJET	Study and planning	VUDAA

expansion	Procurement of container for primary collection	SJET	Procurement of container for primary collection	Part of collection fee collected from resident by VUDAA and Collection company
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET, VUDAA, Ban, Collection company, MONRE	Awareness raising, education and monitoring	VUDAA, Ban, Collection company
Strategy 3: Final Disposal System Improvement				
3.1.1 Proper management of existing final disposal site	Study and planning	SJET	Study and planning	VUDAA
	Procurement of equipment and Construction of facility	SJET	Procurement of equipment and Construction of facility	Part of tipping fee collected from users by VUDAA, Donor and subsidies from VTE Capital
	Implementation	VUDAA	Implementation	Tipping fee from VUDAA and users other than VUDAA
	Awareness raising, education and monitoring	VUDAA, MONRE	Awareness raising, education and monitoring	VUDAA
3.1.2. Proper management of waste pickers and improvement of their working conditions	Study and planning	SJET	Study and planning	VUDAA
	Procurement of equipment	SJET	Procurement of equipment and Construction of facility	VUDAA, Waste Picker
	Implementation	SJET, VUDAA	Implementation	VUDAA, Waste Picker
	Awareness raising, education and monitoring	SJET, VUDAA, MONRE	Awareness raising, education and monitoring	VUDAA
3.2.1. Development and management of the treatment facility for the sludge from septic tanks	Study and planning	SJET	Study and planning	VUDAA
	Construction of facility	SJET	Maintenance of facility	VUDAA
	Implementation	Users of facility, VUDAA	Implementation	Users of facility, VUDAA
	Awareness raising, education and monitoring	VUDAA, MONRE	Awareness raising, education and monitoring	VUDAA
Strategy 4: HCWM Improvement				
4.1.1. HCW collection system establishment	Study and planning	SJET	Study and planning	VUDAA, MOH, DOH
	Procurement of equipment	SJET	Procurement of equipment	Part of separate collection fee collected from users by VUDAA
	Implementation	Separate collection fee from medical institutions	Implementation	Separate collection fee from medical institutions
	Awareness raising, education and monitoring	SJET, MOH, VUDAA, DOH, MONRE	Awareness raising, education and monitoring	MOH, DOH, VUDAA

4.2.1. HCW treatment and disposal system establishment	Study and planning	SJET	Study and planning	VUDAA, DOH
	Construction of incinerator	SJET	Construction of facility	Part of incineration fee collected from medical institutions
	Implementation	Incineration treatment fee from medical institutions	Implementation	Incineration treatment fee from medical institutions
	Awareness raising, education and monitoring	SJET, MOH, VUDAA, DOH, MONRE	Awareness raising, education and monitoring	MOH, DOH, VUDAA

5. Evaluation and Achievements

a. Financial system necessary for PP implementation

As for the proposals necessary for the implementation of the PPs for SWM improvement, the following documents were prepared and officially issued:

Strategy 4: HCWM Improvement :

1. Meeting Minute No 019 /DONRE.VTE 21/08/2012: Minute of Meeting on Implementation of Incinerator at KM32 Disposal Site:

- Six major medical institutions (MIs) in VTE Capital agreed on the fee for the separate collection and incineration at 10,656 kip/kg proposed by VUDAA. After this agreement a lot of meetings were held prior to actual contract agreement for the service provision.

2. Contract Agreement on Separate Collection and Incineration of Infectious HCW: No xxx VUDAA/MIs in VTE Capital: Contract for Infectious HCW Collection, Incineration and Disposal Service:

- Contract agreement between VUDAA and MIs in VTE Capital on the separate collection, incineration and incinerated ash disposal of infectious HCW. At the end of July 2015 VUDAA has made contracts with 16 MIs.

As mentioned above, the proposal on the separate collection and incineration fee of infectious HCW regarding strategies for HCWM improvement was accepted by the MIs and was established as the contract agreements with VUDAA and “legal documents”. As for the strategies for Collection and Final Disposal System Improvement, the proposals for the revision of collection and tipping fee have been submitted to the Governor of VTE Capital in 2012 but not approved yet. For the 3Rs Promotion, the implementation of PPs did not need financial proposals for the implementation of the PPs.

b. Financial system necessary for the continuation, dissemination and expansion of the PPs

The financial proposals for the continuation, dissemination and expansion of the PPs were prepared as shown in the Table 3-42.

As a conclusion the PP indicator was satisfied and the PP purpose was achieved.

Table 3-43: Evaluation of Financial System Improvement PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.5. The following documents are prepared.		
1. Proposal for financial system improvement necessary for SWM improvement is prepared.	1. Proposal for financial system improvement necessary for SWM improvement.	Achieved. The proposal on the separate collection and incineration fee of infectious HCW was established as legal documents in the PPs and other documents could serve for the future regulations. ,

In addition to the above-mentioned targets, the following outputs have been achieved through the implementation of the PP:

- Through the implementation of various PPs, the needs of a financial system improvement plan with fair financial burden among stakeholders became clear.

- In order to prepare and implement the financial system improvement plan, the coordination system have been established among MONRE, MOH and MPWT of central government, local governments at the VTE Capital, District and Village levels and residents through the implementation of various PPs.

6. Suggestion for the Post-Project Activities

Although the implementation of various PPs clarified the needs of a financial system improvement plan and fair financial burden of each stakeholder for the improvement of SWM, the number of legal documents formulated was limited. In order to promote further legal documentation of the financial proposals, relevant organizations are recommended to conduct the following measures:

- The financial capacity on SWM improvement of the local governments is very limited. It is, therefore, recommended to examine O&M cost for SWM improvement based on the beneficiaries-bear principle.
- As for the investment, it is also recommended to apply the beneficiaries-bear principle in general. It is, however, very difficult to manage the large investment cost for the equipment procurement and facility construction with only fees from beneficiaries. It is, therefore, recommended to ask budget from the Central and Provincial governments and financial cooperation of donors and enterprises that promote CSR (cooperate social responsibility).
- As for the preparation of financial proposals it is recommended to utilize the experiences of various PPs as much as possible. Especially for the financial system improvement plan for the continuation of the PPs, and dissemination and expansion of them, it is recommended to utilize Table 3-42: Results of Financial Burdens for PP Implementation in VTE Capital and Proposal of Financial Burdens for Continuation, Dissemination and Expansion of PPs.

Appendix 4.

OPERATION PLAN FOR KM 32 DIPOSAL SITE IN VTE

LPP-Environment

In cooperation with JICA Experts Team

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1. Operation of Landfill Site

1.1 Required Landfill Volume

1.1.1 MSW Flow in 2011

Based on the municipal solid waste management (MSWM) study conducted by LPPE in 2011, MSW flow in VTE in 2011 has been prepared as shown in the figure below.

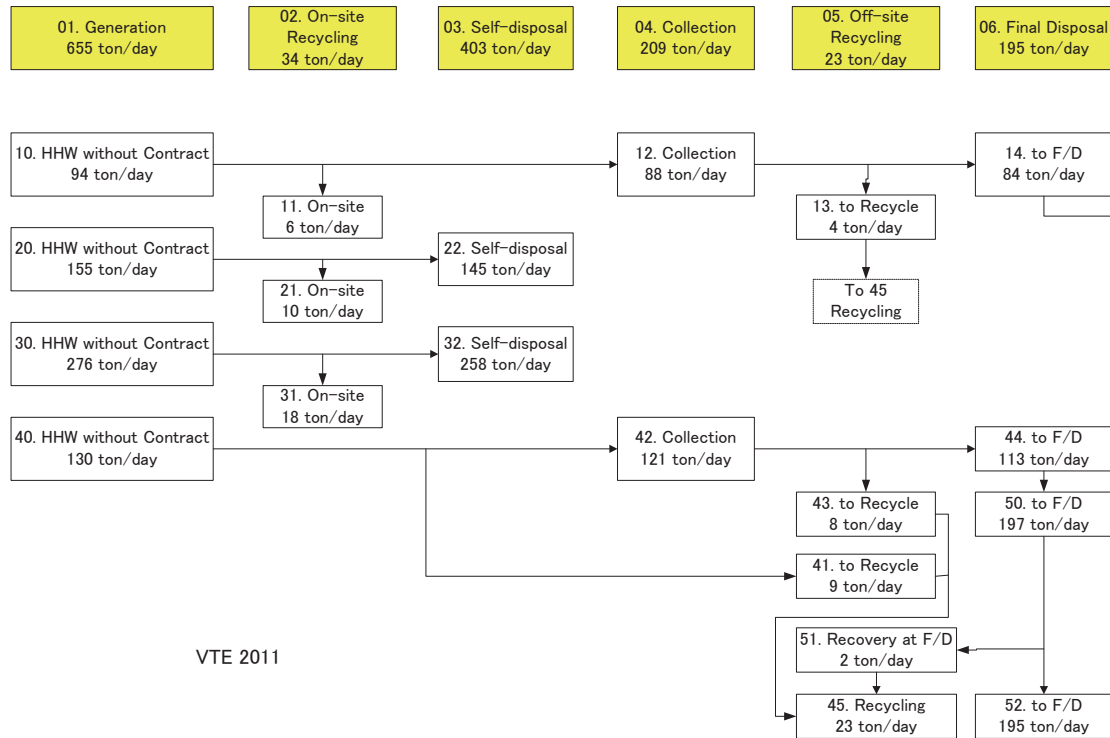


Figure 1: MSW Flow in 2011

1.1.2 Estimation of MSW Disposal Amount

Based on the above-mentioned MSW flow in 2011 the following basic data and assumptions are established for estimation of disposal amount:

- d.1. Population: 731,118 in 2010, Population growth rate 3.93 % from Census in 2005 and data of Provincial governor office in 2012
- d.2. Population in 20xx (Pxx): $731,118 \times (1 + 0.0393)^{(20xx-2010)}$
- d.3. GRDP Growth Rate: 7.5 % from “The Project for Urban Development Master Plan Study in Vientiane Capital”
- d.4. Household waste generation rate in 2011: 691 g/person/day from LPPE waste amount and composition survey in 2011
- d.5. Household waste generation rate in 20xx (HWGRxx):
 $HWGR_{xx} = 691 \times (0.55 \times (1 + 0.075)^{(20xx - 2011)})$
 Note: 0.55 is the coefficient obtained from statistic data in Japan
- d.6. Household waste generation amount in 20xx (HWGAxx):
 $HWGA_{xx} = HWGR_{xx} \times P_{xx}$
- d.7. MSW generation in 20xx: Estimated by considering MSW flow in 2011 and d.2, d.5 and d.6.

d.8. MSW collection coverage rate in 2020: 40% in 2020 according to the Japanese grant aid project.

Based on the above data and assumptions the disposal amount of KM32 disposal site (KM32DS) is estimated as shown in the table below.

Table 1: MSW Disposal in KM32DS by 2020

Items	Unit	2016	2017	2018	2019	2020
Population	person	921,368	957,578	995,211	1,034,323	1,075,000
Household waste generation rate	g/person/day	844	879	915	953	992
Household waste generation amount	ton/day	778	842	911	986	1,066
Others generation amount	ton/day	195	211	228	247	267
MSW generation	ton/day	973	1,053	1,139	1,233	1,333
MSW collection coverage rate	%	34	35	37	39	40
MSW collection amount	ton/day	311	353	398	451	507
MSW disposal amount	ton/day	311	353	398	451	507

1.1.3 Required Landfill Volume

Required landfill volume is calculated by the formula below:

$$YRLV_{xx} = ((YFD_{xx}/UWWL) * (1 + CSR))$$

- YRLV_{xx}: Yearly Required Landfill Volume in 20xx (m³/year)
- DDA_{xx}: Daily Disposal Amount in 20xx (ton/day)
- YDA_{xx}: Yearly Disposal Amount in 20xx (ton/year)
- UWWL: Unit Weight of MSW at the Landfill (ton/m³)
- CSR: Cover Soil Rate to Landfilled Waste
- ARLV: Accumulated Required Landfill Volume (m³)

Considering the current waste composition and future landfill operation the following assumptions is set for the required landfill volume calculation:

- DDA_{xx}: Up to the year 2020 the figure of “MSW disposal amount” in the Table 1 applied. After 2021 it will increase 5% every year.
- UWWL: 1.0 ton/m³
- CSR: 3% of landfill MSW volume. Although it is not enough for sanitary landfill operation (more than 10%), minimum soil cover will be conducted.

Table 2: Required Landfill Volume until 2050

Year	DDAxx (ton/day)	YDAxx (ton/year)	YRLVxx (m3/year)	ARLV (m3)
2016	329	120,085	123,688	123,688
2017	373	136,145	140,229	263,917
2018	422	154,030	158,651	422,568
2019	477	174,105	179,328	601,896
2020	536	195,640	201,509	803,405
2021	568	207,320	213,540	1,016,945
2022	602	219,730	226,322	1,243,267
2023	649	236,885	243,992	1,487,259
2024	700	255,500	263,165	1,750,424
2025	753	274,845	283,090	2,033,514
2026	809	295,285	304,144	2,337,658
2027	870	317,550	327,077	2,664,735
2028	933	340,545	350,761	3,015,496
2029	1,000	365,000	375,950	3,391,446
2030	1,071	390,915	402,642	3,794,088

1.2 Landfill Plan

1.2.1 Possible Landfill Operation Area

1.2.1.1 Landfill Area Operation Plan

Possible landfill area of KM32DS is divided into the eleven areas and landfill operation plan is made from Area 1 to Area 11 respectively as shown in the Figure below.

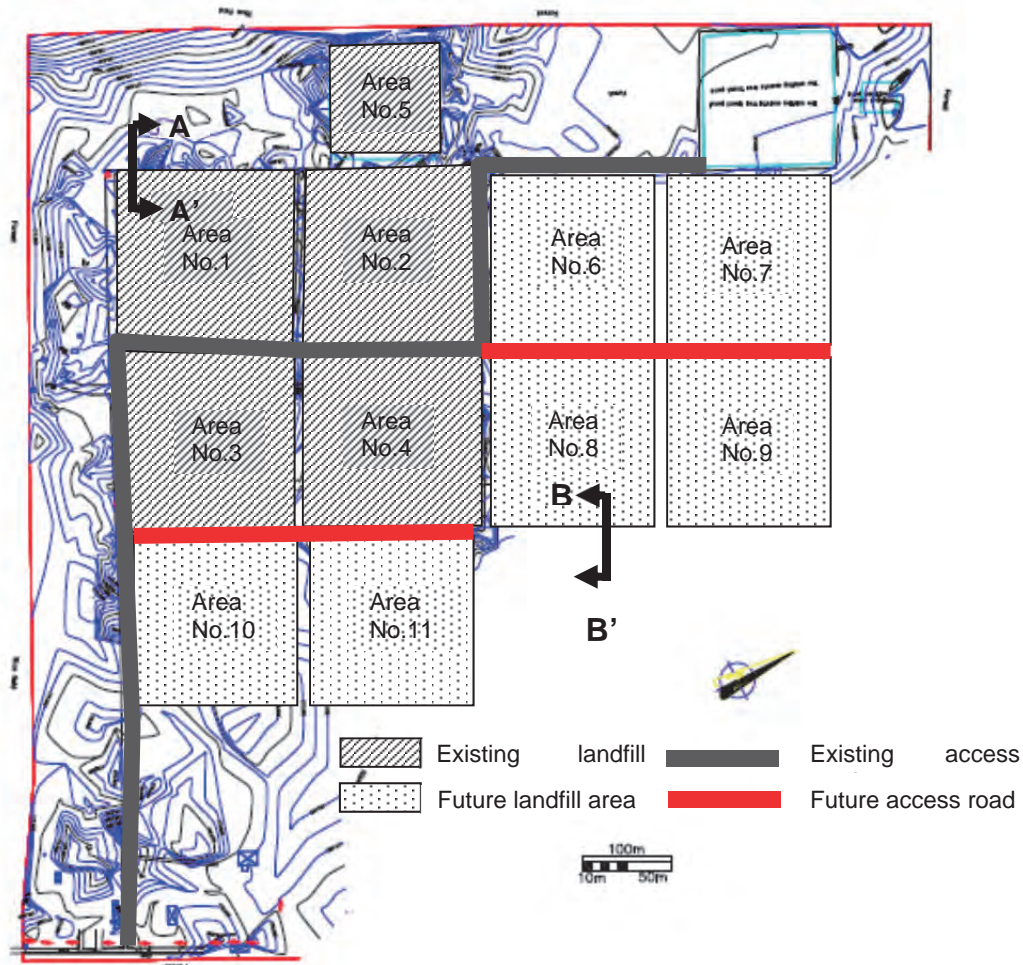


Figure 2: Landfill Area Operation Plan

1.2.1.2 Existing landfill area (No.1-No.5)

Since Area No.1 to Area No.5 have been used as landfill, there is waste dumped as shown the Figure below. It is supposed that average dumped waste height is EL 178m and landfill operation will be continued until landfilled elevation become EL 180m. The highest elevation of the existing road on surround bank is 179.5m.

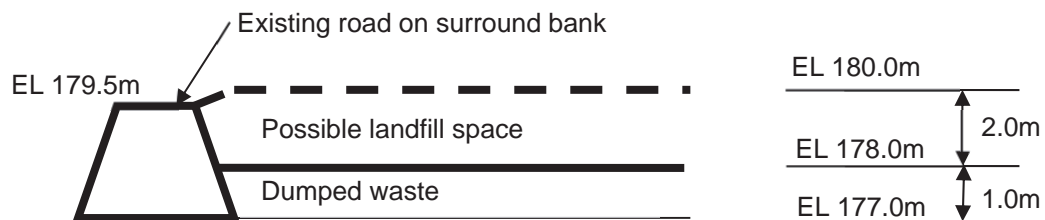


Figure 3: A-A' cross section

1.2.1.3 Future landfill area (No.6-No.11)

As for the Area 6 to Area 11, the new road on surround bank will be constructed. The average height of Area No.6 to No.11 is supposed as EL 177m.

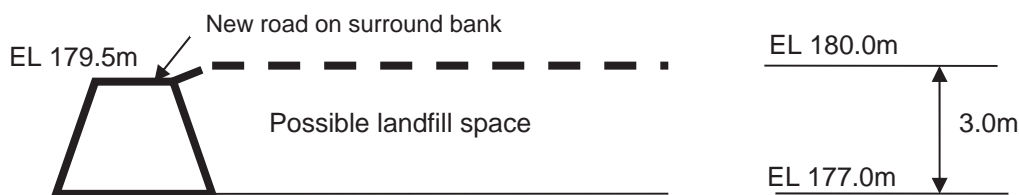


Figure 4: B-B' cross section

1.2.1.4 Enclosing Bank

The construction of a new road surrounding bank is expensive. In this case, in order to dispose waste of at designated place, enclosing bank shall be constructed at the edge of the landfill. It is preferred to construct the bank by excavated soil. Considering very limited landfill budget, however, the bank could be constructed by using dumped waste. As indicate in the Figure below about 1 m height of small bank (as shown in the dot line) will be constructed by using dumped waste. After filled up inside the bank and height of the landfilled area becomes about 3m, about 3m slope will be shaped as instructed in the above and cover soil on the slope.

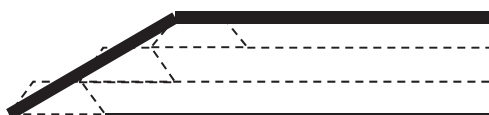


Figure 5: Cross section of enclosing bank

1.2.1.5 Borrow Pit of Soil

The excavated soil at the future landfill area No. 6 to No.11 will be used as the covering soil material and construction of access road. It is advantage that in accordance with the excavation of soil the landfill capacity of Area No. 6 to No.11 will increase.

1.2.2 Order of Landfill Area Operation

Proposed order of landfill area operation is as follows:

- Phase 1. Landfill Area No.1 to Area No. 5 until EL 180m
- Phase 2. Landfill Area No.6 to Area No.11 until EL 180m
- Phase 3. Lifting up 3m more in the landfill Area No.1 to No No.11

1.2.3 Duration of Landfill Area Operation

1.2.3.1 Possible Landfill Volume Calculation

Possible landfill volume of Landfill Area No.1 to Area No. 5 as Phase 1 is calculated as shown in the Table below. As shown in the table possible landfill volume of Phase will be 348,800 m³.

Table 3: Possible Landfill Volume by Phase 1 Operation

Area No.	Area (m2)	Height (m)	Volume (m3)
1	40,000	2	80,000
2	40,000	2	80,000
3	40,000	2	80,000
4	40,000	2	80,000
5	14,400	2	28,800
Total			348,800

Possible landfill volume of Landfill Area No.6 to Area No. 11 as Phase 2 is calculated as shown in the Table below. As shown in the table possible landfill volume of Phase will be 720,000 m³.

Table 4: Possible Landfill Volume by Phase 2 Operation

Area	Area (m2)	Height (m)	Volume (m3)
6	40,000	3	120,000
7	40,000	3	120,000
8	40,000	3	120,000
9	40,000	3	120,000
10	40,000	3	120,000
11	40,000	3	120,000
Total			720,000

Possible landfill volume of Landfill Area No.1 to Area No. 11 as Phase 3 is calculated as shown in the Table below. As shown in the table possible landfill volume of Phase will be 1,243,200 m³.

Table 5: Possible Landfill Volume by Phase 3 Operation

Area	Area (m2)	Height (m)	Volume (m3)
1	40,000	3	120,000
2	40,000	3	120,000
3	40,000	3	120,000
4	40,000	3	120,000
5	14,400	3	43,200
6	40,000	3	120,000
7	40,000	3	120,000
8	40,000	3	120,000
9	40,000	3	120,000
10	40,000	3	120,000
11	40,000	3	120,000
Total			1,243,200

1.2.3.2 Duration of Landfill Area Operation

Based on the possible landfill volume of Phase 1, 2 & 3 operations, and the required landfill volume shown in the Table 2, the duration of landfill operation of each phase is estimated as follows:

Phase 1. Landfill Area No.1 to No.5 up to EL 180m

Possible Landfill Volume of Area No.1 to No.5: about 348,800m³

Possible Duration of Area No.1 to No.5 Operation: **Until the end of 2018.** Because the required landfill volume up to the end of 2018 is 422,568 m³ according to the Table 2.

Phase 2. Landfill Area No.6 to No.11 up to EL 180m

Possible Landfill Volume of Area No.6 to No.11: about 720,000m³

Possible Accumulated Landfill Volume of Area No.1 to No.11: 1,068,800m³

Possible Duration of Area B&C Operation: **Until the beginning of 2022.** Because the required landfill volume up to the end of 2020 is 1,243,267 m³ according to the Table 2 and total possible accumulated landfill volume of Area 1 to Area 11 is about 1,068,800 m³ (348,800m³+720,000m³).

Phase 3. Lifting up 3 m more Landfill Area No. 1 to No. 11 up to EL183m

Possible Landfill Volume of lifted up Area No.1 to No.11: about 1,243,200m³

Possible Accumulated Landfill Volume of lifted up Area No.1 to No.11: 2,312,000m³

Possible Duration of Area B&C Operation: **Until the end of 2026.** Because the required landfill volume up to the end of 2026 is 2,337,657 m³ according to the Table 2 and total possible accumulated landfill volume of Area 1 to Area 11 is about 2,312,000 m³ (348,800m³+720,000m³+1,243,200m³).

1.3 Infrastructure Development Plan

In order to use the eleven possible landfill area (Area No.1 to No.11) the new access road and enclosing bank shall be constructed as shown in the Figure below.

Volume of the works as follows;

- New access road : 800m
- Mound up existing road: 2,400m

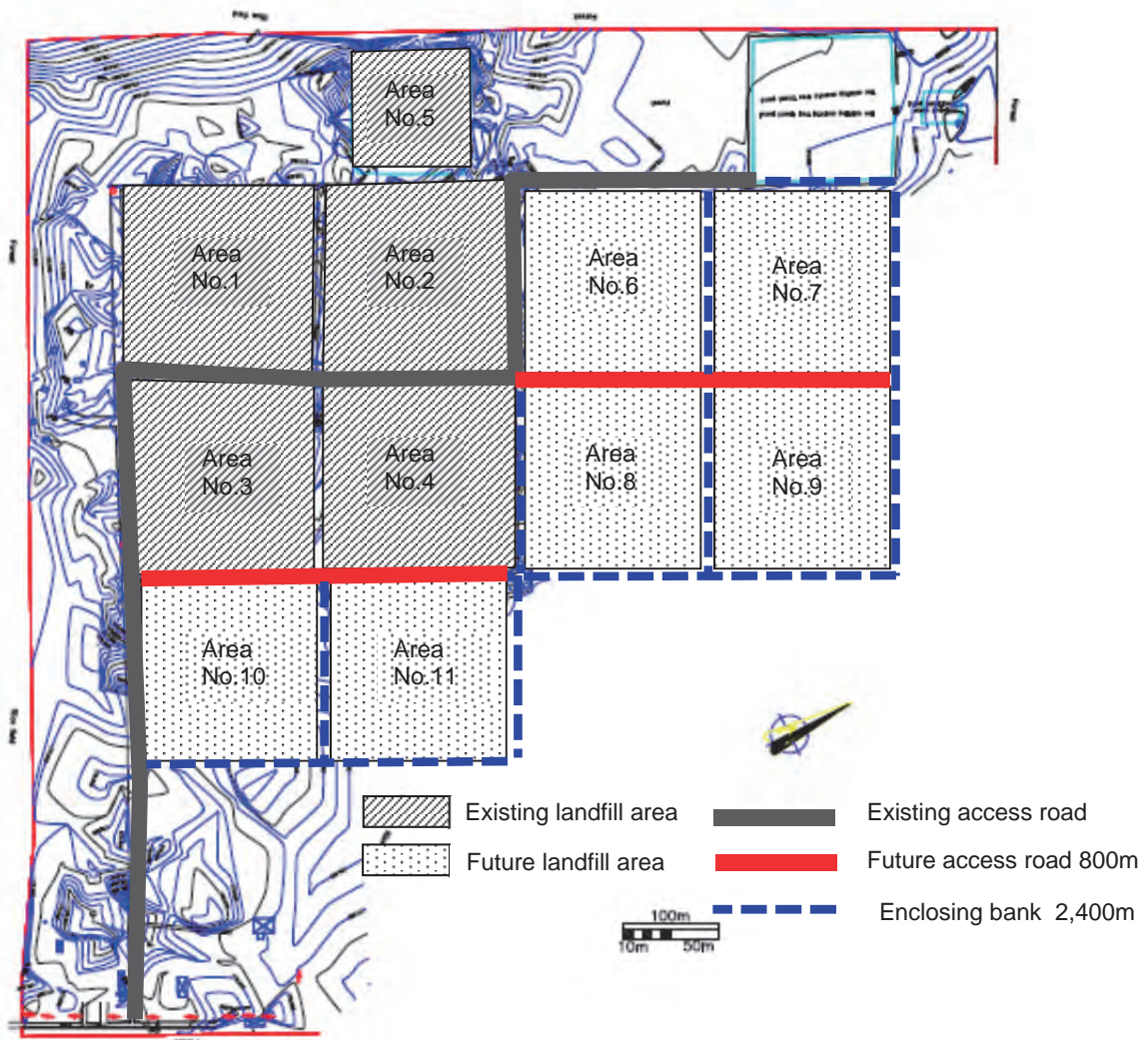


Figure 6: Infrastructure Development Plan

1.4 Operation Cost Estimation

Monthly operation cost of the landfill is calculated based on the Table below.

Table 6: Monthly Landfill Operation Cost

Items	Quantity	Monthly Cost (kip)
1. Landfill Equipment		
1.1 Bulldozer D4	2	56,326,400
1.2 Excavator (Bucket 0.6 m ³)	1	28,163,200
1.3 Dump trunk for covering soil (10ton)	1	11,265,280
2. Staff for operation of landfill site		
2.1 Manager	1	2,000,000
2.2 Bulldozer D4	2	3,000,000
2.3 Excavator operator	1	1,500,000
2.4 Dump truck driver for covering soil	1	1,500,000
2.5 Foreman	1	1,500,000
Total		105,254,880

1.5 Other Important Issues for Proper Landfill Operation

For proper landfill operation the following issues shall be cleared:

- Clear instruction and control of dumping area to the landfill user incoming vehicle. If an incoming vehicle does not follow the instruction, the vehicle shall be penalized.
- Provide the incoming vehicle smooth access to the dumping area. There for conduct frequent maintenance of access road. For the access road from paved road to the dumping area, concrete plate will be installed.
- Establish fare tipping fee system. Then revise tipping fee in order to conduct sanitary operation as much as possible, i.e. frequent cover soil, etc.
- Clear instruction and control of waste pickers not to work at the place where landfill equipment working.

2. Management of Waste Pickers

2.1 Identify the waste pickers

The ID cards of waste pickers are issued to identify and organize the waste pickers.

2.2 Rules and measures for the control of waste pickers in the KM 32 Disposal Site

In order to regulate and control the activities of waste pickers, VUDAA established and issued “Rules and Measures for Km 32 Disposal Site, No 3988/SWCT” in 2012. Furthermore, in order to facilitate control of waste pickers, VUDAA in cooperation with SJET states the control of waste pickers in the KM32 disposal site as follows.

- Waste pickers are required to be registered for working at the disposal site.
- Waste pickers are required to bring the issued ID cards when they work at the disposal site.
- Waste pickers are required to put on safety jackets, gloves, masks and long boots.
- Waste pickers are required to have Preventive injection for infection disease
- Waste pickers are required not to work at the active disposal area to avoid any accident.

VUDAA instructs the waste pickers to put on the gloves, boots and safety jackets when they work on waste picking and warned anybody.

2.3 Waste picker meeting

The regular waste picker meeting shall be held to manage the waste pickers.

2.4 Other Important Issues for Proper Waste Picker Management

After the reception of a bulldozer by the grant aid of the Japanese Government in November 2015, the operation method of the final disposal will be changed. For example, the frequency of waste movement and soil coverage will increase and the waste disposal work and waste picking work can have conflicts. The waste picker management rule will need a revision and all the waste pickers should understand it.

3. Monitoring

The on-site monitoring shall be carried out approximately once a year. It is recommended that the member of monitoring be from governmental agencies at the national, capital and district levels, social organizations (Labor Union, Women’s Union and Youth Union).

The member of monitoring are given a lecture about the facility and operation of the disposal site, observed the facility operation and answered prepared questionnaires.

The questionnaire had a structure and questions shown below. The questions of Category A and B are asked every time of the monitoring. The result of monitoring shall be submitted to DONRE and VUDAA and feedback to develop the operation of landfill site.

Check List for Monitoring Committee for the Landfill Site					Date:	
					Time:	
Category A: Environmental effect (Before and after construction)						
No	Items	Acceptable	Medium	Terrible	Score	Notes
A1.	Fire & Smoke	0	1	2		
A2.	Offensive odour	0	1	2		
A3.	Waste water (Leachate)	0	1	2		
A4.	Withering of trees caused by discharged waste	0	1	2		
A5.	Waste scattering	0	1	2		
A6.	Animals (dogs, monkeys, birds etc.)	0	1	2		
A7.	Vermin (Flies, etc.)	0	1	2		
A8.	View	0	1	2		
A9.	Working condition of waste pickers	0	-	2		
Total of Category A						
Category B: Function of Facilities (After construction)						
No	Items	Functioning	Medium	Not functioning	Score	Notes
B1.	Covering soil at new discharge area	0	1	2		
B2.	Rain water drainage system	0	1	2		
B3.	Access road	0	1	2		
B4.	Treatment facility of sludge from septic tanks					
	Fence	0	1	2		
	Sedimentation pond	0	1	2		
	Treatment pond	0	1	2		
Total of Category B						
<u>Comment:</u>						
<u>Name & Signature</u>						

Appendix 5.

OPERATION AND MAINTENANCE MANUAL FOR THE SEPTIC TANK SLUDGE TREATMENT POND AT VTE KM 32 (2015)



LPP-Environment-Component

In cooperation with JICA Experts Team

This is the Operation and Maintenance Manual for the septic tank sludge treatment pond established at KM32 final disposal site in Vientiane Capital.

1. Outline of the septic tank sludge treatment ponds

The objective of the septic tank sludge treatment ponds is to remove the suspended solid (SS) of septic tank sludge collected in the Vientiane Capital. The septic tank sludge treatment ponds contribute to reduce the suspended solid (SS) load in the oxidation pond. The septic tank sludge treatment ponds consist of two parallel lines of a receiving tank and two sedimentation pits and following existing oxidation pond. The layout of receiving tank, sedimentation pits and existing oxidation pond is shown in the following figure.

- The functions of the receiving tank is to screen the large particle matter of discharged septic tank sludge and to avoid the turbulence at the sedimentation pit due to high velocity of influent from receiving tank.
- The function of the 1st and the 2nd sedimentation pits is to removes the suspended solid (SS) of septic tank sludge.
- The effluent of the 2nd sedimentation pit is flowing to the existing oxidation pond to remove BOD₅.

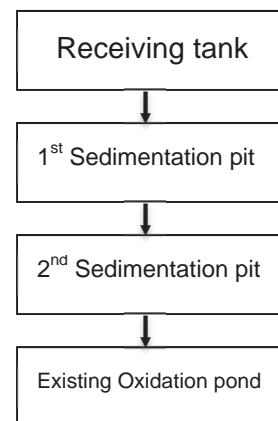


Fig: The layout of receiving tank, sedimentation pits and existing oxidation pond

2. Specification the septic tank sludge treatment ponds

(1) Designed treatment capacity: 18m³/day x 2 lines

(2) Volume capacity of tank and pit

- receiving tank : 24m³ x 2 lines
- the 1st sedimentation pit : 36m³ x 2 lines
- the 2nd sedimentation pit : 36m³ x 2 lines

(3) Retention time

- The 1st sedimentation pit : 2days (=36m³ / 18m³/day)
- The 2nd sedimentation pit : 2days (=36m³ / 18m³/day)

3. Operation principles of the septic tank sludge treatment ponds

There are following four principals of operation of the septic tank sludge treatment ponds.

- (1) Target of treatment is the septic tank sludge
- (2) Usually one line of the septic tank sludge treatment ponds is operated.
- (3) In case that the amount of discharged septic tank sludge is quite large and one line is not enough, two lines of the septic tank sludge treatment ponds are operated.
- (4) Sedimentation settled out and scum floating in the receiving tank and the sedimentation ponds is regularly removed to avoid blocking of drains and decreasing of retention time.

4. Work procedure of the collection vehicle of septic tank sludge and administration office at KM32 final disposal site

- (1) The collection vehicle of septic tank sludge shall be designated at the administration office at KM32 final disposal site beforehand.
- (2) The driver of collection vehicle of septic tank sludge shall report the amount and collection area of septic tank sludge to the administration office at KM32 final disposal site before approaching the septic tank sludge treatment ponds.

- (3) The administration office shall record the reported information and instruct the location of the septic tank sludge treatment ponds where septic tank sludge should be discharged.
 - (4) The driver of collection vehicle of septic tank sludge shall properly discharge sludge to the receiving tank instructed by administration office.
 - (5) The driver of collection vehicle of septic tank sludge shall clean the surrounding of receiving tank after discharging the sludge.
5. Maintenance of the septic tank sludge treatment ponds
- (1) Receiving tank, sedimentation pits and drains shall regularly be inspected and the clog shall be cleared, such as scum in the drains.
 - (2) The sedimentation settled out in the receiving tank and sedimentation pit shall be removed more than two times in a year; beginning and end of dry season.
 - (3) In case that the receiving tank and sedimentation do not function well due to the too much sedimentation, the sedimentation shall be removed more frequently.
 - (4) The area between two lines can be used as the access road for the operation of heavy machinery and dump truck.
6. Methodology of removing sedimentation
- (1) The sedimentation in the receiving tank shall be removed by manual.
 - (2) The wastewater in the sedimentation pit shall be sucked by collection vehicle of septic tank sludge before removing the sedimentation and scum in the pit. The volume of wastewater sucked is estimated 18 m³ and three loading of 6m³ collection vehicle of septic tank sludge are required.
 - (3) The sedimentation settled out in the sedimentation pit shall be removed by the excavator and load it to the dump truck. The volume of removed sedimentation is estimated approximately 18m³ from one line.
 - (4) The removed sedimentation shall be discharged at the designated place in the final disposal site.
 - (5) Maintenance of oxidation pond is not implemented for a while.



Photo: Removal of sedimentation by excavator

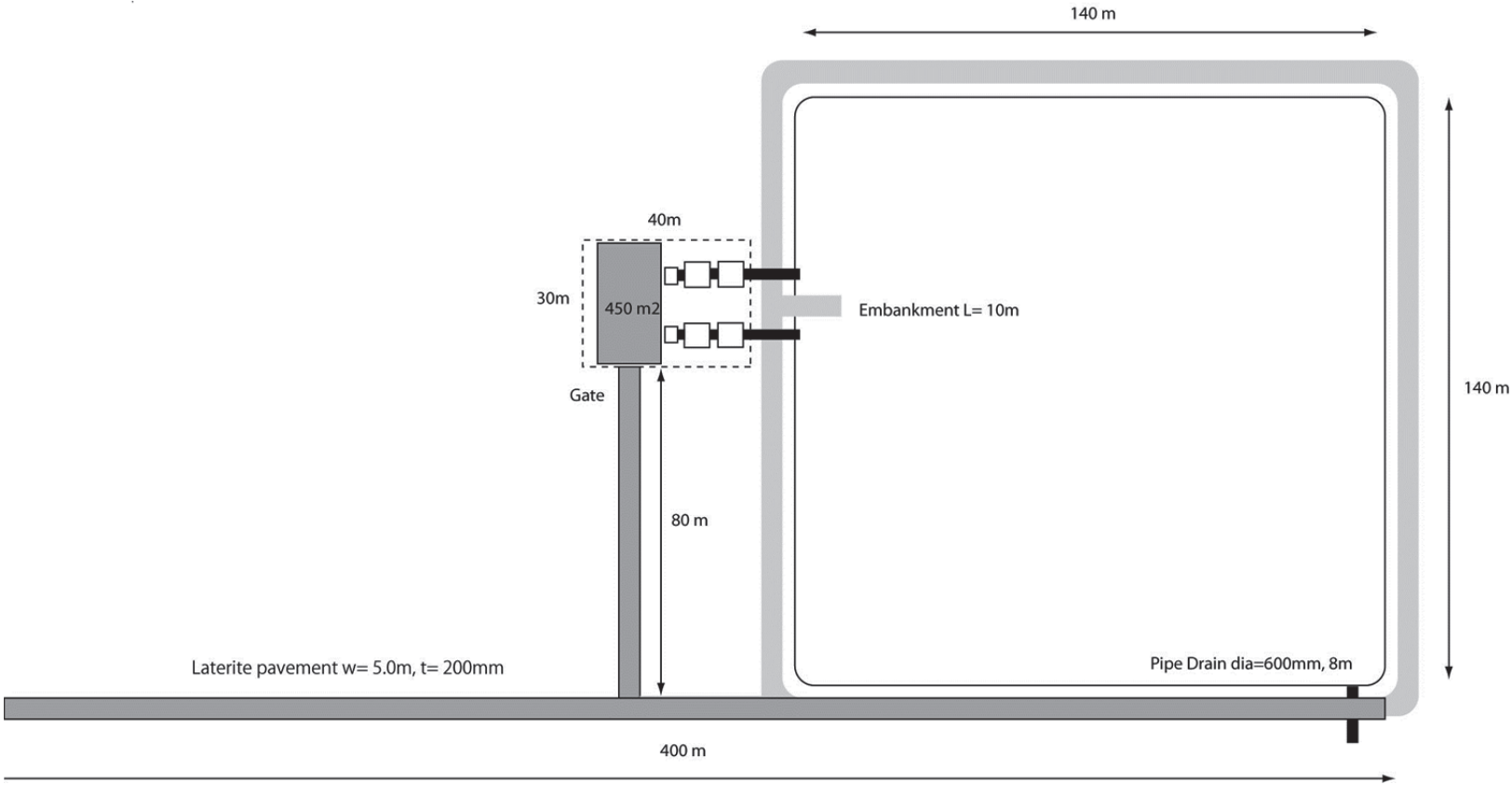


Photo: Removal of sedimentation by excavator

7. Annex

(1) Layout of septic sludge treatment pond

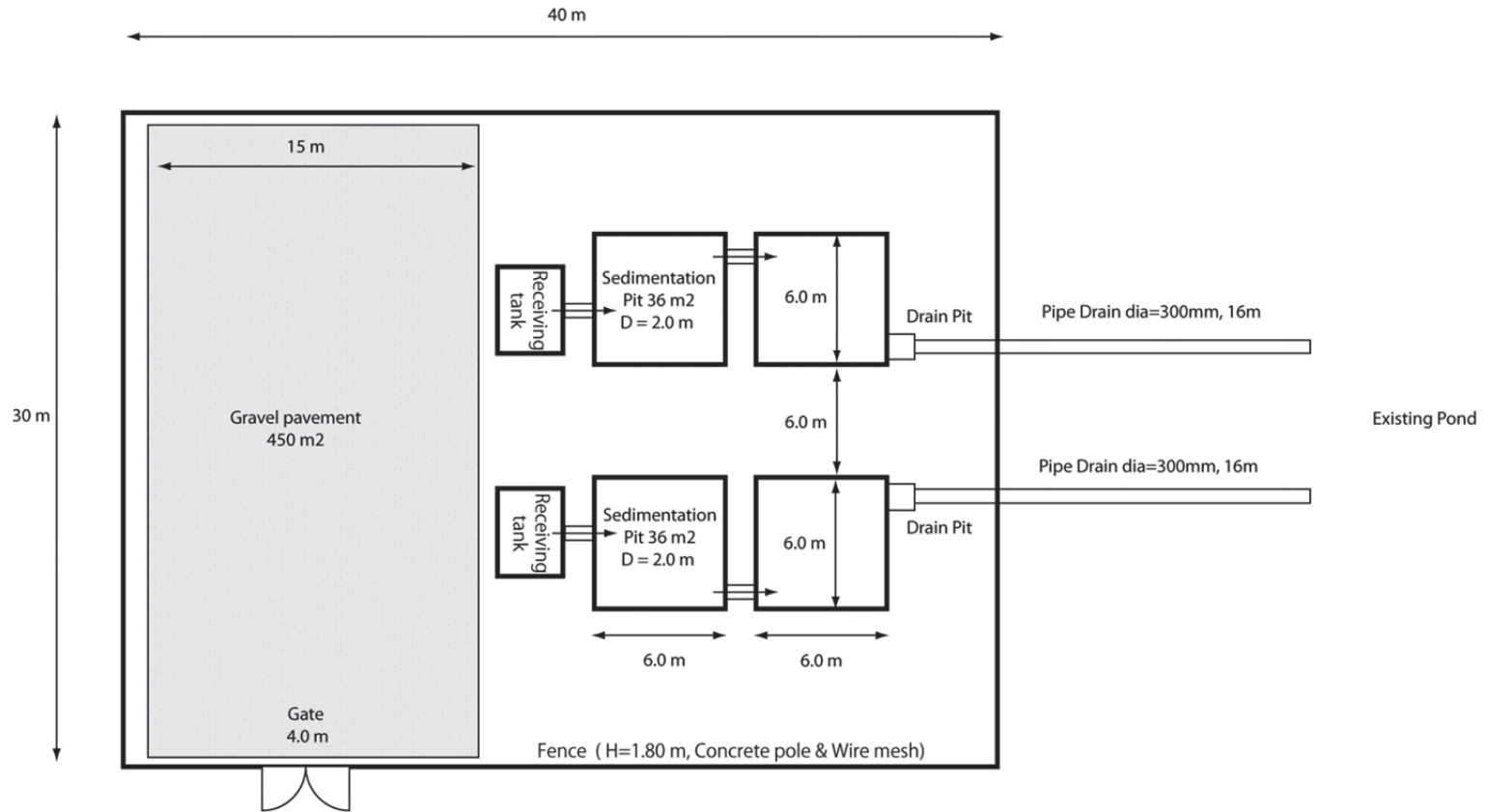
KM 32 Sewage Facility Plan



(2) Structure drawings

a. Plan

Sewage treatment facility

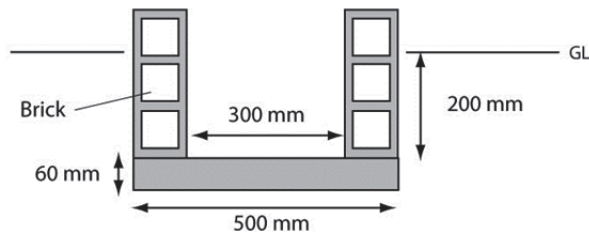


b. Cross section

1.5 Wall protection

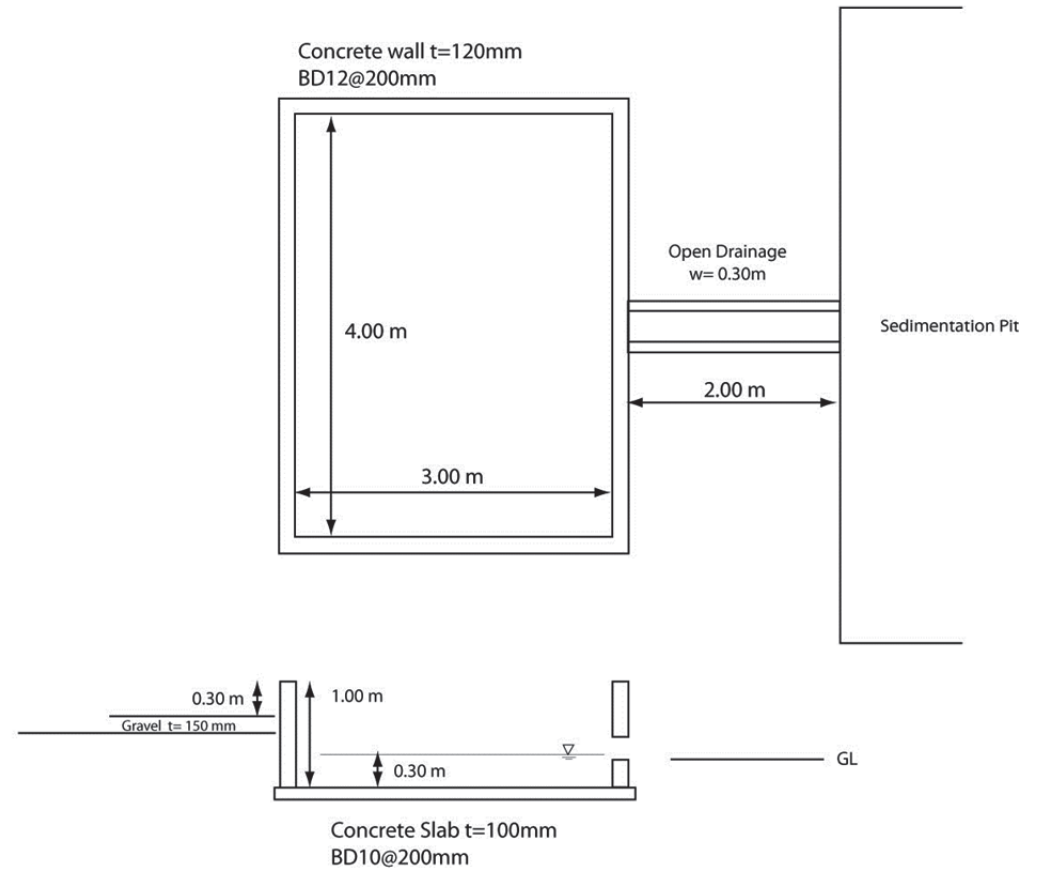


1.6 Open Drainage $w=30\text{ cm}$



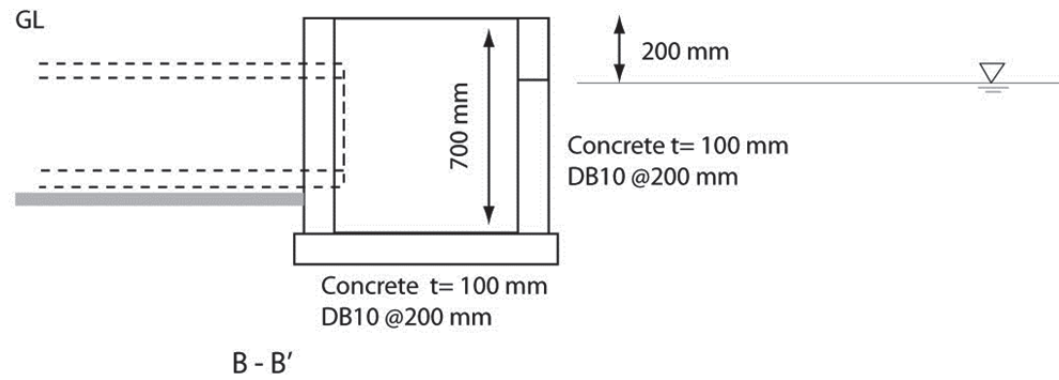
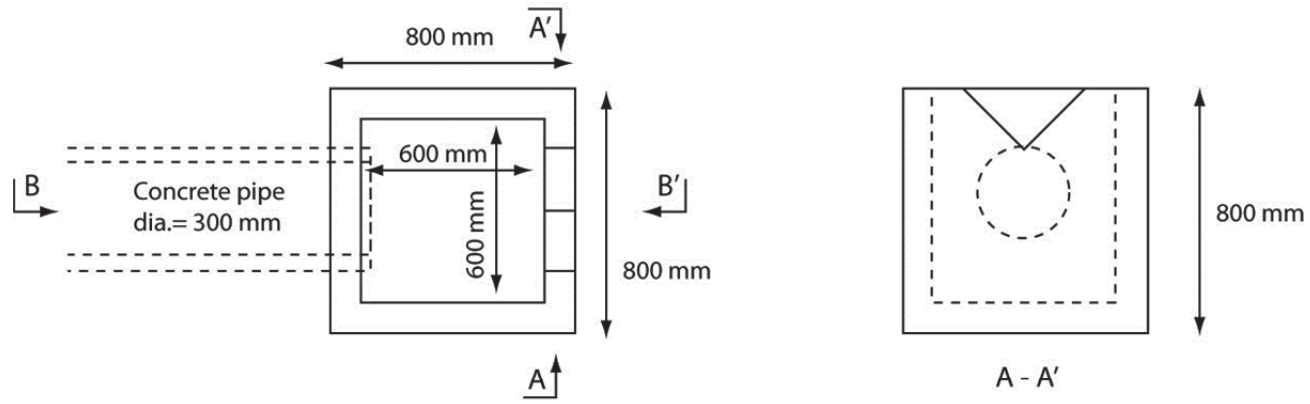
Sewage Facility

1.7 Receiving tank



c. Others

1.8 Drain pit A



Appendix 6. Plan for Healthcare Waste Management (HCWM)

1 HCWM in May 2012

1.1 HCWM in VTE

1.1.1 HCWM in the Five Main Hospitals

In the late May 2012, an interview survey started to know the internal waste management system at the five hospitals, which are considered to be the target hospitals of the incinerator.

In Laos, Ministry of Health issued Decree on the Management of Waste from Health Care Facilities (No 1706 /MOH). All the hospitals interviewed basically follow this decree. They further develop their own internal waste separation rules and conduct trainings to the hospital staff. The waste is separated into three, namely general waste, infectious waste and sharps. Sharps are kept in containers such as PET bottles and put into yellow plastic bags together with infectious waste. General waste is stored in black plastic bags. Such separation practices are observed at all the hospitals.

As far as some of the internal separation rules were reviewed, however, the instruction of waste separation is not organized well enough to allow the hospital staff to separate waste in a standardized way. In fact, the site observation revealed that the yellow plastic bags, which should be used only for infectious waste and sharps, often contained general waste such as food or drink packages. Waste is separated, but waste separation requires improvement in practice.

1.1.2 Collection Service for the Five Main Hospitals

In May 2012 the waste collection provided to the 5 hospitals is summarized below.

Table 1: Waste Collection Service for the Five Main Hospitals in VTE Capital in 2012

	A	B	C	D
No	Name of Hospitals	Fee for General Waste (kip/month)	Fee for Infectious Waste (kip/month)	Separate Collection
1	Mahosot	10,000,000	LS	Yes
2	Friendship	3,600,000	588,000	Yes
3	Police	1,400,000	LS	Yes
4	Sethathirath	5,500,000	None	No
5	Military (103)	7,500,000	880,000	Yes

LS: lump sum (fee for general waste collection covers infectious waste collection)

As shown in Column D, four hospitals use separated collection services for general waste and infectious waste, for which VUDAA utilizes the vehicle specialized to carry infectious waste provided by JICA in 1998. However, this separate collection service does not have a uniform fee structure (see Column C) and fee is determined for each hospital individually. Sethathirath hospital does not use the separate collection service, because the hospital is supposed to treat its waste by an incinerator installed at the hospital. When it was interviewed, however, the incinerator had operation troubles and was not used. The hospital was discharging all the waste to the general waste collection service.

1.1.3 HCW Generation

In May 2012, a one-week waste weighing survey started at the five hospitals by the hostel staff using a scale to know the amount of waste generated and all the data were collected in July. The result shows the following.

- The five hospitals have 1,225 beds, 1,154 outpatients per day at average, 1,522 kg/day of all kinds of waste in total.
- At the interview survey, the hospitals gave us data of waste amount based on only their estimation. In this weighing survey, the total amount of infectious waste (including sharps) from five hospitals was 319 kg/day.
- From this weighing survey we could find infectious waste generation rate as **0.26 kg/bed/day**.

If these figures are compared with data shown in the WHO report¹ that refers different reports, total waste volume seems to be relatively large. This will be considered in the planning of internal waste separation, infectious waste collection, incinerator operation and financial management.

Table 2: Results of Weighing Survey (VTE)

Name of Hospital	Nos of beds	Occupation rate	Total staff	Out-patients/day	In-patients/day	Waste Total (hearing survey)	Infectious + Sharps (hearing survey)	Infectious+ Sharps (Weighing)
		rate	Persons	person	person	kg/d	kg/d	kg/d
Mahosot	450	70%	914	415	43	402	196	137
Friendship	250	60%	482	200	195	600	50	136.2
Police	100	50%	150	100	40	50	5	12
Sethathirath	175	70%	426	200	80	250	20	23.5
Military (103)	250	50%	1018	239	252	250	20	10
Total	1225		2990	1154	610	1552	291	318.7

1.2 Medical Institutions (MIs) in VTE

According to the information from the Health Care Division of Department of Hygiene and Health Promotion (DHHP) of MoH and VUDAA, the following medical institutions (MIs) are located in VTE in January 2015. Based on the above-mentioned weighing survey infectious waste generation amount from each institution in 2012 is estimated as shown in the table below.

¹ WHO “Safe Management of Wastes from Health-Care Activities” 1999.

Table 3: Medical Institutions (MIs) in VTE and Infectious Waste (IW) Generation Amount in 2012

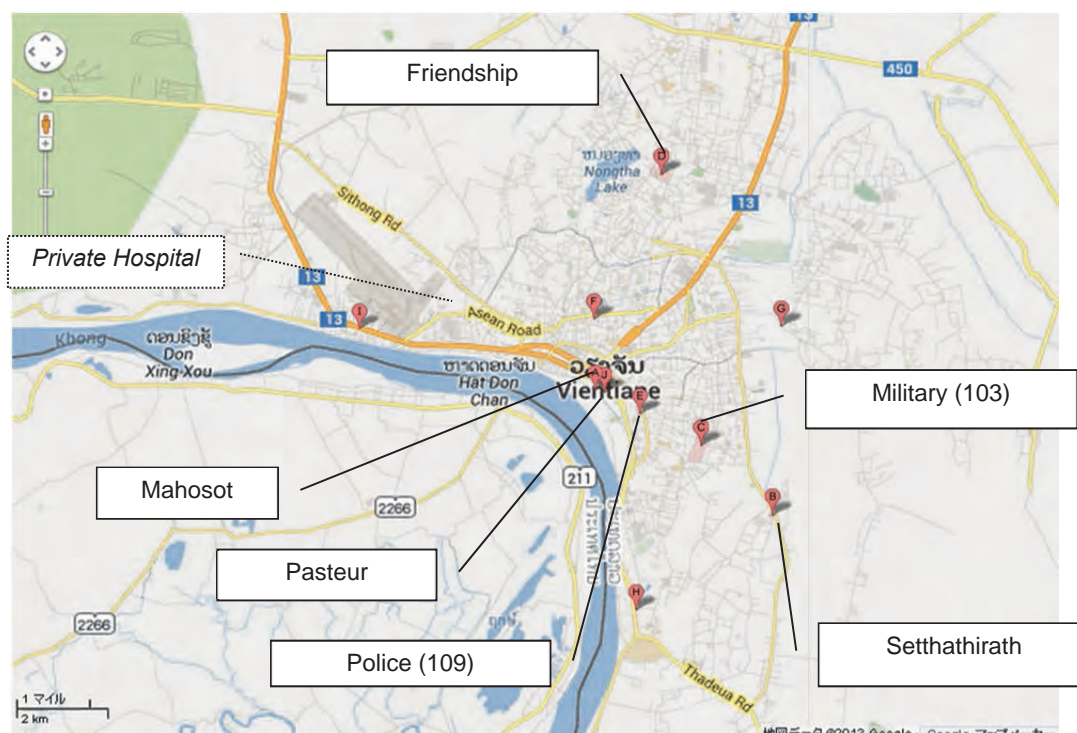
Name of Medical Institution (MI)	Nos of MI	Nos of bed	Occupancy Rate (%)	IW Amount (incl. Sharps) in 2011 (kg/day)	Waste Collection Service Provider
1. Mahosot Hospital	1	450	70.0	137 (*1)	VUDAA with IW incineration service
2. Friendship Hospital	1	250	60.0	136 (*1)	VUDAA with IW incineration service
3. Sethathirath Hospital	1	175	70.0	24 (*1)	VUDAA with IW incineration service
4. Military (103) Hospital	1	250	50.0	10 (*1)	VUDAA with IW incineration service
5. Police Hospital	1	100	50.0	12 (*1)	Private for general waste and VUDAA for IW incineration service
6. Mother & Child Hospital	1	150	51.0	39 (*3)	VUDAA with IW incineration service
7. Child hospital	1	70	70.0	18 (*3)	VUDAA with IW incineration service
8. Pasteur Institute	1	0	0	2 (*2)	VUDAA with IW incineration service
9. Dermatology Center	1	30	40.0	8 (*3)	Private waste collection
10. Rehabilitation Center	1	100	50.0	26 (*3)	Private waste collection
11. Ophthalmology Center	1	30	40.0	8 (*3)	Private waste collection
12. Hanoi-Vientiane hospital (private)	1	30	60.0	8 (*3)	VUDAA with IW incineration service
13. International diagnostic center (private)	1	NA	NA	NA	Private waste collection
14. Lao's Doctor Clinic	1	NA	NA	NA	Private waste collection
15. Merieux Analysis center	1	NA	NA	NA	VUDAA with IW incineration service
16. Epidemiology-Lab center	1	NA	NA	NA	Private waste collection and its own incinerator
17. Medical science university	1	NA	NA	NA	Private waste collection
18. Blood Bank (National Lao Red-cross)	1	NA	NA	NA	VUDAA with IW incineration service
19. Mekong Hospital	1	NA	NA	NA	VUDAA with IW incineration service
20. Districts Hospital	9	95	50.0	25 (*3)	3 VUDAA with IW incineration service, 3 VUDAA without IW incineration service, 3 Self-disposal
21. Private Clinics	190	NA	NA	NA	VUDAA + Private collection
22. Dental Care Clinics	17	NA	NA	NA	VUDAA + Private collection
Total	225	1,730 + ?		453 + ?	

Source : Health Care Division, DHHD of MoH and VUDAA in January 2015

(*1) Data obtained by weighing for a week

(*2) VUDAA record for incineration from October 2012 to May 2013.

(*3) 0.26 kg/bed/day multiplied by the number of beds.



* VUDAA received an inquiry from the private hospital on the map about waste treatment.

Figure 1-1: Location of the Seven Main Medical Institutions in VTE Capital

2 HCWM Plan in VTE Capital

2.1 Goal of the HCWM in VTE Capital

In order to improve HCWM in VTE Capital, SJET and the C/P (VUDAA and DONRE) established the target year as 2020 and the following goals.

Table 4: Goal of the HCWM in VTE Capital VTE Capital in the Year 2020

Name of Medical Institution (MI)	Nos of MI	Nos of bed	Collection Service Provider	Treatment & Disposal Method
1. Mahosot Hospital	1	450	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
2. Friendship Hospital	1	250	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
3. Sethathirath Hospital	1	175	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
4. Military (103) Hospital	1	250	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
5. Police Hospital	1	100	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
6. Mother & Child Hospital	1	150	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
7. Child hospital	1	70	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
8. Pasteur Institute	1	0	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
9. Dermatology Center	1	30	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020

10. Rehabilitation Center	1	100	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
11. Ophthalmology Center	1	30	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
12. Hanoi-Vientiane hospital (private)	1	30	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
13. International diagnostic center (private)	1	NA	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
14. Lao's Doctor Clinic	1	NA	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
15. Merieux Analysis center	1	NA	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
16. Epidemiology-Lab center	1	NA	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
17. Medical science university	1	NA	Private Co.	Separate collection, Incineration, Separate disposal of ash by 2020
18. Blood Bank (National Lao Red-cross)	1	NA	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
19. Mekong Hospital	1	NA	VUDAA	Separate collection, Incineration, Separate disposal of ash by 2015
20. Districts Hospital	9	95	6 use VUDAA, 3 Self-disposal	Separate collection, Incineration, Separate disposal of ash by 2020
21. Private Clinics	190	NA	VUDAA + Private collection	Separate collection, Incineration, Separate disposal of ash by 2020
22. Dental Care Clinics	17	NA	VUDAA + Private collection	Separate collection, Incineration, Separate disposal of ash by 2020
Total	225	1,730 + ?		

2.2 HCWM Plan in VTE Capital

2.2.1 Basic Conditions

HCWM plan in VTE Capital is formulated based on the following conditions:

- HCW is divided into **i. General waste** (non-infectious waste) and **ii. Infectious waste**.
- Infectious waste is divided into **ii-1. Combustible infectious waste** (subjected waste for incineration) and **ii-2. Incombustible infectious waste** (needles, sharps, etc.).
- Since general waste (non-infectious waste) is collected, treated and disposed of by the municipal collection service, HCWM plan focuses on the infectious waste (IW).

2.2.2 Basic HCWM Flow in 2020

Basic HCWM Flow in 2020 is made based on the following assumptions:

1. All the HCW generated in VTE should be separated into i. **General waste** and ii. **Infectious waste**.
2. General waste shall be collected by municipal solid waste (MSW) collection service and disposed of at KM32 DS together with MSW.
3. Infectious waste shall be separated into ii-1. **Combustible infectious waste** (Contaminated cottons, etc.) and ii-2. **Incombustible infectious waste** (sharps, etc.).
4. The **incombustible infectious waste** shall be treated by the generation source if

treatment facility like an autoclave is available, and separately collected and disposed of at the infectious waste (IW) pit at KM32 DS.

- The **combustible infectious waste** shall be separately collected and transported to the incinerator at the KM32DS. Then it shall be incinerated and ash from incineration shall be disposed of at the IW pit at KM32 DS..

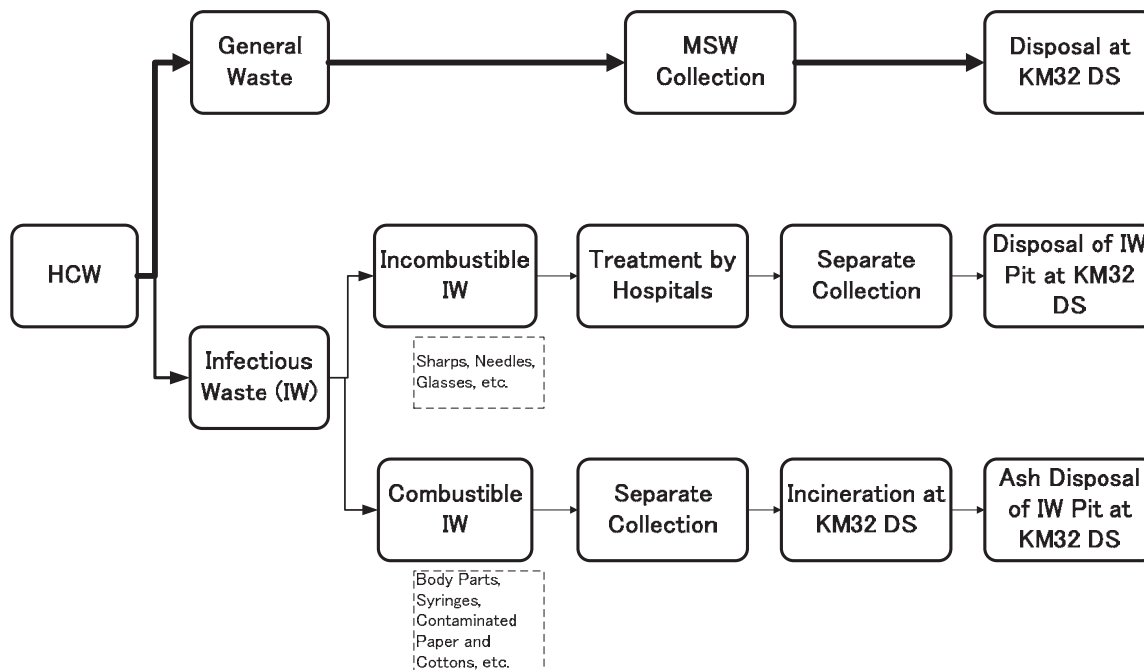


Figure 2-1: Basic HCWM Flow in 2020

2.2.3 Estimation of the Infectious Waste Generation

Future infectious waste generation is estimated by setting the following conditions:

- Infectious waste generation amount in 2012 is based on the survey results as shown in the Table 3.
- Although LPPE has asked and tried to collect medical institution data in VTE capital, the latest and reliable data obtained is the one shown in the Table 3.
- As understood by the table the data of the medical institution data in VTE capital is not complete ones. Consequently this HCWM plan is formulated based on the insufficient data.
- Then total infectious waste generation amount in 2012 in VTE capital is more than 453 kg/day.
- The infectious waste generation amount is assumed to increase in accordance with the population growth, **3.9%**². Consequently infectious waste generation amounts in 2015 and 2020 is calculated as more than 508 and 615 kg/day respectively.

² “The Project for Urban Development Master Plan Study in Vientiane Capital”

- According to the incineration record, the combustible infectious waste generated in the Provincial Hospital in LPB is calculated as 8.8 kg/day in September 2014. Since infectious waste generation amount in the Provincial Hospital of LPB District in 2014 is calculated as 35.5 kg/day, the rate of combustible and incombustible infectious waste is assumed as 1:3.

Based on the above-mentioned assumption, infectious waste generation amount is estimated as shown in the table below

Table 5: Estimation of Infectious Waste Generation Amount

Unit: kg/day

HCW	2012	2015	2020
ii-1. Combustible Infectious Waste	>113	>127	>154
ii-2. Incombustible Infectious Waste	>340	>381	>461
ii. Infectious Waste	>453	>508	>615

2.2.4 Discharge, Collection and Transportation

In order to achieve the goal and realize the HCWM flow in 2020, improvement of discharge, collection and transportation system will be implemented as described below.

1. First of all, as shown in the Table 3 the basic data of medical institutions (MIs) in VTE Capital is not complete one. Since formulation of the HCWM needs the basic data of MIs, which identifies generation sources and amount of HCW, MOH together with DOH and VUDAA in VTE Capital shall find or make up a reliable data of MIs.
2. Once they could make the reliable list of MIs, they should revise this HCWM plan.
3. By 2015, the path forwards 2020 must be clear. Therefore, the seven large HCW generators should be obligated to separate their HCW and to discard infectious waste separately using designated bags and/or container.
4. An additional collection vehicle for infectious waste collection shall be procured by the end of 2015.
5. Necessary legal documents (contract agreement, etc.) should be prepared by the commencement of separate collection service.
6. Financial management system (proper collection fee system, etc.) shall be established in order to support the separate collection service.

2.2.5 Treatment and Final Disposal

In order to achieve the goal improvement of treatment and disposal system will be implemented as described below.

1. In 2012 an incinerator shall be constructed at the KM32 disposal site (KM32DS) and conduct test operation.
2. By the beginning of 2013 the incinerator shall be commenced full operation for the combustible infectious waste (IW) generated in the large HCW generators.

3. By December 2015 the infectious waste separately collected from the seven large generators, i.e. Mahosot, Military hospital, etc. The combustible infectious waste should be treated at the incinerator and the incombustible infectious waste together with ash from the incinerator shall be disposed of at the IW pit of KM32DS.
4. By 2020, capacity of incinerator will be increased to treat all combustible IW generated in VTE Capital.
5. By 2020, all infectious waste generated in VTE capital should be separately collected, treated and disposed as described above.
6. Necessary legal documents should be prepared by the conduct of infectious waste treatment and disposal of at the KM32DS.
7. Financial management system shall be established in order to support the infectious waste treatment and disposal of at the KM32DS.

Based on the above-mentioned assumption, infectious waste management in 2012, 2015 and 2020 is described as shown in the table below.

Table 6: Targets of Infectious Waste Management

Unit: kg/day

HCW	2012	2015	2020
A. Infectious Waste Generation	>453	>508	>615
B. Combustible Infectious Waste Generation	>113	>127	>154
C. Incombustible Infectious Waste Generation	>340	>381	>461
D. Separate Collection	NA	>508	>615
E. Incineration	NA	>127	>154
F. Disposal at the Isolated Pit of KM8 DS	NA	>406 ^{*1}	>492 ^{*1}

Note: *1 = C + (E x 0.2)

3 Implementation of HCWM Plan

3.1 Implementation of HCWM Plan

3.1.1 Before the Implementation of HCWM Plan

Separate collection and disposal of IW has been conducted in VTE Capital from 1998, when VUDAA received a special collection vehicle for IW by JICA's grant aid. This means VUDAA has established separate collection and disposal system of IW before the commencement of LPPE in August 2011. However, the HCWM study in the five main hospitals conducted in May 2012 found out the system has not well functioned as follows:

- Since a lot of general HCW were disposed of at IW pit in KM32DS together with IW, waste pickers have been collecting recyclables from the IW pit.
- IW such as needles has been observed at general waste disposal area of KM32DS.

These facts showed strict IW separation system was not established at MIs, i.e. generation source of IW. The reasons of non-establishment of strict separation of IW at MIs are:

- MIs have not been clearly instructed for strictly separation of IW;
- MIs have not clear needs of strict separation due to cheap IW collection fee;
- There were not clear tariff for separate collection of IW.

3.1.2 Implementation of HCWM Plan

In order to improve the HCWM LPPE in cooperation with VUDAA has drafted HCWM plan that installs a HCW incinerator at KM32DS, incinerates separately collected IW and disposes ash from incineration of at HCW pit. Then the incinerator has been installed in May 2012 and set the tipping fee of IW separate collection, treatment disposal as 10,656kg/kg after test operation. The plan set the targets of separate collection, treatment disposal of IW generated in the seven main hospitals.

As understood by the Table below, the incinerator has not well operated until late 2014. The reasons it did not operate well for two and half years are objection of targets hospitals against newly set tipping fee for IW collection and treatment. To solve this problem MOH together with DOH have made efforts to teach and instruct MIs.

Table 7: Incineration Amount from May 2012 to August 2015

Duration	Total Working Hour		Total Incineration	
	hours	hours/day	kg	kg/day
May 2012 to Dec 2012	25	0.1	420	1.75
Jan 2013 to Dec 2013	38	0.1	739	2.02
Jan 2014 to June 2014	19	0.1	392	2.15
July 2014 to Dec 2014	668	3.7	10,858	59.50
Jan 2015 to Apr 2015	1,043	8.6	20,456	168.13
May 2015 to July 2015	877	9.5	18,614	202.33
Total	2,670	-	51,479	-

3.2 Issues and Problems of Current HCWM

3.2.1 Insufficient Capacity of Current Incinerator

Upon consideration of capacity, operational method, working conditions and maintenance, daily possible incineration amounts is calculated as **76 kg/day**.

1. Capacity: 20 kg/hour
2. Required operation hours for one batch: 2hours 20 minutes (Two hours operation + 20 minutes cool down)
3. Maximum numbers of batch operation: 3 times/day
4. Maximum incineration amount: 120 kg/day (20 kg/hour x 2 hours x 3 batch)
5. Monthly possible operation days: 21.4 days (30 days x 5/7)
6. Monthly maintenance days: 2 days
7. Yearly maintenance days: 5 days
8. Yearly operation days: 232 days ((365 x 5/7) – (2 x 12) – 5)
9. Yearly incineration amount: 27,840 kg/year (120 kg/day x 232 days)

10. Daily possible incineration amount: **76 kg/day** (27,840kg/365 days)

According to the calculation above, the incinerator is being operated far beyond the possible capacity. Overcapacity operation is conducted **without holidays and maintenance days, and over 8 hours operation everyday day**. It is afraid that these overcapacity operation may cause frequent break down of the incinerator.

The Figure below shows the change of monthly incineration amount and it clearly indicates the incinerator is being operated far beyond its capacity.

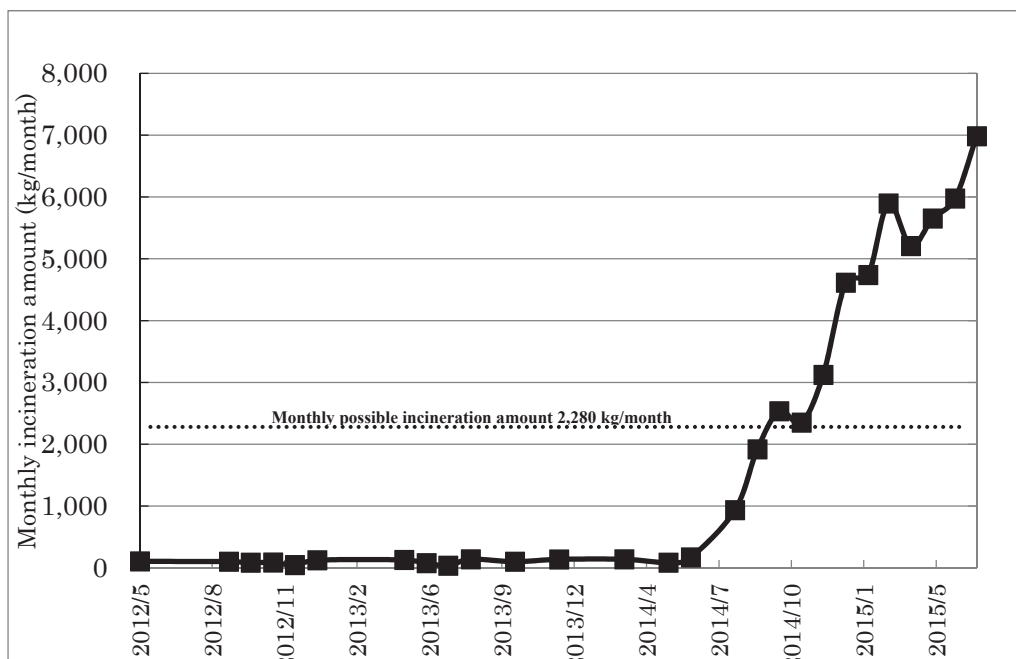


Figure 3-1: Change of Monthly Incineration Amount

3.2.2 Tremendous Increase of Incineration Amount

The reasons of tremendous increase of incineration amount are as follows:

1. First of all education and strict instructions to MIs conducted by MOH and DOH forced them to follow the separate collection, treatment and disposal system successfully.
2. Numbers of MIs in VTE Capital in the new list of January 2015 increase very much comparing the one of year 2012. Even though the new list may not include some of MIs. To precisely estimate HCW generation, relevant authorities are requested to prepare a reliable list as soon as possible.
3. According to the HCWM Plan the incombustible infectious waste (IW) is treated by the generation source if treatment facility like an autoclave is available, and separately collected and disposed of at the infectious waste (IW) pit at KM32 DS. There are, however, many hospitals that neither have treatment facilities nor use those due to broken down. Consequently a lot of incombustible IW are separately collected and incinerated.

3.3 Recommendation of Improvement Measures

Considering current implementation of HCWM plan and the targets of the plan 2020, i.e. to establish separate collection, treatment and disposal of all IW generated in VTE Capital, VUDAA, MOH and DOH are recommended to take the following measures for improvement:

1. Review of the HCWM plan by making reliable list of MIs in VTE Capital and using data of the list.
2. Examine the needs of incineration of incombustible IWs from MIs that do not have any treatment facilities for the IWs when review of the plan.
3. Based on the review of the HCWM plan VUDAA shall formulate and implement a construction plan of an incinerator which has enough capacity to treat all IWs in VTE Capital.
4. MOH shall legalize the ministerial decree on HCWM in order to establish the separate collection, treatment and disposal of all IW generated in VTE Capital as soon as possible.
5. Based on the above decree MOH in cooperation with DOH and VUDAA shall strengthen monitoring and enforcement system on improper management of IWs.
6. VUDAA shall examine the measure to improve IW disposal pit to control and manage leachate generated in the pit.

Appendix 7.

OPERATION AND MAINTENANCE MANUAL FOR HEALTH CARE WASTE INCINERATOR AT VTE KM 32 (2015)



LPP-Environment component

In cooperation with JICA Experts Team

This is an operation and maintenance manual for the incinerator for health-care waste (HCW) installed at KM32disposal site in VTE.

1. Outline of the incinerator for health-care waste
 - (1) Model name: Medical solid waste VHI-18B-20
 - (2) Manufacturer: Vietnam Academy of Science and Technology Institute of Environmental Technology
 - (3) Specification of the incinerator for health-care waste VHI-18B-20

Items	Unit	Capacity
Capacity	kg/h	20
Operation time	Per batch	2hours 20 minutes
Daily maximum capacity	kg/day	120 (3 batch)
Target medical waste	-	Combustible infectious waste
Total weight of incinerator	kg	4,500
Dimensions: length x wide x height	m	1.39 x 1.39 x 2.49
Temperature of primary combustion chamber	°C	500 - 800
Temperature of secondary combustion chamber	°C	1050 - 1200
Retention time in the secondary chamber	sec	1.5 – 2
Operation cost : Electricity consumption	kw/h	1.5
Operation cost : Diesel oil consumption	liter/h	8 - 10

【Yearly incineration amount】

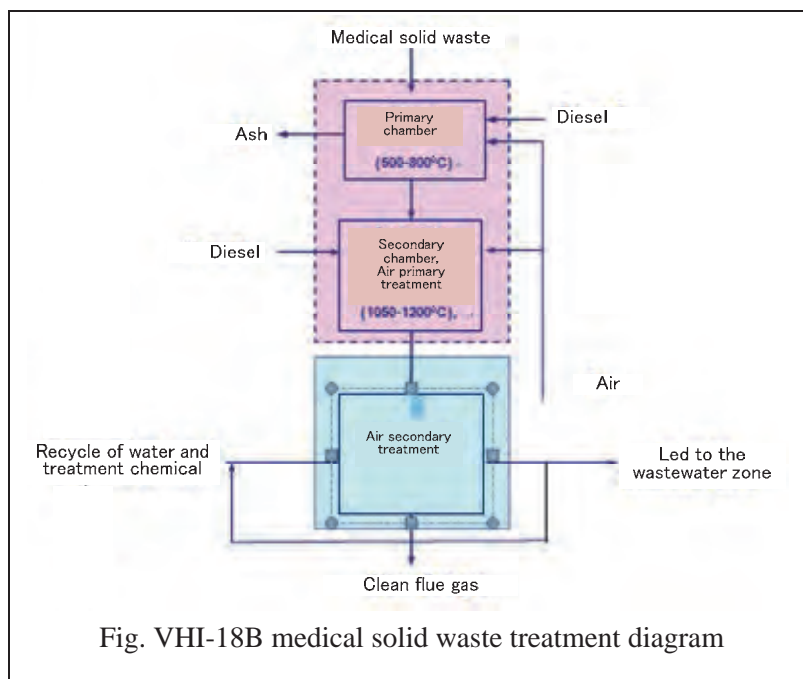
1. Capacity: 20 kg/hour
2. Required operation hours for one batch: 2hours 20 minutes (Two hours operation + 20 minutes cool down)
3. Maximum numbers of batch operation: 3 times/day
4. Maximum incineration amount: 120 kg/day (20 kg/hour x 2 hours x 3 batch)
5. Monthly possible operation days: 21.4 days (30 days x 5/7)
6. Monthly maintenance days: 2 days
7. Yearly maintenance days: 5 days
8. Yearly operation days: 232 days ((365 x 5/7) – (2 x 12) – 5)
9. Yearly incineration capacity: 27,840 kg/year (120 kg/day x 232 days)
10. Daily possible incineration capacity: 76 kg/day (27,840kg/365 days)

2. Operation principles

Incinerator VHI-18B-20 is designed based on the multi-zone combustion technology that has been widely used in developed countries.

Waste are fed into the primary combustion chamber, which is maintained at a temperature of 800 °C. Air is continuously supplied to the combustion process. Smoke exhausted from the primary chamber (product of incomplete combustion which contains dusts and toxic matters) is mixed with air and then exhausted to the post combustion chamber.

In the secondary chamber, the incomplete combustive products (containing dioxins and furan) will be continuously broken down and combusted at high temperature (1,050 °C – 1,200 °C) with a good enough retention time of 1.5 – 2 seconds. Smoke from the secondary chamber will be exhausted to the flue gases treatment system for removing dust, heavy metals and other environmental pollutants: NOx, SOx, HCl, HF, etc.



3. Operation manual

Part 1: General regulations on using incinerators

A. Regulations on labor safety

- (1) Workers have to use protective wear: clothing, head protection (hat or helmet), shoes, gloves and glasses.
- (2) Check the electricity system (automatic and circuit-breakers) to ensure there are no possible causes of electrical fires or leakages.
- (3) Check the fuel supplying system (diesel oil) to ensure there is adequate oil and no leaks.
- (4) The operating house for medical solid waste incinerator VHI-18B has to be clean, obstruction-free, and has windows and doors wide open.
- (5) The operating house always stores type 03 fire extinguishers.

B. Regulations on using incinerators

- (1) This incinerator is only used to burn medical solid waste, so it is necessary to sort out waste in accordance with regulations before putting it into the furnace.
- (2) There must be an incinerator log (recording specific volume, time and dates of operation and finishing of a batch, incidents, etc.)
- (3) While the incinerator is in operation, there must be an operator present.
- (4) In case of an incident that cannot be remedied, a record identifying the cause must be made, and this must be reported to the installation unit.

Part 2: Process of operation of Medical Solid Waste Incinerator VHI-18B

A. Operating instructions

- (1) Clean the combustion chamber (scrape all the glass, ashes and so on through the discharge

opening at the back).

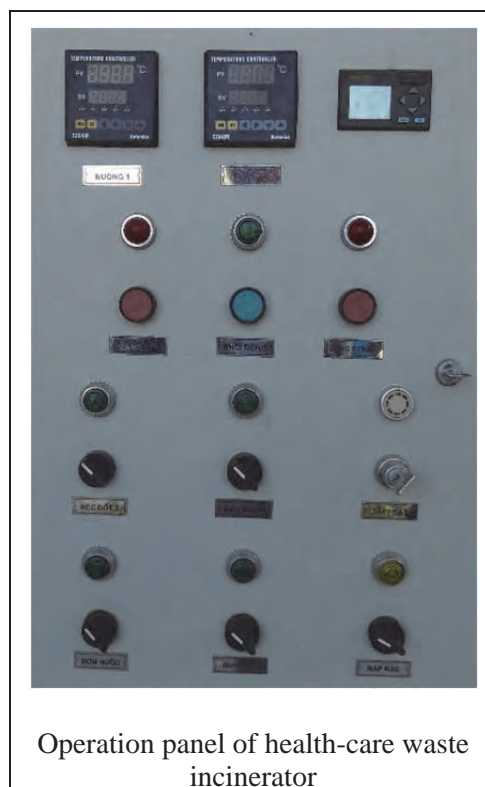
- (2) The grate and the ash pit in the combustion chamber have to be cleared.
- (3) Load about 40kg of medical solid waste (i.e. one batch) into the No.1 combustion chamber (primary). Basically, incinerating one batch of health-care waste (HCW) takes two hours.
- (4) Check the diesel oil level and open the oil charge valve for the burner.
- (5) Check the water pump and pit under the waste cyclone for cooling water system.
- (6) Add alkaline solution such as sodium hydroxide (NaOH) or Ca (OH)₂ (residue-free lime water) into the tank and stir.

(note: the cooling water system is designed to pump and circulate. Besides cooling the water, it has a very important role of absorbing and neutralizing acid gases such as: NO_x, SO_x, CO ... and cyclone dust. Hence the cooling water must satisfy the following conditions:

- + *Maintain temperatures below 30°C*
- + *Maintain pH level between 8 and 10*
- + *Add water regularly*
- + *Clean the tank every 3 months to remove sediment*

- (7) Switch the power switches to general automatic (including the one in the control box).
- (8) Turn OFF both switches on the control box (to the left)
- (9) Lock the air-charging valve into the furnace.

- (10) Press the START button.
- (11) Turn ON the switches "WATER PUMP", "EJECTOR FAN", "BURNER 1", "BURNER 2"(to the right) in tum to start the water pump, ejector fan, and burner.
- (12) The system will then start working automatically. Observe the corresponding signals on the control cabinet and check the operation of the devices.
- (13) At this time the burner No.2 will operate first. When the temperatures of the secondary chamber (chamber No.2) reach 500°C, the automatic control program will power on burner No.1 to waste.
- (14) When the temperature of the primary chamber (chamber No.1) reaches 350°C the automatic control program will power off burner No.1 as the waste is now self-combustible. At this time the air-charging valve into the furnace should be open to maintain the burning (note: the valve must be opened slowly and the airflow regulated appropriately)



Operation panel of health-care waste incinerator

B. Actions to suspend the operation of the system.

- (1) The burner No.2 must be manually switched off after two (2) hours of operation.
- (2) After a further 20 minutes, turn OFF the "EJECTOR FAN" and "WATER PUMP" (to the left).
- (3) Press the stop button and turn off automatic on the control box.
- (4) Shut the incoming circuit breaker and half-open the discharge opening at the back.
- (5) In case that the amount of health-care waste cannot be incinerated in the first batch process, two or more batches of incineration must be conducted in a day. When the temperature of chamber No.1 cools down to 350°C at the end of the batch processing, the next batch processing can be started by conducting the same procedures as the first batch. The operator and workers should be aware of the high temperature of the incinerator.

Note: During the whole working process of the incinerator, it is possible to perform an emergency stop at any time by pressing the "EMERGENCY STOP" button. However, we should only press it in case of an incident or when the incineration process is complete to stop the system.

C. Incidents and solutions.

- (1) When the incinerator is not working properly according to the set mode (no light, or the wrong light is on) press the "EMERGENCY STOP" button and then press the "START" button to "RESET" the system. To restart the system, press "START", then turn on the switches as desired.
- (2) If the light of one of the burners is still ON without the burner operating, press the "RESET" button(s) on the burner(s).
- (3) In case of oil shortage in the burners, after fully charging, press the "RESET" button on the burner(s). In case the light is still ON without performing burner operation on which the "RESET" button was pressed, check if the burner is clogged and if the light sensor (magic eye) is stained by black smoke or distorted by heat (note: periodically maintain the burner by cleaning the magic eye, oil filters, air atomizer, igniters and unclog oil injectors inside the burners)
- (4) If the temperature gauge on the control box does not display the temperature in the furnace, check if the temperature sensor (the temperature gauge plugged into the furnace) is open-circuited.
- (5) If a lot of black smoke appears on top of the chimney, it is necessary to reduce the charging air from the blower into the furnace through the valve behind. In case of an emergency, burner No.1 can be shut down temporarily.
- (6) If all such incidents are excluded and the system still does not operate, some function (if the equipment does not work and indicates that no lights are ON in the control box, check the fuses on the control box; if the light of a fuse is ON, this indicates that the fuse is open-circuited and needs replacing (cut-off value of the fuses in the box is 10A)

D. Countermeasure for black smoke exhausted from chimney

【Causes of black smoke】

- (1) The burner No.1 is not working well and the burning process is not complete (oil is not completely burned)
- (2) There is insufficient supply of air

- (3) The composition of the input waste contains high humidity or too much rubber and plastic

【Countermeasures for black smoke】

- (1) Clean the second burners: clean the nozzles, flame rods, diffusers, oil filters and oil tank
- (2) Adjust supply air appropriately (when the incinerator starts working, close the air valve. When the temperature of burner No. 1 reaches 350 °C, slowly open the air valve and if the black smoke is discharged at the top of the stack, reduce the supply of air)
- (3) Strictly control waste separation stage. This incinerator was designed for solid waste only, not for high humid waste. In a batch, do not burn waste containing too much rubber and plastic.

4. Maintenance

- (1) List of spare parts

The spare parts to properly operate the incinerator of HCW are shown in the following table.

No.	Spare-parts	Unit	Proposed quantity	Remark
1	Photoelectric eyes	Piece	1	Model OM-1N/OM-0N
2	Ignition electrode	Piece	1	Model OM-1N/OM-0N
3	High-voltage cable	Piece	1	Model OM-1N/OM-0N
4	Control relay	Piece	1	Model OM-1N/OM-0N
5	Temperature sensor	Piece	1	Model OM-1N/OM-0N
6	Nozzle	Piece	2	Model OM-1N/OM-0N
7	Solenoid valve	Piece	1	Model OM-1N/OM-0N

- (2) Supplier of spare parts

- Name of supplier: Vietnam academy of science and technology (VAST), Institute of environmental technology (IET)
- Address. : 18 Hoang Quoc Viet Road Cau Glay District, Hanoi, Vietnam

(3) Procedure of HCW incinerator operation at VTE

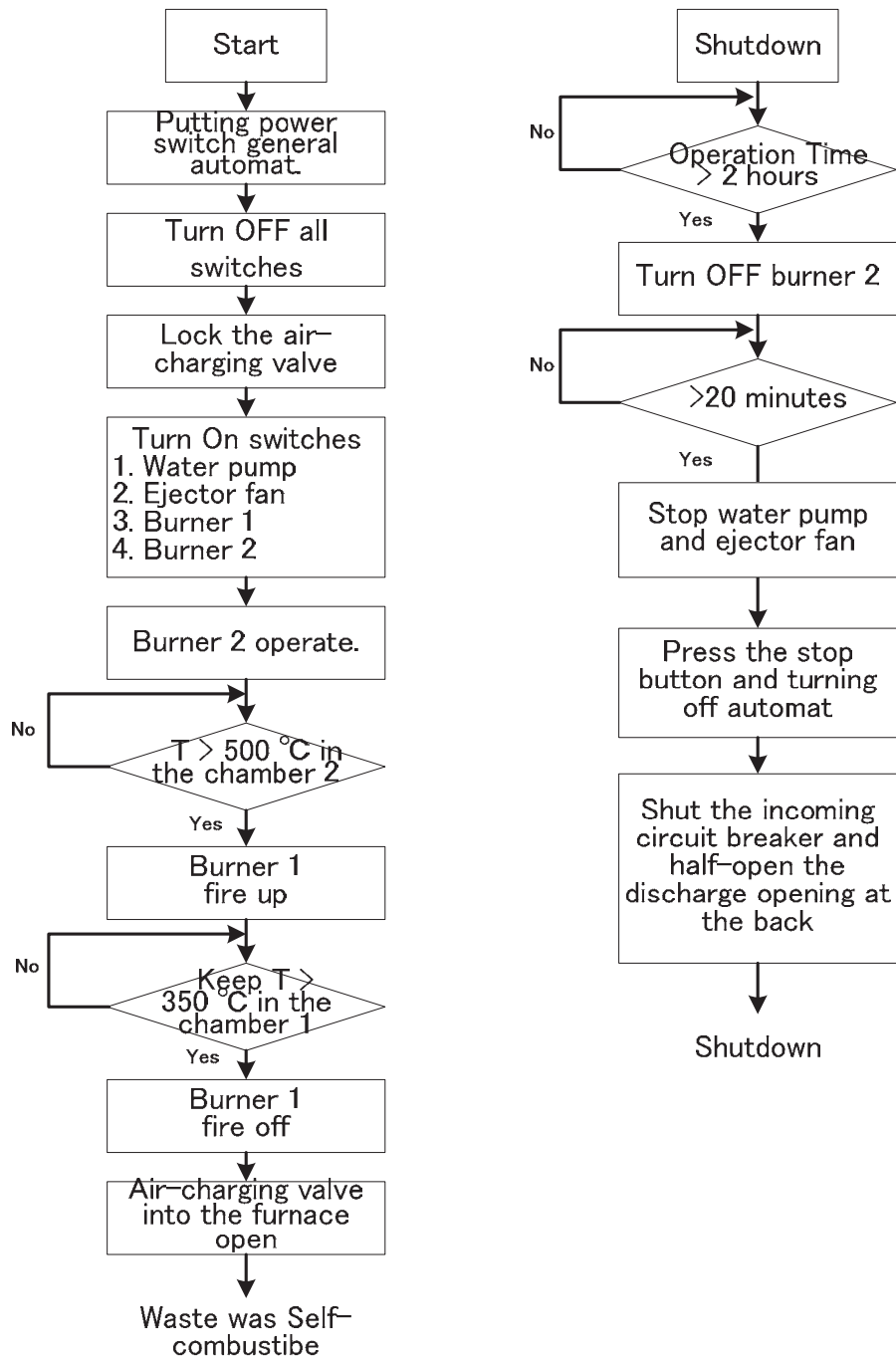


Fig. Procedure of medical solid waste incineration at VTE

(4) Comparison of operation time, temperature and total consumption of oil amount

Comparison of operation time, temperature and total consumption of oil amount between chamber No.1 and chamber No2. are shown in following figure.

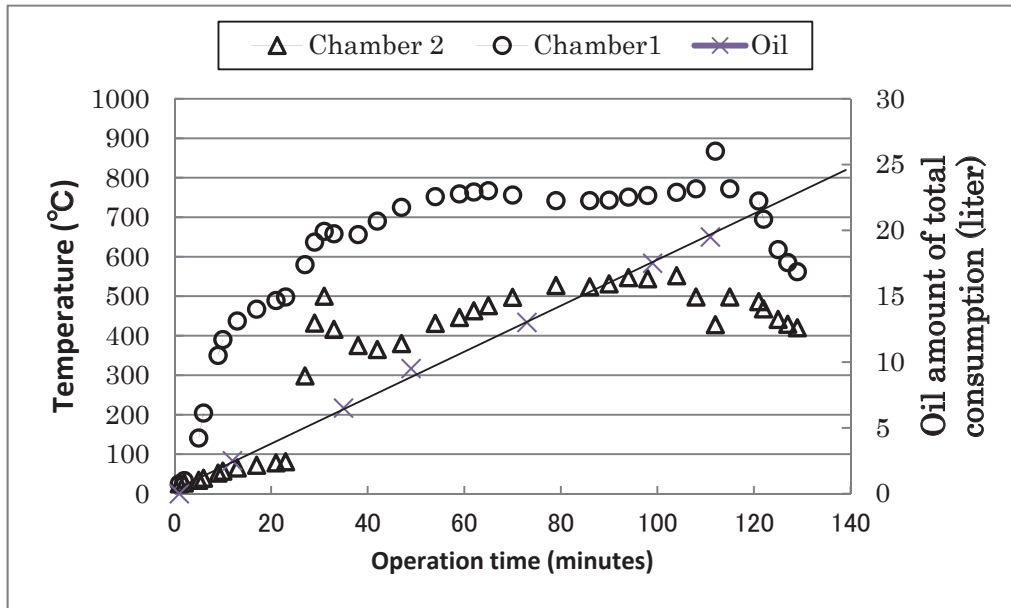


Fig. Operation data (24 June 2014)