

# Local Initiatives for Affordable Wastewater Treatment in the Philippines/LINAW-1

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## FINAL REPORT

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# **LINAW**

## **Local Initiatives for Affordable Wastewater Treatment in the Philippines**

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### **Final Report**

#### **Executive Summary**

This final report discusses activities and results of the Local Initiatives for Affordable Wastewater Treatment (LINAW) project that has assisted four selected cities of the Philippines to develop low-cost wastewater treatment facilities. The project was funded by the United States Agency for International Development (USAID) and was implemented by Planning and Development Collaborative International (PADCO) from October 1, 2003 to December 30, 2005. LINAW utilized a stakeholder-driven approach to project planning within each of the four cities, namely Dumaguete, Iloilo, Muntinlupa, and Naga. The facilities developed and planned by the cities include low-cost onsite treatment systems for public markets and slaughterhouses, offsite septage treatment lagoons, and community-based Decentralized Wastewater Treatment Systems (DEWATS) developed in partnership with the Bremen Overseas Research and Development Association (BORDA). This final report also discusses the need for urban sanitation in the Philippines; the approach, objectives and activities of the project; the project's accomplishments; and the policies currently in place and suggestions for improvements to meet the requirements and intent of the Clean Water Act of 2004.

The LINAW project aimed to improve water quality management by local government units through the promotion and adoption of low-cost sanitation technology and innovative financing solutions. Specifically, the project had the following objectives:

- Develop wastewater and sanitation action plans through a participatory stakeholder process, including the identification of medium and long term strategies;
- Implement incremental steps for low-cost technology solutions to address site-specific sanitation and wastewater management problems; and
- Develop and implement a public awareness campaign regarding sanitation and wastewater problems, management issues, and technology and financing options.

At the end of the project, approximately 5700 people had improved access to adequate sanitation and six pilot projects were developed. More than 580 (396 male and 184 female) people were trained in 13 major workshops and training seminars. More than 80 consultations and technical working group meetings were held at the local level and eight site visits/study tours were conducted. Seven city council resolutions were passed and four action plans were enacted, one by each city. All four pilot cities prepared and implemented social marketing and information, education and communication (IEC) campaign plans.

The success of the LINAW project has caught the attention of other local government units (LGUs), many of which have requested assistance from the project. Because of this interest and to help the four cities complete their pilot projects, USAID has developed a phase two of the project that will be implemented over two years. LINAW 2 will assist the four original cities plus two new cities in improving water quality management and is set to benefit an additional 130,000 people with planned projects. Phase 2 will be implemented by PADCO.

#### **Need for Urban Sanitation**

Inadequate sanitation and sewerage management increasingly impact health, the economy, the environment and quality of life in Asia. The World Bank's Philippines Environment Monitor 2003

estimates that approximately 12 people die each day from diarrhea in the Philippines and water-borne diseases resulted in 31% of all reported illnesses from 1996-2000. The report also states that water pollution costs the Philippine economy an estimated P67 billion (US\$1.3 billion) annually, of which P3 billion is attributed to health, P17 billion to fisheries production, and P47 billion to tourism. Such losses continue as more than 90% of the sewage generated in the Philippines is not treated, or is disposed in an environmentally unacceptable manner. Most households, which constitute the largest source of organic pollution (48%), have septic tanks that are not watertight and not regularly desludged, and the highly polluted effluent flows untreated into the drainage system. When households do have their septic tanks emptied, the septage<sup>1</sup> is usually dumped into water bodies or on land without proper treatment to kill pathogens.

Despite this growing problem, the Philippine national and local governments have devoted limited human, technical and financial resources<sup>2</sup> to address sanitation and sewerage issues. In Asian cities, Metro Manila ranks second to the lowest in providing piped sewerage systems. According to the World Bank, only 7% of the population of Metro Manila is connected to a piped sewerage system, compared to Dhaka, Bangladesh with 30%, Karachi, Pakistan and Phnom Penh, Cambodia with 50%.

The Japan International Cooperation Agency (JICA) conducted a study for the Department of Interior and Local Government (DILG) in 1999, and concluded that investments needed to provide sanitation and sewerage services for at least 50% of existing population served by Metro Manila Water Supply and Sewerage (MWSS) and those in other urban and rural areas is estimated to be PhP366.8 billion. For sewerage facilities alone, per capita cost estimate is PhP9,000 or a total of PhP170.7 billion covering 19 million people. For sanitation facilities, per household cost estimate is PhP28,411 or a total of PhP196 billion covering 6.9 million households.

The prospect of getting these funds from the national government given the current budget deficit is very low indeed. The burden then falls to the local governments and water districts, which are mandated to provide both water supply and sanitation services. LGUs are mandated by the Philippine Clean Water Act of 2004 to "...share the responsibility in the management and improvement of water quality within their territorial jurisdictions" (Sec. 20) and each LGU shall prepare a compliance scheme within six months after the water quality management area action plan is completed. This is a large burden for LGUs, since they are already hard-pressed to provide basic services to their citizens and are struggling to meet the deadlines contained in the Ecological Solid Waste Management Act to develop improved landfills. Given these constraints, LGUs need assistance in developing long-term strategies based on realistic targets and implemented in incremental steps to improve present water quality management.

## **LINA Approach**

To address these challenges, the LINA project promoted installation of decentralized wastewater systems that apply innovative, low-cost technologies tailored to a community's resources and needs. These technologies are not only more affordable, they can also be more effective for low-income urban communities because conventional centralized sewerage systems require highly skilled workers for construction and operations, high operating costs, and access to a reliable supply of piped water, in

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<sup>1</sup> Septage is the mix of liquid and solids in a septic tank, which becomes a major source of pollution when it is disposed without treatment, either on land or into water bodies.

<sup>2</sup> Only 3% of the government's total annual investment for water supply, sanitation, and sewerage is devoted to sewerage and sanitation. Source: Ancheta, Christopher. 2000. *Water Supply and Sanitation Performance Enhancement Project: Urban and Sanitation-Three Years of Experience and Lessons*. World Bank: Manila.

addition to the high investment costs. Experience in Thailand has shown serious problems with operations and maintenance of conventional sewage treatment plants throughout the country.<sup>3</sup>

Since October 2003, with funding from USAID and the US-Asia Environmental Partnership (US-AEP), Planning and Development Collaborative International, Inc. (PADCO) has implemented the LINA) project in four Philippine cities. These cities have taken a proactive approach to addressing wastewater management and improving the quality of life of their citizens.

LINA) has assisted these four cities in pilot testing a range of strategies with the primary goal of strengthening LGU capabilities in implementing the Clean Water Act. LINA) has worked with municipal leaders and other stakeholders in a participatory process to identify pilot project priorities, introduce decision-makers to appropriate technology and financing solutions, and support project design.

The first step was to select the four cities. USAID and PADCO worked together to identify cities with a good track record in implementing environmental or urban development projects, a mayor strongly committed to taking action to improve wastewater management, and staff with the capacity to implement the project. LINA) consultants worked with each mayor to select the technical working group (TWG) members and team leader, and develop a memorandum of understanding (MOU) for the project that was signed by the mayor and approved by the city council. The TWGs typically consisted of members of the city government staff, including the city environment and natural resources officer, the planning officer, health officer and engineering staff, an official from the water district, and representatives from the nongovernmental organization (NGO) sector and the city council. The TWG and team leader have played critical roles in the implementation of the project—their enthusiasm, dedication and hard work have led them to accomplish much more than the project designers and managers envisioned at the start of the project.

With assistance from LINA), the TWGs engaged local stakeholders to identify the sources of pollution and generate ideas for short-term and medium-term projects that would address wastewater pollution from different sources and make use of low-cost technologies. The ideas were used by the TWGs to develop action plans to guide their work over the two-year LINA) project and beyond. These initial stakeholder workshops also raised awareness and solicited buy-in from the stakeholders. Short-term projects focused on city-owned sources of pollution such as markets and slaughterhouses since the city governments felt they should “clean up their own house” first before asking others to implement improvements. Medium-term projects have focused on domestic and institutional sources (such as hospitals) using either off-site or on-site treatment facilities.

A technology-finance workshop was held with all four cities and other interested LGUs to present low-cost technology options including waste stabilization ponds, improved and communal septic tanks, and sludge drying cross-visits; to discuss cost factors and available financing windows; and to share best practices in implementing user fees. Engineers from the LGUs, academe and the private sector have been trained in designing, operating and maintaining low-cost wastewater treatment technologies to begin developing a local pool of engineers that can develop projects for interested LGUs.

According to a US-AEP publication titled, “Partnership Practices that Work in the Philippines” (August 2005), major factors contributing to LINA)’s success included:

- Strong support from mayors, who committed to source funds for the construction costs and implement fee systems to cover O&M costs.

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<sup>3</sup> From a presentation made by Dr. Wijarn Simachaya at the LINA) “Innovative Technology and Financing Solutions for Wastewater Management: Sharing Local and International Best Practices” workshop held April 21-22, 2004 in Dumaguete City.

- Participatory process that involved community stakeholders led by a team leader and multi-sector technical working group in each city.
- Phased strategy with short-, medium- and long-term goals.
- Cities focused on large city-owned sources of pollution such as public markets and slaughterhouses before asking others to take action.
- Selection of simple wastewater treatment technologies with low construction and O&M costs.
- Reliance on mixed financing from internal sources (regular revenues), loans from local development banks and the private sector for the capital expenditures, and user fees for the operations.
- Effective public awareness campaigns to educate the public about wastewater pollution and develop support for user fees.

### **Promoting Adoption of Effective Solutions**

To effectively address wastewater treatment at the city level, the LINA project has promoted septage management and a decentralized wastewater treatment system developed by a German NGO, financing solution, and the use of social marketing to raise public awareness and increase the public's willingness to pay for wastewater treatment services.

#### Septage Management

Under the Philippine Clean Water Act, by 2009 all sources of wastewater in highly urbanized cities must connect to available sewerage systems, while smaller cities must employ a septage or combined sewerage-septage management system. There are virtually no sewerage systems outside Metro Manila, and building a piped sewerage collection and treatment system is prohibitively expensive; therefore, the LINA project has encouraged the adoption of city-wide septage management systems as an effective first step to fulfill the requirements of the Clean Water Act. A septage management system entails improving septic tanks, desludging them on a regular basis, and then treating the septage before released to waterways or land application as fertilizer. If a septic tank is deslugged every three years, it can perform primary treatment as intended by design. The current practice of waiting until it overflows to have it pumped out essentially means that from year three until it gets pumped out, untreated and partially-treated raw sewage is being released into the drainage canals.

#### Recommended Septage Management System

1. **Septic Tanks** – Septic tanks should be water tight and multi-chambered. Bottomless septic tanks are prohibited. They must also be accessible (have a removable cover and not be located directly under the house) so they can be pumped out when the sludge level becomes too high. Concrete is the preferred material for septic tanks but watertight plastic or fiberglass septic tanks are acceptable. (The potential for cracking or failure of plastic tanks is greater than that of concrete or fiberglass, and concrete tanks may be the least expensive to mass produce). Small housing blocks may share a communal septic tank to reduce per household costs.

Households should be encouraged to minimize their use of water and be careful about what they put into their septic tanks. Households should not put the following down the drain or toilet: excessive amounts of any household chemicals, cleaning water for latex paint brushes and cans, coffee grounds, cooking fat and grease, wet-strength towels, disposable diapers, facial tissues, cigarette butts, and other non-decomposable materials.

2. **Desludging** – Septic tanks should be deslugged when the sludge level becomes too high, probably every three years. They should be checked for sludge depth every three years by probing. The probing and desludging can be done by a private contractor, LGU or water district. Currently, costs are paid by the household directly to the private contractor, but it is up to the household to request the service. There is a need for the LGU and/or water district to develop a system to ensure that all septic tanks are deslugged regularly and that the septage removed is treated. Each

LGU should develop a system that works for them. The LGU/water district could collect fees from the households and pay the contractor for each truck-full of septage brought to the treatment facility. This would give the contractor an incentive not to simply dump the septage somewhere as is currently being done. The best way to reduce pumping costs is

- a. Education. Provide users with appropriate care and maintenance information on how to use and operate a septic tank. This includes what can and cannot be disposed of in a septic tank. The better a septic tank is cared for, the cheaper it will be for the owner to maintain it (i.e., less frequent pumping).
  - b. Sizing septic tanks so that the volume is at least 1.6 times the daily flow but preferably 2 or 2.5 times the daily flow. The bigger the tank, the less frequently it will need to be desludged.
  - c. Probing septic tanks for sludge depth on a regular basis.
3. Treatment of Septage – The LGU/water district/private contractor should build a treatment facility that will properly treat the septage before it is disposed of. The best low-cost options are waste stabilization ponds and anaerobic pond systems, all of which can be designed to use no electro-mechanical power. However, they require a large land area. The main and cheapest options for sludge disposal are sludge drying, sludge landfill and sea disposal by barge.

## **Achievements and Results**

### Decentralized Wastewater Treatment System

To learn more about effective low-cost technologies, LINA) organized two study tours, one to Indonesia and one to the United States, for representatives of the four cities, NGOs, the Committee on Ecology of the House of Representatives, and the League of Cities of the Philippines. During the trip to Indonesia, the group visited several operating DEWATS developed by BORDA, an NGO based in Germany. DEWATS has proved effective in China, India, Indonesia, and Vietnam and is used by small enterprises to treat industrial wastewater and by communities to treat septic tank effluent piped from up to 200 households. The system varies depending on the application but typically includes: (1) sedimentation in a septic tank; (2) anaerobic digestion in a multi-chambered anaerobic baffled reactor; (3) aerobic and facultative decomposition in a planted gravel filter; and (4) post treatment in ponds. A biogas digester and sludge dryer can also be added. Given the interest from the LINA) cities and others in the Philippines in DEWATS, BORDA opened an office in Manila in January 2005 and has been working with cities and small enterprises to develop projects.

### Financing

While LINA) provided overall technical assistance and help with engineering design work, the cities are funding the projects themselves. LINA) has provided the cities with advice and assistance on accessing financing for their projects and suggested innovative financing schemes, particularly private sector participation. The overall strategy was for the cities and the private sector to finance the capital expenditures to build the facilities and to cover the operation and maintenance (O&M) costs through user fees.

The investment cost for a septage management program for a medium-sized city of 100,000 people would be approximately P13 million, when land is available for waste stabilization ponds. For highly urbanized settings where space is an issue, a hybrid system may be considered. Depending on the technology used, O&M costs would be relatively low.

Multi-sourcing of funds can be used to effectively reduce the funding requirements of LGUs by encouraging project investment and O&M counterparts from other stakeholders. Funds can also be raised by selling by-products, such as treated water and sludge as soil enhancers. Re-use of treated water for irrigation, flushing and washing can reduce water bills. For example, the Metro Manila

Development Authority buys cheap treated water from the Metropolitan Waterworks and Sewerage System to water vegetation around the metropolis.

### Public Information Campaigns

Citizen awareness of sanitation and wastewater treatment issues is very low and must be elevated to build support for the cities' pilot projects and willingness to pay required user's fees. Builders, homeowners and business owners also need an improved understanding of the proper design and maintenance of septic tanks. LINA organized a two-day social marketing workshop for the LGUs and partner NGOs to learn how to utilize social marketing techniques in public information campaigns and provided assistance to each city to develop a detailed communication plan, key messages and campaign materials. Each city developed a programmatic five year campaign plan to promote wastewater management and help ensure safe water for city residents. The campaigns were launched from June to August 2005 and will continue in parallel with the implementation of wastewater management projects.

The primary focus of LINA's information campaign assistance was on the quality and effectiveness of the materials and the proper use of the social marketing approach. The cities developed positioning strategies to motivate target audiences to take a specific action or change a behavior, such as urging people to take action by having their septic tanks desludged. The plans are being implemented in phases, with the awareness and knowledge generation phases during the first six months of the campaign and promotion of the desired practices from years two to four, depending on the progress of project implementation. Continuing education will be done throughout the duration of the campaigns.

All four plans contained the following basic ideas and practices to be marketed and communicated to the target audiences:

#### 1. Ideas

- a. Disease incidence from contaminated water is rising. Untreated sewage or wastewater contaminates the water that we use and has caused one third of all diseases and 25 deaths per day in recent years. It also causes foul odor and attracts flies.
- b. Almost all sewage (90%) in the country is untreated. There is a need to prevent water contamination from untreated sewage or wastewater.
- c. Owning a septic tank is not enough. It provides only primary treatment of wastewater which is only the first step in managing wastewater. The effluent from septic tanks must be treated (either piped to a treatment facility or percolated through soil where there is enough space).
- d. The septic tank must be properly designed and placed. It has to be water-tight, multi-chambered (at least three chambers) and accessible for periodic desludging. Most septic tanks in the country are not designed properly and are only desludged when they overflow.
- e. To maintain proper functioning of the septic tanks, the septage inside the tanks needs to be taken out (desludged) once every 3-5 years. The septage should be treated to kill pathogens before it is disposed.
- f. Do not put the following down the drain since it will reduce the septic tank's ability to function: excessive amounts of household chemicals, cleaning water for latex paint brushes and cans, coffee grounds, cooking fats/grease, paper towels, disposable diapers, sanitary napkins, cigarette butts, and other non-decomposable materials.
- g. A 35% reduction in diarrhea can be achieved when people wash their hands with soap after using the bathroom and before eating.
- h. The Clean Water Act requires wastewater treatment and provides sanctions against polluters and violators.
- i. Clean and safe water is possible again through viable and community-based wastewater management solutions available.

## 2. Practices

- a. Washing of hands after using the bathroom and before eating to prevent diseases from contaminated water.
- b. Periodic inspection of septic tanks to determine condition.
- c. Saving for desludging of septic tanks.
- d. Construction of properly designed septic tanks for new households.
- e. Desludging of septic tanks once every 3-5 years.
- f. Renovating the tank or building a new one if septic tank cover cannot be opened for desludging.
- g. Paying of fees for the operation and maintenance of a community wastewater treatment facility and septage treatment facility.
- h. Setting up a DEWATS or a decentralized wastewater treatment system (for business establishments and groups of up to 200 households).

### **Status of Pilot Projects**

The current status of the pilot projects in each of the four LINA cities is summarized below, followed by progress in other cities.

#### Dumaguete

Dumaguete City is developing the first septage system in the country to be operated by an LGU. Septic tanks from the city's 22,000 households and 2,500 business establishments, including the public market and institutional buildings, will be pumped out and the septage treated in a series of eight lagoons and a constructed wetland. The lagoons will not use electricity or chemicals. The construction costs and acquisition of vacuum trucks will total approximately P15 million and the operation and maintenance costs will be approximately P46,000 per month. The city is also developing a corresponding septage management ordinance and user fees that will cover the operation and maintenance costs and a portion of the capital costs of the system. After three years, the city will turn over the operation and management of the facility to the water district. A successful public hearing for the proposed project was held on December 5, 2005. Financing will be secured from a local development bank and construction will be completed within 4 months. As a first step in addressing the city's wastewater management, the city emptied the full septic tanks at the public market at a cost of P80,000 in 2004. The tanks can now provide primary treatment of wastewater, which they were not able to do for several years preceding the desludging.

#### Iloilo

Iloilo City will build its new slaughterhouse in Barangay Tacas in Jaro district in 2006. LINA's technical working group designed a wastewater treatment system for slaughterhouse. The facility, which will cost about P4.8 million, is being funded by the Department of Agriculture through a grant given through the National Meat Inspection Service. The system is designed to accommodate a capacity of 500 hogs and about 50 large cattle daily. The slaughterhouse and the wastewater treatment systems were designed to accommodate the City's meat requirements as well as those from nearby municipalities. The wastewater treatment system shall make use of several sewage (anaerobic, facultative and maturation) ponds and may be upgraded later to incorporate biogas harvesting for purposes of heating utensils and aquaculture.

Barangay Bakhaw, a community of about 1,500 households, is developing a septage management program in which a private hauler will remove septage from the community's septic tanks, treat and dispose of it. The city also plans to construct six communal DEWATS for the six zones of Bakhaw. BORDA has completed the design for a decentralized treatment system for a private hospital in the city and is negotiating a contract for the construction.



### Muntinlupa

In Muntinlupa City, a P6.6 million wastewater treatment facility has been constructed at the public market and will begin operating in mid-January 2005. It will provide more than 1,500 market workers and surrounding communities with access to improved sanitation. The facility will treat wastewater coming principally from the wet and eatery sections and the public toilets. It utilizes a hybrid design using non-mechanized and mechanized systems and tertiary treatment to allow re-use of the treated water for flushing toilets and watering plants. O&M costs are estimated at P10,000 per month.

Three informal communities within Barangay Sucat are planning to build community-based sanitation centers with three toilets and three baths each, using community labor and materials donated by the local Rotary Club and barangay. The centers will serve 600 urban poor residents and protect the adjacent Laguna Lake from untreated sewage from these communities. A pilot project is also planned for a housing subdivision that will allow for the effluent from septic systems to be collected and treated on-site.

### Naga

The Naga City Public Market, once the biggest public market in Asia, occupies a total floor area of 3.2 hectares, contains about 1600 stalls with 3000 customers a day. An onsite wastewater treatment facility will be built to treat the market's 300 cu. m. of wastewater a day, which is currently flowing directly into the Naga River. The system, designed by the LINA) technical working group, includes a grit-removal chamber, a large holding interceptor tank, an anaerobic baffled reactor and a sequencing batch reactor to further treat the effluent before it flows into the river. Construction costs will be approximately P7.5 million and O&M costs will be about P15,000 per month.

LINA) is also assisting the city to rehabilitate the wastewater treatment system of its public slaughterhouse, which will cost about P3.5 million. The wastewater treatment system shall make use of several sewage (anaerobic, facultative and maturation) ponds. The old wastewater treatment ponds were abandoned due to overloading caused by an undersized design. The engineering designs for the two systems are completed and the feasibility studies are being finalized. Financing will be obtained from the LandBank of the Philippines through a World Bank lending facility.

### Other Cities

During the U.S. study tour in October 2004, the LINA) delegation visited Environmental Compliance International (ECI), a company located in Arizona that used coco-peat technology as a low-cost filter media for wastewater treatment. During the visit, Calbayog City Mayor and LCP Secretary General Mel Sarmiento offered to pilot test the coco-peat filter technology at a private orphanage in Calbayog City. The research project is being done in collaboration with a local university, and receiving some financial support from ECI and LINA). The filter is just one aspect of the research project, which includes a septic tank, pumping system and leach reuse system. The filter technology will also be included in the Muntinlupa public market facility mentioned above. Mayor Sarmiento also decided to move the city slaughterhouse away from river, and is planning facilities to treat wastewater from the market, hospital and resettlement areas.

In Santa Rosa City, BORDA has designed a treatment facility for the public hospital and signed an MOU with the city to develop the project. BORDA has also designed a facility for the Negros Oriental Provincial hospital. In Antipolo, BORDA has designed a community-based sanitation system that includes toilet and bath facilities for an informal settlement in partnership with a local NGO and Antipolo City.

## **Developing Improved Policies**

Existing policies and regulations on wastewater treatment for households and public facilities and domestic waste from commercial and industrial buildings are very limited and often incomplete. Since this is a fairly new field in the Philippines, policy makers have a limited understanding of domestic wastewater treatment, and treatment systems for facilities such as slaughterhouses and markets.

LINA) has developed a comprehensive model septage management ordinance for use by the four cities and has conducted workshops in each city to begin developing a septage management program and local ordinance. This includes more detailed and comprehensive requirements for septic tank design, improvements to the building/occupancy permit system and improved enforcement of these regulations when issuing building permits for new construction.

At the national level, there is a need to work with DENR, Department of Health (DOH), and Department of Public Works and Highways (DPWH) to develop more detailed guidelines or amendments to the Sanitation Code including requirements for septic tank design, septage management, public markets and slaughterhouses, and housing developments. Since it will be very expensive for existing households to replace improper septic tanks, the first priority for this information will be new housing developments, including middle class subdivisions and urban poor relocation sites. On February 10, 2004, then DENR Secretary Elisea Gozun issued a memorandum directing all regional directors of the Environment Management Bureau to require malls, restaurants, hotels, apartelles, and other residential buildings, subdivisions, hospitals, and similar establishments to set up sewage treatment facilities as a condition to the granting of ECCs and permits to operate. The memorandum also required all existing facilities and establishments to set up sewage treatment facilities as a condition to the renewal of their permits. LINA) plans to help the government develop information on low-cost technical options to help these facilities meet this requirement.

LINA) has held initial discussions with the National Meat Inspection Service (NMIS) to discuss the need for wastewater treatment in slaughterhouses. Meetings will continue with the aim to share the low-cost wastewater treatment facility design that LINA) engineers prepared for the Iloilo and Naga slaughterhouses with NMIS so they will incorporate it in all future slaughterhouse plans throughout the country.

## **Ensuring Sustainability and Replicability**

LINA) plans to further its initial work with national and local universities and engineering associations to develop training programs for local engineers and LGUs. The aim is to create institutionalized courses that will train local engineers on the design of low-cost wastewater treatment systems for LGUs, housing developers and private companies. LINA) has provided training materials and advice to several universities and associations, such as the Philippine Society of Sanitary Engineers, Philippine Water Works Association, Philippine Institute of Civil Engineers, Water Environment Association of the Philippines and Tanggol Kalikasan, which provides training to barangay and municipal LGU staff through several Institutes of Environmental Governance.

LINA) will also support the four cities in working with partner engineering schools and universities in their area to create a technical course on low-cost wastewater treatment systems in 2006. This will allow participating LGUs in the metro cluster to advance their knowledge in designing, operating and maintaining low-cost wastewater treatment systems. The team leaders can also provide assistance by acting as resource persons available within the region for special topics such as septage management, hybrid design of wastewater treatment plants, DEWATS, and septage treatment lagoons.

## Summary of Results

The LINAW project has achieved the original objectives as follows:

- Four wastewater and sanitation action plans were developed (one per city) through a participatory stakeholder process, including the identification of medium and long term strategies.
- Four public awareness campaign plans were developed and 3-5 month campaigns were undertaken by each city.
- Pilot projects:
  - Dumaguete City City-wide septage treatment facility designed and financing secured and the septic tanks at the public market were emptied. BORDA has designed a system for a hospital.
  - Iloilo Engineering designs completed for slaughterhouse and financing secured; developing barangay septage management program, BORDA has completed the design for a private hospital system.
  - Muntinlupa On-site system under construction at market; designs completed for community-based sanitation centers.
  - Naga Engineering designs and feasibility studies completed for market and slaughterhouse systems; financing is being finalized.
  - Others BORDA completed the design for a hospital in Sta. Rosa and a community-based sanitation system in Antipolo.

At the end of the project, approximately 5700 people had improved access to adequate sanitation. Within 2006 we expect four more systems to be completed that are currently in the design phase, which will provide about 120,000 people with improved access to adequate sanitation. During the LINAW project, 580 (396 male and 184 female) people were trained in 13 major workshops and training seminars. More than 80 consultations and technical working group meetings were held at the local level. Eight site visits/study tours were conducted, namely to Indonesia, the US, the MWSS sewage treatment plants, a privately-owned wastewater treatment facility in Ortigas, and treatment lagoons in Malabon City, and several facilities in Laguna.

Three ordinances were drafted and passed by the city and barangay councils of Dumaguete<sup>4</sup> and four action plans were enacted, one by each city. Each city council also passed a resolution authorizing the mayor to enter into an MOU with PADCO at the beginning of the project. A draft septage management ordinance is still being finalized as of this report by Dumaguete City. All four pilot cities prepared and implemented Social Marketing and IEC campaign plans with Naga, Iloilo and Muntinlupa coming up with their official mascot.

## Conclusion

Although water pollution has a large negative effect on the economy, health and quality of life of Filipinos, most stakeholders are wary of addressing this critical issue because it is viewed as expensive and complex, containing a whole host of other interrelated issues. Therefore, it is difficult to provide sustainable solutions that address all of the socio-economic, technical and space constraints. These constraints include weak enforcement of environmental regulations, lack of funds for infrastructure, very little awareness among communities and local and national government agencies, and lack of local expertise and capacity to design and implement solutions. This complex problem is only going to get worse, particularly in the case of the Philippines, which has one of the highest population growth rates in Asia and where urbanization is leading to greater population density and congestion.

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<sup>4</sup> 1. City Resolution No. 367 siting the biological wastewater treatment facility, 2. Barangay Resolution No. 09 Affirming the location of the planned treatment facility, and 3. City Resolution No. 232 Further requesting USAID for the technical assistance of LINAW to assist in the completion of the pilot projects.

In spite of these obstacles and challenges, government and other stakeholders must persevere in trying to solve the problem, one small step at a time and with assistance from projects such as LINA. Adequate, affordable and appropriate sanitation system provision, operation and maintenance is likely one of the most important problems facing large urban settlements, both formal and informal, in all developing countries.<sup>5</sup>

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<sup>5</sup> Mara, D. D. 2003. *Domestic Wastewater Treatment in Developing Countries*. Earthscan: London.