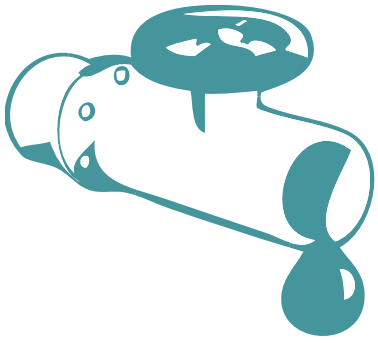
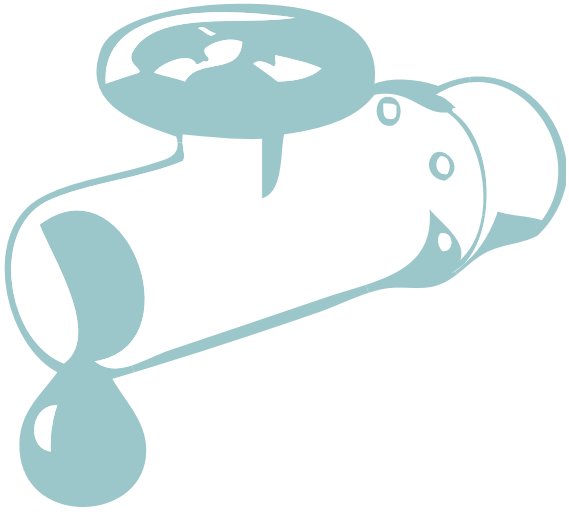


THE PHILIPPINE SUSTAINABLE SANITATION KNOWLEDGE SERIES

Septage Management Program: The General Santos City Experience



DEPARTMENT OF HEALTH

THE PHILIPPINE SUSTAINABLE SANITATION KNOWLEDGE SERIES

Septage Management Program: The General Santos City Experience

Published by the Department of Health (DOH) Philippines
San Lazaro Compound, Rizal Avenue, Sta. Cruz,
Manila, 1003 Philippines
November 2010
ISBN-978-971-0569-27-4

This document was developed through the Sustainable Sanitation in East Asia Program-Philippine Component (SuSEA). Water and Sanitation Program-Philippines. The World Bank Office Manila 20th Floor, The Taipan Place F. Ortigas Jr. Road, Ortigas Center Pasig City 1605 Metro Manila. Philippines Telephone: +632-917-3143

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- *Guidebook for a Sustainable Sanitation Baseline Study*
- *Guidebook for a Local Sustainable Sanitation Strategy*
- *Guidebook for a Local Sustainable Sanitation Promotion Program*
- *Guidebook for Community-Led Total Sanitation*
- *Guidebook for a Zero Open Defecation Program*
- *Guidebook for Onsite Sanitation Technologies*
- *Guidebook for Designating a Water Quality Management Area*
- *Guidebook for Marketing a Septage Treatment Facility*
- *Guidebook for Monitoring and Evaluation*
- ***Septage Management Program: The General Santos City Experience***
- *The SuSEA LGU Experience: Dagupan, Guiuan, Polomolok, General Santos City, Alabel, Bauko*
- *Guidebook for a Disease Prevention and Control Program for Soil-transmitted Helminth Infections and Diarrheal Diseases*
- *Guidebook on Water Supply Protection Program*
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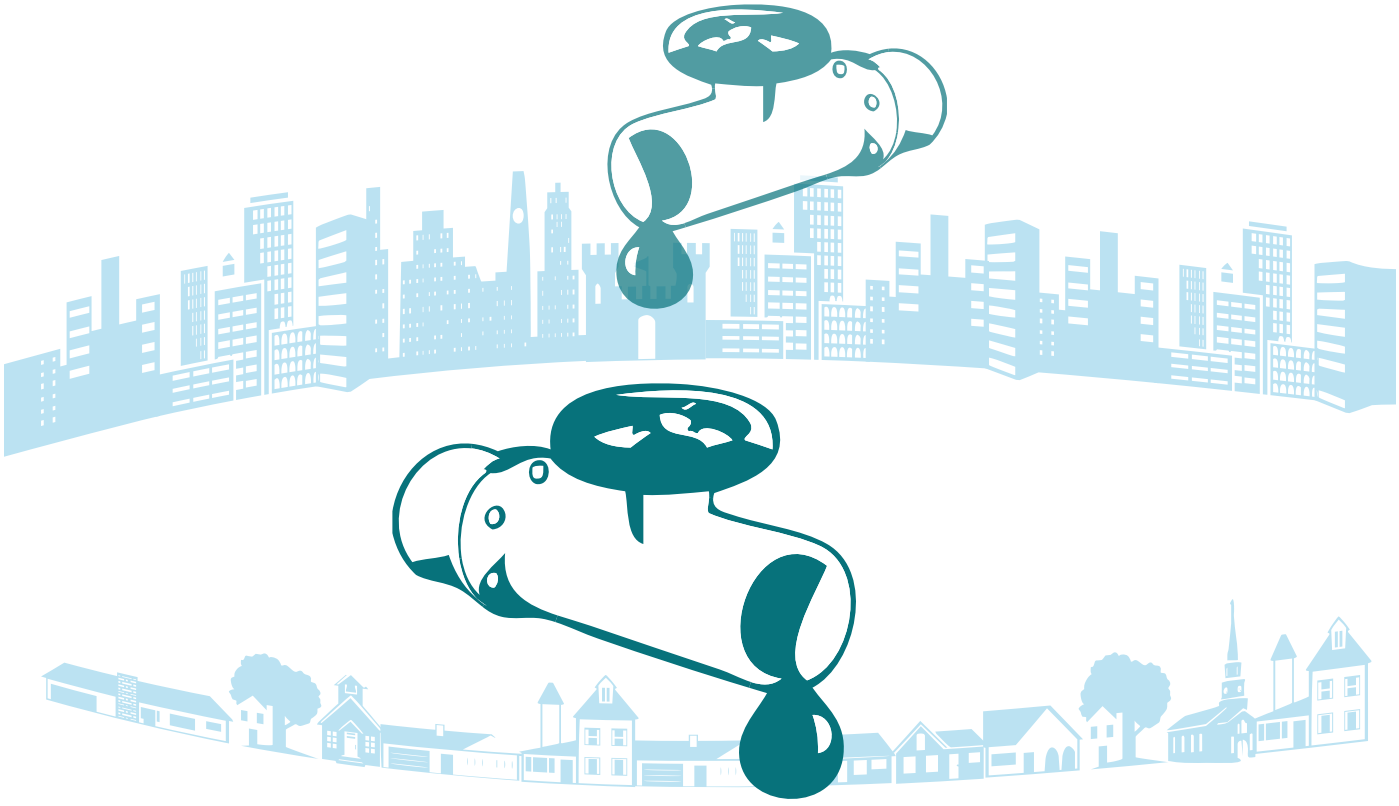

ACKNOWLEDGMENTS

We would like to express profound thanks to the following individuals for their invaluable support and commitment.

Dir. Eduardo Janairo, Dr. Yolanda Oliveros, Engr. Joselito Riego De Dios, Engr. Rolando Santiago, Engr. Luis Cruz, Engr. Gerardo Mogol, and Engr. Ma. Sonabel Anarna (DOH)

Dir. Juan Miguel Cuna, Dir. Julian Amador, Asst. Dir. Jonas Leones, Reg. Dir. Datu Tungko Saikol, Engr. Renato Cruz, Engr. Marcelino Rivera (DENR)

Ms. Jema Sy, Mr. Edkarl Galing, and Ms. Shiela Dela Torre (WB-WSP)

Dr. Leonardo Carbonell of Dagupan City, Dr. Socorro Flores of Guiuan Municipality, Dr. Samuel Masidong of Bauko Municipality, Engr. Nael Joseph Cruspero of General Santos City, Mr. Ronnie Muno of Polomolok Municipality, and Engr. Allan Rivera of Alabel Municipality (LGU Partners)

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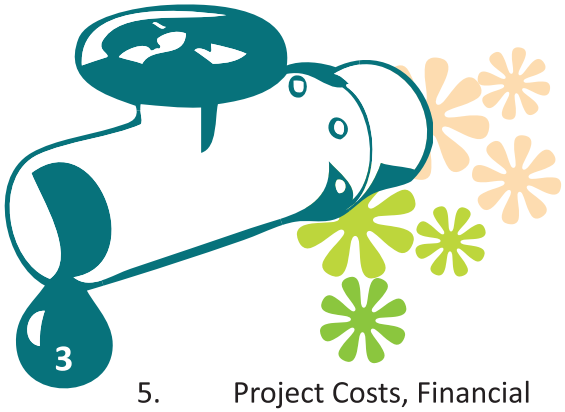
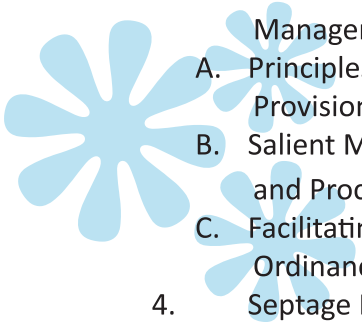
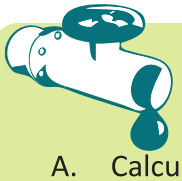
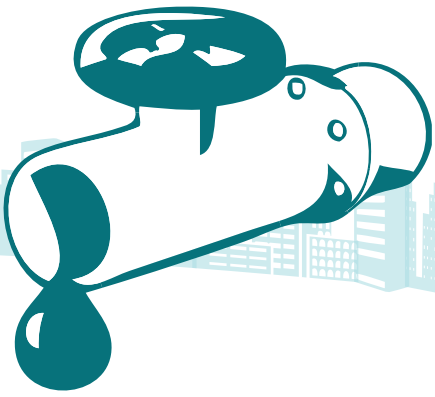


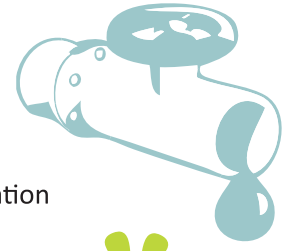




ACRONYMS AND ABBREVIATIONS



ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
Brgy	-	Barangay
CCPAP	-	Coordinating Council of the Philippine Assistance Program
CPDO	-	City Planning and Development Office
CWA	-	Clean Water Act or Republic Act 9275
DAO	-	Department Administrative Order
DENR	-	Department of Environment and Natural Resources
DOST	-	Department of Science and Technology
DPWH	-	Department of Public Works and Highways
ECC	-	Environmental Compliance Certificate
ESC	-	Environmental Sanitation Clearance
GenSan	-	General Santos City
GSCWD	-	General Santos City Water District
HH	-	Household/s
IRR	-	Implementing Rules and Regulations
JBIC	-	Japan Bank for International Cooperation
LGU	-	Local Government Unit
LWUA	-	Local Water Utilities Administration
MOA	-	Memorandum of Agreement
MWSS	-	Metropolitan Water and Sewerage System
NSO	-	National Statistics Office
O&M	-	Operations and Maintenance
PD	-	Presidential Decree
RA	-	Republic Act
RWSA	-	Rural Waterworks and Sanitation Association
SC	-	Water Service Connection
SMO	-	Septage Management Ordinance
SMP	-	Septage Management Plan
SMICZMP	-	Southern Mindanao Integrated Coastal Zone Management Project
SP	-	Sangguniang Panlungsod
ST	-	Septic Tank



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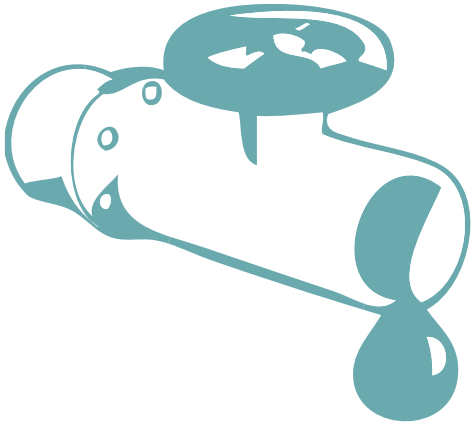


STF	-	Septage Treatment Facility
STP	-	Sewage Treatment Plant
SuSEA	-	Sustainable Sanitation in East Asia Philippines
SWMB	-	Sustainable Waste Management Board
SWOT	-	Strengths, Weaknesses, Opportunities, and Threats
TAMS	-	Technical Assistance Management Services (of SuSEA)
USAID	-	United States Agency for International Development
VT	-	Vacuum Truck
WD	-	Water District
WQMA	-	Water Quality Management Area

UNITS

cum	-	cubic meter
cumd	-	cubic meter per day
g	-	gram
ha	-	hectare
kg	-	kilogram
km	-	kilometer
l	-	liter
lpcd	-	liter per capita per day
m	-	meter
M	-	million
mg/l	-	milligram per liter
PHP or P	-	Philippine peso
sqm	-	square meter

The SuSEA Program

The Sustainable Sanitation in East Asia Program-Philippine Component (SuSEA) supported by the Water and Sanitation Program (WSP) of the World Bank and the Swedish International Development Cooperation Agency (SIDA), and implemented through the leadership of the Departments of Health (DOH) and Environment and Natural Resources (DENR), is geared towards increasing access by poor Filipinos, primarily low-income households, to sustainable sanitation services by addressing key demand and supply constraints. Aside from this, the program hopes to learn from local implementation of sanitation programs as basis for national policy and operational guidance.

SuSEA Philippines commenced in July 23, 2007 as a learning program to support the Government of the Philippines (GoP) update its approaches and interventions in sanitation and needs that were not present or not addressed in traditional sanitation programs that focused on two extremes: 1) toilet-bowl distribution and hygiene education and 2) centralized sewerage systems. The most important of these emerging needs are:

- Complementing interventions related to the reduction of risks of sanitation- and poverty-related diseases such as soil transmitted helminthiasis and acute gastroenteritis
- Linking sanitation interventions with environmental objectives, such as the improvement of water quality and water resources
- Sanitation in rapidly urbanizing towns and cities, including the occurrence of disease episodes that aggravate impacts of poor sanitation (such as flooding) on the economy and quality of life of city populations
- Reaching pockets of communities that comprise the remaining 20% of those without access to basic sanitation, particularly in the rural areas (among whom include indigenous peoples/ cultural minorities) and urban slum communities.

SuSEA-Philippines was designed using four different models as the platform for developing specific interventions (according to themes below). The learning gained and the tools developed from these models served to assist other local governments units (LGUs), as well as informing national sanitation policy and programs for GoP-led expansion and scaling up. The four models are:

Model 1 Disease Prevention and Control – Sanitation interventions for the eradication/ reduction of disease

Model 2 Water Quality Management – Sanitation interventions for the improvement of water quality within a water quality management area

Model 3 Liveable Cities - Sanitation interventions for the improvement of quality of life in cities and low-income urban poor communities

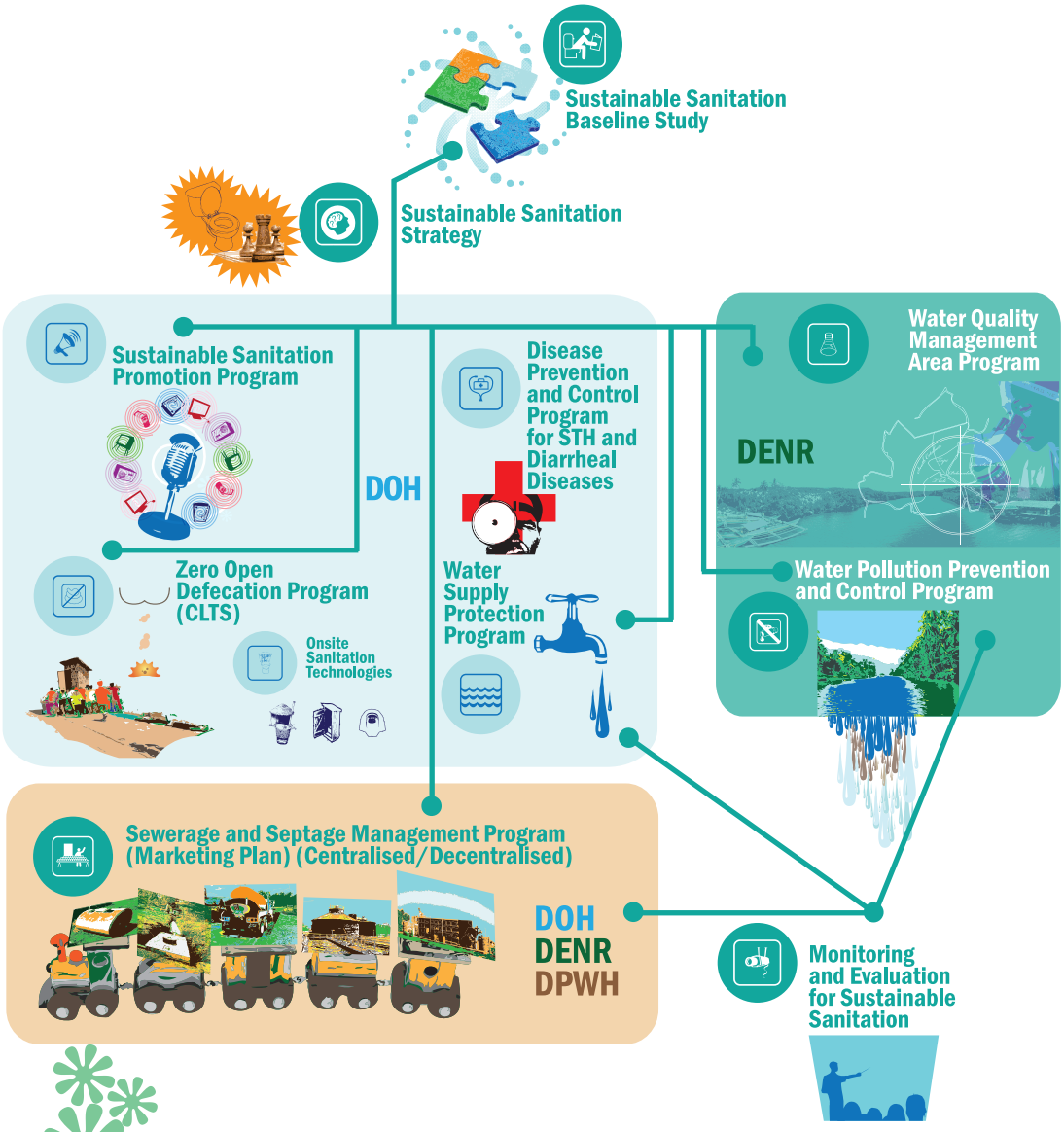
Model 4 Sustainable Rural Livelihoods - Sanitation interventions to support sustained livelihoods in rural areas

Six sites participated in the main program sub-component of SuSEA. These are: Bauko Municipality in the Mt. Province, Dagupan City in Pangasinan Province, Guiuan Municipality in Eastern Samar Province, General Santos City and Polomolok Municipality in South Cotabato, and Alabel Municipality in Sarangani Province. The desired outcome in each of the project sites varied according to the model and agreements by the Program Steering Committee and the local government. While outcomes varied per site, each of the projects were additionally intended to provide the LGUs with a fount of information on developing and running their own sanitation programs based on the on-field experiences of the SuSEA team and their partners. This information has been packaged for your use in a Sustainable Sanitation Knowledge Series, to which this guidebook/report belongs.

The reader is encouraged to familiarize himself/herself with all the guidebooks/reports in this series beginning with the Guidebook for Conducting a Baseline Study and followed by the Guidebook for Developing a Local Sustainable Sanitation Strategy. What guidebooks/reports you choose to utilize next will be determined by your community's particular needs and your LGU's proposed sanitation programs.

On the succeeding page, you will find an illustration of the various sustainable sanitation programs (SSPs) under the National Sustainable Sanitation Plan (NSSP). For each of these SSPs, SuSEA has also developed materials under the Philippine Sustainable Sanitation Knowledge Series, intended to guide local government units in implementing the various sanitation programs and initiatives in their own area. The information gathered in the Knowledge Series is, in turn, based on specific SuSEA projects and activities in each of the six project sites.

Sustainable Sanitation Programs

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Septage Management Program: The General Santos City Experience

1. Introduction

This book describes the development of the septage management program for General Santos City. The program consisted of the drafting/passage of a septage management ordinance, the development of a septage management plan, and the implementation of a septage management program under a Memorandum of Agreement (MOA) between the General Santos City Government and the Alabel Municipal Government. This MOA provided for the latter to undertake the septic tank desludging of city-owned buildings, with the collected septage disposed/treated at the presently underutilized Alabel Septage Treatment Facility.

Septage management addresses the reduction of pollution from domestic wastewater by properly maintaining the treatment effectiveness of the septic tank, the most common and predominant treatment facility for human excreta and wastewater from toilets of residences and buildings.

The program is a strategy to improve urban sanitation and the environment through the reduction of domestic wastewater pollution load (particularly, the effluent from septic tanks) to water bodies and to the groundwater, to protect the people's health, thereby making the city more livable.

During program implementation, it is very important that coordination be made with the Department of Public Works and Highways (DPWH) and the Department of Environment and Natural Resources (DENR) on the infrastructures and water quality monitoring components, respectively.

A. Wastewater Sources

The sources of wastewater are domestic, commercial/institutional, agricultural, and industrial establishments. Study results by the World Bank in the various regions of the country and recent water quality monitoring at the Silway River that traverses General Santos City and bordering towns are shown in Table 1. The pollutant level in terms of the Biochemical Oxygen Demand (BOD) parameter indicates that wastewater from domestic sources contribute about 40-50% of the total pollution in the National and Region XII area (Table 1). Recent measurements on the Silway River indicated a higher (67%) contribution from domestic sources.

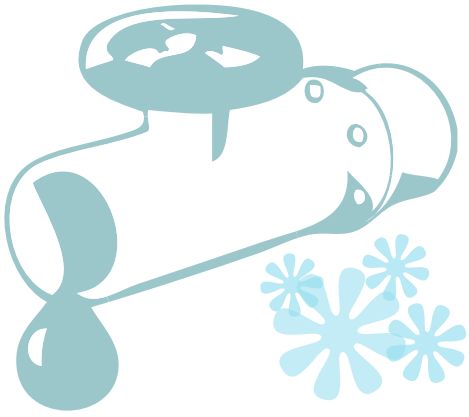


Table 1

Source	BOD LOAD DISTRIBUTION		
	National*	Region XII*	Silway WPC Study**
Domestic	48%	42%	67%
Commercial/ Institutional			2%
Agricultural	37%	49%	31% (Agro-Indus)
Industrial	15%	9%	
BOD Load			3.4 million tons/yr

*WB-Philippine Environment Monitor, 2003

**SuSEA Silway Watershed Study, 2009

B. Sanitation Strategies

Considering that domestic wastewater is the major source of water pollution in the Silway River of General Santos City, sanitation strategies are focused on "on-site" options like the increased use of septic tanks, improvement of septic tank design/efficiency (like use of multi-chambers, baffled reactors, etc), promotion of regular desludging and promotion of the use of on-site secondary treatment. "Off-site" sanitation strategies like sewerage systems have been proposed for GenSan several times in the past years but have not prospered due to high costs and the apparent lack of a proper information campaign to stakeholders. The septage management program for GenSan described here adopts "on-site strategies".

From various studies in the country, a comparison of the various alternatives for sanitation is shown in Table 2.

Table 2

Strategy	Pollution Reduction Potential	Indicative Capital Cost (P*000)
"On-site" sanitation option		
1. Increase septic tank use	Up to 50% (for new, properly constructed septic tanks)	15 to 20 per unit
2. Upgrade/Retrofit existing septic tank design (3-chamber, waterlit)	Up to 30%	5 to 10 per unit
3. On-site secondary treatment (decentralized wastewater treatment system)	Up to 90%	20 to 40 per unit treatment plant unit capacity (cumd)
4. Septage management (septic tank regular desludging)	Up to 50%	1.5 to 3.5 per service
"Off-site" sanitation option		
1. Combined sewerage (interceptor) system	Up to 90%	15 to 20 per system unit capacity (cumd)
2. Separate sewerage system	Up to 90%	25 to 40 per system unit capacity (cumd)

C. Objectives

The General Santos experience illustrates how a septage management program for a city is undertaken, covering the entire process: from formulation, planning, discussion/consultation with stakeholders to the start-up or piloting of program implementation.

2. Legal and Regulatory Framework

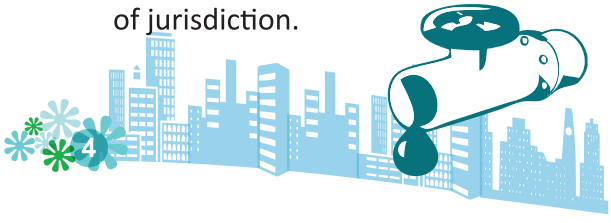
The Clean Water Act of 2004 (RA 9275) and its IRR of 2005 and the Code of Sanitation of the Philippine (PD 856) and its IRR of 1995 & 2004 provide the regulatory framework for sewerage and septage management programs.

The Water District Law (PD 198) and the Local Government Code (RA 7160) reinforce the program framework for project implementation.

In June 21, 2010, the DOH AO No. 2010-0021 was issued. The AO declares sustainable sanitation as a national policy and a national priority program of the DOH. To support the policy and program, it is expected that enactment of related laws will follow.

A. Clean Water Act

The Act provides a comprehensive national water quality program to protect, preserve, and revive the quality of the country's fresh, brackish, and marine waters. Three provisions of the Act that are relevant to sanitation are: (i) formation of the water quality management area led by the DENR-EMB; (ii) development and implementation of the National Sewerage and Septage Management Program (NSSMP) led by the DPWH, focused on septage and sewerage infrastructures for the urban cores of cities and municipalities; and (iii) mandating the Water District to be responsible for sewerage facilities and the septage management program in their area of jurisdiction.



Water Quality Management Area (WQMA) – The WQMA is formally organized through the DENR-Environmental Management Bureau (EMB). The strategies for sanitation are closely linked with the water quality objectives set by the WQMA. A Governing Board is formed to set-up the policies and programs. The Silway River was officially designated as a WQMA in April 19, 2010 under DENR DAO No. 2010-10. The WQMA covers the Silway River catchment area in General Santos City and the adjoining three (3) municipalities of T'boli, Tupi, and Polomolok.

National Sewerage and Septage Management Program (NSSMP) – The overarching objective of the NSSMP is to assist local implementers in building sewerage and septage management facilities using a stakeholder demand-driven bottom-up planning process. The NSSMP targets LGUs, water districts, and private service providers in program implementation. These three have the mandate to address sewerage and septage management and the ability to design, implement, and manage projects. While the NSSMP presents the full spectrum of sanitation solutions, the primary focus are large sewerage and septage infrastructures servicing densely populated urban areas outside the Metropolitan Waterworks and Sewerage System (MWSS) service area in Greater Metro Manila.

Table 3

Breakdown of Targets 1 and 2

Targets	Short-term: By Yr 2013	Long-term: By Yr 2020
Target 1: No. of LGUs with local sanitation plans	18	42
Target 2: No. of sewerage/ septage management systems built & opening	14	76

The targets of the NSSMP set for areas outside[1] Metro Manila are:

- Target 1: By 2020, 60 LGUs have developed local sanitation plans;
- Target 2: By 2020, local implementers have built and are operating and maintaining 76 sewerage or septage management systems;

The short and long-term breakdown of Targets 1 & 2 is shown in Table 3.

- Target 3: By 2020, approximately 9,877,000 people have access to improved sanitation (sewerage and septage treatment facilities). Of these, 2,145,300 will have new sewer connections;
- Target 4: By 2020, PHP14.7 billion has been invested in sanitation improvement projects,
- Target 5: By 2020, more than 216 million kilograms of BOD have been diverted from the environment as a result of sewerage and septage management projects.

Role of Local Water Utilities – The Act's Section 8.6 stipulates the role of the Water Supply Utilities as: *In the case of highly urbanized cities (HUCs), non-HUCs, and LGUs where water districts, water utilities, and LGU waterworks have already been constituted and are operational, the water service provider shall be responsible for the sewerage facilities and the main line pursuant to PD No. 198 and other relevant laws. In areas where there are no existing facilities, the LGUs, water districts, or water utilities may adopt septage management program or other sanitation alternatives.*

[1] *Two concessionaires operate the sewerage and septage management systems of the Metropolitan Waterworks and Sewerage Systems' (MWSS) service area covering Metro Manila, all towns/cities of Rizal Province, and Manila Bay coastal towns/city of Cavite Province, under a concession agreement that stipulates the coverage targets for sewerage and sanitation.*

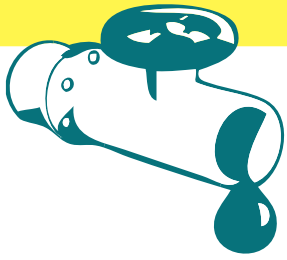
B. **Sanitation Code**

The Code provides the rules and regulations for health and sanitation. Relevant to septage management is Chapter XVII – Sewage Collection and Disposal, Excreta Disposal and Drainage and the Supplemental IRR – Collection, Treatment, and Disposal of Sludge and Septage. Featured are requirements on septic tanks, septage and domestic sludge collection and transport, manifest system, disposal of sludge, Environmental Sanitation Clearance (ESC) and requirements, etc.

The Code has specific provisions for septic tanks, the predominant household treatment facility. Some of these provisions are as shown in the box above right.

SANITATION CODE:
Septic Tank Requirements

- Shall be located such that desludging equipment can have convenient access to opening the manholes;
- Shall not be located under the building
- Shall be cleaned before excessive sludge or scum is allowed to accumulate and seriously



C. **Water District Law (PD 198)**

Title II of the Decree is referred to as the Local Water District Law, which provided the formation of Water Districts to operate water supply and distribution systems, wastewater collection, treatment and disposal facilities, and to conduct the function and operations incidental to water resource development, utilization, and disposal (Section 5).

At present, there are 851 Water Districts in the country operating in cities and large municipalities. However, only a few have extended their services to cover sewerage and septage management. The most recent ones are located in the cities of Zamboanga and Dumaguete.

D. **Local Government Code (RA 7160)**

Under Section 17, LGUs are mandated to effectively provide basic services and facilities to their constituents, including drainage and sewerage; as well as to encour-

age the active participation of the private sector in local governance and through the sale, lease, and disposal of public economic enterprise owned by the local government units in their proprietary capacity.

3. General Santos City Septage Management Ordinance

In 2008, General Santos City officially adopted the City's Sustainable Sanitation Plan, which included the implementation of a Septage Management Program. To support the Program, Ordinance No. 01 Series of 2010, an ordinance promulgating septage management for the City of General Santos was passed by the Sangguniang Panlungsod on its 130th regular session on February 11, 2010.

A. Principles and General Provisions

The Ordinance is based on the constitutional mandate (i.e., the "State shall protect and promote the right to health of the people and instill health consciousness among them"), the Local Government Code, and other laws described in Section 2 earlier.

The Ordinance applies to all existing and future buildings and structures, whether public or private, residential, commercial or industrial, institution and establishment, whether public or private as well as all kinds of sea vessels found within the city waters, generating domestic sewage.

B. Salient Mandates and Procedures

The salient mandates of the Ordinance are focused on sanitary toilets and septic tanks, structural requirements, periodic cleaning or desludging of septic tank contents or septage, and septage treatment and disposal.

Sanitary Toilets and Septic Tanks Mandatory – A sanitary toilet facility is required in every house and building occupied or used by persons. The type and design of such facility shall conform to the specified requirements and shall be approved by the City Engineer/Building Official prior to construction.

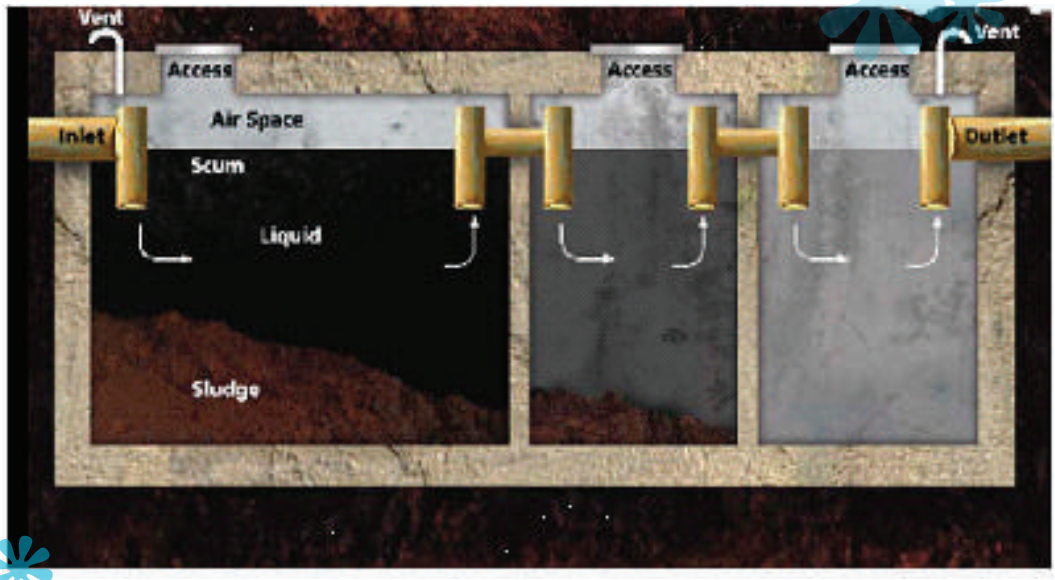


Figure 1

All sanitary toilets shall be connected to septic tanks. The more significant requirements for construction and maintenance are as follows:

- The septic tank shall have three (3) compartments, watertight and shall be constructed of sound durable materials, as illustrated in Figure 1;
- Septic tanks shall be located such that desludging equipment can have convenient access to opening manholes;
- Septic tanks shall not be located under the building;
- Plans and specifications for all septic tanks shall conform to the minimum standards prescribed by city authorities and the National Plumbing Code;
- Roof drains, foundation drains, area drains or cistern overflows shall not be made to enter the septic tank; and,
- Septic tanks shall not be washed or disinfected after cleaning. A small residue of sludge shall be left in the tank for seeding purposes.

The City Engineer shall evaluate the application for septic tank construction clearance and conduct site visits to verify if the plans and drawings submitted match with the actual site conditions. If satisfactory, the construction clearance is issued upon payment of the required fees. Construction clearance is also required where substantial remodeling or repairs of the septic tank are to be made.

Owners of existing septic tanks not constructed in accordance with the specifications shall be given a period of one (1) year from the effectivity of this Ordinance to comply with the requirements either by constructing a new one or by retro-fitting or repairing the existing ones. Costs shall be shouldered by the owner.

Desludging, Collection, and Transport by Service Providers – Among others, the Ordinance stipulates the following:

- Desludging of septic tanks is mandatory once in every four years for household septic tanks and once every two years for commercial and institutional establishments by authorized service providers;
- Collection by authorized service providers shall be coordinated with designated barangay officials who shall sign the prescribed manifest form;
- Collection operation shall be done during light traffic in the area and traffic cones or safety devices should be installed around the collection vehicle;
- The service provider shall maintain good working condition of its equipment as well as provide the proper protective and safety gears of its workers such as masks, gloves, etc.;
- Any spills during the desludging operation shall be cleaned and disinfected;
- Vehicles used to transport septage must be equipped at all times with spill control or absorbent and disinfectant material, in addition to other specifications such as having a leak proof tank with secure lock to cover and being able to withstand collision with other vehicles or structures; and,
- Septage transporters/haulers shall display at both sides the company name & logo, contact number, and body number of the vehicle, which should be legible and permanent.

Treatment and Disposal - All domestic sludge/septage are to be processed and treated in a treatment facility authorized by the DOH and/or the DENR. The city shall endeavor to establish its own septage treatment facility or encourage the private sector to set-up such facilities within a period of seven (7) years from approval of the Ordinance. In the meantime, the city shall make arrangements with neighboring LGUs for the use of their existing septage treatment facilities.

The Ordinance specifies the requirements needed to set-up a treatment facility, such as ESC, ECC, sanitary permit, designation of a Pollution Control Officer, and others.

Disposal of treated sludge and septage shall be done by landfilling, spreading on land, or other new technology options approved by the DOST. Under no circumstances shall untreated sludge or raw septage be placed in a sanitary landfill. Guides for land application shall conform to the requirements of the Department of Agriculture.

Manifest System and Recording - All transport of domestic sludge and septage must possess a prescribed manifest form. The collection and transport service provider must complete the manifest form by providing information such as:

- Origin of sludge or septage: name of the client, address, and contact number;
- Date and time of collection;
- Source of sludge or septage whether residential, commercial, or institution;
- Destination: name of facility and date & time received; and,

- Duly signed forms at the origin and destination.

Service providers shall establish and maintain a record/report system or logbook of its collection activities to include such information as client, volume, inventory of tools, etc. The manifest forms shall be kept for a period of five (5) years.

The service provider shall submit quarterly reports to the City Health Officer of its activities and other pertinent information.

Administration and Enforcement - The General Santos City Sustainable Waste Management Board (SWMB) shall act as the over-all septage management policy coordinator and perform oversight functions on the implementation of the City Septage Management Program as well as in the enforcement of this Ordinance. The SWMB shall be assisted by the Technical Working Group (TWG) until a regular Office or Department has been duly created and filled up.

By a system of qualifications and criteria, the SWMB shall select desludging service providers, including the setting of desludging fees and payment to the service provider. The TWG, assisted by the City Planning and Development Office (CPDO), will prepare the desludging zoning and schedule including record keeping and monitoring.

A desludging/tipping fee shall be collected monthly from households, commercial, and institutional establishments for the mandatory desludging of septic tanks and the treatment of septage. Such fees shall be set through public consultation.

The General Santos City Water District and Rural Waterworks and Sanitation Associations (RWSAs), under an agreement with the City Government, will collect the approved desludging monthly fees of households and establishments within their service areas and remit such collections to the City Treasurer. A septage management trust fund shall be established at the City Treasurer's office.

Information, Education and Communication - To ensure widespread understanding and support of the objectives, components, and implementation mechanics of the City Septage Management Program among the households, establishments, and institutions in General Santos, the City Information Office shall formulate an appropriate and stakeholder-directed information, education, and communication (IEC) program and materials. It is essential for the program to make

use of behavior change communication as the effectiveness of the Septage Management Program depends on stakeholder support through change in behavior towards sanitation.

Penalty Clause - The City Engineer/City Health Officer shall issue citation tickets to persons or entities caught violating the Ordinance with the following penalties:

- First offence – attendance in a seminar on the City Septage Management Program;
- Second offence – fines ranging from PHP1,000 to PHP2,000 and attendance in a seminar or imprisonment of one (1) day to not more than six (6) months; and,
- Third and succeeding offence – fines ranging from PHP2,000 to PHP4,000 and attendance in a seminar or imprisonment of one (1) month to not more than one (1) year or both depending on the discretion of the Court.

C. Facilitating the Process of Ordinance Making

The City Septage Management Ordinance took almost a year from the preparation of the draft ordinance to its passage by the Sanggu-niang Panlungsod. The Consultant Lawyer prepared the draft, which was reviewed by the Consultant Team in several sessions. Advance copies of the Draft Ordinance were circulated and discussed among the city officials led by the CPDO and SWMB.

The first formal presentation/briefing of the draft was made to two (2) SB members, namely the chairmen of the Environment Committee and Rules Committee. This was followed by several meetings with the SB sponsor for clarification and revision of the draft ordinance.

While under discussions with the SB, the Consultant Team presented the draft ordinance to various stakeholders such as the Water District, Rural Waterworks Association, private desludgers, government agencies, barangay officials, and the private sector.

The final draft of the ordinanance was presented formally by the Consultant Team to City Officials and most members of the SP in a one-day session at the City Hall. Afterwards, the draft ordinance was submitted to the SP and calendared for public hearings, where the Consultant Team continued to provide clarifications and input.

The Septage Management Ordinance was passed as Ordinance No. 01 Series of 2010 on the 130th session of the 15th Sangguniang Panlungsod on February 11, 2010.

4. Septage Management Plan

Septage Management Plan (SMP)- The SMP sets the schedule for desludging and upgrading of all the existing septic tanks so that their primary treatment capability is restored and consequently the BOD load of the tank's outflow is reduced. The proposed upgrading consists of retrofitting or replacing the 1- and 2-chamber septic tanks to 3-chamber types as prescribed by the City Septage Management Ordinance. Households with no toilets or dry-type toilets are required to install pour-flush type toilets with septic tanks. Septage removed from the septic tanks by vacuum trucks are transported safely to septage treatment facilities for treatment and safe disposal.

A. Development Phases of Sanitation and Sewerage

For the urban area of a city or municipality, the stages of developing sanitation and sewerage are illustrated in Figure 2. A typical street in a community of residential or mix-use development is illustrated in [A] wherein households or establishments have installed septic tanks as part of their toilet facility or have not installed any septic tank at all thus, discharging sewage directly to the street drain. The septic tank provides primary treatment of the human excreta and wastewater it receives and provides anaerobic treatment by retaining the wastes for two or more days within its chamber. If the chambers are filled with solids or septage, the retention time is reduced to zero and, therefore, no treatment is made (i.e., raw wastewater flows in and out of the septic tank).

From the typical sanitary situation in **Figure 2 [A]**, this situation is improved in stages: Stage 1 – Sanitation phase (**Figure 2 [B]**), Stage 2 – Combined sewerage phase (**Figure 2 [C]**) and Stage 3 – Separate sewerage phase (**Figure 2 [D]**). These stages are described below and strategies for maintaining sanitary conditions are provided.

The typical urban condition illustrated in Figure 2 [A] represents the local sanitation condition in General Santos City. The proposed SMP for General Santos City aims to move forward to Stage 1 – Sanitation Phase, as illustrated in Figure 2 [B].

Stage 1 or Sanitation Phase [Figure 2 [A] – The strategies are:

- Maintain existing septic tanks (an estimate of which is shown in the Baseline Survey) but pump out the tank contents (septage) periodically at 3- to 5-year intervals;
- Initiate a program to upgrade the 1-chamber and 2-chamber septic tanks to the 3-chamber septic tanks prescribed by the septage management ordinance;
- Also, initiate a program to inform/convince those households with no toilets with dry type toilets to upgrade to the prescribed pour-flush type toilets with a 3-chamber septic tank as well as those households with inaccessible (inside the house) septic tanks to relocate or develop access to these septic tanks; and,
- Implement an information campaign on the provisions of the septage management ordinance, particularly on the periodic desludging program and the directive that new septic tanks should be the 3-chamber type with lined or non-porous bottoms.

Stage 2 – Combined Sewerage Phase (Figure 2 [C]) - Considering that septic tank outflows or effluent need to be further treated to comply with the water quality standards of the receiving water bodies, the effluent or wastewater have to be collected using the drainage systems or dedicated sewer system for further processing in a treatment plant. Correspondingly, new residential, commercial, or mixed residential-commercial developments in GenSan should be required to install gravity sewerage and treatment facility.

Stage 3 – Separate Sewerage System Phase (Figure 2 [D]) - The ideal sewerage development is a

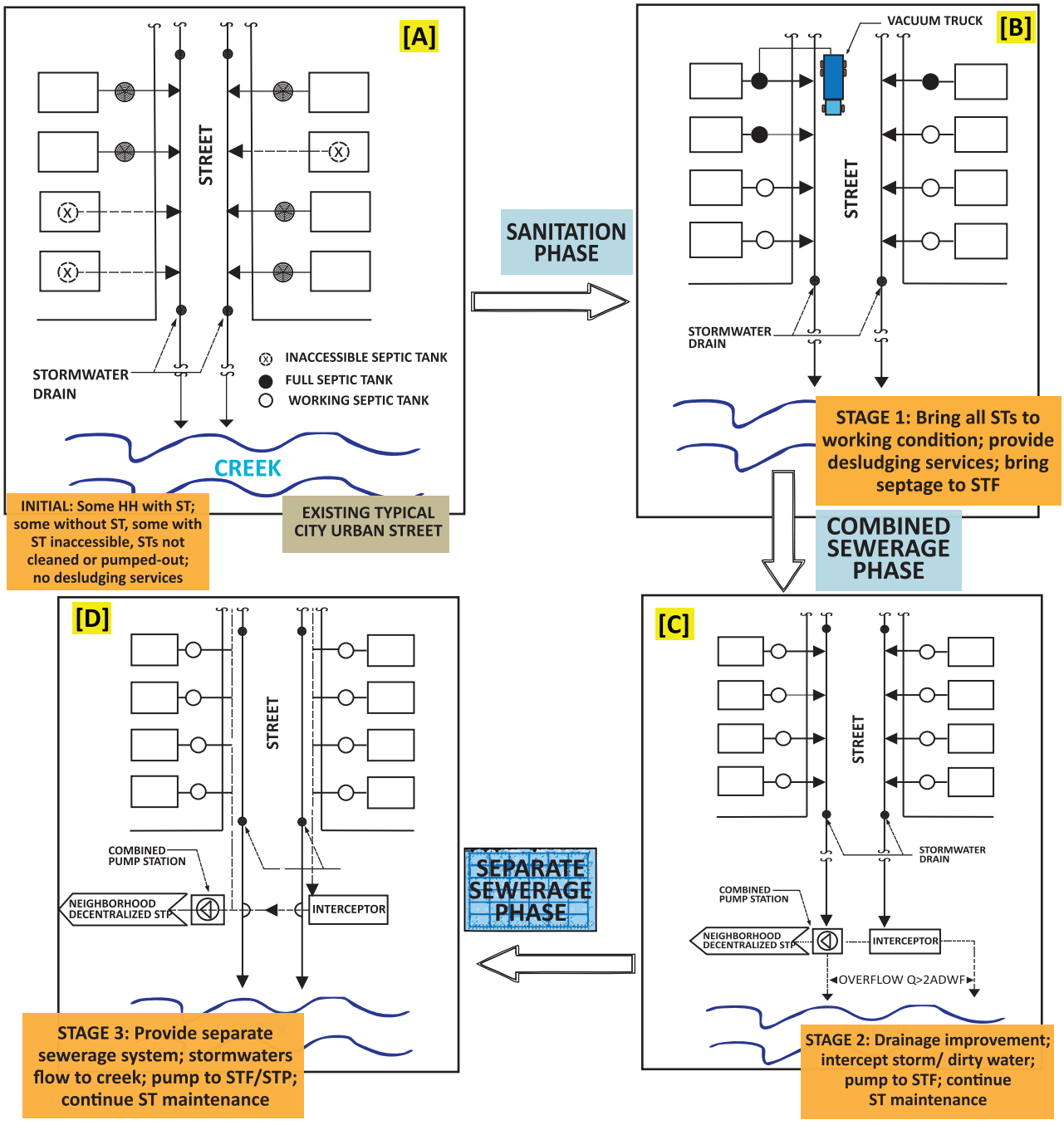


Figure 2 - Stages in the Development of Urban Sanitation and Sewerage

separate sewerage system where wastewater effluent from house-holds or establishments are collected by a sewer network and conveyed to a treatment plant. Storm run-offs are directed to water bodies by a storm sewer system.

Separate sewerage systems that are integrated in the development of urban utilities – roads, drainage, water supply, at the early stage of development are considered much less expensive than when installing the system in an existing developed urban area. As the sewer pipes are installed at the middle of the road (in accordance with standard practices), the cost of the sewerage system increases tremendously, due to the road breaking and restoration, while traffic rerouting causes major inconvenience.

B. Planning the SMP

B.1 Pre-planning Activities

In developing the SMP, the following pre-planning activities enable the planner a better appreciation of the background, rationale, and importance of septage management:

1) Orientation on the relevant institutional and regulatory framework for developing the SMP.

Current laws and administrative orders that provide legal and regulatory frameworks on the planning, design, and implementation of a septage management project include the Philippine Sanitation Code, the Clean Water Act, and local ordinances such as the General Santos City Septage Management Ordinance. Brief discussions were presented earlier in Section 1.

2) Review of related project and studies relevant to the septage management plan.

Metro Manila and highly urbanized cities (HUCs) in the country have been recipients of international grants in the past years. For General Santos City, relevant project studies in the past include: (a) First Stage Priority Project for Sanitation and Sewerage, a USAID-funded feasibility study in 1995, (b) Updated Sewerage Project Feasibility Study for General Santos City in 2001, a component of the JBIC-funded Southern Mindanao Integrated Coastal Zone Management Project (SMICZMP), and (c) City Comprehensive Land Use Plan of 2000.

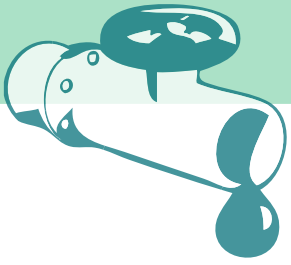
Relevant information is also provided by other project studies such as the Sewerage and Sanitation Master Plan for Metro Manila to 2025 . In the absence of actual data for planning and design purposes, septage characteristics such as those shown in Table 4 is most helpful. For planning purposes, the cost estimates of a septage treatment plant, vacuum trucks, and equipment, including operation and maintenance costs should also be useful.

Table 4

Typical Sewage and Septage Characteristics in Metro Manila (Applicable to Urban Areas)

Parameter	Sewage	Septage
BOD (mg/L)	150-350	6,000
COD (mg/L)	300-700	15,000
Suspended Solids (mg/L)	50-150	10, 000-40,000
Total Nitrogen (mg/L)	50-60	700
Total Phosphorus (mg/L)	8-15	100
Fecal coliform (CFU/100 mL)	10^8-10^9	10^8-10^9

Source: Section 7, Final Report-Sewerage and Sanitation Master Plan for Metro Manila



3) Situational analysis

The current situation of sanitation and facilities of the city or municipality needs to be evaluated through a situational analysis, which should cover water supply situation and the conditions of sanitary facilities of households and establishments, in particular toilets and septic tanks.

Population census data (e.g., Table 5) may be downloaded from the National Statistics Office (NSO) website (e.g., Years 2000 and 2007 population), including number of households and household population. The planning offices are likely to have population projections used in various project planning such as the Comprehensive Land Use Plan (CLUP) report.

SuSEA Survey – In March-April 2009, a survey of households was conducted. The survey focused on socio-economic conditions including willingness to pay and sanitation conditions, in particular, sanitary toilet and septic tank conditions. Survey results are shown in Table 6.

Table 5

National Census Office

GENERAL SANTOS CITY	Yr 2000	Yr 2007
Population	411,822	529,542
Population Growth Rate	3.53%	
Household Population	410,844	
Number of Households	86,595	
No. of Persons/Household	4.74	
Ratio: Household/Total	0.9976	

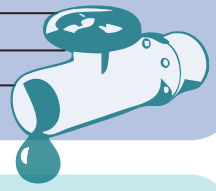


Table 6

2009 SuSEA Survey General Santos City	No. of Respondents	Share
Households: total	1,900	
without toilet	1,900	10.8%
with toilet		89.2%
withdry-type toilet	1,696	6.0%
with toilet & septic tank		94.0%
with 1-chamber septic tank	1,595	39.9%
with 2-chamber septic tank		57.8%
with 3-chamber septic tank		2.3%

Local Sustainable Sanitation Plan (LSSP) – The local sustainable sanitation plan is formulated in accordance with the NSSP.[3] The LSSP is part of the GenSan's strategy to address the Silway WQMA in which septage management is a priority component.

B.2 Planning the SMP using the SuSEA-TAMS Model

A spreadsheet model for septage management planning was developed for the General Santos City SMP. A basic input to the model is a population projection, which is the basis of the projection of the annual number of households and subsequently, the number of households with and without a toilet facility, and the types of septic tanks. A 12-year design period[4] is taken starting from Year 1 of project operation. Project preparation (feasibility study, engineering design, procurement, and construction) is conducted 2 to 3 years prior to start of operation. A typical schedule is shown in Table 8.

B.3 Formulation of the SMP using the SuSEA Model

The SuSEA-TAMS Model for developing a septage management plan is a spreadsheet model of several calculations, which can be obtained as follows:

1) Undertake various projections:
   - Population and household projections from Year 2009 to Year 2021. Assume a 12-year project period;
   - Projections of households with and without toilet facility, types of septic tank (1-, -2, or 3-chamber). SuSEA survey statistics were used for the projections.

2) Calculate the annual number of desludgeable septic tanks:
   a) Address the 2009 backlog of septic tanks for improvement and conformity with the local septage management ordinance. (Refer to Table 7).
   - Address households without a septic tank: Convince these households to install a toilet and septic tank in 2 years? 4 years? Or 8 years? Decide on a target.
   - Address households with a 1-chamber septic tank to convert to the prescribed 3-chamber ST. Retrofit/ replace all in 2 years? 4 years? Or more? Decide on a target.

[3] National Sustainable Sanitation Plan, Department of Health.
[4] The 12-year design period provides a 3-cycle period at a desludging interval of 4 years. Uncertainties in a 12 year projection are considered less risky than the normal 25-year planning period.

Table 7

STRATEGY	Units of Septic Tanks	Schedule: *DECISION ANNUAL TARGETS*
1) Provide T & ST for Households with none & dry toilet		
2009 Backlog	**19,472**	100% in 2 cycles for 8 years
2) Upgrading/ Desludging: Households with toilets		
2a) 1-Chamber STs: Start to convert to 3-chamber in 2011		
2009 Backlog	**38,423**	100% w/in 2 cycles for 8 years
2b) 2-Chamber STs: Start to convert to 3-chamber in 2011		
50% of 2009 Backlog for conversion	**38,423**	100% w/in 3 cycles for 12 years
50% of 2009 Backlog for desludging	**38,423**	100% w/in 1.5 cycles for 6 years
2c) 3& + Chamber STs:		
2009 Backlog	**2,293**	100% w/in 1 cycle for 4 years
3) New households annual increments: Install 3-chamber ST		
Annual New Sts	**540**	in 2011 to 670 in 2022
4) Periodic desludging: Every 3 years		
Backlog + New STs	**608**	in 2011 to 10,309 in 2022

- Address households with a 2-chamber septic tank to convert to the prescribed 3-chamber ST. Retrofit/ replace all in 2 years? 4 years? Or more? Decide on a target.
- Desludge the existing 3-chamber septic tanks of households within 1 year or 2 years?

b) Annual growth increments of households that will install the prescribed 3-chamber type of septic tanks; and,

c) Sum up the annual number of desludgeable septic tanks and given the total annual desludgeable ST, decide on the % target for each year.

3) Calculate the daily volume of septage for the target number of septic tanks. Assume 2.5 cubic meters per septic tank.

4) Calculate the facility requirements for desludging and treatment:

a) Required number of vacuum trucks. Use units of 5 cum or 10 cum capacity with 2 trips per day, working 5 days per week or 260 days per year; and,
b) Required design capacity of Septage Treatment Plant at modules of 25 to 50 cumd capacity for staged procurement/construction.

5) Estimate project costs (based on similar projects as suggested) and project viability:

a) Use unit costs of PHP3.25M and PHP4.5 M respectively for 5 cum and 10 cum capacity vacuum truck;
b) Use PHP0.85M per cumd capacity for the Septage Treatment Facility;
c) Estimate operations and maintenance (O&M) costs for a 12-year period;
d) Estimate project revenue assuming a user fee of PHP50 per month per household;
e) Calculate the Net Present Value (NPV) of costs and revenues for the 12-year period assuming 10% interest rate; and,
f) Calculate project viability by comparing the NPVs of costs and revenue. There is profit if revenue exceeds costs.

The SuSEA-TAMS model covers items 1 to 4. A model iteration, (i.e., repeating the calculation process from items 1 to 4) with a revised set of annual targets which are either increased or decreased, is undertaken until the computed septage volumes are about equal the capacities of vacuum trucks and treatment plant. The cost of the plan is computed using the spreadsheet depending on the LGU's available financial resources and priorities as outlined in its LSSS.

B.4 Results of the SuSEA Model

The spreadsheet model output illustrating Steps 1 to 2 and the results are shown in Annex A. Steps 3 to 4 and the results are illustrated in Annex B. The results of Step 5 are shown in Annex C.

B.5 Choice of Facilities

Septage management has two physical components: the desludging vehicles or vacuum trucks (VTs) that pump out the content of the septic tank and safely transport them to the second component, which is the treatment plant where septage is treated and disposed

cleanly to the environment. The City Septage Management Ordinance prescribes the specifications of vacuum trucks and the septage treatment facility.

Choice of Vacuum Trucks – A five-cubic meter capacity vacuum truck is shown in Figure 3. A sturdy sealed tank is fixed at the truck bed and is equipped with a vacuum pump and flexible rubber hose to pump out the contents of a septic tank.

The LGU can choose to employ different types of vacuum trucks in their area, depending on the needs and available resources. In Metro Manila, operators use imported VTs due to guaranteed performance. Local desludgers (e.g., Malabanan and Soliman EC) use local assembly of vacuum pumps and tankers mounted commonly on a reconditioned 6-wheeler truck. Such assembly costs much less.

Figure 3

B.6 Recommended Septage Treatment Plant

For the septage treatment plant, a waste stabilization pond is recommended due to low O&M and likely available space in rural or peri-urban barangays for cities and abundance of rural barangays in a cluster of municipalities. The treatment process is shown schematically in Figure 4a, while a model rendition is shown in Figure 4b.

Options for other septage treatments are available in publications such as the Philippine Sanitation Sourcebook and Decision Aid.[5]

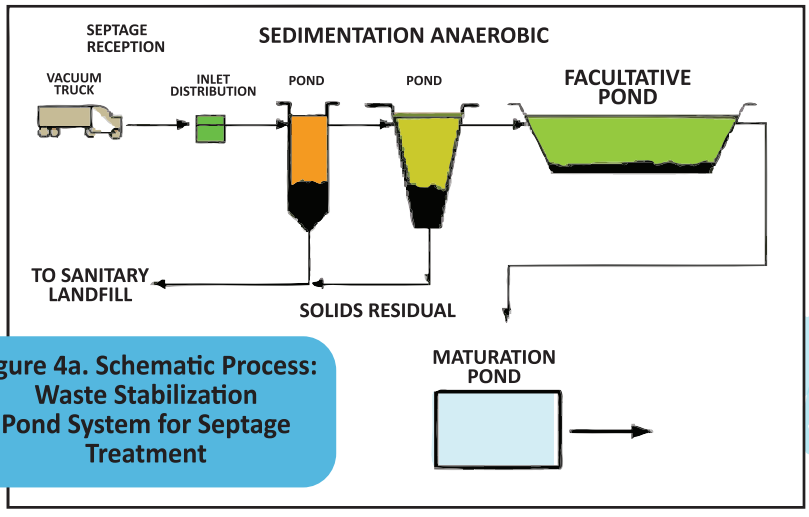


Figure 4a. Schematic Process: Waste Stabilization Pond System for Septage Treatment

[5] *Philippines Sanitation Sourcebook and Decision Aid, World Bank Water & Sanitation Program, 2005*

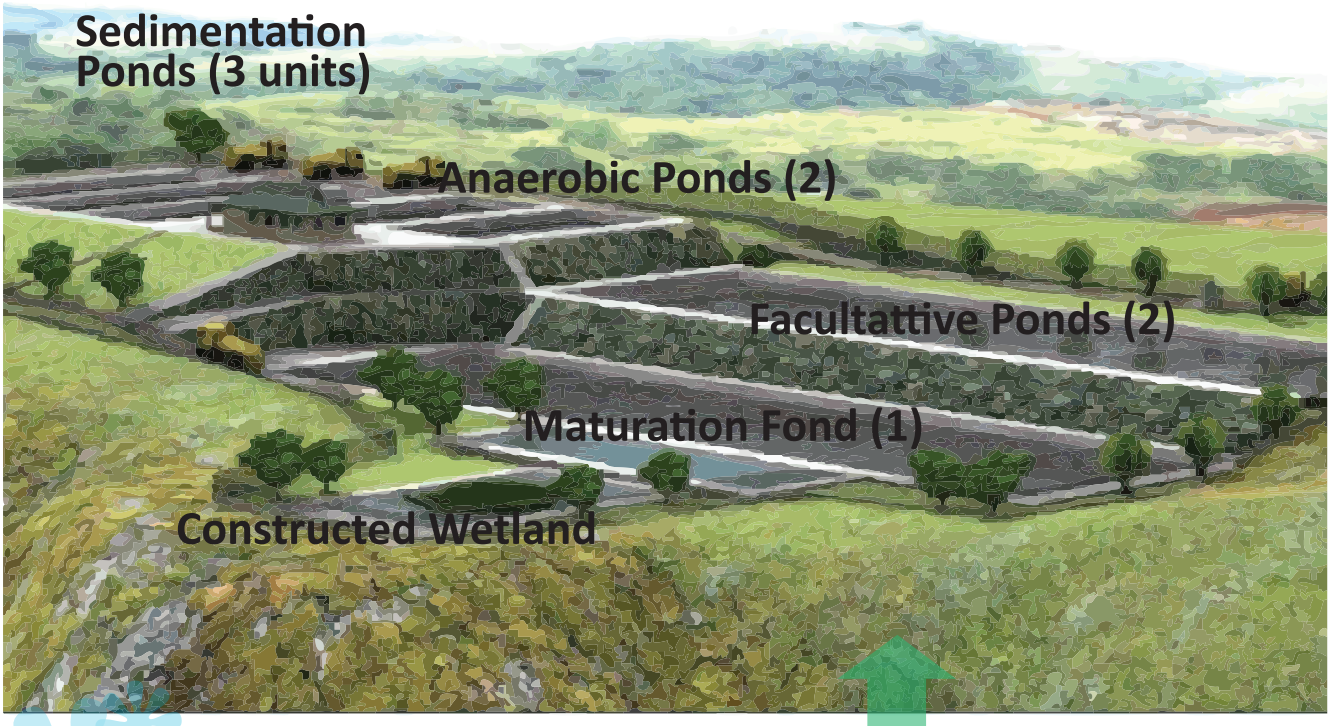


Figure 4b. Model Rendition: Alabel (Sarangani) Septage Treatment Facility with a Wetland for Effluent Polishing

5. Project Costs, Financial Viability, and Institutional Arrangements

A. Implementation Schedule

A typical project implementation schedule is shown in Table 8, for a 12-year period. Project preparation, consisting of a feasibility study, engineering design, procurement, lot acquisition, and construction supervision, starts in mid-2010 and is expected to be completed in 2013. The STF (Phase 1) starts operation in 2014 and a Phase 2 expansion is made in mid-2018. Prior to the STF Phase 1 operation, septic tank desludging undertaken by private service providers and their collected septage is brought to existing STFs of nearby municipalities such as Alabel and Maasim. Upon construction of GenSan's new STF, desludging activities will be increased to meet target schedules set in the SuSEA Model for septage management.

Table 8. Typical Implementation Schedule for a Septage Management Project

ACTIVITIES	2010	1st Cycle: 2011-2014				2nd Cycle: 2015-2018				3rd Cycle: 2019-2022			
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Project Processing by LGU													
A. Septage Management													
1. Feas. Study/ Update SuSEA Report													
2. Engineering Design/ BID Documents													
3. Land & ROW Acquisition													
4a. Procurement: Vacuum trucks													
4b. Procure Construct/ Commission: STF													
5. Operation/ Maintenance: VTs & STF													

B. **Estimation of Capital and O&M Costs**

The project cost estimates consist of capital investment costs for the infrastructure, facilities and equipment, and operations and maintenance costs. Project revenues were also estimated.

a unit cost of PHP0.85 M per cumd capacity is used. The basis of these unit costs were the unit prices of VTs of the Metro Manila sanitation master plan and the escalated actual costs of the Alabel STF. For the Gensan SMP, the capital investment is PHP233.60 M (Table 9).

Table 9

ITEM	Unit	Quantity	Unit Cost	Cost PHP million
Project Preparation (FS, D, B, CS)	ls	Included in cost of VT & STF		
Vacuum trucks: 5 cum cap	unit	12	3.250	39.00
Vacuum trucks: 10 cum cap	unit	6	4.000	24.00
STF (2 of 100 cumd)	cumd	200	0.853	170.60
Land	ha	4	0.000	0.00
Total Capital				233.60

Present values at 10% interest rates were computed for the 12-year stream of costs and revenues.

Capital Investments - Capital investment is required for the purchase of vacuum trucks and the construction of STFs. The unit costs of 5 cum and 10 cum vacuum trucks are PHP3.25 M and PHP4.0 M per unit respectively. For the STF,

Considering that the proposed Gensan STF will be located on the sanitary landfill lot, no land cost is attributed to the STF facility.

Table 10

ITEM	NPV Costs @ 10% Discount Rate			
	Capital	O&M	Depreciatn	Total
STFs	146.20	26.81	25.87	173.02
VTs	39.52	94.37	19.50	144.50
Tipping Free	35.85		35.85	35.85
TOTAL	221.57	121.18	81.21	423.97
Land	Use vacant lot in Sanitary Landfill site			0.00
Revenue	(75% collection efficiency; P50/HH/month			443.42
Profit				19.45

C. **Net Present Values of Costs**

The capital investment streams for the 3-cycle period from 2010 to 2021 (or 12 years) for the GenSan SMP are shown in Table 10. The present values of the capital cost streams at 10%[6] annual discount rate are PHP144.50 M and PHP173.02 M for the fleet of vacuum trucks and STFs respectively.

D. **Project Implementation Arrangement**

In most cities and municipalities, there are a number of private desludgers that operate on an on-demand basis. Around Metro Manila and provinces north of Manila, desludging services are provided by Malabanan and Soliman EC. The lack of a duly authorized STF in addition to the lack of local ordinances for mandatory periodic desludging hinders large-scale desludging services.

A recent implementation arrangement for septage management and sewerage is a public-private partnership, the private entity normally being the water district, as shown in Figure 5.

The responsibilities of the partners: Water District (WD) and LGU are also shown in Figure 5. Project funding or financing for the STF may be shouldered alone by the LGU or jointly by both. The LGU provides the enabling ordinance as well as builds/operates the STF. Desludging services are led by the WD who may opt to bid out the services to private entities. Service fee collection is by the WD as an add-on to the water bill by households and establishments. Both WD and LGU lead in the promotional and IEC campaign.

E. **Facilitating the Formulation of the Septage Management Plan**

The City Septage Management

[6] *This rate is similar to the discount rate of 8 – 10% used in the loan facility of the Support for Strategic Local Development and Investment Project (S2LDIP) of World Bank – Land Bank of the Philippines*

Dumaguete City and Water District Collaboration

The LGU and the water district have signed a memorandum of understanding to jointly develop a septage management program. The LGU and WD will equally share the cost of constructing the treatment facility. The LGU has passed a city ordinance and will manage the facility and enforce compliance, while the WD will own and operate a fleet of vacuum trucks and perform billing and collection. Revenues from the collection of fees will be shared evenly.

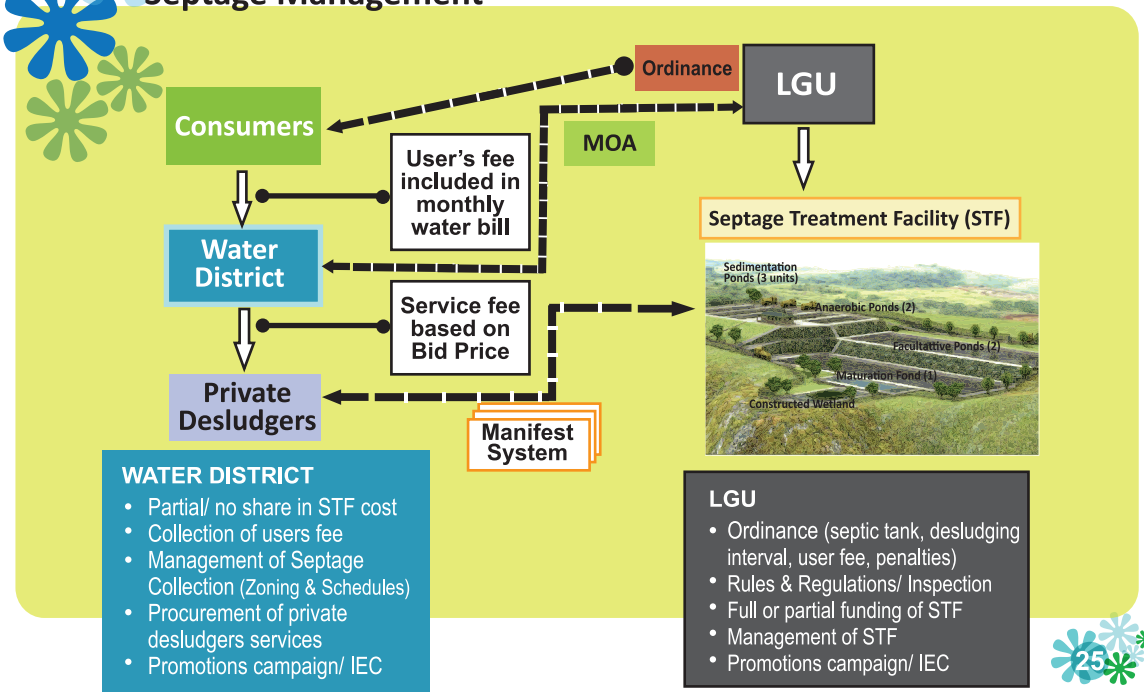
Plan took about six (6) months to finalize, from the preparation of the draft report, site visits, data gathering, report review, discussions with concerned LGU officials to acceptance of the final report by General Santos City.

The principle of the SuSEA spreadsheet model and initial output was presented to the Consultant Team and WB-WSP. Refinements were made resulting in the final model as presented in Section 4.

The modeling process and results were also presented to concerned LGU officials and stakeholders (e.g., Water District, Rural Waterworks and Sanitation Association, government agencies, private desludgers, etc.) in several meetings and fora. Comments and suggestions were incorporated in the final draft, which underwent a final peer review by the Consultant Team.

The SMP final report was accepted by the LGU in June 2010.

Figure 5. The Modified Dumaguete City Model of Septage Management



Annex A. Gensan SMP Spreadsheet Model: Calculating the Annual Number of Septic Tanks by Addressing the 2009 Backlog

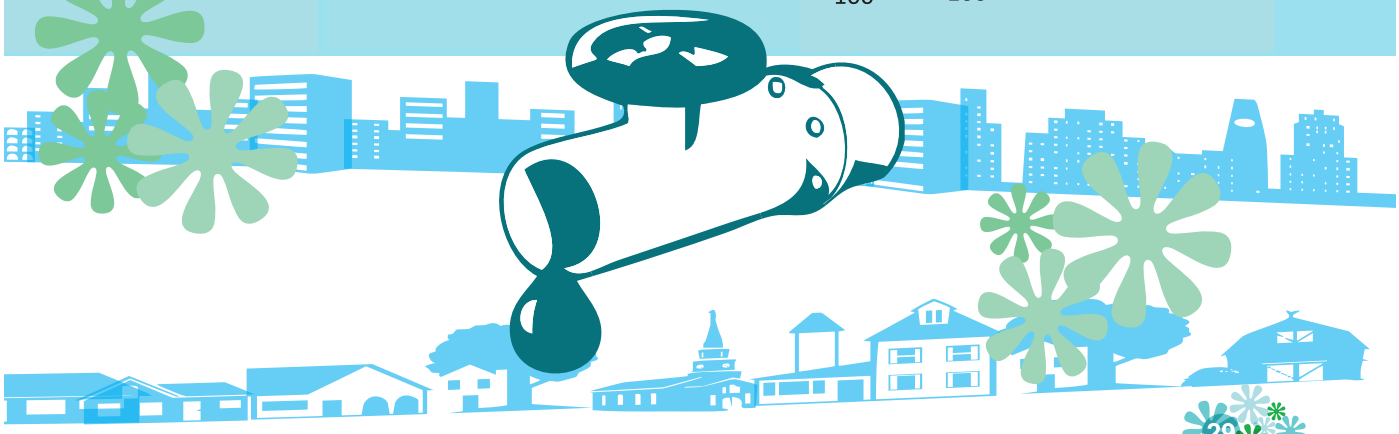
		2010	2011
		1	2
GENSAN CITYWIDE	**2.009**	**1st cycle: (@4years)**	
1) **Number of Households**	119,170	123,377	127,732
2a) Households with none & dry toilet	19,472	20,160	20,871
2b) Households with Toilet & Septic Tank	99,698	103,217	106,861
2c) Households with 1-chamber T&ST	39,779	41,184	42,637
2d) Households with 2 chamber T&ST	57,625	59,660	61,765
2e) Households with 3& more chamber T&ST	2,293	2,374	2,458
3) **Upgrading Households with none & dry toilet**			
2009 Backlog	19,472	19,472	19,472
Target % to convert STs from Backlog to toilet-/ST		10%	15%
New 3-chamber STs from Backlog		1,947	2,921
New 3-chamber STs from increment	13,041	687	712
Cycle Carry-over for de-sludging		0	0
4) **Upgrading/ Desludging: Households with Toilets**			
4a) 1-Chamber STs: Start to convert to 3-chamber in 2010			
2009 Backlog	39,779	39,779	
Target % to convert backlog to 3-chamber ST		10%	20%
New 3-chamber convert STs from Backlog		3,978	7,956
New 3-chamber STs from increment	27.377	1,404	1,454
Cycle Carry-over for de-sludging		0	0
4b) 2-Chamber STs: Start to convert to 3-chamber in 2010			
50% of 2009 Backlog for conversion	28,813	28,813	
Target % to convert backlog to 3-chamber ST		5%	5%
New 3-chamber convert STs from Backlog		1,441	1,441
50% of 2009 Backlog for desludging	28,813	28,813	
Target % to desludge 50% of 2009 Backlog STs		30%	10%
Old 2-chamber STs from Backlog		8,644	2,881
New 3-chamber convert STs from Backlog			
New 3-chamber STs from increment	39,659	2,034	2,106
Cycle Carry-over for de-sludging		0	0
4c) 3&-Chamber STs:			
2009 Backlog	2,293	2,293	
Target % to desludge 2009 Backlog STs		40%	20%
Old 3-chamber STS from Backlog		917	459
New 3-chamber STs from increment	1,578	81	84
Cycle Carry-over for de-sludging		0	0

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
3	4	1	2	3	4	1	2	3	4
:2010 to 2013		2nd cycle: 2013 to 2017				3rd cycle: 2018 to 2021			
132,241	136,909	141,742	146,746	132,241	136,909	162,841	168,589	174,325	180,262
21,608	22,371	23,161	23,978	24,825	25,701	26,608	27,547	28,485	29,455
110,633	114,538	118,581	122,767	110,633	114,538	136,233	141,042	145,840	150,807
44,143	45,701	47,314	48,984	50,713	52,504	54,357	56,267	58,190	60,172
63,946	66,203	68,540	70,960	73,464	76,058	78,743	81,522	84,295	87,167
2,545	2,634	2,727	2,824	2,923	3,027	3,133	3,244	3,354	3,469
19,472	19,472								
20%	20%	15%	10%	5%	5%				
3,894	3,894	2,921	1,947	974	974				
737	763	790	818	846	876	907	939	937	970
0	0	2,635	3,633	4,631	4,657	6,345	6,397	6,451	6,507
20%	20%	20%	10%	0%	0%				
7,956	7,956	7,956	3,978						
1,505	1,558	1,613	1,670	1,729	1,790	1,853	1,919	1,914	1,982
0	0	5,382	9,410	9,461	9,514	14,951	15,058	11,190	11,304
5%	5%	10%	10%	10%	10%	10%	10%	10%	10%
1,441	1,441	2,881	2,881	2,881	2,881	2,881	2,881	2,881	2,881
30%	30%		100%						
8,644	8,644								
		8,644	2,881	8,644	8,644				
2,180	2,257	2,337	2,419	2,505	2,593	2,685	2,780	2,773	2,871
0	0	3,475	6,428	12,265	12,342	17,337	14,610	26,295	26,460
25%	15%								
573	344	0							
87	90	93	96	100	103	107	111	110	114
0	0	998	542	660	434	1,091	639	760	537

Annex B.
Gensan SMP Spreadsheet Model:
Number of Desludgeable Septic Tank, Volume of Septage and the Required Vacuum Truck Units and STF Capacity

		2010	2011
		1	2
GENSAN CITYWIDE	**2.009**	**1st cycle: (@4years)**	
5) **Desludging Number of STs**			
5a) Un-desludged ST from previous year		0	5,737
5b) Total De-sludgeble ST		9,561	11,722
5c) Desludging Target %		40%	50%
5d) Number of Desludged ST		3,824	8,729
5e) Cumulative No. Desludged ST		3,824	12,554
5f) % Desludged at End Cycle			
6) **Septage Volume & Vacuum Trucks**			
6a) Septage Annual Volume, cum		9,561	21,823
6b) Septage Daily Volume, cum (@2.5 cum/ST & 260 days/yr)		37	84
6c) Average no. of VT trips per day		2.0	2.0
6d1) Total volume hauled by VTs per day		30	90
6d2) Volume hauled: deficit(-) /excess (+) cum		-7	6
6e1) Total No. of VTS per day		3	7
6e2) No. of 5 cum Vacuum Trucks		3	5
6e3) No. of 10 cum Vacuum Trucks		0	2
7) **STF capacities**			
7a) Underload(-), Overload(+), cumd		-3	-6
7b) STFs Total Capacity, cumd		40	90
7c) Alabel-Malapatan-Maasim STFs, max 105 cumd		40	90
7d1) GENSAN STP, 100 cumd		0	0
7d2) GENSAN STP Expansn1: + 100 cumd			
7d3) GENSAN STP Expansn2: + 100 cumd			
7d4) GENSAN STP Expansn3: + 100 cumd			

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
3	4	Yr1	2	3	Yr4	Yr1	2	3	Yr4
:2010 to 2013		2nd cycle: 2013 to 2017				3rd cycle: 2018 to 2021			
2,993	3,088	2,977	2,556	4,981	6,113	5,539	9,662	7,146	10,550
12,210	12,076	15,467	22,568	31,998	33,059	45,363	46,365	51,842	55,359
60%	60%	70%	70%	70%	70%	70%	70%	70%	65%
9,121	9,099	68.540	70.960	73.464	76.058	35,702	39,219	41,292	42,841
21,675	30,773	2.727	2.824	2.923	3.027	150,280	189,499	230,791	273,632
	254.8%				**346.6%**				**494.3%**
22,803	22,747	32,278	43,968	64,715	58,551	89,254	98,047	103,230	107,102
88	87	124	169	249	264	343	377	397	412
2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5
90	90	150	165	240	255	360	360	420	420
2	3	26	-4	-9	-9	17	-17	23	8
7	7	8	9	12	13	18	18	18	18
5	5	6	7	8	9	12	12	12	12
2	2	2	2	2	4	6	6	6	6
-2	-3	-16	-1	-1	-6	-27	7	27	42
90	90	140	170	250	270	370	370	370	370
90	90	40	70	50	70	70	70	70	70
0	0	100	100	100	100	100	100	100	100
				100	100	100	100	100	100
						100	100	100	100



Annex C. Gensan SMP Spreadsheet: Computation of Capital Investment and O&M Costs

CAPITAL INVESTMENT AND O&M COSTS

SMP MODEL 2.5

			CYCLE 1	
CAPITAL INVESTMENT VACUUM TRUCKS			**2010**	**2011**
6c) Average no. of VT trips per day			2	2
6e1) Total No. of VTs per day			3	7
6e2) No. of 5 cum Vacuum Truck			3	5
6e3) No. of 10 cum Vacuum Truck			0	2
5 cumVT, $	65,000		3.25	*Peso, million*
10 cumVT, $	80,000		4.00	*Peso, million*
Capital Costs, P million	50	P/$		
5 cumVT			9.75	6.50
10 cumVT			0.00	8.00
Total P million	39.52		9.75	14.50
CAPITAL INVESTMENT FOR STF:			**2010**	**2011**
7a) STFs Total Capacity, cumd			40	90
7b) Alabel-Malapatan-Maasim STFs, max 110 cumd			40	90
7c1) Gensan STP, 100 cumd			0	0
7c2) Gensan STP expansn1: + 100 cumd			0	0
7c3) Gensan STP expansn2: + 100 cumd			0	0
7c4) Gensan STP expansn3: + 100 cumd			0	0
Unit price of STP (P/cumd capacity), P million**			0.853 **	
Total Costs, P million	146.20		0.00	0.00
7c1) Gensan STP, 100 cumd				
7c2) Gensan STP Expansn1: + 100 cumd				
7c3) Gensan STP Expansn2: + 100 cumd				
7c4) Gensan STP Expansn3: + 100 cumd				

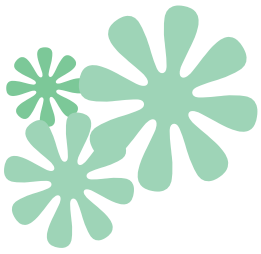
**Alabel STF only – PHP45.850 M; Add 10% for site development: Costs = PHP50.428 M or equiv PHP0.841 M/cumd; escalate 2003 price to 2009 at 3% per annum, or 1.194 x 0.841 = PHP1.004 M/cumd & reduced by 15% for economy of scale, i.e., PHP0.853 M/cumd

	CYCLE 2					CYCLE 3			
2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
2	2	3	3	3	3	3	3	3.5	3.5
7	7	8	9	12	13	18	18	18	18
5	5	6	7	8	9	12	12	12	12
2	2	2	2	4	4	6	6	6	6
0.00	0.00	3.25	3.25	3.25	3.25	9.75	0.00	0.00	0.00
0.00	0.00	0.00	0.00	8.00	0.00	8.00	0.00	0.00	0.00
0.00	0.00	3.25	3.25	11.25	3.25	17.75	0.00	0.00	0.00
2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
90	90	140	170	250	270	370	370	370	370
90	90	40	70	50	70	70	70	70	70
0	0	100	100	100	100	100	100	100	100
0	0	0	0	100	100	100	100	100	100
0	0	0	0	0	0	100	100	100	100
0	0	0	0	0	0	0	0	0	0
0.00	85.30	0.00	85.30	0.00	85.30	0.00	0.00	0.00	0.00
	85.30								
			85.30						
					85.30				

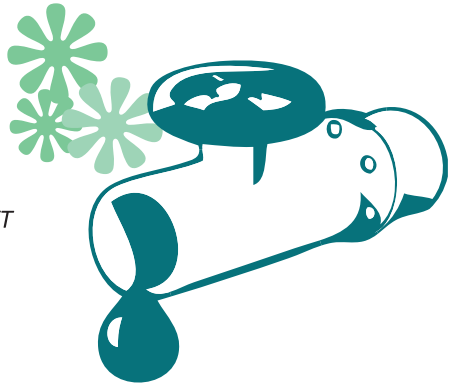
Annex C. Gensan SMP Spreadsheet: Computation of Capital Investment and O&M Costs (continued)

SMP MODEL 2.5

0&M COSTS & DEPRECIATION FOR STF & VACUUM TRUCKS		**2010**	**2011**
1) **STF**			
O&M Unit cost, P per cumd STF capacity	35,369	P/cumd	**per Alabel STF**
Life cycle - 25 years	0.03537	P million/cumd capacity	
STF: O&M Costs	10%	0.000	0.000
NPV, P million	**26.81**	for 3 - cycles	
Depreciation Cost: 25-year straight: total		0.000	0.000
NPV, P million	**25.87**		
7c1) Gensan STP, 100 cumd			
7c2) Gensan STP Expansn1: + 100 cumd			
7c3) Gensan STP Expansn2: + 100 cumd			
Depreciation - NPV, P million			
2) **Vacuum Truck:**			
Capital cost:			
5 cum VT, P million		3.25	
10 cum VT, P million		4.00	
Annual Fuel Cost per Trip, P million			
Annual O&M (Persnl, Maint'nce, etc), P million			
Depreciation			
Life cycle, yrs 12			
5 cum VT			
Annual Fuel Cost, P million		1.872	3.120
Annual O&M, P million		0.975	1.625
Annual Depreciation, P million		0.813	1.354
Subtotal, P million	**57.10**	2.847	4.745
10 cum VT			
Annual Fuel Cost, P million		0.000	2.080
Annual O&M, P million		0.000	0.800
Annual Depreciation, P million		0.000	0.667
Subtotal, P million	**32.27**	0.000	2.880
Total, Depreciation	**19.50**	0.813	2.021
Total, P million =		2.847	7.625
Interest Rate	**10%**		
NPV, Depreciation	**19.50**		
NPV, Total O&M	**94.37**		



2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
data reduced by 15% for economy ofscale									
0.000	0.000	3.537	3.357	7.074	7.074	10.611	10.611	10.611	10.611
0.000	0.000	3.412	3.412	6.824	6.824	10.236	10.236	10.236	10.236
		3.412	3.412	3.412	3.412	3.412	3.412	3.412	3.412
				3.412	3.412	3.412	3.412	3.412	3.412
						3.412	3.412	3.412	3.412



0.312 30 l / trip x P 40/l x 260 days/yr: 5 cum VT
0.520 50l/ trip x P40/l x 260 days/ yr x No. of trips/ day: 10 cum VT
0.325 10% of VT costs, 5 cum VT
0.400 10% of VT costs, 10 cum VT
0.271 Straight line in 12 yrs for 5 cum VT
0.333 Straight line in 12 yrs for 10 cum VT

3.120	3.120	5.616	6.552	7.488	8.424	11.232	11.232	13.104	13.104
1.625	1.625	1.950	2.275	2.600	2.925	3.900	3.900	3.900	3.900
1.354	1.354	1.625	1.896	2.167	2.438	3.250	3.250	3.250	3.250
4.745	4.745	7.566	8.827	10.088	11.349	15.132	15.132	17.004	17.004
2.080	2.080	3.120	3.120	6.240	6.240	9.360	9.360	10.920	10.920
0.800	0.800	0.800	0.800	1.600	1.600	2.400	2.400	2.400	2.400
0.667	0.667	0.667	0.667	1.333	1.333	2.000	2.000	2.000	2.000
2.880	2.880	3.920	3.920	7.840	7.840	11.760	11.760	11.760	11.760
2.021	2.021	2.292	2.563	3.500	3.771	5.250	5.250	5.250	5.250
7.625	7.625	11.486	12.747	17.928	19.189	26.892	26.892	26.892	26.892

Annex D. Direct Cost of Formulating a Septage Management Program (Ordinance & Plan) in Philippine pesos

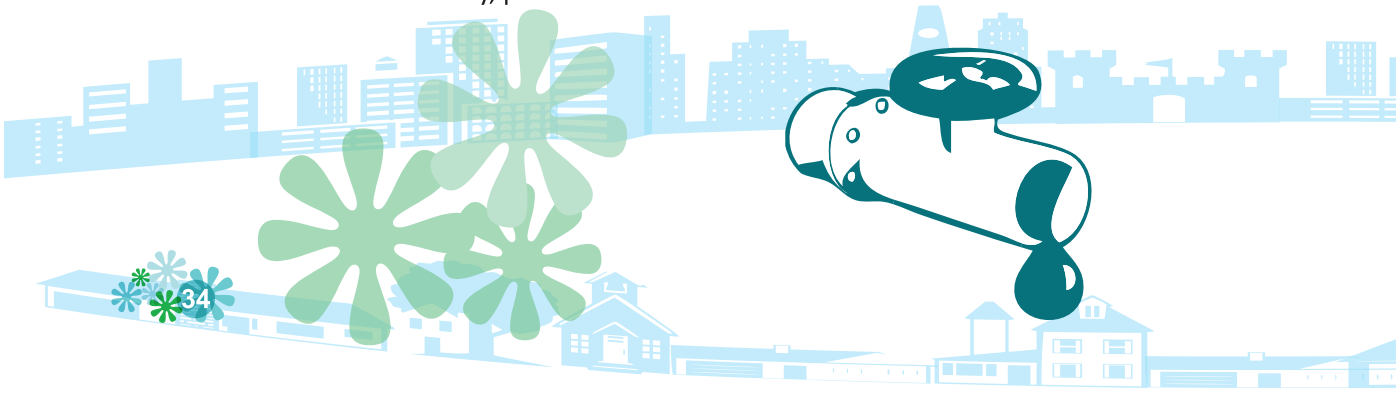
Consultants: Lawyer & Engineer

A	Meetings, Orientations	No. of pax	Meals/day
	Orientation, all stakeholders: Program	100	300.00
	Presentation of First draft: Ordinance	30	200.00
	Special Presentations Ordinance: Councilors	15	200.00
	Presentation of First draft: Plan	50	200.00
	Presentation of Final draft: Ordinance	30	200.00
	Presentation of Final draft: Plan	50	200.00

B	Survey and Data Gathering	No. of questionnaires
	Survey of establishments (poblacion & peri-urban)	75
	Survey of households (municipal/ city wide)	200
	Analysis of results	
	Other data	

C	*Travel	No. of pax	Meals/day
	Site inspection of facilities (drainage, treatment plant, pump station, etc) & interviews	5	300.00

*Local cost of travel only, plane fare not included

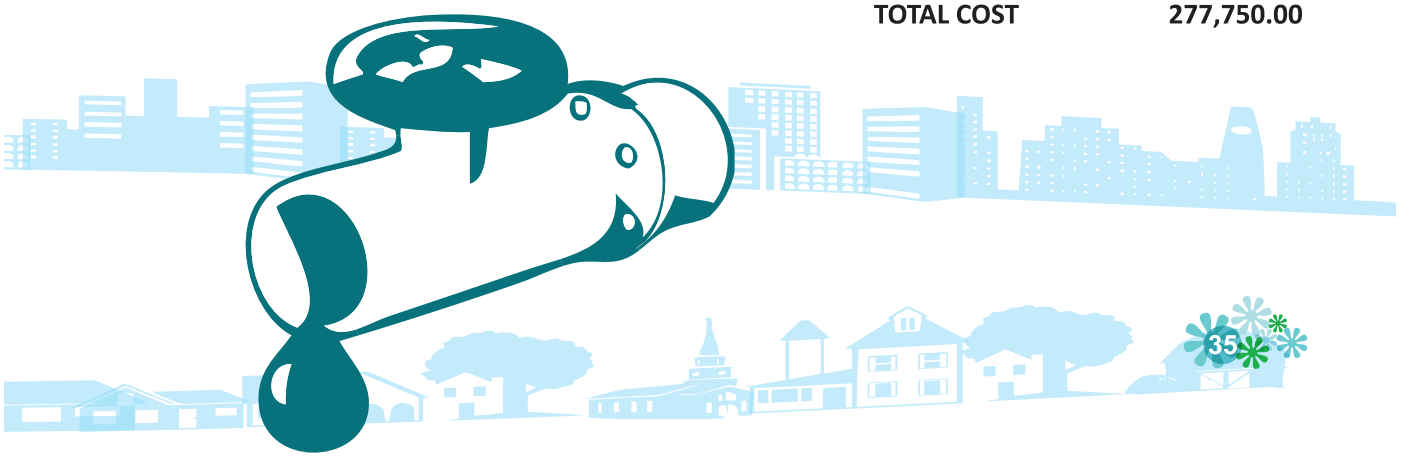


Annex D

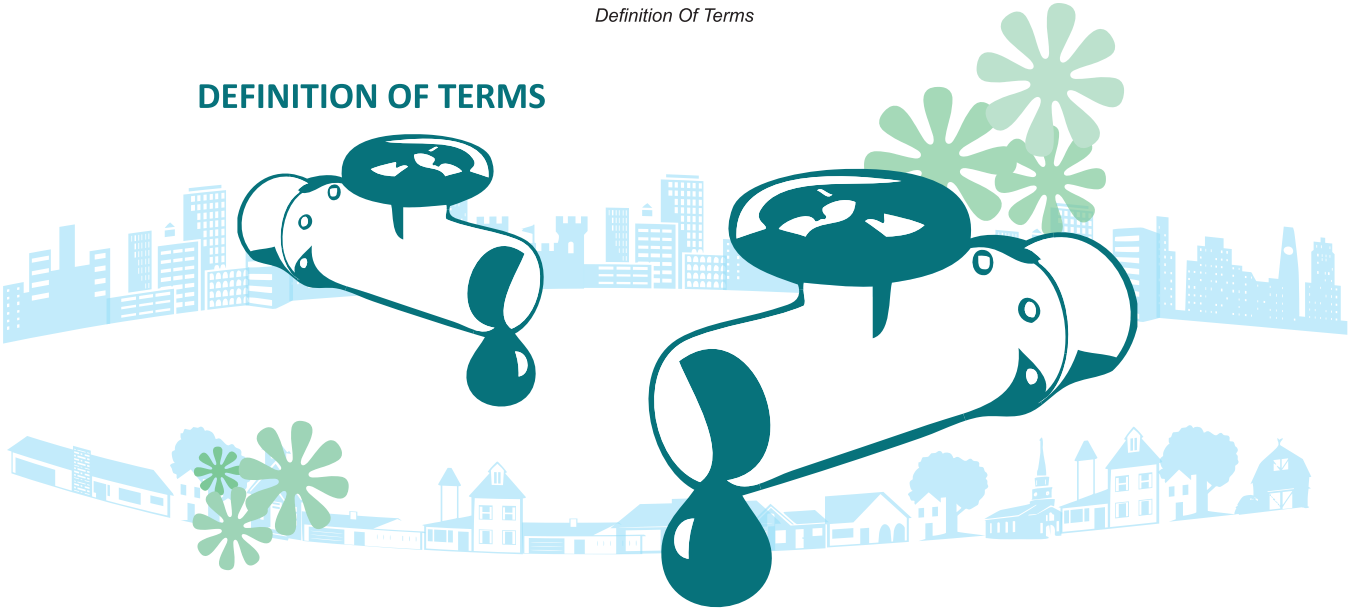
No. of days	No. of activities	Total	Supplies, handouts (per person)	Documentation	TOTAL COST
1	2	60,000.00	100	1,500.00	**81,500.00**
1	1	6,000.00	50	1,500.00	**9,000.00**
1	2	6,000.00	50	1,500.00	**9,000.00**
1	1	10,000.00	50	1,500.00	**14,000.00**
1	1	24,000.00	50	1,500.00	**27,000.00**
1	1	10,000.00	50	1,500.00	**14,000.00**
				Sub Total A	**154,500.00**

Duration	Cost per questionnaire	Total Cost
1 week	150.00	**11,250.00**
2 weeks	150.00	**30.000.00**
		50,000.00
		10,000.00
	Sub Total B	**101,250.00**

No. of days	No. of activities	Total	*Transportation	Total Cost
4	2	12,000.00	10,000.00	**22,000.00**
			TOTAL COST	**277,750.00**



DEFINITION OF TERMS



BIOCHEMICAL OXYGEN DEMAND (BOD) – quantity of oxygen that will be required to biologically stabilize the organic matter present.

DESLUDGING – the process of cleaning or removing the accumulated sludge or septage from a septic tank by pumping out or vacuuming, and transporting it to a treatment facility.

DRAINAGE – A system that deals with surface run-off, resulting from rain, and conveying it to water bodies. In actual practice, septic tank overflow and sullage/excreta find its way to the drainage system.

EFFLUENT – a general term for any wastewater, partially or completely treated, or in its natural state, flowing out of a drainage canal, septic tank, building, manufacturing plant, industrial plant, treatment plant, etc.

SANITATION - refers to the hygienic and proper management, collection, disposal or reuse of human excreta (feces and urine) and community liquid wastes to safeguard the health of individuals and communities. It is concerned with preventing diseases by hindering pathogens, or disease-causing organisms, found in excreta and wastewater from entering the environment and coming into contact with people and communities. This usually involves the construction of adequate collection and disposal or reuse facilities and the promotion of proper hygiene behavior so that facilities are effectively used at all times.