



# **Terms of Reference for a Solid Waste Management Initiative for the Greater Manado Region (SWIM)**

July 2001



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# Terms of Reference for a Solid Waste Management Initiative for the Greater Manado Region (SWIM)

NRM/EPIQ Regional Governance Initiative Office  
for North Sulawesi

July 2001

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## Acronyms and Glossary

ADB	Asia Development Bank, a multilateral development bank, based in Manila
BAPPEDA	<i>Badan Perencanaan Pembangunan Daerah</i> , Regional Development Planning Board (at provincial and kabupaten/kotamadya levels)
BAPEDAL	<i>Badan Pengelolaan Dampak Lingkungan</i> , Environmental Impact Management Agency. Regional offices called <i>Bapedalda</i> (“da” for <i>daerah</i> or region). In this region, one each for Manado and Minahasa.
BAPPENAS	<i>Badan Perencanaan Pembangunan Nasional</i> National Development Planning Board, the GOI sponsor of the NRM Program
BPD	<i>Badan Perwakilan Desa</i> . Village Assembly. Under UU22/1999 this body governs with the village chief or <i>lurah</i> .
BPPKM	<i>Badan Pengelolaan Pembersihan Kota Manado</i> . Manado’s Garbage Agency (before Perda 13/2000: Dinas kebersihan).
CBNRM	Community-based natural resources management
DPR	National Parliament of Indonesia
DPRD	Local elected Assemblies/Councils at the province ( <i>provinsi</i> ) and district/municipality ( <i>kabupaten/kotamadya</i> ) levels
DPTNB	<i>Dewan Pengelolaan Taman Nasional Bunaken</i> , Bunaken National Park Advisory Board
GOI	Government of Indonesia
IUIDP	Integrated Urban Infrastructure Development Project, a standard World Bank loan package for urban infrastructure projects in Indonesia
IRG	International Resources Group, Ltd. (EPIQ’s prime contractor)
<i>Kabupaten</i>	District or Regency (archaic). Primary unit of governance in a province.
<i>Kecamatan</i>	Sub-district. Between a <i>kelurahan</i> and a <i>kabupaten</i> . No longer has a direct governance role but rather coordinating and administrative roles
<i>Kelurahan</i>	Urban village – lowest formal division of government, newly empowered under UU 22/1999; in rural areas called a <i>desa</i> or village, where leadership is still community elected.
<i>Kotamadya</i>	Urban municipality; a designation equivalent in governance powers and status to a <i>kabupaten</i> . Towns that do not have municipality status are called <i>kota</i> .
LSM	<i>Lembaga Swadaya Masyarakat</i> , community self-reliance institution, the Official term for a registered Indonesian NGO (q.v.)
MSW	Municipal Solid Waste
NGO	Non-governmental Organization

NRM	Natural Resources Management, the subject and the USAID-funded Program
NRM/EPIQ	Natural Resources Management Program/Environmental Policy and Institutional Strengthening Indefinite Quantity Contract, an NRM Program partner
NSWSA	North Sulawesi Water Sports Association. A voluntary association of diving and other water sports companies concerned with environmental management of Bunaken National Park.
O&E	Outreach and Education, an NRM/EPIQ Task Order 833 sub-component
OTI	Office of Transition Initiatives, a USAID program for countries in democratic transition
PDAM	<i>Perusahaan Daerah Air Minum</i> (government-owned) Drinking Water Utility of Manado.
POL	Policy and Planning, an NRM/EPIQ Task order 833 sub-component
PPIS	Monitoring and technical support contractor for the World Bank's Second Sulawesi IUIDP (q.v.) based in Manado.
Propenas	<i>Program Pembangunan Nasional</i> , National Development Program, from October 1999 replaces Repelita for essentially the same function
RT & RW	<i>Rukun Tetangga</i> or Neighborhood Association is the primary unit of organization (semi-official) in urban and rural villages. <i>Rukun Warga</i> or Citizens Association consists of a group of neighboring hamlets. Also called a <i>Kampung</i> or <i>Lingkungan</i>
SO	Strategic Objective, a primary level, operational objective to guide USAID-funded assistance implementers
SWM	Solid waste management (solid waste: SW)
TO	Task Order
UI	University of Indonesia, Jakarta
UNSRAT	Sam Ratulangi [State] University, in Manado, North Sulawesi
URI/CRMP	University of Rhode Island/Coastal Resources Management Project (also known as <i>Proyek Pesisir</i> in Indonesia), an NRM Program partner
USAID	United States Agency for International Development
Walikota	A city mayor.

# 1. Executive Summary

From July 11 through 17, 2001, an evaluation team travelled to Manado to assess Solid Waste Management (SWM) practices in the city and its hinterland. Over the last several years, Manado has been transformed from a relatively clean environment into a seriously polluted one that not only is endangering the health of its residents but also is polluting Manado Bay and thus endangering important economic livelihoods from the fishing community, tourism industry and dive operators. The purpose of the assessment is to develop Terms of Reference (TOR) for an activity within the current scope of work for the NRM/EPIQ contract that addresses SWM issues in Manado.

Pollution in Manado Bay comes from a variety of sources including deficiencies in SWM in the City of Manado. Sources of municipal and commercial solid waste throughout the city are linked to the problem by potential transport of uncollected solid waste through Manado's natural drainage courses and storm drainage system. About 1,500 cubic yards of municipal solid waste are generated within the municipality each day while only about 30% of this waste is collected by the municipality. Many of the concentrated housing areas within the city are inaccessible to collection vehicles. As a result, people who live within these areas must carry their solid waste long distances to the closest collection points. As an alternative, they often dump their wastes at informal locations that evolve in their neighborhoods or directly into Manado's drainage courses.

The Mayor of Manado has acknowledged that the City SWM system has a number of problems including: 1) low public awareness and discipline; 2) insufficient transport vehicles for effective collection; 3) a lack of modern technology in the collection system; 4) insufficient or improperly collected fees to sustain an effective program; and 5) no law enforcement that prevents littering or indiscriminate dumping of solid waste. There are a number of factors that may have contributed to the current ineffectiveness of the collection program in Manado including:

1. The country's economic crisis where less money was made available to municipalities to provide basic services including solid waste management.
2. Rapid government decentralization, which, in turn, resulted in confusion of authorities landless enforcement of rules and regulations governing solid waste management and, in particular, littering.
3. Increased responsibility on the part of local officials to manage the SWM function without the accompanying increased technical capacity to assure that they do so in the proper manner.

4. Rapidly increasing population and urbanization thereby generating more solid waste at a time when funds available to provide municipal services are decreasing.
5. A rapid influx of refugees that also generate solid waste and are often not served by any formal solid waste collection or disposal programs.
6. Changes in political leadership with resulting changing priorities that may divert funds from solid waste management to other programs.

Still, there is some basis for optimism that the existing solid waste management problems in Manado can be addressed. A number of important activities are ongoing:

- The mayor of Manado has acknowledged publicly the existing problems and has identified technically sound remedies.
- An active community group at the *kelurahan* level has begun a pilot program aimed at enhancing recycling opportunities and making the collection process within their district more effective.
- Based on interviews by the evaluation team, it appears that people in Manado recognize the value of tourism associated with Bunaken National Park. This helps to provide an overall incentive for implementing an effective SWM program to protect the tourism economy.
- Anecdotal information from numerous sources indicates that cleaner conditions had been maintained in the not too distant past when local regulations concerning littering were rigidly enforced. This may provide a basis for similar enforcement that may again lead to the same cleaner environment within the city.
- A new disposal site to serve Manado is now being implemented with World Bank assistance. This new facility may provide an incentive to evaluate and remedy deficiencies that exist in the current solid waste collection program.
- The local media has already begun a campaign for more effective SWM within the municipality. This should help assure their cooperation in any future public awareness campaign.
- NGOs are already addressing the issue of scavengers within the city's SWM program. These NGOs may provide a basis by which to educate scavengers as well as provide greater control over their activities.
- The local NRM/EPIQ office in Manado has established excellent contacts with local officials who will play an important role in fostering more effective SWM and its Bunaken National Park partners are already developing proposals to address SWM on Bunaken.

The evaluation team recommends that USAID support a program of strategic interventions aimed at mitigating the effects of improper solid waste management. These interventions should

be aimed at increasing the effectiveness of the collection of solid waste and should be provided in both reactive and proactive approaches to the core problem. In a reactive approach, support should be provided to develop a sustainable means to clean up accumulated solid waste at Bunaken on a regular and systematic basis. In the proactive approach, assistance should be provided to enhance the collection of solid waste in Manado through capacity building elements at both the municipal and district level, and support for collection and recycling initiatives.

Recommended support activities for these initiatives include:

- 1. Technical support for the improvement and expansion of the formal solid waste collection program in Manado** - This activity is intended to increase the technical knowledge of municipal and district leaders and solid waste managers in the design, implementation, management and monitoring of effective solid waste collection in the city.
- 2. Technical and financial support for development and implementation of village-level (*kelurahan*) solid waste collection and recycling/reuse programs** - Support should be provided to further develop and evaluate the existing pilot project for community-based solid waste management and recycling for use as a model. The emphasis would be on developing appropriate systems and capacity at the *kecamatan* and *kelurahan* levels.
- 3. Technical and financial support for development of a programmatic solid waste monitoring and cleanup program at Bunaken Island** - Support should be provided for alleviating solid waste problems in proximity to and at Bunaken Island through development of a regular cleanup program and support for more effective solid waste management within the villages of Bunaken Island. Inclusion of the Bunaken National Park Advisory Board in this ongoing monitoring and clean-up program will also be a target of this support element.
- 4. Institutional support for development of a public awareness campaign concerning solid waste management.** - A public awareness program should be developed and implemented aimed at increasing the awareness of the public in Manado concerning their role in effective solid waste management. This would be linked to recommendation 2 (above).



## 2. Background

### 2.1 Intent of this Assessment

USAID/Indonesia's country strategy for Indonesia is focused on supporting Indonesia's decentralization process in a manner that promotes democratic, good governance and economic stability and growth. Many, if not most of Indonesia's decentralization challenges are inherently cross-sectoral in nature and require government and civil society to work together. Indonesia has always been heavily dependent upon its natural resources for subsistence livelihoods and economic growth. They are also very important to many of its cultures as well as to global biodiversity. Thus, degradation of environmental and resource systems almost always has serious direct and indirect economic and social costs in Indonesia.

The purpose of this assessment is to develop a terms of reference (TOR) for an activity within the current scope of work for the NRM/EPIQ contract (see Section 6.2) that addresses one such cross-sectoral, resource management problem affecting the economy and society of North Sulawesi, i.e. solid waste management in the City of Manado.

USAID/Indonesia has given NRM/EPIQ one specific and one general objective to guide the development of this TOR. The **specific objective** is to reduce the amount of solid waste and especially plastic waste that washes up on Bunaken Island and at least part of its fringing reef as soon as possible. The **general objective** is to work with partners and counterparts to explore ways of strengthening the management of solid waste in Manado so as to prevent current and future solid waste contamination of Bunaken Island and the Manado Bay environment.

This assessment addresses these objectives by defining and describing the solid waste pollution problem in Manado; describing the current SWM of the City of Manado and its strengths and weaknesses; describing the impact of the economic crisis and decentralization in exacerbating the weaknesses of the existing system. The assessment then goes on to identify specific recommendations for the design of a new SWM activity and specific levels and types of effort that would be required to address those problems. A photographic record is also included for visual reference in the discussion.

## **2.2 Problem Statement**

Over the last several years, the city of Manado has been transformed from a relatively clean and pleasant environment into a seriously polluted one that not only is endangering the health of its residents but also is polluting Manado Bay and thus endangering important economic livelihoods (and tax revenues) from the fishing community, tourism industry and dive operators. This pollution comes from a variety of activities and sources including uncontrolled mercury discharges from small-scale gold mining in the Talawaan watershed; erosion and sedimentation from agricultural activities in the Tondano watershed, and a serious degradation in the system of solid waste management in the City of Manado and to a lesser extent in the surrounding Minahasa Kabupaten. NRM/EPIQ has been actively engaged in assisting partners and local government to address the first two environmental threats for more than a year and now has been asked to assist with the problem of solid waste management as well.

The management of solid waste is a basic and very visible function of city governments and a basic need for most of its citizens. The noticeable deterioration in the City of Manado's performance in this area over the past several years has sparked a public outcry, along with spasmodic efforts to deal with the problem. Moreover, a superficial tour of the city provides evidence of a general decline in urban physical infrastructure and management and not a city, which is just having a problem collecting its garbage.

Nevertheless, the management of garbage or solid waste, which is the term that will be employed in this report (abbreviated SWM), when done badly can have serious local economic and health costs and when done well can generate new businesses and income. In Manado, the failures of SWM are very visible. As described more fully below, in Sections 3 and 4, tourists encounter large amounts of solid waste on streets, boat docks and especially on some of the reefs and parts of the beaches of Bunaken Island. Considering that most have paid many thousands of dollars and travelled far to enjoy the marine beauties of Bunaken National Park, they are understandably disappointed. Dive operators have reported the comments of tourists who have decided to cut short their trips or decided not to return to Bunaken because of the garbage problem. In addition, uncollected solid waste is a serious health hazard. Its organic component attracts and supports disease vectors and vermin, contaminates air and water resources and can be physically dangerous.

## **2.3 A Note on the Assessment Methodology**

Though SWM failures are certainly visible, deciding how to tackle the problem is not something that should be done on the basis of anecdote or casual observation. This is especially true for NRM/EPIQ which has relatively limited resources and which works best by catalysing the energies and resources of its partners and local counterparts. Hence, this assessment has employed a variety of methods to develop sufficient information for this TOR. The Consultants and NRM staff physically walked through several neighbourhoods and business districts and the city dump and interviewed local residents, workers and SWM staff directly. In addition, the team interviewed a variety of local government officials, members of NGOs, university staff and other key informants. Finally, the team drew upon local literature, statistics and databases to amplify its direct findings.

The Assessment team included an international expert on SWM who has worked in many developing countries on problem assessment, design and training related to SWM and an Indonesian expert with background in SWM and the informal sector as well as human settlements. Combining their experience with the participatory rapid appraisal approach (PRA) used by the team, which included NRM/EPIQ Manado and Jakarta staff was sufficient to provide enough information to develop this draft TOR for a SWM task order.

Of course, the collection and analysis of data and other kinds of information will be a continuing and vital part of the proposed activity. One of the weaknesses of standard SWM designs in Indonesia One of the weaknesses of standard SWM project designs is the failure to collect and use the right kinds of information to design an intervention that will respond to local needs or changes in underlying social-economic parameters. Since SWM is a function of social and economic behaviour, the use of accurate information not only can improve the existing system but also help develop new forms of management, improve public awareness of the problem and what the range of stakeholders can do about addressing the problem.

## **2.4 Demographics and Geography**

Manado and its hinterland is a hilly and mountainous region with a very narrow coastal plain fronting the Sulawesi Sea, where the plain exists at all. The region as a whole is very volcanic with the extinct Klabat volcano the most important landmark. Thus water catchments are relatively steep and short and the region, as a whole, is prone to flooding in the rainy season (November to March).

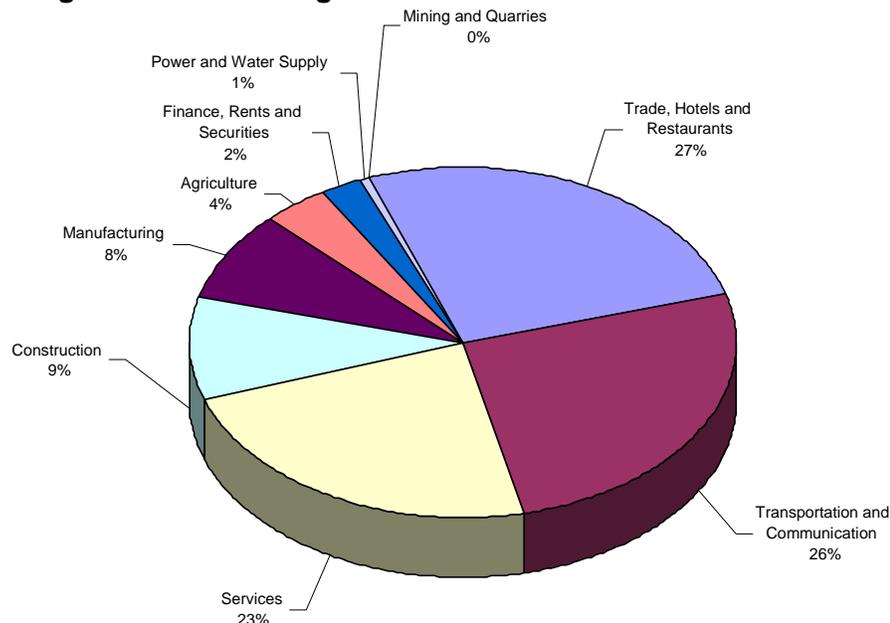
### **2.4.1 Population and Population Growth**

By Indonesian standards, Manado, with less than half a million population, is a small city. {See the Profile in Section 3 for additional statistics and information.] Like many of Indonesia's municipalities, however, it is growing fast and considerably larger than the city's layout was intended to support and considerably faster than the city's infrastructure can keep pace with. It is likely that Manado will continue to expand even though it is not the site of much significant industry. Considering that most land use in the upper watershed surrounding Manado is already in extensive farming systems on relatively steep slopes, there would seem to be little scope for further population expansion in the upper watershed and more likely a continued drift of population to the lower watershed in search of jobs, education or other opportunities.

Bunaken National Park lies partly within the City of Manado and partly in *Kabupaten* Minahasa. Bunaken Island and Manado Tua Island are within the city limits and, in fact, have just become a new "urban" *kecamatan*. Of the two, Bunaken Island is the one mainly affected by the solid waste management problem. Bunaken Island has 3,417 permanent residents on an island of 704.3 ha while neighbouring Manado Tua Island has a population of 2,698 permanent residents on an area of 1,040.6 ha. (NRM/EPIQ, 1998, Bunaken N.P. Natural History). These figures do not include the influx of tourists that stay mainly on Bunaken Island in homestays but, of course, though their total is only a fraction of those tourists staying in Manado City, they nevertheless generate a seasonally significant share of solid waste as well as contributing directly to local incomes. In the first part of USAID's SWM Initiative, a profile of the SWM system will develop better information about the tourist sector in terms of location and impact (see Section 3 below).

The general physical and demographic characteristics of Manado City may be contributing to the solid waste problem in Manado Bay. Sources of municipal and commercial solid waste throughout the city are linked to the problem through potential transport of uncollected and, therefore uncontrolled solid waste through the natural drainage courses that flow through Manado and through the storm drainage system that is part of the city's infrastructure. For example, the Tondano River originates at Lake Tondano and eventually flows through Manado before it reaches the Bay. There are many informal settlements along the banks of the river flowing through the city that are not served by the city's formal collection program. These informal settlements and other formal but unserved areas do not have any city solid waste collection. As a result, it appears to be common practice for residents simply to dump their solid waste into the river or discard it along the riverbanks. Solid waste deposited along the riverbanks will be periodically "flushed" to the Bay during the wet season or during any significant storm event.

**Figure 2.1 Gross Regional Product for N. Sulawesi - 1999**



## 2.4.2 Commercial and Industrial Development

Manado is not a significant commercial or industrial centre. Its harbour, which is small, silted up long ago for deep draft vessels. North Sulawesi's main port is in the smaller city of Bitung on the eastern part of the peninsula, 54 km. from Manado. However, because it is the provincial capital and the center for administrative, educational, cultural and service industries, especially the important tourist industry centered on Bunaken National Park, and the main market for rural North Sulawesi, it is economically important from a regional perspective.

As Figure 2.1 indicates, the largest single economic sector in north Sulawesi is agriculture. Like other parts of Sulawesi, tree crops are very important commercial income sources for farmers, especially coconut, cloves, cocoa and others. Fisheries (including various forms of mariculture) also are a fast growing sector (categorized under Agriculture). Parts of the trade, restaurant, hotels and the transportation and communications categories represent the impact of the fast growing service industry supporting tourism and recreation of which Bunaken National Park is the most important draw. As is the case for most of the relatively resource-poor provinces,

government services are a sizeable proportion of the regional GDP and of employment as well (schools, hospitals, government agency workers).

The province of North Sulawesi has coped relatively well with the economic crisis since 1997. In the period of 1997-1998, it's economy experienced a contraction of only 2.8% against a national contraction of 13%. Like other provinces with significant agricultural exports, the collapse of the Rupiah in 1998 benefited local farmers since many of their costs were denominated in Rupiah but many of their crops fetched strong commodity prices in dollars.

After a drop of almost 50% in foreign investment in 1998, since 1999 new investment in Sulawesi has recovered somewhat, especially in mining, manufacture, trade, plantations and fisheries. However, these positive trends have been mitigated, as they have elsewhere in the country, by ongoing political instability, a marked decline in the rule of law and a general disorganization in governance following a rapid decentralization process. These countertrends have led to a near collapse in foreign and even much domestic investment in new businesses, which has made local tax generation to support government services much more difficult as well.

### **2.4.3 Solid Waste Generation**

The generation of municipal solid waste is primarily a function of population, which for a city such as Manado, is by far the largest single source of waste generation. Based on population and on typical household unit generation rates, which have been estimated at about 18.3 liters/household/day, solid waste managers from the municipality of Manado estimate that about 1,500 cubic meters of municipal solid waste are generated within the municipality each day (see Section 3).

In addition to that generated by Manado households, solid waste also originates from commercial centers and businesses and from industrial facilities within the city. This solid waste is often collected and transported directly by the generator (as is often the case with industrial waste) or through integration into the formal public collection system (as is often the case with commercial waste, particularly that generated in city center market areas). To the degree that the observed solid waste floating into the Bay is derived from commercial and industrial waste sources, it contributes to the problem. This is especially the case for those Manado commercial areas that are directly adjacent to the Bay.

Ultimately, in any planning for improving the effectiveness of solid waste management in Manado, a better understanding of the various sources of solid waste as well as the manner in which those sources deal with their solid waste is very important in determining both the design of processes such as collection and disposal as well as for assuring that wastes from non-municipal sources are properly managed. While Manado is not a major industrial center, particular attention will still need to be paid to industrial waste streams with hazardous properties. The management of this material is particularly crucial if environmental damage and health effects for those coming into contact with this material are to be mitigated.

During a site visit to the current municipal dumpsite at Sumompo, in the northeast of the city, it was reported that about 200 m<sup>3</sup> of commercial and industrial waste had been received during the day on which the site was visited. Further analysis will be required to determine the total amount and type of commercial and industrial waste is generated in Manado. This analysis will also have to determine what proportion of the commercial and industrial waste actually reaches the City's disposal location.

## **2.5 Institutional Issues Relating to Manado's SWM Problem**

### **2.5.1 Indonesia's Decentralization Process**

Indonesia's current decentralization process is the culmination of a series of half-hearted attempts that began more than a decade ago during the Suharto administration and which actually targeted some of the public works type functions, initially. However, the form of decentralization chosen was "deconcentration" that is the transfer of implementation and operations and maintenance functions to lower levels of government. Meanwhile, budget authority, and planning, design and policy and regulation authorities mostly remained concentrated in the line sectoral agencies in Jakarta (agriculture, public works, forestry, trade and industry, etc.).

Real decentralization in the form of devolution of authorities and responsibilities for governance began with the passage of two basic laws in 1999 (U.U. 22 on the transfer of authorities to regions and U.U. 25 on fiscal decentralization). These laws were passed as a consequence of the political reform movement and at the same time were the government's reaction to the explosion of frustration and demands for public participation in governance and development that followed the long authoritarian reign of Suharto's "New Order". Because of growing political pressures

including secessionist movements in three provinces (Aceh, East Timor and Irian Jaya) and similar rhetoric from some other resource rich provinces, the decentralization legislation provided for a very short period of preparation and legal/regulatory transition of about 18 months before full decentralization would take place on 1 January 2001.

This has proved to be far too short a time span to bring regional governments, which had little or no previous experience with their own governance and resource management, up to speed in terms of management capacity, fiscal responsibility, legal and regulatory reforms and basic planning (including land use and development planning). Compounding this foreshortened transition period was the fact that it was occurring during a time of severe political and economic crisis in which local tax revenues had been drastically reduced and foreign and domestic investment had dried up in many places.

The immediate impact of too rapid decentralization in the context of a weakened State and economy has been a deterioration in public services on the one hand and an increase in illegal licensing of resource exploitation, corruption and theft on the other. The lack of certainty and stability in the licensing and regulatory regime has only served to deter foreign and domestic investment still further, thus compounding the local economic situation. However, not all is bleak. Decentralization has also afforded a number of opportunities to create new local multi-stakeholder management institutions, to reform laws and regulations to make them more locally appropriate and reduce the length of time required to develop new local initiatives and partnerships. This new policy and institutional “space” is one in which NRM/EPIQ and its partners have tried to work with some local successes, especially in North Sulawesi.

### **2.5.2 Aspects of UU22/1999 and UU25/1999 Relevant to SWM**

For the purposes of this assessment, there are some characteristics of the fiscal and governance decentralization laws and associated regulations that have an impact on the SWM situation in Manado and what can be done to ameliorate it. This discussion and the following section will focus on those aspects rather than a commentary on the decentralization process as a whole.

The Regional Autonomy Law was designed to bypass the potentially politically powerful governors and to extend the principal regional governance authorities directly to the far more numerous *kabupaten* (districts) and *kelurahan/desa* (administrative villages). Provinces would retain a coordinating and administrative function, as would the *kecamatan* level (between villages and districts) but mostly they would not have significant regulatory, budget-setting or

judicial functions. The effect of this has been to complicate many resource management functions. Existing resource concessions in mining, forestry, oil and gas frequently extend across kabupaten and even across provincial boundaries. This is even more the case for watershed management and its critical provision of water supplies, flood control and sometimes electricity, as in North Sulawesi.

There is no formal mechanism for settling inter-kabupaten conflicts over licensing and permitting, at this time, as well as the regulation of levies and other duties on trade between kabupaten. At the village level, it is possible for villages, through the new village assemblies to pass legislation that gives resource permits to external parties without any effective review or to regulate the use of resources and environmental services without reference to impacts on other villages (upstream vs. downstream, for example). NRM/EPIQ is currently working on village spatial planning and inter-village conflict resolution as a part of its DAS Tondano workplan in order to come up with some workable models for village regulations that promote good resource management. Some of these lessons may be applicable to the SWM initiative as well. Fortunately, the proportion of solid waste entering Manado through the Tondano River from the upper watershed appears to be fairly low, though episodic major storms flush large quantities of sediment, plant matter and non-biodegradable garbage out into the Bay, at times.

### **2.5.3 National, Provincial and Local Interactions in Public Service Decision-making**

#### **2.5.3.1 Sectoral Development Programs and Implementation in Public Works**

In addition to the basic governance issues that have arisen as a result of the rapid decentralization process, Indonesia is in the midst of a transition in governance culture. Many of the characteristics of the New Order regime still linger in the way that systems of public services are administered, SWM included.

In the old system, public works was a major focus of the development budget in Indonesia since the need for physical infrastructure and basic urban services was huge and ongoing. The national Public Works Department's mandate, now called the Department of Human Settlement and Regional Infrastructure (*Kimpraswil* in the Indonesian acronym), consisted of roads and highways, irrigation and other water supply and urban infrastructure. Almost all of the authorities for this huge collection of activities now have been devolved to the regions. However, whereas public works implementation had been deconcentrated during the last decade, much of the planning, design, technology research and monitoring and budgeting remained in Jakarta.

Likewise, foreign donor projects in infrastructure and urban services were negotiated and managed from Jakarta as well.

For many years, the development community has regarded this concentration of powers in Jakarta as both inefficient and conducive towards corruption since contracts and budget allocations both were controlled by Jakarta without serious oversight. Not surprisingly, the most powerful of the Jakarta line departments have been the ones most resistant to decentralization in the form of real devolution. Moreover, because the political transition has occurred so quickly, a number of donor projects retain their previous centralized management structures, which has led to some confusion and delays in implementation and decision-making as well as the duplication of some budgets.

Typically, revenues for local and regional governments (provinces and *kabupatens*) were overwhelmingly central government funded. Ratios of 9:1 central to local and regional or greater were the norm. This was because, prior to UU25/1999, all resource revenues went to Jakarta as did VAT and corporate and personal income taxes. This left local and regional governments with the land and building tax and local “*retribusi*” (local licenses and levies) which bring in tiny amounts of income where they are enforced at all. Certainly, the levies imposed on local citizens for garbage collection were not intended to support the entire SWM (see Section below).

However, with decentralization, urban services like SWM will now need to compete with all other government priorities including capital investment and operations across all sectors because local governments will receive one large block grant (*dana alokasi umum*, DAU) instead of specific Jakarta-determined sectoral budgets. The question is whether unglamorous activities like SWM will receive their appropriate share of budget or not. Complicating this situation is the fact that Kimpraswil (the successor to Public Works) has still tried to retain its own project and program budgets for infrastructure with all of the powers those confer and so parallel – but unsustainable – infrastructure budgeting may also be occurring in some cases.

### **2.5.3.2 Administration versus Management**

The rapid transition from centralized governance to local governance has caught many of the service agencies unprepared to manage their agencies efficiently as opposed to simply administering a program designed at the national level. As noted above, the budgeting and revenues issue is a particular problem. As described in Section below, Manado’s citizens have

become reluctant to pay local levies for garbage collection when the system so manifestly appears to fail in its core function of collection and disposal.

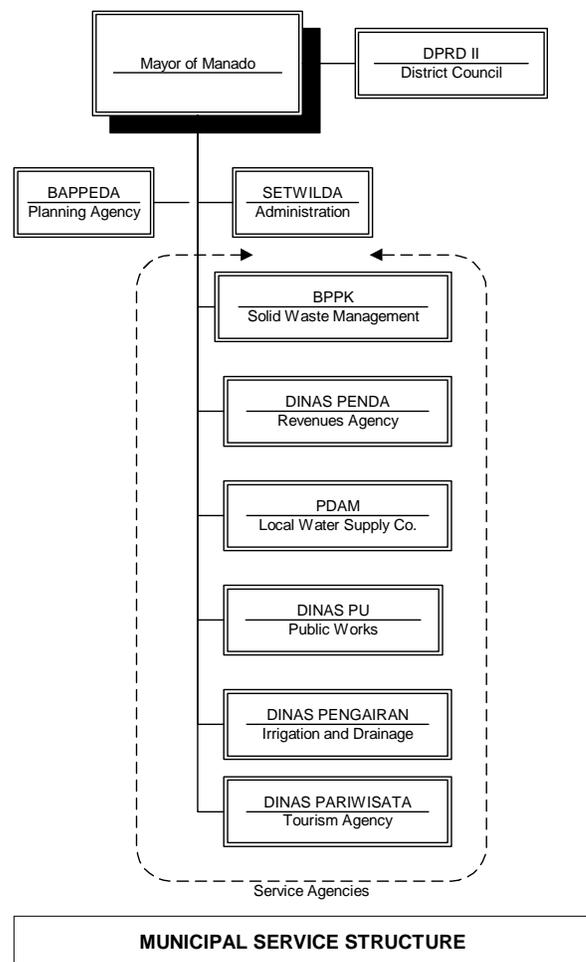
Because the old system of administration was passive and reactive, at best, local and regional governments did not need to assess which functions they could afford to do and how to do them on a cost-effective basis. Suddenly, they are now faced with precisely this challenge, which is the essence of management of an enterprise or agency. However, few, if any, of the staff of Manado’s government agencies, not just the BPPKM, are trained and experienced in management. This is one immediate challenge posed by decentralization that needs to be tackled.

## 2.6 Roles of NGOs, Private Sector and the Media in Local Development

Fig.2-2 Structure of Manado municipality

A second challenge for Manado’s SWM lies in the nature and scale of solid waste management itself. The task is a highly fragmented and disbursed one. The point sources of solid waste pollution are thousands of individual households, markets, stores, industrial enterprises and offices scattered over a wide area. As a practical matter, without the active participation of all citizens, businesses and other enterprises, the solid waste management system would barely function at all. In the absence of the rule of law, as is largely the case across Indonesia these days, this means that a regulatory approach alone will be ineffective.

Fortunately, the democratization and decentralization process has also opened up a new political space for civil society institutions in the form of local and international NGOs, community organizations (LSMs), churches and other religious institutions, cultural bodies and the private sector.



This is because these institutions have either retained their popular legitimacy and credibility or they are able to demonstrate their ability to provide goods and services demanded by the public. The roles of these institutions will be discussed in other sections below since they are already an essential part of the NRM/EPIQ strategy resource management in the context of decentralization.

## **2.7 Solid Waste Management in Manado**

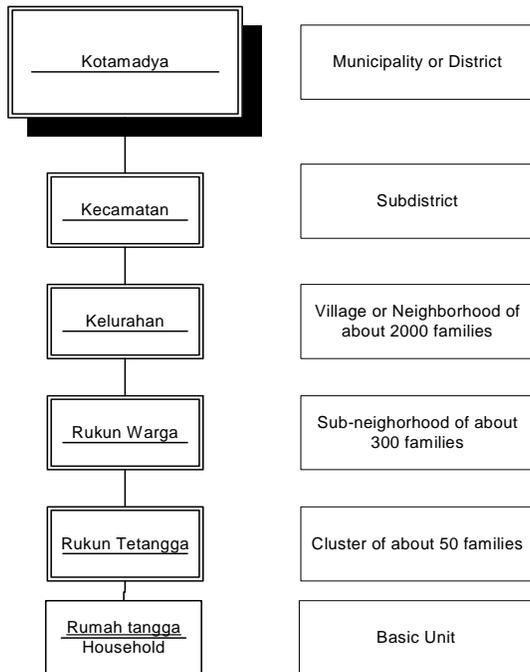
### **2.7.1 The Structure of Manado's SWM System and the Mayor's New Plan**

Currently, the agency responsible for solid waste management in Manado (BPPK) is one of several providing public services through the municipal services structure shown in Figure 2-2. The BPPKM and its predecessor (*Dinas Kebersihan*) manage the collection of municipal solid waste in Manado as well as operation of the Sumompo dumpsite. The mayor of Manado has recently begun the process of transferring the municipal solid waste collection responsibility to the individual districts (*Kelurahan*) within the municipality. This transfer of responsibility will include the allocation of equipment to the districts through which they can manage their own municipal solid waste stream.

As is typical with most Indonesian communities, Manado is subdivided into a number of smaller administrative layers. Below the municipal level, various subdivisions exist that are generally determined by population. This general hierarchal structure of representative and population units is shown in Figure 2-3. Those elements of the municipal administrative structure that are anticipated to have a future role in solid waste management in Manado include the following:

- ***Kotamadya***: The Municipality of Manado currently operates the formal collection and disposal system from the point of collection of municipal solid waste from the temporary collection points (TPS) to the final disposal location (TPA). The Mayor of Manado announced in June a plan to decentralize the management of solid wastes to the kecamatan level (there are nine kecamatan) and kelurahan level. This means that the municipality will only be responsible for the transportation of solid wastes to the TPA and for the management of the disposal site. The daily responsibility for household collection will be divested to the Kelurahanans.

Fig. 2-3. Municipal units of organization



- **Kecamatan:** Subdistrict, with government-appointed head. According to the Mayor’s decree 136/2000, these will be responsible for coordination of the SWM that is carried out at the *kelurahan* level. What this “coordination” will actually mean is not clear at this time.
- **Kelurahan:** This is the administrative level where, under the mayor’s decentralization program, *LPMs* (community councils) will take over the responsibility for solid waste collection within their individual districts. Each *kelurahan* is subdivided into *RWs* (in Manado called “*lingkungan*”) each of which covers about 8 to 12 *RTs*, or groups of about 50 households. The KPS prototype project, which is described later in this report, is organized at the *Kelurahan* level of administration.

- **Household:** This is the basic level within the current and proposed solid waste management system. Individual households are the generators of a major share of municipal solid waste and in the present system are responsible for its transport to appropriate collection points such as the formal collection system TPS locations.

The evaluation team believes that the hierarchal administrative structure shown in Figure 2-3 provides an opportunity for education and peer influenced management of solid waste at a truly “local” level. With the potential of working with the KPS prototype project to develop a viable model, the overall size of the city of Manado and its representative number of *Kecamatan* and *Kelurahans* units of administration may allow for focused planning in each of the districts to determine the best means for effective collection. The physical variation that may exist in the different districts in Manado may lead to different choices as to how solid waste is collected based on each district’s specific characteristics.

## 2.7.2 The Core Challenge to Manado’s Solid Waste Management System

The common target for any planning associated with solid waste management throughout the world is the development of an integrated solid waste management system where appropriate

technologies are applied to specific components of the waste stream. Generally, integrated solid waste management planning is focused toward accomplishing:

- Source reduction of the amount of solid waste generated at its source.
- Recovery and reuse of components of the solid waste stream with intrinsic value and
- Effective disposal of the remaining portion of the solid waste stream that has not been recovered because of its value.

In Manado, there has been considerable activity aimed at the relocation of the city's disposal facility (TPA). A new disposal site is currently being developed with the assistance of the World Bank to replace the existing TPA at Sumompo.

Basic to each of the above integrated solid waste management processes is the manner in which solid wastes is collected and transported. This collection process can involve both formal and informal components that control the solid waste as it proceeds from generation at its source to final disposal at the landfill site. In many municipalities, including Manado, the manner in which solid waste is collected and transported often creates the most visible problems that people associate with an ineffective solid waste management program. This is due to the fact that the people in the collection service area directly experience the failure of a collection system since the solid waste is not effectively collected and often accumulates or is dropped along roadways near their residences. The evaluation team believes that the ineffectiveness of the collection program in Manado is the primary source of the problem evaluated in this assessment.

### **3. Preliminary Profile – Solid Waste Management in Manado**

The evaluation team believes that proper solid waste management in Manado is as much a process as it is technological features such as equipment and facilities that are developed to reasonable and acceptable standards. This process requires a base level of management accountability and discipline among all of the active participants in the solid waste management program including individual waste generators. While we believe that all residents of the city desire a clean environment in which to live, we also believe that their actions will often be governed by whether they have something to lose by not conforming to a reasonable standard of solid waste management. The link between potential economic losses due to a drop-off in tourism can directly influence many individuals and businesses in the community including municipal officials who must count on the revenue generated from tourism to help pay for local services. However, at a basic level of solid waste generation within the city, enforcement of litter regulations may also be required to ensure that all waste generators conform uniformly. Anecdotal information collected during the field evaluation suggested that, in the recent past, there was greater enforcement of litter laws. As a result, this was perceived to provide a greater incentive for people to prevent litter and ensure that their solid waste was managed in an appropriate manner.

#### **3.1 Waste Generation in Manado**

According to a very recent estimate, the Municipality (*Kotamadya*) of Manado has a population of 418,000 in 81,892 households (Frederik, 2001), which yields an average household size of 5.1. The area of Manado City is 2,922 km<sup>2</sup> (GOI, 1998, Manado in Figures). The city population has been growing, on average, approximately 3.6 % per year <sup>1</sup> between 1995 and 2001, which includes an influx of about 11,000 IDPs from Maluku to Manado, since the end of 1999. The surrounding *Kabupaten* Minahasa had a population of 249,886 in an area of 79,876 km<sup>2</sup> (GOI, Minahasa in Figures, 1997). The growth in the upper watershed has been 0.78%/year while in the lower watershed the figure is 1.03% (GOI, Minahasa in Figures, 1997).

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<sup>1</sup> Source: Wempie Frederik, Mayor of Manado, May 2001, and Manado Spatial Plan 1999 (Laporan Fakta & Analisa/RTRW Mdo'99). Compare these growth rates to the much lower annual provincial population growth rate 1995-1997 of 1.6% according to the Central Bureau of Statistics (BPS).

The BPPKM estimates that the Manado municipality generates approximately 1,500 cubic meters of solid waste per day, as noted in the previous section. Manado public officials have estimated that only about 30 percent of this solid waste is actually collected by the municipality's formal collection system. According to the BPPKM, the garbage agency, this proportion is based on the volume of the city's operating garbage trucks (18 out of 22) multiplied by the number of trips for each fully loaded truck per day. Hence, this estimate is a) only able to account for the solid wastes brought to the formal collection bins (TPSs) and b) some unspecified proportion of commercial waste that has been absorbed directly into the public collection system. Actual household solid waste generation rates are largely unknown and the formula used to generate the 1500 m<sup>3</sup> figure is based on international studies. Commercial generation (and collection) is more problematic still since businesses span a wide range from small food stalls and kiosks to large businesses. While the latter have privately organized collection of garbage or arrangements with the City, the small operators no doubt collectively generate a large amount of uncollected wastes, including a lot of plastic bags. The disposition of the uncollected solid waste generated in Manado is no doubt an important cause of the problem associated with the solid waste that reaches Manado Bay.

The total MSW stream is anticipated to increase at a rate reflective of the increase in population. Anomalous increases in population such as refugee migration to Manado will also increase the total amount of solid waste generated in the region. However, similar to the fate of solid waste from peri-urban areas, the solid waste from the refugee areas is not expected to reach the formal collection system and, more than likely, may be disposed of by periodic burning or random dumping at or near the refugee camp sites. For those sites located near Manado's watercourses, this may mean direct dumping in the waterways and eventual transport to Manado Bay.

### **3.2 Waste Composition**

There are few major industrial sources of solid waste in Manado. As a result, most of the solid waste contributing to the Bunaken Marine National Park problem may originate from municipal and commercial sources. Some generalizations can be made on the composition of waste that would be expected within the Manado waste stream. The components of the waste stream that is most apt to reach the Park are plastic bags and beverage/water containers that can float long distances once they have reached the Bay without degradation.

Ultimately, the overall composition of the solid waste in Manado will determine the quantity of materials that may be worth recovering through more formal recycling and reuse programs. An

assessment of the overall composition of solid waste generated in Manado should be completed in the future so as to determine those components of the solid waste stream that may be recovered for recycling and composting. While such an assessment is important for planning of various integrated solid waste management processes and facilities such as compost production facilities and landfill disposal sites, it becomes less important for collection planning other than the specific consideration in this assessment that particular components such as plastic bags and beverage containers are those components which are most likely to reach the Park.

### **3.3 Status of Integrated Solid Waste Management Processes and Infrastructure in Manado**

In a recent speech, the mayor of Manado estimated that only 30 percent of all MSW generated in Manado is actually collected by the Municipality's formal collection program. The evaluation team's observations and interviews with the Sumompo dump personnel would seem to bear this out. Many of the concentrated housing areas within the city are inaccessible to collection vehicles. As a result, people who live within these areas must carry their solid waste long distances to the closest TPS collection points. As an alternative, they often dump their wastes at informal TPS locations that evolve in their neighborhoods or directly into Manado's watercourses or drainage system.

#### **3.3.1 Source Reduction**

There are no formal programs aimed at educating solid waste generators in Manado of the benefits of source reduction. It is anticipated that commercial and industrial organizations within the city may be practicing some form of source reduction as a means of reducing their overall production costs since this is common business practice.

#### **3.3.2 Source Management/Storage**

The evaluation team believes that the manner in which individual waste generators manage their solid waste is the fundamental SWM problem in Manado. Since the formal collection system does not reach a significant portion of the population, some residents of the city (particularly those in concentrated housing areas and in areas where there are no readily available or accessible TPS collection points) are left to fend for themselves when it comes to disposal of their solid waste.

There are scattered TPS collection points throughout the city that, in some cases, are serviced by the municipal collection program. Unfortunately, there are also many informal TPS sites that are not serviced at all by the BPPKM because of their inaccessibility.

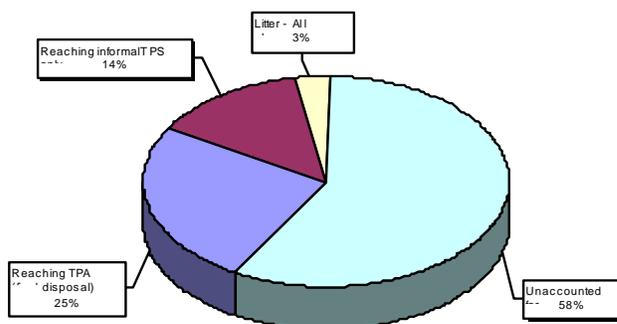
While some random solid waste accumulations were observed in the commercial areas of Manado, this material is usually collected daily and hauled either to TPS collection points or directly to the TPA disposal location at Sumompo. Where those commercial areas are located directly on the waterfront, some of the solid waste generated from these areas falls into the water and becomes part of the solid waste migration toward Bunaken Island.

### 3.3.3 Collection and Transfer

The formal public collection system in Manado consists of 22 open-topped trucks (of which only 18 are currently active). These trucks provide the transport of the MSW collected from TPS throughout the city to the current TPA. Most TPS collection points that are part of the formal collection program are serviced three times per day. About 364 workers are involved in street sweeping and waste collection/transport. Of these, there are 34 employees are involved in the administration of the program and 330 are responsible for the direct physical process of collection and street sweeping. Each collection vehicle has a complement of 5 workers, including a gang supervisor. The collection crews operate on assigned structured routes collecting waste from the formal TPS collection points.

Figure 3 - 1 presents a schematic of the general collection and transfer processes in Manado. Ideally, household carry their solid waste to the City’s designated TPS collection points which serve as the primary interface to the municipality's formal collection system. At that interface, the TPA collection points are usually fixed storage containers (See Annex 2: the photographic reference) located along Manado’s roadways. The formal collection program provides pick-up service to the TPS up to 3 times per day.

**Figure 3 -1 Current Estimated Municipal Solid Waste Disposition In Manado**



In performing this initial assessment, it was the evaluation team’s observation that most of the formal TPS system collection points were effectively (and possibly excessively) serviced by the municipal collection crews. However, it was also our observation that many residents must carry their waste long

distances to reach one of the TPS collection points regularly serviced by the municipal program. Because of the inconvenience of doing this, a number of informal TPS collection points have evolved. More often than not, solid waste placed in these informal TPS collection point is not collected by the City and transported to the disposal site at all. Figure 3.1 above, is our estimate of the disposition of solid waste in Manado based on discussions with local officials, observation and some collected data. Accumulated solid waste at the informal TPS is often burned to reduce the amount of solid waste accumulation or to mitigate nuisance effects (odors, insects, etc.) associated with these sites. As an alternative to placing solid waste in an informal TPS, residents who live in proximity to waterways within the city simply dump their solid waste into the Tondano River or other waterways so that it eventually washes out into the Bay. Solid waste ending up at informal TPSs and waterways may account for more than 60 - 70% of the total SW of Manado.

### **3.3.4 Recycling/Reuse**

There are currently no formal recycling and reuse programs within the municipal solid waste management program. However, there are informal activities where scavengers recover materials for sale to brokers. Scavengers recover materials from the TPS and dump site. During the site visits associated with this assessment, scavengers were observed recovering glass, corrugated cardboard, plastic and metal. There is also a strong indication that the municipality collection crews also regularly recover materials for eventual sale as they pick-up waste from TPS collection points, especially at hotels and offices. (Unfortunately this latter practice can also affect the efficiency of the overall collection program by increasing the amount of time required to service each collection stop.)

During the field investigation, the evaluation team visited a business located in Airmadidi, a less than half hour drive from Manado, where recovered plastic was accumulated, processed and packaged for eventual shipment to Jakarta. This facility had been in existence for about 10 years and may serve as an outlet for recyclables recovered from any enhanced solid waste management program in Manado. There are at least 3 plastic collecting businesses that ship plastics to Java, and several other businesses, which collect all sorts of metal for shipment to Java (mostly Surabaya). Selected amounts of metal are also re-used by welding workshops around Sumompo. Prices of plastic chips or metal scrap are highly sensitive to local prices in Surabaya. Aluminium scrap is sent to an enterprise Kecamatan Langoan, in Minahasa, which produces spoons, fence parts, and pans.

### 3.3.5 Disposal

Considerable work has been done recently on the relocation of the municipality's disposal facility to a new landfill site at Teling Atas in the west of the city near its boundary with Minahasa Kabupaten, that is supposed to be designed and operated at improved environmental standards.

The effort of relocating and developing this new controlled landfill has been supported by a loan from the World Bank, which have also provided technical assistance in its development. There has been some controversy concerning the selection of the new site and socialization programs have been ongoing to assure that the selected site is acceptable to all interested and impacted parties. The evaluation team clearly recognizes the importance of effective disposal. Significant health and environmental effects can result from improperly sited and operated disposal areas. During the field investigation, the evaluation team visited the existing disposal site at Sumompo. The environmental and health concerns associated with that site are evident and clearly the effort to relocate to other site is justified (See Annex 2). However, in focusing its evaluation on the problem of solid waste off the shores of Bunaken Island, it does not appear that the existing dumpsite is a significant source of the solid waste reaching the Bay. It is expected that the new disposal location will only have an effect on the problem under evaluation by its impact on the efficiency of solid waste collection in Manado.

#### **Box 1 - The Village of Kleak Waste Management Pilot Project**

The principal objectives of the Kleak Waste Management Pilot Project include the intent to:

1. Assist the BPPK Manado Municipality in improving performance of solid waste collection and management
2. Increase community participation in storing, collection, and processing of waste through a pilot project that can be replicated

The *Kelurahan* (urban village) of Kleak, part of the *Kecamatan*/Subdistrict of Malayang in the east of Manado, has a population of 13,500 people. Kleak is a village situated around Sam Ratulangi University (UNSRAT), the leading University in North Sulawesi and consists of six "lingkungans" (neighborhoods of about 300 families).

Kleak was selected because many prominent figures (local council members, University faculty) living in the area. It was hoped these people would provide strong motivation for recycling since such processes currently are unorganized at the household and RT levels. Their participation also was thought to be helpful in the replication of the experience in other parts of the city.

To this point, the following groups have been active participants in the Kleak pilot project.

1. PPIS (The Provincial Project Implementation Support team for the Second Sulawesi IUIDP (Integrated Urban Infrastructure Development Program) for North Sulawesi (John Taylor, Agustinus R. Bari)
2. Kelompok Peduli Sampah (Concern for Solid Waste) Group – Manado (Arini Waworoentoe)

Within the pilot project, a number of taskforces are working on a voluntary basis addressing a number of issues including: Socialization/community facilitators (5 people), collection (4 people), composting (4 people) and SW composition (2 people). The first phase of the project occurred during the months of January and February 2001 including 1) deliberations with the local government of Manado, 2) socialization and awareness building at the local community level and 3) domestic waste data collection. The project undertook to separate waste into organic/biodegradable and inorganic/non-biodegradable.

After four months of project activities, the team is expecting to continue with modest World Bank support (under a training component) to recruit local SWM operators, implement composting, study of waste composition, and the development of final recommendations on how the program can be replicated in the rest of the city.

## **3.4 Economic Aspects**

### **3.4.1 Budget Development Process**

In the late seventies, the traditionally centralized planning and budgeting process acquired more participatory character. The local district or municipal routine and development budget would be concluded after a process of bottom-up planning process from the village level up, accumulating in a Rakorbang (inter-agency development coordination conference) at district level, as stipulated by the P5D guidelines (bottom-up planning procedures and forums). Further on, a mayor or Bupati (district head) would require the local Council's endorsement before implementing the plans.

With central government loans from the World Bank and ADB, since the mid 1980s the nationwide Integrated Urban Infrastructure Development Program (UIDP) has assisted local governments to improve inter-agency coordination and plan infrastructure development programs through a medium-term planning and decision-making process. The development plans (PJMs / Intermediate Term Investment Plans) would not only integrate one agency's activity with the other's, but also integrate the technical aspect with the financial aspect and revenues plan as well as with the required institutional preparations and development plans. The PJMs can then become a reference for World Bank loans through central government granted to the district level, or through subsidiary loan agreements to the district.

### **3.4.2 Historical Budget Allocations**

Since 1991/92 Manado's annual development budget process has received assistance through the UIDP for all infrastructure components including SWM. The Reviewed PJM for 1996/97 – 1999/2001 provided Manado with additional vehicles, and is presently waiting for an approval from the World Bank for the final landfill site at Teling Atas. The previous year 2000's routine budget of Rp 2,053,769,400 (about \$205,377 at current exchange rates) with an estimated Rp 1,000,000,000 (\$100,000) for revenues could not be fully realized, as SWM revenues through payments to the revenues agency, PDAM / water supply company and the SWM agency itself only amounted to Rp 825,350,000 (\$82,505).

Although this year the local city council (DPRD) has put higher priority on SWM, nevertheless BPPKM has not been able to prepare a convincing plan to present to the council to obtain a better budget. The present routine budget is not significantly different from the previous year

2000, and does not indicate significant steps to improve performance of the system other than some salary increases, which at the same time does not widen the coverage of service and therefore also participation from citizens (see following table).

The overall magnitude of budget allocated to SWM as well as the revenues generated by garbage fees are not expected to show any changes from the previous year and so represent a real decline in operational budget.

### **3.4.3 User Fees**

Local regulations do exist that govern solid waste management in Manado. These regulations provide a definition of user fees that must be paid for the SWM service. User fees charged for SWM services are based on the type of housing in which waste generators live. For example, residents who live in temporary houses (i.e. bamboo or other non-permanent materials) pay approximately 1,500 Rupiah per month while those who live in permanent houses (defined as all masonry or concrete) pay between 3,000 and 6,000 Rupiah per month depending on their location within the city. Although not enforced, the existing regulations also include sanctions up to 50,000 Rupiah and a three-month jail sentence for not abiding with the regulation.

For office areas, a similar scheme has been defined, with a rate that has been considered too low (according to the media): between Rp 7,500 – Rp 20,000 per month for offices of less than 75m<sup>2</sup> to multi-storey offices over 75m<sup>2</sup>. In addition, it must be noted that many of the larger enterprises bring their SW with their own trucks to the disposal site at Sumompo, without a (formal) fee to pay. Their SW has more of a recycle value.

Payment of fees was previously done at the PDAM / local water supply company. However, only a minority of the population used piped water, resulting in very low revenues. About 3 months ago this was shifted to the PLN / electrical company. However, a large number of citizens refuse to pay on the basis that pick-up of waste is not reaching their neighbourhood.

## **3.5 Historical Solid Waste Management Performance in Manado**

In the period from 1989 to 1994, the City of Manado received 4 consecutive Adipura awards, which are presented by the President to clean communities. In 1994/1995, Manado received the Adipura Kenana (Golden Adipura) for its continuing excellence in urban cleanliness. Unfortunately, the SWM situation in Manado has significantly deteriorated since that time. In a

recent speech presented at a seminar concerning the legal aspects of handling urban cleanliness in Manado, the mayor of the city, Dr. Wempie Frederik, stated that he believed that there were a number of current problems with the city's solid waste management system, including:

- No law enforcement that prevents littering or indiscriminate placement of solid waste
- Low public awareness and discipline,
- Insufficient transport vehicles for effective collection
- A disposal site that needs to be replaced,
- A lack of modern technology in the collection system,
- Insufficient or improperly collected fees to sustain an effective program, and

One of the unanswered questions from the assessment was exactly why the sudden turnaround in performance of Manado's SWM between 1994 and 2001. Was the deterioration a sudden one occurring only in the last year or two or more a gradual deterioration, a function perhaps of lack of leadership, changing priorities and, of course the political and economic turmoil since the start of the "Asian economic crisis" in late 1997? Were the Adipura awards reflective of good performance only in the accessible and serviced areas of the city rather than the entire city? After all, the densely packed shanty-towns and poor kampongs along the Tondano River and Manado Bay are unlikely to have sprung up overnight given the structural nature of a good many of the houses. On the other hand, it is clear that throughout the city, the physical infrastructure of the city, as reflected in the roads, drainage systems, garbage collection, electricity and other utilities have not been maintained very well much less kept up with rising demands. Certainly, one of the early priorities of a new project will be to undertake some research on the causes of the present SWM problem both with respect to public opinion and with respect to the functioning of the City's SWM system.

In the speech referred to above, the Mayor outlined a number of municipal initiatives to improve Manado's solid waste management program including:

- A restructuring of the institutions involved in solid waste management,
- An increase in the capacity of the solid waste management program by purchasing additional trucks, developing a new TPA at Teling Atas and improving the technical capacity of the department responsible for solid waste management in the city.
- Continued decentralization of the solid waste function at all levels of government. (This decentralization process would include the distribution of trucks to all Kecamatans.
- Promoting technologies that will increase composting of organic waste and the recycling of non-organic waste,

- New programs to increase public awareness of solid waste management issues through the use of electronic and print media,
- Increasingly enforcement of existing laws or regulations that would provide sanctions for littering and other activities that the defeat the purpose of the SWM program in the city, and
- Development of a means for equitable contributions to pay for enhanced solid waste management services.

The evaluation team believes that the above statement of the problem and definition of the initiatives that may be required to improve SWM in Manado are consistent with the steps that we would recommend for improvement of the municipality's program,

## **4. Assessment of Current Solid Waste Management Problems**

### **4.1 Identification of Current Problems**

As stated in the preliminary solid waste management profile in Section 3, the evaluation team believes that the primary cause of the problem that we are investigating is a lack of service coverage within the municipal collection program and with indiscriminate dumping of solid waste into uncontrolled locations in the Manado area.

### **4.2 Probable Causes**

There are a number of factors that may have contributed to the deterioration and current ineffectiveness of the collection program in Manado including:

1. Various interviewees from both government and NGOs suggested the following socio-political explanatory trends. The country's economic crisis created a situation in which less funding was made available to municipalities to provide basic services including solid waste management. Increased decentralization, in the last two years, has resulted in less enforcement of rules and regulations governing solid waste management and, in particular, littering. This has accompanied a general lack of awareness among citizens who remain partly rural in their behavior patterns, exacerbated by a declining sense of discipline.
2. Increased responsibility on the part of local or subdistrict officials to manage the solid waste function without the accompanying increased technical capacity to assure that they would do so in a proper manner.
3. Rapidly increasing population and urbanization, which has generated increasing amounts of solid waste during a time when the money available to provide municipal services in general is decreasing.
4. A growing area of informal or spontaneous settlements that is not accessible by the common collection vehicles. In addition, a rapid influx of refugees and internally displaced persons

from the Maluku social conflict region that have become an additional load on the formal solid waste collection and disposal program.

5. Changes in political leadership with resulting changing priorities that may have diverted funds from solid waste management to other programs thereby affecting available budgets to maintain or expand service.

These factors have probably caused many of the phenomena and problems that the team has observed in the field, especially the lack of collection and disposal facilities, lack of coordination among agencies and local *kecamatan*s / subdistricts in the placement of collection facilities (like on drains) as well as collection schedules, littering along streets and shoreline, and the overall shortage of equipment. Diagram 4.1 shows an estimate of the rough orders of magnitude of these factors influence on the SWM problem. It also can be concluded that several problems need immediate, “reactive” response, while others need a “pro-active” approach to change the causes of the SWM problems.

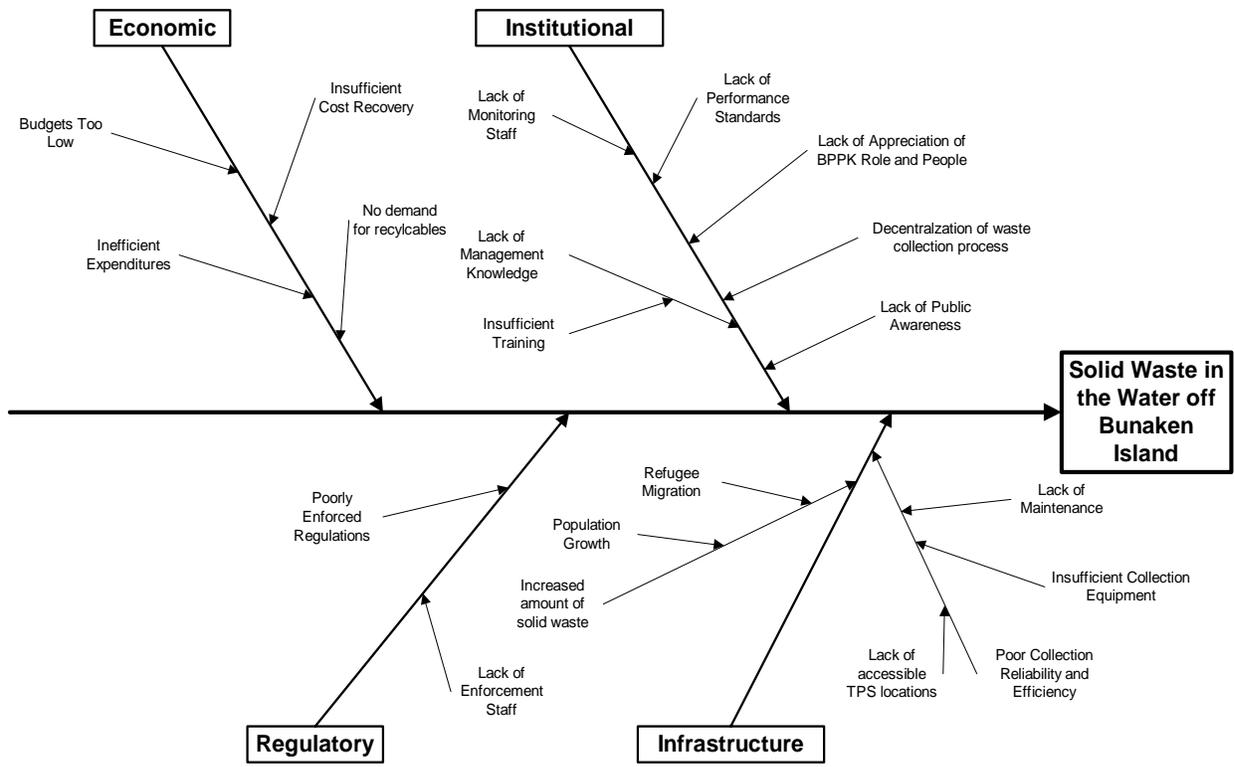
### **4.3 Alternative Solutions to Current Problems**

There is some basis for optimism that the current solid waste management problems in Manado can be addressed. A number of current activities, which may be supported by a USAID supported intervention, are ongoing. These include:

- The mayor of Manado recently presented his observations concerning the solid waste management program in Manado. The observations included what the evaluation team believes is a realistic portrayal of the deficiencies that currently exist in the solid waste management program in Manado. In addition, the mayor's statement included his *proposed plan of action* intended to improve solid waste management within the municipality which the evaluation team believes presents the proper steps that must be taken to improve conditions.
- An active community group at the Kelurahan level, the *Kelompok Peduli Sampah* (KPS, Citizens Concerned about Garbage) has begun a pilot program in the Kleak Kelurahan (coincidentally the same one in which the NRM/EPIQ office is located) with support from a number academics and members of an NGOs, aimed at enhancing recycling opportunities and making the collection process within their district more effective. (This pilot project may serve as one possible model for other areas within the municipality as they assume more

responsibility for solid waste management in their areas. The Mayor is aware of this experiment and has endorsed its efforts.

- Based on a number of interviews by the evaluation team, it is our impression that the people of Manado recognize the value of tourism associated with Bunaken National Park. This helps to provide an overall *economic incentive* for implementing an effective solid waste management program to protect the tourism economy.
- Anecdotal information received from a number of sources during this initial evaluation demonstrated that *recent historical experience with cleaner conditions* in Manado when local rules and regulations concerning littering were rigidly enforced was a part of most citizens' experience. This fact may provide a basis for recognition that similar enforcement may again lead to the same cleaner environment within the city.
- A *new disposal site* to serve the municipality is now being implemented with World Bank assistance. This new facility may provide an incentive to also evaluate and deal with deficiencies that exist in the solid waste collection program. (The new landfill location will have an effect on the formal municipal collection program since routing and time of transport of collected waste to the new TPA will change as a result of the new location. As a result, re-evaluation of the collection and waste transport process is warranted.).
- The local newspaper, The Manado Post, has already begun *a media campaign for more effective solid waste* management within the municipality. This should help assure their cooperation in any future public awareness program developed as a result of a USAID supported project.
- One or more NGOs already have been addressing the issue of *the role of scavengers* within the city's solid waste management program. These NGOs may provide a basis by which to educate scavengers as well as provide a greater control over their activities in various elements of Manado's solid waste management program.
- The *local NRM/EPIQ office in Manado* has established excellent contacts with local officials who will play an important role in fostering more effective solid waste management in the municipality. Further, the NRM/EPIQ program in Manado has developed a successful track record in performing activities that are similar to the proposed SWM initiative.



SOLID WASTE PROBLEMS AT BUNAKEN ISLAND - CAUSE AND EFFECT DIAGRAM

<b>PROBLEM PERCEPTION AND CORRECTION MATRIX</b>				
	<b>PROBLEMS</b>	<b>EFFECTS</b>	<b>CAUSES</b>	<b>REMEDIES</b>
<b>1</b>	Solid Waste in Manado Bay reaching Bunaken Island	<ol style="list-style-type: none"> <li>1. Visual impact</li> <li>2. Impact on tourism</li> <li>3. Corral deterioration</li> </ol>	<ol style="list-style-type: none"> <li>1. Inefficient collection</li> <li>2. Random dumping</li> <li>3. Poor disposal area practices</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve collection practices</li> <li>2. Improve disposal operations</li> <li>3. Develop and enforce litter regulations</li> <li>4. Enhance recycling opportunities</li> </ol>
<b>2</b>	Waste accumulation and burning in streets and inappropriate areas	<ol style="list-style-type: none"> <li>1. Visual impact</li> <li>2. Health effects</li> <li>3. Impact on tourism</li> </ol>	<ol style="list-style-type: none"> <li>1. Inefficient collection</li> <li>2. Random dumping</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve collection practices</li> <li>2. Develop and enforce litter regulations</li> </ol>
<b>3</b>	Burning waste at informal TPS and at TPA	<ol style="list-style-type: none"> <li>1. Health effect on neighbors</li> <li>2. Poor impression</li> </ol>	<ol style="list-style-type: none"> <li>1. Arson</li> <li>2. Spontaneous combustion</li> <li>3. Hot loads</li> </ol>	<ol style="list-style-type: none"> <li>1. Monitor for fires and put them out</li> </ol>
<b>4</b>	Leachate and air contamination from TPA	<ol style="list-style-type: none"> <li>1. Health effects</li> <li>2. Poor impression</li> </ol>	<ol style="list-style-type: none"> <li>1. Poor siting</li> <li>2. Poor design</li> <li>3. Poor operations</li> </ol>	<ol style="list-style-type: none"> <li>1. Develop and operate new disposal areas to reasonable standards</li> </ol>
<b>5</b>	Liquid leakage and littering from collection system vehicles	<ol style="list-style-type: none"> <li>1. Health effects</li> <li>2. Visual impact</li> <li>3. Impact on tourism</li> </ol>	<ol style="list-style-type: none"> <li>1. Ineffective maintenance</li> <li>2. Obsolete equipment and containers</li> </ol>	<ol style="list-style-type: none"> <li>1. Procure new equipment and containers</li> <li>2. Improve maintenance</li> <li>3. Plan for periodic replacements</li> </ol>
<b>6</b>	Human contact with biomedical waste	<ol style="list-style-type: none"> <li>1. Contact health effects</li> </ol>	<ol style="list-style-type: none"> <li>1. Indiscriminate integration into MSW stream</li> </ol>	<ol style="list-style-type: none"> <li>1. Train scavengers and workers about health effects</li> <li>2. Special handling of infectious waste</li> </ol>
<b>7</b>	Human contact with toxic industrial waste	<ol style="list-style-type: none"> <li>1. Contact health effects</li> <li>2. Ground and surface water pollution</li> </ol>	<ol style="list-style-type: none"> <li>1. Indiscriminate integration with MSW Stream</li> </ol>	<ol style="list-style-type: none"> <li>1. Train scavengers and workers about health effects</li> <li>2. Require special handling of particularly dangerous waste</li> </ol>
<b>8</b>	Water pollution from Agricultural Industrial waste	<ol style="list-style-type: none"> <li>1. Pollution of surface and groundwater</li> </ol>	<ol style="list-style-type: none"> <li>1. Improper waste handling</li> </ol>	<ol style="list-style-type: none"> <li>1. Improve management practices</li> </ol>



## 5. Recommended Sustainable Performance Targets

Currently, the two main objectives of the BPPKM with reference to solid waste management planning are a) to improve the disposal function within the city and b) to decentralize the collection function. However, neither of these two objectives will be met nor will the overall SWM program be more effective unless there is a clear definition of the performance standards that must be met by the various elements of the SWM program in Manado, not just the city government's SWM agency. Moreover, these performance standards and hence the actual program elements have to be much more integrated so that all participants in the program including those responsible for generation, collection, recycling, and disposal can meet them.

If developed to appropriate standards, the **disposal function** within the city should be significantly improved as a result of the development of a new landfill. As far as **collection** is concerned, convenient locations have to be provided for *all residents* of the city where they can deposit their solid waste without too much effort. If these collection points are inconvenient, if there is a lack of clarity about who is responsible for what and if there is no enforcement of rules and regulations that prevent discharge of solid waste outside of the designated collection points, SWM collection coverage and effectiveness in Manado will not improve.

Since solid waste collection is being decentralized from the municipality to the *kecamatan* and *kelurahan* levels, each *kelurahan* needs to take the responsibility for analyzing its particular needs, including physical constraints, the mix of domiciles to small businesses, etc. to determine how effective collection can be maintained in their areas of responsibility. Individual characteristics of each district may determine how solid waste is collected in their areas. The target performance standards should be to collect most if not all of the solid waste generated in each district so that it reaches the ultimate disposal site in a controlled manner. For example, while in theory there is coordination between the Tata Kota office that handles siting and building permits along with infrastructure support, there is, in fact, little integration with service provision, especially for residences.

In addition, each *kelurahan* should, in coordination with the *kecamatan* office plan an individualized SWM program, tailored to reducing the amount of dependence upon the city collection system and to try to reduce amounts disposed, and reuse and recycle as much recoverable material as possible. Since recycling and compost opportunities will, more than likely, be a function of overall economics associated with the ultimate value of recovered

materials, close cooperation between *kelurahans* should be fostered to take advantage of the economies of scale that are extremely important in solid waste recycling and reuse programs.

Target performance in an effective SWM program can be defined through a variety of factors including:

**Affordability** - An effective level of service must be provided in any SWM program that is affordable based on the level of economic resources available to pay for the Service. The project will assist in *defining the minimum budget levels* that will achieve effective performance. Available economic resources may define the actual level of service that can be provided. In addition, user fees developed to support the desired level of service must be affordable to those having to pay them. Obviously, the more reliable and useful the service the greater the likelihood people will be willing to pay for it. In the poorest areas at present, households get little or no service and so they don't choose to pay for this non-existent service thus perpetuating the present situation.

**Reliability** - All waste generators must view the solid waste management service as being reliable whether the service is provided at the municipal or *kelurahan* level. This is particularly important at the collection system interface with the solid waste generators (e.g. households). Target performance standard should be the establishment of a reliable collection schedule that experiences minimal variation.

**Full stakeholders involvement** - All stakeholders currently participating in the solid waste management program for any reason must be integrated into the overall program so as to eliminate any "weak link" aspects of their involvement. This is particularly important for those participants who specifically influence the current perceived problems within the solid waste management system. Target performance in this factor should be the full awareness on the part of waste generators as to their responsibilities and required actions in the solid waste management program. These include households who dispose of their garbage in the river or in informal tips, scavengers and itinerant material recyclers, small businesses and city officials.

**Enforced discipline** - All participants within the system, particularly waste generators, must practice a certain level of discipline in the management of their solid waste. In some cases, reasonable discipline will need to be enforced. Target performance should be the reinstatement and enforcement of litter control standards throughout the municipality or as administered in each *kelurahan*. In the present political environment, this will require a more aggressive public education and awareness campaign and not simply coercion alone.

**Sustainability** - The improved system must be sustainable in the near and long-term. Sustainability must include the ability to recognize deterioration of service in any element of the program and in the performance of any of the program participants. Target performance in this factor should include a full definition of the resources required to provide an effective level of service and the dedication of sufficient resources to do so in the long term. Again, a design that clearly identifies the roles of stakeholders other than the city's BPPKM is essential to sustainability.

**Defined levels of service** - The level of service to all solid waste generators (households, businesses, industries) must be clearly defined so that it can be programmed into the day-to-day lives of the service area residents and regularly monitored for adequacy and effectiveness. The target level of performance at this level should include the definition and maintenance of a reasonable level of service (frequency of collection, etc.) that can be supported by available resources. Manado also needs to start focusing on special types of service requirements including medical wastes, toxic materials, recycling of hazardous materials (e.g. batteries and industrial wastes), which it has not done until now.

**Management/performance accountability** - A system of management and performance accountability must be established in which all elements of the SWM program are continually scrutinized for effectiveness. The target level of performance in this fact should be a management structure that provides continual monitoring of the performance of the SWM program and its participants. This means establishing coverage targets and some sort of monitoring system that is able to capture real reductions in waste overtime as well as some plan for matching revenues to costs (increasing revenues or reducing costs or both).

**Environmental soundness** - All services and facilities that are included within the City's SWM program must be environmentally sound. This must include the collection, transport, recovery and disposal of solid waste within the program service area. Generally accepted sound SWM practices are well defined and should form the basis for design of any SWM processes and facilities in Manado. While it is clear that the BPPKM has had some level of training and exposure to environmental (and worker safety) practices, it is also clear that these are indifferently enforced currently.

The implementation of all of the above target performance standards can be assisted by a USAID sponsored SWM initiative that builds on NRM/EPIQ project focus and strengths.



## **6. Alternative Intervention Approaches**

### **6.1 Alternative Approaches**

The evaluation team believes that interventions sponsored by a USAID SWM initiative in Manado can have a major beneficial impact on the development of effective solid waste management in Manado. However, we believe that the interventions may have to focus on two parallel implementation tracks, namely **proactive** and **reactive approaches** to the current situation.

In an attempt to immediately address the issue of solid waste reaching Bunaken Island, a *reactive program* should be implemented that basically seeks to simply cleanup solid waste as it accumulates. If diligently accomplished, this will have the immediate result of decreasing the perception of a solid waste management problem at the island. As is the case in any solid waste collection effort, regular programmed cleanup should decrease the overall accumulation that can be observed (by tourists, for example) at any specific point in time.

Conversely and in parallel to an ongoing clean-up effort, *proactive interventions* can assist in eliminating the source of solid waste reaching Bunaken. These will also help facilitate the current decentralization transitions that are occurring in the SWM program in Manado. It must be noted, however, that many of the proactive interventions will require a level of patience and persistent application before the problems with the Manado are alleviated. However, there are some positive locally based initiatives that have commenced and NRM/EPIQ support can significantly strengthen those initiatives and help assure their success.

### **6.2 Overview of NRM/EPIUQ Task order 833 Workplan and Implementation**

#### **6.2.1 Task Order Objectives and Scope of Work**

The Natural Resources Management Program (NRM) is an umbrella program that combines all of the USAID/Indonesia Mission's environmental and resource management activities into a single program for the period of 1996-2003 and responds to the renewable resource management needs and biodiversity conservation priorities of Indonesia. The task order contract with the global EPIQ contract is one of these NRM partners.

Since late 1998, and in the wake of the major political and economic upheavals that Indonesia has experienced since then, the NRM Program has been explicitly focused on helping Indonesia through its challenging transition to a more democratic and economically pluralistic society. The existing NRM Program's Strategic Objective: *"Decentralized and strengthened natural resources management"* is quite appropriate to the GOI's policy of rapid devolution and decentralization of governance authorities and finances. Indeed, a major premise underlying the design of the NRM Program is that a decentralized system of natural resource management that also possesses robust governance structures supporting accountability, the rule of law and popular participation is much more likely to meet Indonesia's biodiversity conservation, social equity and economic growth needs than the previous centralized and authoritarian system. Hence, the goal of the NRM/EPIQ Task Order between 1999 and 2001 is *support emergence of natural resource management policy and planning processes, at the national and regional levels, that are more transparent, accountable, inclusive and empirically based.*

Given the urgency of the NRM governance challenge and the long-term effort required, USAID/Indonesia gave NRM/EPIQ a scope of work intended to create the conditions for decentralized and sustainable natural resource planning, policy making and management. These tasks take the form of four objectives:

- *Clarify the roles and responsibilities of government, non-government, communities and private sector parties concerned with utilization and management of Indonesia's forests, protected areas, and coastlines*
- *Creation of a broad-based constituency for sustainable use of natural resources at the local level*
- *Local planning processes that impact on natural resource utilization and management are made more transparent, accountable, inclusive and empirically based.*
- *Synthesize and disseminate information regarding the conditions under which decentralized natural resources management has led to sustainable management of forests, coastlines and protected areas. Use these examples to inform natural resources policy and planning, to promote replication of good practices; (sic)*

## **6.2.2. NRM/EPIQ Workplan Organization and Implementation Approach and Its Relation to This SWM TOR**

NRM/EPIQ's current two-year workplan is organized around several technical teams that cooperate on task implementation both in Jakarta and in several Indonesian provinces. The teams

work *cross-sectorally* since the objectives that drive their workplans are themselves cross-sectoral and capacity-building and governance directed in nature.

Because the decentralization process and its impact on natural resource management is the primary driver of the workplan and because that process has been haltingly implemented by Jakarta and has taken various forms in the regions, the NRM/EPIQ workplan has had to retain a dynamic and flexibly responsive character. NRM/EPIQ's flexibility and ability to achieve its objectives is in large part due to its two "focus province" offices: North Sulawesi's and East Kalimantan's regional governance initiative offices (RGIs) as well as its three secondary province offices in West Kalimantan, Central Sulawesi and Irian Jaya. The RGI offices provide critical integration, coordination, communications and networking support for all NRM partners and key collaborating organizations including government, NGOs and private sector entities, academic organizations and others working with the NRM Program in those provinces. In both provinces, but especially in North Sulawesi, the RGI offices have more recently also begun limited direct construction and equipment provision, especially in Bunaken.

NRM/EPIQ's Jakarta Secretariat maintains a core group of expatriate and Indonesian technical consultants in several economic, legal/institutional and technical fields as well as management services to provide backstop support to the RGI and secondary provincial offices as well as national level agencies and USAID. The RGI offices, by contrast, are staffed primarily to serve the priorities and activities in the regional workplans. The RGI offices build alliances with local organizations, government agencies, the media and universities to bring those parties together to plan and implement activities, resolve conflicts and to develop new legal mechanisms and institutions. The RGI offices are also in a good position to leverage the financial or technical resources of other donors, projects and local stakeholders (including private sector) partly because they are perceived to be a "neutral party" and partly because their local presence insures a continuously active and responsible party and co-implementer. NRM/EPIQ's local outreach, awareness and environmental education activities help to support both more effective and better informed constituencies for environmental management and also to demonstrate how informed advocacy, transparency and public participation can be critical to sustainable resource management. This aspect of the RGI structure and approach is likely to be critical to this SWM initiative in which widespread public awareness and participation is essential to success.

The NRN/EPIQ project provides a number of significant strengths for the proposed solid waste management initiative because:

1. The NRM/EPIQ project provides a **strong local presence** through its Manado office to monitor and provide input to each activity defined in the solid waste management initiative.
2. The NRM/EPIQ project has developed a **successful model for local participation in the management of an environmental resource** through the Bunaken National Park advisory council. This can serve as a model by which to build a similarly structured municipal or village level advisory group to support the solid waste management initiative in their jurisdiction.
3. The mayor of the municipality Manado has already stated that there is a problem with solid waste management in the city. This statement has included summary points concerning the sources of the problem as well as potential remedies, which are in concert with evaluation team's perception of the problem. **Several of these potential remedies are in concert with the type of activities that the NRM/EPIQ project has successfully accomplished in the past.**
4. A local grassroots organization, KPS, has already been formed in one of Manado's Kelurahan and has begun a pilot program aimed at enhancing solid waste management at the village level. This local group and their program can serve as a model for expanding and enhancing the basic level of solid waste management in similar units of government throughout the city. **The NRM/EPIQ project has successfully worked with other local groups in its current program.**

For the purposes of this activity design, USAID/Indonesia may choose to bring in one or more other USAID partners, including those from other offices such as the Decentralized and Participatory Local Government (DLG). It is beyond the proper scope of work for this assessment team to make recommendations to USAID about the choice of specific partners. However, in sections 7 and 8 following, we will try to be as specific as possible in identifying specific tasks and also where NRM/EPIQ, at least, is suitable to tackle these and where another entity might be more appropriate.

## 7. Recommendations

The evaluation team recommends that USAID support a program of strategic interventions aimed at mitigating the effects of improper solid waste management in Manado. These interventions should be aimed at increasing the effectiveness of SWM in Manado with a particular emphasis on better and more efficient organization of the **collection** of solid waste. USAID's support should be provided in both a **reactive and proactive approach** to the problem.

In a **reactive approach**, support should be provided to provide the means by which accumulated solid waste can be cleaned up on a regular and systematic basis, focusing on the periodic flows through Manado Bay and Bunaken Island as a first priority. This will require a guarantee from the side of the municipality of Manado that community-collected solid-waste will be picked up, and that the final controlled landfill site will be managed in accordance with technical requirements. However, neither USAID nor its partners can be responsible for ensuring the compliance with the design and operation of the new TPA. The assessment team hopes and expects that the World Bank will remain engaged with the City of Manado on this issue into the future.

In the **proactive approach**, assistance should be provided to enhance the collection of solid waste in Manado through capacity building elements at both the municipal and *kecamatan/kelurahan* levels, support for collection and reduction/reuse/recycling initiatives through continued support of the pilot project in Kleak, Kecamatan Malalayang and other selected communities to be determined in the course of the proposed activity. The manner in which this assistance is provided is further described in the following section of this assessment report.



## 8. Intervention Workplan

The evaluation team recommends that the solid waste interventions supported by USAID should focus on four activity areas for which the following Terms of Reference (TOR) have been established. The proposed TOR relate to specific activities, which the evaluation team believes can have both an immediate and long-term impact on SWM in Manado. However, it should be noted that some of the objectives related to these initiatives will require some time to take hold and to achieve the overall desired result of improved SWM in Manado and the elimination of solid waste flowing to Bunaken Island.

The following TOR is aimed primarily at *knowledge transfer and program support*, which will assist those involved in enhancing SWM in Manado. Through the initiatives defined by the TORs, technical knowledge can be transferred concerning the basics of how the current solid waste problems can be managed without the necessity of high technology solutions, which require technical specialists and significant financial resources to implement. The assessment team strongly believes the SWM problem in Manado has little to do with technology or even basic equipment but more to do with planning, organization, training and incentives. The initiatives proposed here also are intended to assist in the transition of responsibility currently occurring as a result of decentralization of the SWM process in Manado.

### 8.1 Recommended Activities

Recommended activities for the USAID Solid Waste Management Initiative in Manado include the following:

**1. Capacity Building Element 1 – Technical support for the improvement and expansion of the formal solid waste collection program in Manado** - The intent of this activity is to increase the technical knowledge of municipal and district leaders and solid waste managers in the design, implementation, management and performance monitoring of effective solid waste collection in the city.

**Implementers:** *Primarily “Other USAID” with support from NRM/EPIQ (see specific activities below)*

**2. Capacity Building Element 2 – Technical and financial support for development and implementation of village-level solid waste collection and recycling/reuse programs -**

Support will be provided to the Kleak community group to further development and evaluation of their experimental project for community-based solid waste management and recycling. The intent of this activity is to sustain their pilot program effort and to refine their experience as a model for other *kelurahans* and districts in Manado. Using the Kleak community as technical resource and motivator, a number of other typical *kelurahans* will be similarly supported to develop their own collection systems that integrate into the formal BPPK collection and disposal system. The communities will be strategically located to achieve best impact and demonstration effect. In addition, assistance will be provided to *Kecamatan* level officials who will be responsible for developing SWM management programs for their districts.

**Implementers:** *Primarily “Other USAID” with support from NRM/EPIQ (see specific activities below)*

**3. Technical and financial support for development of a programmatic solid waste monitoring and cleanup program at Bunaken Island** - Support will be provided for alleviating current solid waste problems at Bunaken Island including development of a regular cleanup work plan and support for more effective solid waste management within the villages of Bunaken Island. Inclusion of the Bunaken National Park Advisory Board in this ongoing monitoring and clean-up program will also be a target of this support element.

**Implementers:** *Primarily NRM/EPIQ, World Wildlife Fund-Indonesia (SulUt office), the Bunaken National Marine Park Advisory Board, Bapedalda-Kota Manado and BPPKM Manado (see specific activities below)*

**4. Institutional support for development of a public awareness campaign concerning solid waste management.** - A public awareness program will be developed and implemented aimed at increasing the awareness of the public in Manado concerning their role in effective solid waste management. This program will also include the development and dissemination of information relative to the economic and environmental impacts of ineffective solid waste management in Manado to demonstrate its importance to all residents of the city.

**Implementers:** *Primarily NRM/EPIQ with the assistance of local NGO and media partners (see specific activities below)*

Although it is difficult to estimate precise timeframes for these four activities, our best guess for the purposes of activity design are that the two Capacity Building Elements would take 1 year for detailed design, implementation, evaluation and follow-up (especially for further training). The time frame required for Activities 3 and 4 would be six months with continuous monitoring and follow on activities as needed.

## 8.2 Specific Work Tasks by Activity

Specific work tasks for each of the above activities are presented below. It should be emphasized that any further specification of detail beyond that provided herein really requires the participation of a) the Manado City Government, discussions between NRM/EPIQ and any other USAID implementer that might be requested to be involved and local NGO and university partners already active to some extent in the improvement of SWM in Manado. This section can identify partners and types of activities for NRM/EPIQ and for the partners with whom it works in Manado. USAID/Jakarta will determine the roles of other USAID partners in an appropriate contractual or grant vehicle, to be specified by the Mission.

Ideally, the development of joint workplans with appropriate MOUs or other protocols with local partners would be an early implementation step (as noted below).

### 8.2.1 Detailed Design and Preparation Stage

#### Activity 1: Development of Further Information: Manado SWM Profile

- 1 Based on the results of this assessment, there clearly are gaps in the knowledge base that would constitute a proper planning and managing profile for solid waste management in Manado. The information needed can be sorted into three categories:
  - a) Physical impacts and location characteristics
    - i. Areas of the city mapped by kelurahan and/or RT where the biggest problems of lack of collection and/or improper disposal occur. This can also contribute to targeting of awareness and clean-up campaigns and additional KPS-type neighborhood experiments.
    - ii. Seasonal fluctuations in solid waste flows
    - iii. Better understanding of composition of solid waste flows in the environment especially waterways and informal TPS
  - b) Behavioral information
    - i. Surveys of public knowledge, attitudes and practices with respect to SWM specifically aimed at development and/or support for the new *kecamatan/kelurahan* decentralization
    - ii. Surveys and other research on the roles of scavengers, potential for business development in recycling, reuse and source reduction, especially public attitudes towards reducing the use of plastic bags.

c) Management related information

- i. BPPKM budget trends and allocation including use of existing levies and taxes; how these would change under the local decentralization plan
- ii. Coordination and integration of *Tata Kota, Tata Ruang, Prasarana Kota, BPPKM, Bapedalda-Kota, DPRD-Kota* (city council) in city infrastructure planning, design, licensing and budgeting. Aimed at helping to design future training and re-organization where needed.
- iii. Issues and procedures related to management of basic BPPKM functions: training and capacity development needs, fiscal and planning needs, etc.

**Activity 2: Selection of Other USAID Implementer and Determination of the Roles of the Various Partners, including local governments and NGOs.**

- d) Development of a USAID task order, contract, grant or other mechanism for portions of the Solid Waste Initiative for Manado (SWIM)
  - e) Further discussion and development of MOUs or other informal agreements with NGOs and government counterparts on SWIM activities and roles. These include WWF-Manado, DPTNB, Kelola for Bunaken related activities and Kelompok Peduli Sampah, Dian Sulawesi, and Yayasan Bina Sulawesi or others on community roles and initiatives in reuse, recycling, scavengers and similar
2. Development of a joint workplan, performance objectives and annual targets

**Activity 3:**

**OBJECTIVE: Technical support for the improvement and expansion of the formal solid waste collection program in Manado**

Work tasks within each this general activity include the following:

1. Complete a detailed assessment and program profile of existing BPPKM solid waste collection in Manado including, but not limited to, level of service, available assets, and current performance standards. *NRM/EPIQ and local government*
2. Based on the detailed assessment completed in Task 1 above, determine program deficiencies and areas of improvement necessary to make the current collection program more efficient and to increase its area of service coverage. *NRM/EPIQ and local government with Other USAID*

3. Develop a transition plan for decentralization of the solid waste collection function in Manado. *NRM/EPIQ and local government with Other USAID*
4. Develop a collection primer based on the preliminary technical information presented in Annex 1 to be used in facilitating the decentralization of the collection process with a strong focus on household level collection within each district. In the near term, this primer should assist the municipality in evaluating its collection program and in facilitating the transfer of responsibility for collection to the districts in Manado. *NRM/EPIQ and local government with Other USAID*
5. Organize and present a workshop concerning the design, implementation and performance monitoring of sustainable and effective SWM in Manado. (This single day workshop may be coordinated with activity 2 shown below and could be the first day of a two day comprehensive program on waste collection at the municipal, district and household level.) *NRM/EPIQ and local government with Other USAID*
6. Additional training in budget planning, performance standards, hazardous waste management, participatory (*kelurahan* level) planning, extension and enforcement. *NRM/EPIQ and local government with Other USAID.*

### **Activity Deliverables**

The following activity deliverables will be derived from accomplishing the above activity tasks.

1. A detailed assessment report and program profile of the existing SWM collection program in Manado
2. A collection primer for education of SWM managers in the City of Manado

A workshop aimed at the design, operation and sustainable maintenance of an effective solid waste collection system in Manado. (This workshop should be developed in conjunction with work tasks associated with Activity 4 outlined below.)

### **Activity 4:**

**OBJECTIVE: Technical and financial support for development and implementation of village-level solid waste collection and recycling/reuse programs**

Work tasks within each this general activity include the following:

1. Define and present typical solid waste collection processes available to individual village configurations within Manado including collection from residential and commercial areas as well as from informal and refugee settlements. Table 8.1 presents an array of actions by type *NRM/EPIQ and Other USAID*.
2. Provide technical information by which to estimate TPS service and location requirements for effective, regular collection in each district based a reasonable standard of convenience to household waste generators. (This activity is intended to assist *Kecamatan* leaders to review the collection impact of specific conditions within their area of jurisdiction.) *Other USAID*
3. Define and evaluate market and reuse opportunities for recycled and recovered materials (including recovery of materials for sale and for compost production and use) for the purpose of increasing the rate of recycling and material recovery in Manado. *NRM/EPIQ, local NGO partners and some local government (kelurahan)*
4. Evaluate and present information concerning small-scale compost systems that can be functional at household or village sub levels. *NRM/EPIQ, local NGO partners and some local government (kelurahan)*
5. Organize and present a one-day workshop concerning the collection and recycling/reuse of solid waste at the district level. (This single day workshop may be coordinated with activity 1 shown above and could be the second day of a two-day comprehensive program on solid waste collection.) *NRM/EPIQ, local NGO partners and Other USAID*.

### **Activity Deliverables**

The following activity deliverables will be derived from accomplishing the above work tasks.

1. A work plan for support and documentation of the Kleak pilot project defining the means by which financial support will be provided for the pilot program and the target results for the program.
2. An evaluation report of the Kleak pilot project aimed at defining the project as a model for use in the other districts of Manado.

3. A collection primer for education of district leaders who will adopt responsibility for SWM in the Manado districts as a result of the SWM program decentralization.
4. A workshop aimed at the design, operation and sustainable maintenance of an effective solid waste collection system focused at the household level of the SWM process. (This workshop should be developed in conjunction with work tasks associated with Activity 3 outlined above.)

#### **Activity 5:**

#### **OBJECTIVE: Technical and financial support for development of a programmatic solid waste monitoring and cleanup program at Bunaken Island**

Work tasks within each this general activity include the following:

1. Provide financial assistance in repairing the boat historically used to transport solid waste from Bunaken Island to Manado for disposal. *NRM/EPIQ with DPTNB and BPPKM*
2. Assist the municipality in preparing and managing regular drainage cleanup at critical points to prevent (a) flooding as well as (b) solid waste entering the Manado bay. *NRM/EPIQ with DPTNB, WWF-Manado and BPPKM as well as Kecamatan Bunaken*
3. Organize the technical and economic means by which periodic cleanup of the beaches along Bunaken Island can occur on a programmed regular schedule. *NRM/EPIQ with DPTNB*
4. Involve the Bunaken National Park advisory board in monitoring and implementation of regular cleanup efforts on the Island and in the supervision of waste collection and transport from Bunaken Island to Manado. *NRM/EPIQ with DPTNB*
5. Establish the means by which progress in reducing the amount of solid waste that reaches Bunaken Island and its natural resource areas can be monitored. *NRM/EPIQ with DPTNB*

#### **Activity Deliverables**

The following activity deliverables will be derived from accomplishing the above work tasks.

1. Repair and renewed operation of the boat for removal of solid waste from Bunaken Island.

2. A work plan defining collection methodology and schedule for regular clean-up at Bunaken Island. The work plan will also include the integration of the Bunaken National Marine Park Advisory Council in the administration and monitoring of the clean-up program.
3. Financial support for implementation of the programmed clean-up program.

#### **Activity 6:**

#### **OBJECTIVE: Institutional support for development of a public awareness campaign concerning solid waste management in Manado, including Bunaken Island**

Work tasks within each this general activity include the following:

1. Develop poster and alternate media presentations and materials for increasing the awareness of solid waste management matters for use within the city of Manado and on Bunaken Island. *NRM/EPIQ with WWF-Manado and possibly Kelola*
2. Organize media cooperation and events aimed at increasing the awareness of solid waste management issues including the effect of improper solid waste management in Manado, on the Bunaken National Park and on the tourism economy of Manado and region. *NRM/EPIQ with DPTN, WWF-Manado, Manado Post, Suara FM and local businesses*
3. Secure the involvement of the Manado business community in developing a sustainable public awareness program that continues beyond the USAID supported program initiative. *NRM/EPIQ with DPTN, WWF-Manado, Manado Post, Suara FM and local businesses.*

#### **Activity Deliverables**

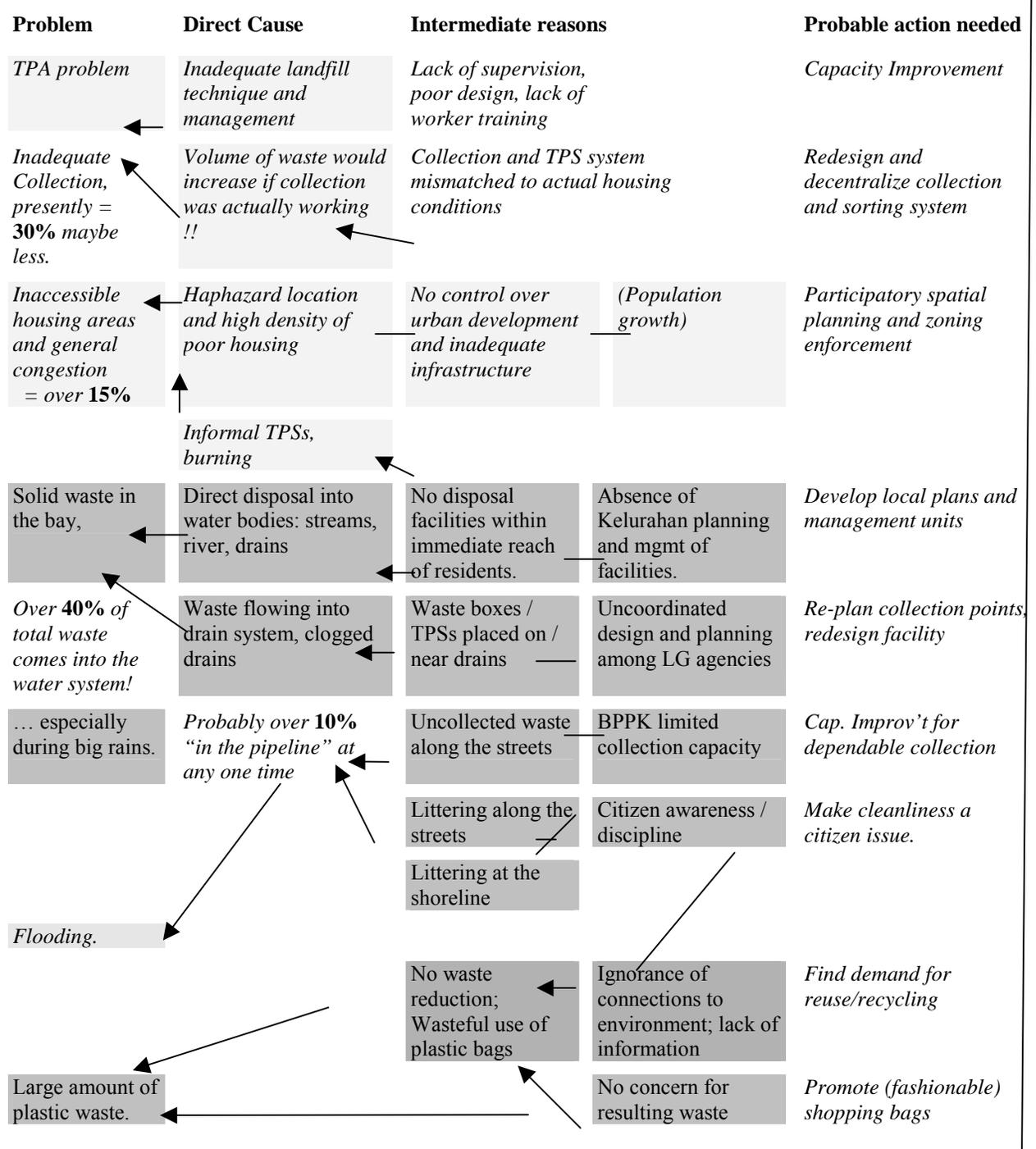
The following activity deliverables will be derived from accomplishing the above activity tasks.

1. A work plan for development and implementation of an effective public awareness outreach campaign for SWM in Manado

Campaign materials and organizational support

# Annex 1: Additional Background Material, References and National Schedule

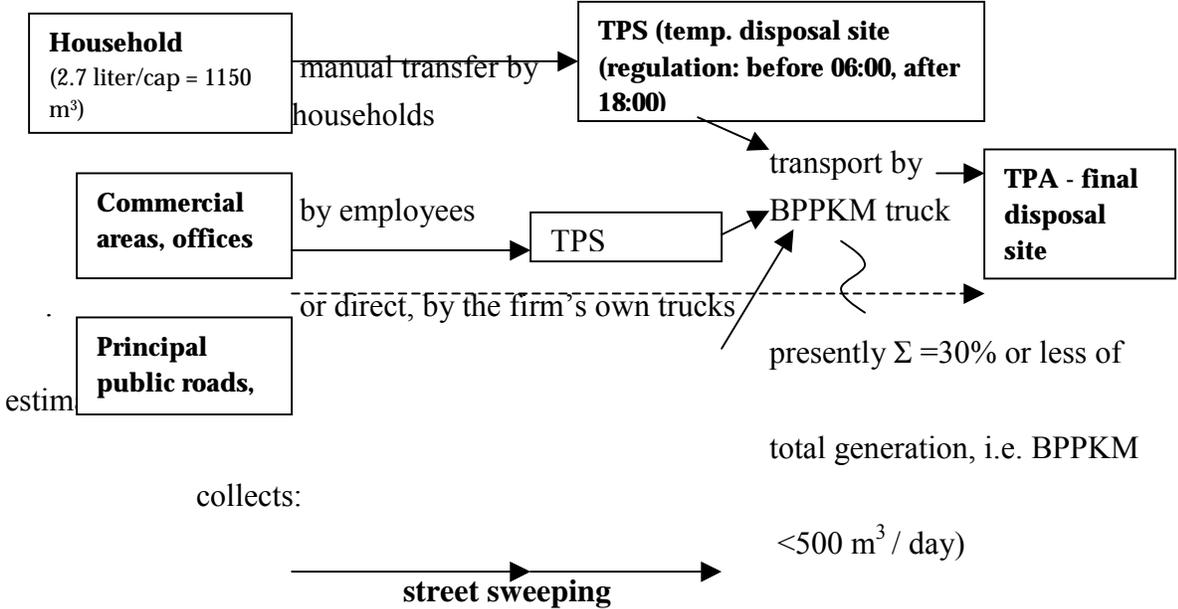
**Schematic of the various causes and Probable Solutions to the SWM problem in Manado**



## Examples of Some Types of Actions SWM Might Undertake

<b>1 No littering</b>	
➤ Clean environment	<ul style="list-style-type: none"> <li>• Campaign with media, in schools;</li> <li>• Competitions among RWs and schools; assess the roles of various media in extension</li> </ul>
➤ Waste collected at proper locations and containers: waste coming into the disposal stream at the right points	
<b>2. Collect – dispose</b>	
	<ul style="list-style-type: none"> <li>• Transport system: crew and vehicles → World Bank IUIDP’s concern; can Other USAID contribute?</li> <li>• What is important = NRM’s focus and support at critical organizational points of failure of the system</li> <li>• Local Government – private sector partnerships for collection, disposal, landfill maintenance (?).</li> <li>• Street sweeping</li> <li>• Drain cleaning (sieves/screens which are easy to lift?)</li> </ul>
<b>2 Reduce</b>	
➤ Reduction of volume of solid waste coming into final disposal site	<ul style="list-style-type: none"> <li>• Campaigns. Most of the collected garbage is organic matter. How much can be composted or used in local animal husbandry</li> </ul>
➤ Longer use of articles (packaging, bags, cups, furniture)	<ul style="list-style-type: none"> <li>• Focus on unnecessary use of plastic bags, substitutes, fiscal measures</li> </ul>
<b>3 Reuse, recycling</b>	
➤ value for SW = create demand for waste	<ul style="list-style-type: none"> <li>• Development of fiscal incentives, licensing, organization at the kelurahan level</li> </ul>
➤ reduction of volume of SW	<ul style="list-style-type: none"> <li>• Compost and scavenged materials (glass, plastic and metal)</li> </ul>
<b>4 Recover</b>	
➤ Unrecyclable waste into bricks, fuel, etc. at final dumpsite or kelurahan level:	<ul style="list-style-type: none"> <li>• regulations prevent BPPKM from collecting construction waste (<i>puing-puing</i>); yard waste, tree prunings, etc.</li> </ul>
➤ Also results in longer life of FDS.	

# Schematic of the Current Formal SWM System in Manado.



# Examples of Some Innovations in Urban Waste Management in Indonesia: Some Successful, Others Less So

## *Surabaya*

- 1) Citizen participation:
  - a) Local *kelurahan* waste-collection, support by local government in the form of timely pick-up; smart yellow uniforms for workers
  - b) Provision of garbage bins.
- 2) Transport:
  - a) Sanctions for pick-up when waste is left at TPS (temporary dumpsite)
  - b) Incentives for transporting large volumes.
- 3) Rotating use of dumpsites:
  - a) With large volume of recycling, final waste is 85% organic. KMS (Kotamadya Surabaya) adopts temporary closing of several dumpsites / “*pantang berkala*” to let waste become denser, site is then reused later repeatedly until a hill is created, after which the site is made into a green space.
  - b) Effect on ground water unknown Can this sort of approach be integrated into spatial plans?

## *Bandung*

- 1) ‘Bad Practice’: ADB funded project (mid-1980s): ‘closed’ system from household to sanitary landfill site:
  - a) HH bins used for other purposes (making holes in the bins to prevent this had no effect)
  - b) Containers corroded quickly (humidity of Bandung waste); most containers just became ‘landmarks’ or ‘signposts’ for littering around them.
  - c) Scavengers lost sources of recyclable materials at first. Later negotiations with PDK (local garbage agency) people allowed scavenging inside garbage containers.
  - d) Load-haul trucks still partly in use; however, maintenance problems and obstruction to traffic.
  - e) Sanitary landfill became a controlled landfill site
- 2) Efforts to compost, farming of seedlings at final dumpsite in Cimahi / Leuwigajah were tried with assistance from ITB. Main obstruction getting acceptance by local government, free plot of land and markets for these alternative products.

## *Sources of Further Information and Expertise:*

### **Local Government Agencies:**

Manado: Badan Pengelolaan Pembersihan Kota Manado (BPPKM)

Mayor: Wimpie Frederik 0431-863003, 0431-863086 (?)

Kapet-Bitung (Bitung Industrial Development Zone): Ferdy Cambey

### **North Sulawesi**

Dinas Cipta Karya (agency for human settlements)

### **Surabaya:**

Eddy Indrayana (now head of Public Works, prov. of East Java), Johan Silas (lecturer, ITS dept. of Architecture)

### **Universities:**

Bandung: PPLH-ITB. PD Kebersihan (see sawarung egroups).Puslitbangkim

UNSRAT kampus Kleak 0431-863086 (?) Urban Mgt.: Linda Tondobalo 0811-432657

### **NGOs:**

MSF AudeThorel jl.Tikala Baru 0811-431327 0431-541396

Peka: Yustinus: info-com

PPK - Team Leader FK: Hasan Abdullah 0431-831882 (mbantuin lacak mi) → rural development

Yayasan Bina Mandiri: Manado; John Taylor, Sigit (CO) 869380; Treis 823835; Imelda 843912  
Catur 867813, Meidy

NRM-Manado: (a) EPIQ; (b) CRMP – coastal resources management

### **Resource persons:**

Bob / Sinarko Wibowo (san.engineer, ex PPIS-Manado, now at MIP, MOH-RA)

Nayoan, Eman (former mayor 1984/85-1994/95)

Waworoentoe (Arini, Hannie) Tomohon 0431-352458

## Preliminary Schedule of Activities, Partners, Roles For SWM

	Activity, Tasks	Probable Scope	Target Group	(units)	Possible Other USAID Partners	Role of Counterpart(s)	Recommended Mode of Cooperation	NRM role
1	<b>Technical support to SWM in Manado</b>	municipality of Manado	all municipality agencies	v	SUM / Sustain-able Urban Management - USAID	plan & budget commitments; coordination with related agencies & programs.	(1) coordination; (2) NRM modules for Manado context (see primer); (3) NRM participation in relevant inter-agency meetings.	As (1) entry point for USAID assistance to other sectors; (2) implement general municipal strategy & plans (PJM).
		Manado agencies, community org's, private sector	agencies, CBOs, private sector.		PERFORM project	participatory development (PDPP) planning	communication	assist BPPKM to participate in PDPP process
1.1	profile of existing SWM; determine deficiencies & improvement areas	Manado urban area	all Kecamatans & SW generators	9 Kec.	NRM/EPIQ		NRM task + subcontract to LPM-Unsrat	assessment team
1.2	primer, guidelines for BPPKM, kelurahans				SUM / Sustain-able Urban Management - USAID		NRM task: package for BPPKM > guidelines, training modules; also SUM matter	NRM: BPPKM package > support guidelines, onthejob training modules
1.3	Workshop & training	Training & comparative studies/ "best practice" visits	BPPK staff & kelurahan activists	15 prsns	Unsrat; Surabaya SWM agency			Training workshops, onthejob training
1.4	assist Manado & BPPKM in SWM system improv't				SUM / Sustain-able Urban Management - USAID		NRM responsible for component of SUM or stand alone activity?	NRM: BPPKM package > support guidelines, onthejob training modules

1.5	BPPKM capacity building				SUM / Sustain-able Urban Management - USAID		NRM: * training modules, * personnel motivation	NRM: link to kecamatan & kelurahan SWM personnel* training modules, * personnel motivation
2	<b>Support for SW monitoring &amp; clean-up for Bunaken</b>							Dewan Pengelolaan TN Bunaken has the lead role; support from NRM/EPIQ WWF-SulUt
2.1	Cleanup program: drain system				BPPKM coastal zone pilot kelurahans			Dewan Pengelolaan TN Bunaken has the lead role; support from NRM/EPIQ and BPPKM
2.2	Fix the garbage scow to Buanken							Dewan Pengelolaan TN Bunaken has the lead role; support from NRM/EPIQ WWF-SulUt
3	<b>Support to kelurahan-level SWM</b>				Kelompok Peduli Sampah ( KPS) start with Kleak Kel. move to thers			
3.2		organize recycling / groups	Focus on old TPA & scavengers in kelurahan level	local, TPA				
3.3		link to market for recycled SW	Work with operations and buyers	middle-men				Airmadidi operation; other buyers



**Annex 2:**  
**Developing Effective Solid Waste Management in Manado**

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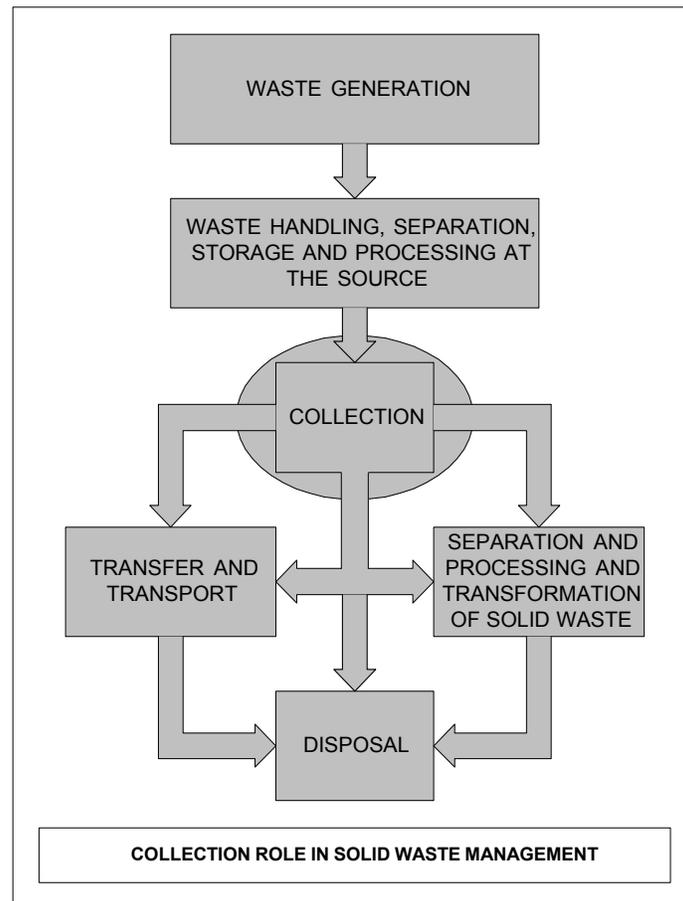
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# 1. User's Guide

This manual is intended to provide a basic level of knowledge concerning effective and sustainable solid waste collection. In its approach, the manual presents background information concerning the principle work tasks associated with achieving effective primary solid waste collection (under the jurisdiction of the local governments) and secondary transfer (under the jurisdiction of the SWM Councils) in Manado. To that end, information is provided for:

1. **Assessing** current collection practices
2. **Designing** a primary collection and secondary transfer system
3. **Operating and maintaining** the primary collection and secondary transfer system to preserve its effectiveness after all resources are in place and designated responsibilities have been assumed.





## 2. Assessing Current Collection Practices

The starting point for any program aimed at achieving effective solid waste collection is an assessment of the current collection system. It is extremely important that both the hard aspects (containers, vehicles, transfer points, transfer stations, etc.) and the soft issues (scheduling, route structures, fee systems and legal/political framework) be evaluated and viewed geographically to determine that they are appropriate to the setting in which collection and transfer is to occur.

### 2.1 Determine Community Goals and Constraints

The inability to manage urban solid waste in any community may be due to problems and failures in a number of areas, including:

- Inadequate services and level of coverage;
- Inadequate financing;
- Random and substandard uncontrolled dumps;
- Inadequate environmental controls throughout the solid waste management program;
- Poor institutional structure including ineffective laws and regulations that do not mandate sound practices; and
- Inadequate sanitation practices by solid waste generators.

Basically, those responsible for solid waste management must seek to address the above problems by establishing community objectives aimed at solving the problems. The objectives must attempt to answer the following questions:

- **Fundamental Changes in the Required Collection Structure** –What impact will the establishment of new regional disposal facilities have on collection practices and the need for secondary transfer?
- **Level of service:** What level of service is required to meet the communities' needs? What expectations exist with respect to the frequency of pickup and the convenience of set-out or communal collection requirements for solid waste generators at the local government level?
- **Roles for the public and private sectors:** Is there a policy preference regarding the roles of the public and private sectors in providing waste collection services? How will the informal private sector participate in the program? Is the informal private sector apt to be an impediment to achieving effective collection?
- **System funding:** How can any improvements in solid waste collection be funded at either the local government or SWM Council level?

Each of the above issues is influenced by a number of factors that often constrain the development and implementation of effective solid waste management systems. These include:

- **Technical Constraints** – Is there sufficient technical expertise to design effective collection systems?
- **Financial and Economic Constraints** – Are sufficient funds available to finance the required improvements and systems?
- **Institutional Constraints** – Are the rules and regulations in the region strong enough to mandate effective collection and transfer practices? Are existing laws and regulations enforced?

Those responsible for collection must understand the nature and local aspects of these constraints so as to establish reasonable objectives for solid waste collection that are sustainable in the region.

## **2.2 Establish Sustainable Objectives for Effective Collection and Transfer**

The development of an effective collection system requires that a desired level of service be defined. The frequency of routine collection and the type of collection service provided to solid waste generators commonly defines **Level of Service**. Type of service will influence the local government level of service and, ultimately, the cost of collection. Whether a collection crew picks up solid waste at specific set-out location such as curbside or backyards determines the time required for each collection stop and ultimately the costs associated with that stop. Curbside collection requires that residents place waste containers at curbside on a designated day. This is usually less expensive than backyard service but significantly more expensive than communal collection configurations. The use of central collection through strategically placed containers can decrease the cost of collection by focusing collection to common locations that serve many residential waste generators.

## **2.3 Define Sustainable Practices for Solid Waste Collection in the Region**

One of the most difficult municipal problems in any country is the management of solid waste generated within them. Deficiencies in the management of solid waste is often pronounced in the villages, towns and cities of developing countries where poorer or remote areas often receive little or no service. In other areas, the level of service is often inconsistent or below a desired standard. Solid waste collection is one of the most visible services provided in any community and the failure of a collection program is often the reason why people feel that a solid waste



Figure 2-1 - Improperly Serviced Containers

management program is ineffective. While few people come in direct contact with dump areas, everybody will come into contact with the collection system in some form.

The primary objective of solid waste collection is to simply provide physical separation of solid waste from its generators and the processing or disposal facilities to which the solid waste is ultimately delivered. Unfortunately, collection is one of

comprehensive solid waste management program's most difficult and complex components.

From an economic viewpoint, solid waste collection is usually that element of a solid waste program that costs the most. In industrialized countries, collection accounts for approximately 60 to 70 percent of the total cost of solid waste management while, in developing countries, collection can be up to 70 to 90 percent of the total costs. Jointly, collection and street sweeping often comprise the largest category of expenditures in many municipal budgets. The magnitude of these expenditures is justified, however, since the failure or inadequacy of a collection system can have significant public health effects and can affect the quality of life where people live and work. In many developing countries, the following generally apply to solid waste collection:

1. Waste collection and street sweeping are often very inefficient and the level of service is low;
2. Workers are often poorly motivated, untrained, and poorly compensated;
3. Collection workers are often equipped with obsolete or barely functioning equipment with no backup equipment to maintain a consistent level of service;
4. Collection routes often do not keep up with rapid urban growth; and
5. There is a major difference between the levels of service in poor areas from more affluent areas.
6. Solid waste generators must often bring waste materials long distances to containers that are often difficult to use and frequently overflowing due to an inability to keep them serviced.
7. Collection activities in developing countries often include a strong involvement of the informal sector such as small businesses or poor individuals who subsist on materials recovered from waste streams.
8. The use of muscle-powered vehicles such as hand or animal-drawn carts is common.

**Alternative solid waste collection and transfer configurations** - There are a number of different methods for collecting solid waste; many of which focus on the alternative interface

points between the waste generators and the entry of their waste into the formal collection program. The following factors have a direct bearing on the collection system choices for any particular situation or location:

1. **Waste generation rate** - The rate of waste generation has a significant impact on the collection system and its technical choices (vehicles, containers, etc.). The more affluent a community, the greater will be the rate at which it generates solid waste. In developing countries, the average generation rate is within the range of 0.3 to 0.5 kilograms per capita per day.
2. **Waste density** - The density of waste varies depending on the relative affluence of the community and the way in which waste is handled and stored. The waste in developing countries is naturally dense, ranging between 300 to 500 kg/m<sup>3</sup>. Compaction trucks are typically designed to compact light refuse to about 100 to 400 kg/m<sup>3</sup>. Therefore, developing countries may require little or no compaction. This may negate the value of technically complex collection vehicles or compactor based transfer stations such as those found in industrialized countries.
3. **Transport conditions** - Road conditions, traffic density and haul distance have a significant influence on collection and transfer vehicle choices.

There are four basic primary solid waste collection approaches available to the local governments to accomplish primary collection, including:

1. Communal collection,
2. Block collection (also referred to as just-in-time collection),
3. Curbside/alley collection, and
4. Door-to-door collection.

In communal collection, a public place is defined as a communal collection point and shared by the community for collection. In block collection, a collection vehicle stops at a convenient place and generators deliver their waste to the vehicle at the designated time of collection. In curbside collection, the householders put out their waste containers that they retrieve later after collection is completed. In door-to-door collection, a collector enters the premises for collection of the waste.

As would be expected, the choice of an approach to collection will influence the convenience of the collection system for the public. Unfortunately, as is the case with many things, increased convenience often translates into increased cost. Various advantages and disadvantages of each of the approaches commonly used in regions similar to Manado are as follows:

**Communal Collection** - One crucial aspect of using a communal collection approach is the decisions as to where containers are placed. These points can consist of street corners, several locations on densely populated streets, or at the edge of neighborhoods or villages accessible to generators and collection vehicles.

One of the main advantages of communal collection points is that they allow a household to potentially have continual access to a disposal point. Conversely, if a communal collection point receives little attention, containers may overflow and cause problems such as odors and insects. In some cases, residents near communal collection points have started fires to minimize odors or insects. This, in turn, increases the health exposure of improper solid waste management to an even larger number of people as a result of the smoke from the fires.



**Figure 2-2**  
**Burning Waste in Communal Containers**

Sound practice in communal collection design requires that solid waste managers understand the potential conflict that exists between the need to accomplish public convenience and the strategies required to maintain cleanliness and sanitary conditions around communal containers.



**Figure 2-3**  
**Improperly Service Containers with Burning Waste**

They must also strategize how to control waste pickers, odors, animals and vectors who affect conditions around communal containers. Sound practice requires that there are an adequate number of containers distributed at appropriately located collection points. These containers must be easy to use even for children who are often called upon by their parents to bring solid waste to the communal collection point. Sound practice

also requires that program managers commit to carry out frequent collection and cleanup overflows as they occur for whatever reason. Basic advantages and disadvantages to the communal collection approach are as follows:

***Advantages:***

- Drop-off in a communal container is the least expensive of methods.
- This method involves lower collection staffing requirements than the other methods.

***Disadvantages:***

- Residents are inconvenienced by having to bring their waste to the collection point.
- There is increased risk of injury to residents.
- Illegal dumping/scavenging may occur leading to waste accumulation near the container.

**Curb-side/Alley Collection** – This method of collection is common in industrialized countries. Advantages and disadvantages of this approach are as follows:

***Advantages:***

- Collection crew can move quickly from one collection stop to another.
- Collection crew does not enter private property.
- This method is less costly than backyard collection because it generally requires less time and fewer collection personnel to access the solid waste and.
- The approach is adaptable to automated and semi-automated collection equipment.

***Disadvantages:***

- On collection days, waste containers are visible from street.
- Collection days must follow a consistent and reliable schedule.
- Residents are responsible for placing containers at the proper collection point.
- The cost of this level of service may be prohibitive in areas with limited resources

The following are general conclusions relative to the various types of collection systems.

1. Communal storage systems probably offer the lowest collection costs and most flexibility in most developing countries.
2. Block collections at fixed time intervals appears to offer low collection costs and avoids the problems that arise with communal storage or curbside collection but requires consistent and reliable application for success. One disadvantage, however, is that it requires that somebody be at home at the time that the truck arrives at the collection point for waste collection.

3. Door-to-door or curbside/alley collection using motor vehicles and collection crews will usually be the most expensive system.

**Primary Collection Vehicles** - Solid waste managers must choose vehicles that are suited to the characteristics of the collection service area. Primary collection vehicles can range from muscle powered carts and wagons to sophisticated solid waste compactors. There are a number of issues that can affect vehicle selection including 1) anticipated service levels, 2) crew size, 3) collection route characteristics and 4) budgetary constraints.



Figure 2-4 Open Collection Truck

Conventional dump trucks are often used in solid waste collection. These have the advantage of being readily versatile and available in most countries. Repair and maintenance is less specialized (and therefore less costly) than that for vehicles designed solely for the purpose of collecting solid waste.

Waste compaction vehicles are normally classified by loading characteristics and is classified as either rear-loaded or side-loaded.

Rear load trucks are best suited to

areas that have a high population and where there are frequent and numerous collection stops. This loading configuration allows both sides of a street or alley to be collected at the same time. Side loaded vehicles are best suited to densely populated areas where collection takes place in only one side of the street or for rural routes.



Figure 2-5 – Front Loader Compaction Collection Vehicle

Solid waste must also be collected from commercial establishments and industries as well as residences. Typically, commercial waste differs in both quantity and composition from residential waste and is usually stored in large containers prior to pick up. Rear loading and side loading trucks similar to those used in municipal solid waste collection are often used. Also,



Figure 2-6 – Commercial Containers

front loading, and drop-off truck configurations are also used. Front loading equipment is designed for use with specifically designed containers. After a front-loading truck maneuvers to the container, the container is picked up by hydraulic arms, lifted over the truck cab, and discharged into a hopper in the top of the rear compaction body.

Trucks that are equipped to physically pick up drop-off containers are also frequently used for the collection of industrial and commercial waste. In this case, collection containers are physically picked up, transported to a disposal or processing location, emptied, and returned to

Figure 2-7  
Tilt Frame Roll-off Truck



the point of origin on the same truck. Two forms of this truck type are normally used. A dumpster type allows a container to be lifted onto a truck by hydraulically actuated arms attached near the rear of the truck. The other type uses a tilting frame that moves roll-off containers on and off using a chain or cable. Some of the advantages and disadvantages of the predominant types of solid waste collection vehicles are described below:

### Muscle powered vehicles

#### *Advantages:*

1. Particularly suited in densely populated areas with minimal street access or unpaved streets
2. Suited for squatter settlements and in rough terrain.
3. Where a relatively small volume of waste from a relatively large number of densely settled housing units must be collected.
4. Such vehicles are often inexpensive and easy to build or maintain.



Figure 2-8 – Donkey Drawn Cart

**Disadvantages:**

1. The public perception that the use of such vehicles is old-fashioned and inefficient.
2. Limited traveling range and slowness.
3. When vehicles are pulled by animals, waste materials from these animals must be cleanup.
4. More greatly affected by weather conditions and exposure.



Figure 2-9 – Muscle Powered Collection Cart

5. More susceptible to decreased efficiency due to animal temperament and health of collectors.

**Non-compactors trucks**

**Advantages:**



Figure 2-10 – Small Collection Vehicle

1. Quite efficient when waste is generally wet or dense
2. Practical where labor is inexpensive
3. Practical where there is limited access to skilled maintenance for more complex vehicles
4. Collection routes are long and relatively sparsely populated
5. Trucks are potentially universally available from local sources
6. Trucks are flexible to perform a number of different collection tasks.

**Disadvantages:**

1. Waste loads often have to be covered while transporting waste to transfer, processing or disposal points so as to prevent the deposition of waste from the trucks onto roads.



Figure 2-11 – Open Body Dump Truck

2. Some non-compactor trucks often do not have an automatic means for offloading solid waste.
3. Many government officials believe that a modern efficient collection program must include compaction vehicles and that non-compactor vehicles represent lower efficiency.
4. Donor agencies tend to recommend equipment used in their own countries and they tend to assume that compactor trucks represent the best use of their donated money.



Figure 2-12 – Rear Loaded Compactor

**Compactor trucks** - These trucks are the standard of sound practice in most industrialized countries where their cost can be afforded. These trucks have been designed specifically for the purpose of collecting solid waste.

***Advantages:***

1. Allow waste to be placed into the vehicle from either the rear or side of the vehicle.
2. Compacts the waste to a higher density using either hydraulic or mechanical pressure
3. Hides the waste from the public thereby adding to the invisibility of the collection system.
4. Prevents vectors from reaching the waste after it has been placed into a compactor truck.

***Disadvantages:***

1. High capital cost
2. They are designed for a limited purpose with little flexibility for alternative use.
3. Significant amount of mechanical mechanisms that require specialized maintenance
4. High fuel usage with the resulting high operating costs,
5. Requires paved streets wide enough to allow passage and turning during collection,
6. The waste must be set out in containers or bags so that the collection crew can to pick them up



Figure 2-13 – Side Loaded Compactor

## 3. Designing an Effective Collection System

### 3.1 Characterize the Existing Collection System

The starting point for the design of an effective solid waste collection system is a characterization of the existing system and practices. The following are a number of factors to be evaluated prior to deciding what collection modifications are warranted.

**Estimate the quantity and composition of solid waste in the service area** - While the total solid waste quantity and composition is important in the design of disposal facilities, the design of a collection and transfer system must evaluate the amount of solid waste generated in the individual segments of the collection service area or in the service areas served by individual transfer stations.

**Define the physical characteristics of collection service areas** - The physical characteristics (topography, road networks, access to collection points, etc.) of the primary collection service area can have a major impact on collection design. The accessibility of roads within the collection area is crucial in determining the types of vehicles that can be used in the collection program. Transportation patterns within the service area will determine which roads will be difficult to use during peak traffic periods.

**Develop an asset inventory** - Solid waste planners should develop an asset inventory for their collection system. This inventory should include all physical assets (trucks, containers, etc.) and personnel dedicated to the collection process. It should also include temporary assets periodically applied to the collection process. If communal containers are used, their number and location should be shown on a collection system plan that shows the extent of container placement and areas served.

**Define existing collection routes** - If curbside collection is utilized, an existing route map should be developed to show the extent and configuration of the collection route structure.

**Determine the effectiveness of the existing collection system** - An efficient collection system collects as much waste as possible with a given amount of labor and capital in as short a period as possible. The effectiveness of the existing collection system can be evaluated in a number of

ways. If the system uses communal collection, the accumulation of solid waste outside of collection containers may be an indication that the containers are not serviced frequently enough. Crew productivity is an important measure of collection efficiency. The factors that influence crew productivity include route structure, service level, collection equipment and the personal characteristics of the crew members. The collection vehicles can affect crew productivity through loading location, loading height, vehicle capacity, compaction density, and the age/condition of the truck. The individual crew member factors that can affect productivity include age, attitudes toward their work, and health. The basic means by which crew productivity can be measured is by simply observing the collection process to determine a practical level of performance that should be expected from collection crews on a regular and measurable basis. Time study observations are required to determine how a collection crew spends its time in performing its duties.

**Identify collection system deficiencies** – Because of the visibility of collection services, system deficiencies can be determined by the extent of waste accumulation outside of the collection components. Complaints are another gauge of system performance and deficiencies. The extent of collection vehicle breakdowns and their impact on the level of service can also be an indication of system deficiencies.

**Identify actual collection costs through full cost accounting** – Proper design requires that solid waste managers understand the total costs associated with solid waste management. In collection, total costs must include all cost components for full time and temporary equipment and personnel. By proper analysis of full costs of the current collection system, the savings that can be realized through improvements in collection efficiency and the service fees that need to be charged can be calculated.

### **3.2 Determine Required Collection Equipment**

In its most simplistic form, collection consists of a collector or collection crew that move through a collection service area with or without a vehicle for collecting waste materials from generators or from communal containers. Vehicles used in this process may range from small and simple to large complex automatic compaction trucks such as those used in many industrialized cities for curbside collection. Collection vehicles used in any area must be appropriate to the terrain and roads over which they must travel, the density of the service areas, the type and quantity of waste that must be collected, the strength and work habits of the collection crew, and distance to the disposal location. The following are important principles to be used in selection of vehicles.

1. Vehicles should be selected that use the minimum amount of energy and technical complexity to collect the solid waste efficiently.
2. Locally made equipment, traditional vehicle design and local expertise should be used in securing collection vehicles.
3. Equipment should only be selected that can be serviced and repaired locally and for which spare parts are readily available.
4. Muscle or animal powered vehicles or light trucks should be considered for primary collection in crowded areas or those with hilly terrain or in informal settlements.
5. Non-compactor trucks, or dump trucks should be considered where the population to be served is dispersed or where the waste material is dense or where versatility is important.
6. Hybrid systems may be considered where satellite muscle or small vehicles are used to feed larger compactor type vehicles within collection routes.
7. Compactor trucks should be considered in industrialized urban areas where roads are paved and where collection routes serve many generators and waste is not dense or too wet.

Designing a collection system means making decisions regarding the method of collection, the type and number of vehicles to be used and the extent of labor to be employed. In most developing countries wage rates are low while vehicle and equipment costs are high. Therefore, primary collection systems that yield high vehicle productivity even at the expense of labor productivity often prove to be most cost-effective.

Generally, when the haul distance does not exceed 20 kilometers, adequately powered non-compaction and semi-compaction vehicles are used to haul wastes directly to disposal sites. Optimizing crew size so that overall vehicle and labor costs are minimized best maximizes vehicle productivity.

In reviewing the transfer approach that will be best for the provision of the services for which the SWM Council's will responsible, consideration has already been given to the differences between collection containers and transfer stations as the point of interface between the primary collection and secondary transfer systems. The following table presents the comparative properties of each approach.



Figure 3-1 – Collection Crew With Open Truck

**Table 3-1  
Central Container and Transfer Facility Comparison Chart**

<b>Central Container</b>	<b>Transfer Facility</b>
Serves a given area of a municipality or village	Serves several neighboring municipalities and villages
Is likely to be located within the borders of a municipality or village	Is likely to be located outside the limits of municipalities and villages
It is possible to change its location based on trial and error	Changing its location would result in costs to build new engineered facilities
A special truck hauls it "as is" to the landfill and returns it to the same location on a pre-set schedule	Depending on its design, may or may not contain large container(s) that would be hauled to the landfill
No need to weigh waste coming to it	Need to weigh waste coming to it (since it originates from several local governments)
Local government is responsible for bringing the waste to it at specific times	Local government is responsible for bringing the waste to it, either at specific times or any time depending on the design (e.g., presence of weighing machine and operators on a continuous basis)
Waste brought to it either by manual workers or transported by vehicle (e.g., tractors-trailers)	Waste brought to it by transportation vehicles only

### **3.3 Determine Required Collection Personnel**

One basic factor in determining the cost and efficiency of primary collection programs is the size, capability, and motivation of the collection crew. The optimum crew size depends on labor and equipment costs, collection methods (curbside, communal containers, etc.) and route characteristics.

### **3.4 Determine Effective Collection Routes**

**Collection Service Areas** - The collection service area is an area that falls within the jurisdiction of a government agency or private company and is often defined by political or geographical boundaries. For definition of the technical aspects of a collection system, these limits as well as location of and routes to disposal sites, transfer stations or waste processing plants should be marked on an overall service area map that will be used for a number of purposes in planning and design. Dividing a service area into zones for daily service sets up collection zones. So as to balance the system to maintain high productivity, the average number of households assigned to each collection zone should be approximately equal.

Each zone may be divided into an optimum daily workload for each collection vehicle and crew. This subdivision should be aimed at assuring that communal containers are serviced on a programmed and consistent basis. The definition of collection zones allows the solid waste manager to estimate the number and size of trucks needed to collect waste in any particular area, evaluate crew performance and to balance or equalize the workloads between the areas.

Major considerations in the development of the balanced districts in curbside collection are the productivity of the crew and the on-route time. Increases in either will lower the costs associated with collection. On-route time is productive time and should be maximized to allow the collection crew to collect as many stops (or communal containers) as possible in a given workday. Generally the major variable in on-route time is the time actually spent in travel to and from a disposal site.

**Collection Routes** - Within a collection zone, collection is structured into routes. A route is the path followed by a single collection vehicle for waste collection on a single day. The objective of routing is to direct the collection vehicle through the zone so that wasted time is kept at a minimum. Routing can be applied to trucks and crews performing curbside collection and to those that are servicing communal containers.

In routing analysis, maps should be prepared showing the number and type of collection stops per street segment or the number and location of communal containers. Where curbside collection is considered, the map should also reflect roadways with specific characteristics such as dead-end streets or particularly busy streets. Each street segment should show truck direction by arrow and whether one or both sides of the street can be collected on a pass.

In curbside collection, routes can be set by a number of different methods including 1) trial and error, 2) computer analysis, or 3) heuristic methods. The heuristic approach consists of applying experience, common sense and certain rules of thumb (or “heuristics”) to develop an acceptable, but not necessarily best, solution to solid waste collection routing. Heuristic routing was developed by the United States Environmental Protection Agency in the mid-1970’s as a compromise between trial and error and computer approaches. While heuristic routing is more precise than trial and error methods, it requires less preparation time and technical resources than computer analysis. The heuristic method of designing collection routes is a good tool for solid waste managers to analyze curbside collection. The heuristic method uses specific routing guidelines as follows:

1. Routes should not be fragmented or overlapping. Each route should be compact consisting of street segments clustered in the same geographical area.
2. Collection plus haul time should be reasonably constant for each route.
3. The collection routes should begin as near the garage or truck point of origin as possible.
4. Within the route, right hand turns are preferred to left-hand turns because of their greater efficiency.
5. Heavily travel streets should not be collected during rush hours.

6. One-way streets are best collected by starting near the upper end of the street working down through a looping process.
7. Dead-end streets should be considered as a segment of the street they intersect. They must be collected by driving down, backing down or making a u-turn. Left turns may be kept to a minimum by collecting dead-end streets when they are to the right of the truck.
8. Steep hills should be collected on both sides of the street while the truck is moving downhill for safety, loading ease, collection speed, vehicle wear, and fuel conservation.
9. Higher elevations should be at the start of a route.
10. For collection from one side of the street at the time, it is generally best to route with clockwise right turns around blocks.
11. For collection from both sides of the street at the same time it is generally better to route with long, street paths along the grid before looping clockwise.
12. For certain block configurations within a route, specific routing patterns should be applied.
13. Residents should be asked to place their waste on specific streets to eliminate the need to transverse and intersect streets.

This type of analysis forms the basis by which solid waste managers can continually review their route structures to determine what improvements to a level of service or cost savings can be accomplished by modifications. A new analysis and change in configuration (rerouting) of collection routes should be considered whenever there is a significant change in the collection system. These changes can include:

1. Frequency of collection;
2. Point of collection (curbside, alley, backyard or communal container);
3. Crew size;
4. Truck size or equipment type;
5. Location of processing and disposal sites;
6. Type of storage containers used; or
7. Number of services.

### **3.5 Determine Optimum Collection Frequency and Schedules**

The frequency at which solid waste is collected is an important factor in defining collection cost and efficiency. In many tropical cities, curbside collection occurs as frequently as once a day. In most industrialized countries, collection occurs once or, at most, twice per week. One advantage of communal containers is that generators can bring waste to the container anytime. As a result, household storage does not become a problem. However, a problem can occur if the collection

schedule for the communal containers is not sufficient to keep them available for waste placement. Sound practice in collection frequency must include an analysis of the needs and desires of the community, the health risks associated with less frequent collection, the importance of nuisance issues such as odor and, finally, the necessity of scheduling collection at times when the streets are not crowded.

### **3.6 Evaluate the Effect of Transfer on the Cost and Efficiency of Collection**

All refuse collection vehicles have an operational radius within which they are cost-effective. This operational radius is a function of the type of truck and the amount of waste collected. Generally, if the travel time to the point of disposal is equivalent to or greater than half the daily loading time, a form of transfer should be considered. Although transfer operations offer potential savings, they involve an additional handling step with an associated. Therefore, the economics of building and running a transfer stations must be thoroughly evaluated to verify that



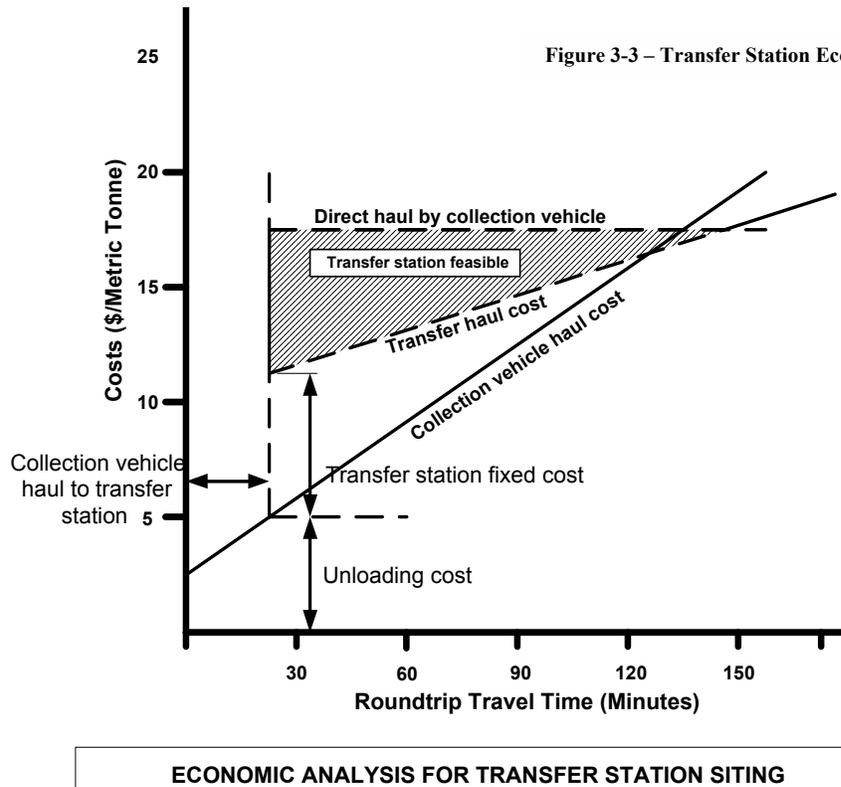
**Figure 3-2 – Transfer Truck with Trailer**

this is the most cost effective manner to get the waste to a disposal location.

Transfer refers to the movement of waste materials from a primary collection vehicle to a secondary (generally larger and more efficient) transport vehicle through a transfer station or consolidation containers for transport to a disposal site. While all

solid waste systems usually include collection, they may not include transfer depending on the proximity of disposal location to collection points or routes. The location of transfer stations should be based on the following factors:

Figure 3-3 – Transfer Station Economic Analysis Example



1. The neighborhood in which the transfer station is located should be willing to accept the transfer point as designed.
2. Odor noise and increased traffic should be minimized during the operation of the station.
3. The station should be close enough to the collection area so that the primary collection vehicles can quickly return to their collection routes.
4. The site should have easy access to major roads.
5. An analysis of haul time from collection locations and routes to disposal location will determine the time that can be saved through transfer.

In many large and heavily populated areas or in regions with dispersed population centers, more than one transfer station may be required. The appropriate number of transfer stations will depend primarily on the number and size of individual service areas and zones and the distance between them. A transfer station may include compaction to increase the volume placed into a transport vehicle for efficient transfer.

There are a number of environmental benefits of transfer. Transfer stations help reduce air emissions and fuel consumption and access to solid waste at the transfer station may help increase recovery rates. The availability of transfer also will allow landfill locations to become less independent on considerations of accessibility by collection vehicles. This allows disposal locations to be sited with more consideration for public health and environmental factors rather than their location in proximity to waste generators.

**Transfer Station Design** - Transfer stations should be designed to be convenient and safe with appropriate storage for the solid waste received from the collection routes. The operating scheme should be as simple as possible and should require a minimum of waste handling while offering the flexibility to modify the facility when needed. The following is the general criteria for transfer station design:

1. **Site** - The site for transfer stations must be large enough to accommodate buildings, waste storage, vehicle maneuvers, and potential for expansion. To the degree possible, the site should have sufficient elevation change to accommodate a two-level building or site design.
2. **Transfer Techniques** - There are three types of transfer stations commonly used where collection vehicles discharge waste 1) onto a tipping floor, 2) into pits or hoppers or 3) directly into transfer trailers. When vehicles are emptied onto a tipping floor, additional equipment such as a front-end loader is needed to push the waste into the receiving transfer vehicle or into a hopper of an external compactor. Basic criteria for each type of transfer station is as follows:

#### **Open tipping floor transfer stations**

- Usually more efficient for small quantities of solid waste
- Can be used to transfer different materials into different vehicles
- Can easily accommodate recovery of materials with recycle value
- Allows for waste picking during transfer
- Maximizes the possibility of spreading out the waste so as to dry it out prior to transfer

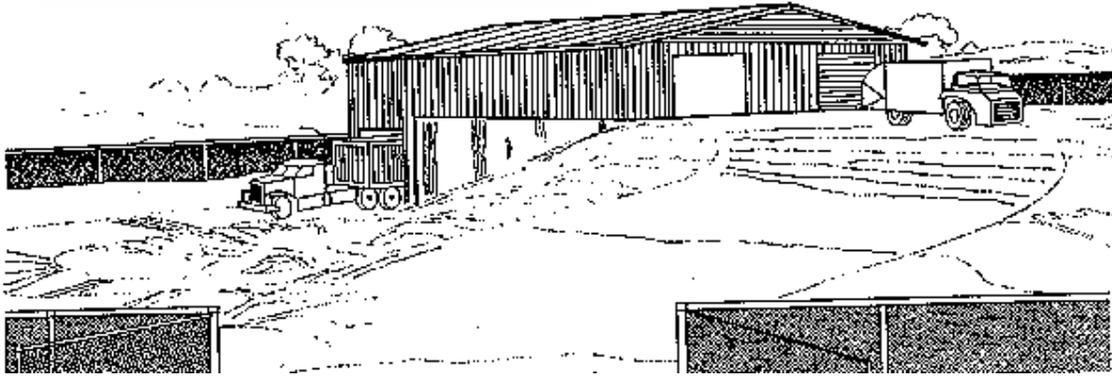
#### **Open pit transfer stations**

- Allows multiple collection vehicles to offload at the same time.
- Can accommodate larger collection vehicles.
- Higher capital and operating costs than open tipping floor concepts
- Preprocessing and separation of recoverable materials is difficult.

### Direct dumping transfer stations

- Have no intermediate handling which increases efficiency and decreases labor
- Does not permit waste picking

Figure 3-4 – Multi-level Transfer Station



- Requires bi-level construction with receiving trailers at a lower level
- Can be quickly constructed or moved and are relatively inexpensive
- Requires sufficient number of trailers depending on amount of waste received and the distance to processing or final disposal.

Figure 3-5 – Transfer Station



Typically, small transfer stations are direct-discharge stations that provide no intermediate waste storage area. These stations usually have drop-off areas for use by the general public to accompany the principal operating areas dedicated to municipal and private refuse collection trucks. Depending on location, site aesthetic requirements, and environmental concerns, transfer operations of this

size may be located either indoors or outdoors. Most transfer stations are usually attended during hours of operation.

Smaller transfer stations used in rural areas often have a simple design and are often left unattended. These stations consist of a series of open-top containers that are filled by station users. These containers are then emptied into a larger vehicle at the station or directly hauled to the disposal site and emptied. The required overall station capacity (i.e., number and size of

containers) depends on the size and population density of the service area and the frequency of collection. For ease of loading, a simple retaining wall will allow containers to be at a lower level so that the tops of the containers are at or slightly above ground level in the loading area.

Factors that should be considered in determining the appropriate size of a transfer facility include:

- Capacity of collection vehicles using the facility,
- Desired number of days of storage space on tipping floor,
- Time required to unload collection vehicles of all types used in the collection system,
- Peak number of vehicles that will use the station and their hours of arrival,
- Waste sorting or processing to be accomplished at the facility, if any,
- Transfer trailer capacity (in use and standby),
- Hours of station operation, and
- Time required to load and haul trailers.



Figure 3-6 – Outdoor Multi-Level Transfer Station with Load Lugger Vehicle

### 3.7 Implementing an Effective Collection System

As with most alterations in a solid waste collection system, a change in routing or collection frequency affects at least three groups of people: 1) those responsible for the solid waste collection and transfer program, 2) the solid waste collection crews, and 3) the waste generators.

An information education program should properly inform each of these groups about what is expected of them and enlist their cooperation in accomplishing the desired change and in the performance of the collection process.

The solid waste collectors and drivers should be informed of all proposed changes to the collection system and encouraged to comment on the effect of the changes will have on their daily operations. Their criticisms or suggestions for further improvement are essential to the final evaluation by the solid waste managers. In addition to being a potential source of pertinent input,

the workers' participation in reviewing the decisions may be a useful managerial tool in that it helps them feel a part of the new system and more in support of the change that may be required. Several mechanisms can elicit cooperation from the collection personnel and help improve or maintain employee morale during and after implementation.

Other public officials (particularly elected officials) also should be apprised of the proposed changes as the new transfer system is implemented. If the reasons for the changes in the collection system are explained to them, they often are important allies during the transition. Should they be approached by waste generators regarding the changes, they should be aware of what is taking place.

The implementation of the technical portions of the new collection/transfer approach will be phased as the need for transfer evolves due to the development of the regional landfills and the closure of the uncontrolled dumps. As a result, solid waste managers will need to plan their system modification service area by service area. An overall plan should be developed defining the technical changes to be accomplished and the schedule for procuring necessary resources and putting them into service.

## **4. Operating and Maintaining an Effective Collection System**

### **4.1 Manage Collection System Operations**

An effective solid waste collection system requires firm and thorough administration and control of operations. This administration and control must include close coordination between the local governments and the SWM Councils to assure that their respective programs operate seamlessly. From the perspective of managing each component, effective administration and control requires that all personnel involved in the process be held accountable for their performance. To achieve this, administration should, at a minimum, include record keeping, direct monitoring of system performance through inspections and observations, supervision of maintenance, dedication of standby equipment, and effective cost accounting.

Record keeping is very important in monitoring and documenting the performance and, hopefully, effectiveness of a collection program. Without proper records, productivity measurements, evaluations, cost studies and preventive maintenance would be impossible to accomplish to the degree necessary to maintain a good level of service. Records that should be routinely kept by a collection manager include:

1. Route maps
2. Vehicle records including purchase data, maintenance and repair record, fuel consumption records, accident reports, operating hours, on route hours, time to disposal sites and return
3. Crew records including amount of waste collected per day, households collected per day, other stops collected per day, truck assignment, time on-route, time off-route
4. Load records including weight, number of trips to disposal per day, percentage of full capacity, etc..

### **4.2 Train Personnel**

All collection personnel need to be trained in the performance of the duties. The training should define the level of productivity expected of them. At a minimum, training should be provided for the following:

- Routing structure and expected collection productivity
- Record keeping
- Health and safety

- Contingency Procedures
- Operations and maintenance of collection equipment
- Operations and maintenance of transfer stations

In addition to the above base training, specialized training should be provided to program managers who will be responsible for monitoring and inspecting system performance. This training should also include training in design such as routing analysis to allow for continual tracking of performance and system needs identification. Training should also be provided to personnel responsible for maintenance of all collection equipment.

### **4.3 Educate Waste Generators about Their Role in Effective Collection Practice**

To maintain program effectiveness, an education program should be directed toward waste generators. Several media are available to accomplish this. One of the best is a letter from the appropriate public official explaining the reasons for any changes in collection methodology and schedules and how the changes may affect the waste generators. Other methods that can effectively inform the public include articles and notices printed in local newspapers. Depending on the nature of individual service areas within the primary collection systems, community organization and NGOs may provide some assistance in educating the public as to their new role in the collection program.

### **4.4 Develop Contingency Procedures for Unusual and Special Circumstances**

Effective collection and transfer requires that contingency procedures be established for any unusual and special circumstances. At a minimum, contingency procedures should be established for the following:

**Accidents** - Given the nature of motor vehicles and the collection process, accidents may be expected to occur. These accidents may solely involve collection system vehicles and personnel but may also involve others. Any accident should be immediately reported and investigated to determine its extent and cause. Contingency procedures concerning accidents should be a function of the severity of the accident. All personnel should be trained as to any contingency procedures to be used in the event of an accident. Collection crews should be particularly trained as to the procedures in the event of an accident where somebody is seriously hurt. In the case of a

life-threatening situation, personnel should be prepared to take required actions including emergency first-aid and the immediate notification of other sources of emergency assistance.

**Complaints** - Complaints may be received concerning the collection system. All complaints should be logged and investigated. As is the case with procedures to address accidents, complaints should be evaluated to determine their cause and to address the reason for the complaint. Adjustments may be made to the collection program to eliminate the cause of justifiable complaints especially those that are recurring. As a contingency procedure, solid waste managers should be prepared to address issues such as overflowing containers or the accumulation of solid waste in areas where it is not intended. It is extremely important that such complaints be addressed in a timely manner since a small accumulation of solid waste in an uncontrolled location can become a major project to clean-up if allowed to grow.

#### **4.5 Develop and Manage an Effective Maintenance Program**

The successful operation and productivity of any collection or transfer system is dependent on the manner in which its various equipment is maintained. In addition to proper maintenance, sufficient back-up equipment must be available to assure that each collection cycle can be achieved with a minimum of variation in the service schedule. Effective routing, operation, preventive maintenance and repair work can contribute to increasing long-term vehicle productivity.

**Types of Maintenance** - There are two types of maintenance that need to be done on a day-by-day basis including repair maintenance and preventative maintenance. Experience has shown that wherever a mechanized equipment is used, there is a direct relationship between the degree of preventative maintenance and the level of repair required. Logically, there is a level of preventative maintenance where the cost effectiveness of a maintenance program is lost. An extremely high level of preventative maintenance can theoretically lead to performance levels where few breakdowns in mechanical equipment are experienced. The cost of this idealistic level of preventative maintenance, however, is prohibitive. Similarly, the cost of repair maintenance, where little or no preventative maintenance is done, may also be prohibitive. The design of an effective maintenance program attempts to establish the optimum balance between repair and preventative maintenance that would be most cost effective.

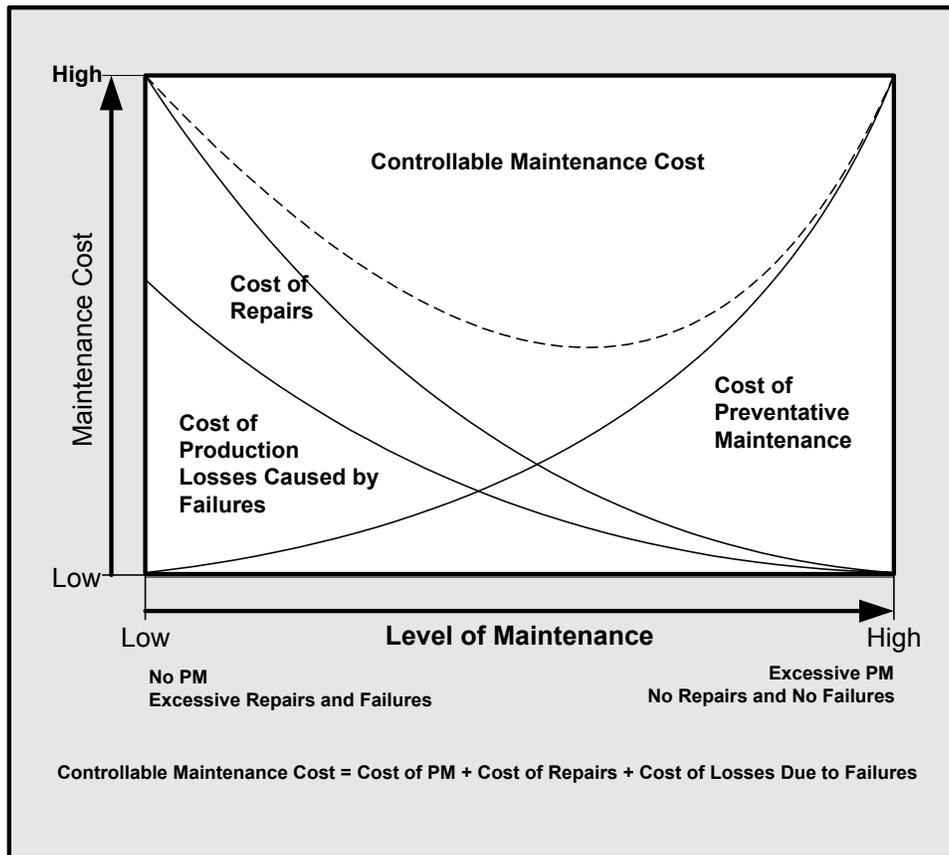
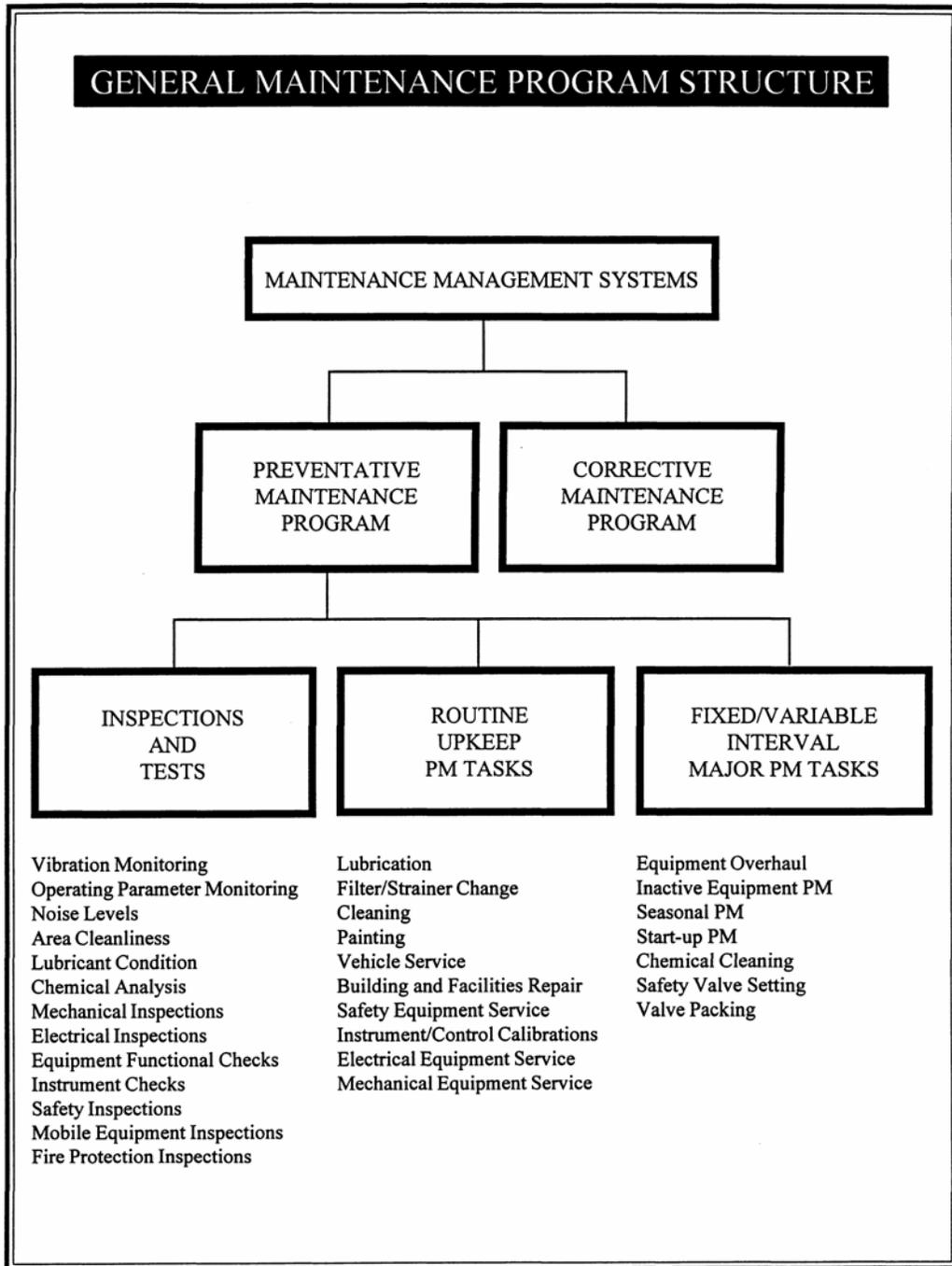


Figure 4-1  
Preventative Maintenance Economic Model

**Repair Maintenance** - Repair or corrective maintenance consists of making repairs when they are required because of equipment breakdown. Since breakdowns cannot be planned, the consequential loss of some equipment as a result of repair downtime must be added to the overall cost of a repair to determine the full economic impact of breakdowns. Additionally, backup equipment is required so that the level of service is not affected by equipment breakdowns.

**Preventative Maintenance** – By definition, preventative maintenance consists of the following:

1. Periodic inspection of equipment to uncover conditions that could eventually lead to breakdowns or harmful depreciation.
2. The avoidance of future difficulties by making minor repairs in advance of major problems.



3. Replacements, adjustments, major overhauls and inspections that are preplanned and scheduled on a cycle that will maintain equipment at the optimum operating efficiency.
4. A policy of operating equipment properly and within its range of design capability.

An effective maintenance program design normally assumes that both preventative and repair maintenance are made part of regular operational procedures. The emphasis of the maintenance

plan, however, is on the preventative maintenance program that minimizes the level of repairs required. Preventative maintenance activities are usually preplanned and scheduled, thus facilitating the programming of maintenance work. This significantly improves the planning and scheduling of all maintenance management activities. The experience gained as collection equipment is operated helps to identify "critical" equipment that should receive priority in the maintenance program. An effective preventative maintenance program is broken down into three categories including: 1) monitoring, inspections and tests, 2) routine upkeep tasks and 3) fixed and variable interval major tasks. These consist of the following:

- **Monitoring, Inspections and Tests** - The inspection of critical equipment is a key part of any PM program. The purpose of inspection is to identify and correct unfavorable conditions that may be developing. This can help prevent breakdowns. Inspection activities may be accomplished in a variety of ways such as visual inspections, monitoring of normal operating parameters, measuring and analyzing data, and the performance of specific tests.
- **Fixed and Variable Period Maintenance** - The performance of routine periodic maintenance improves its reliability and extends service life by maintaining optimum equipment conditions. The routine upkeep tasks on a specific piece of equipment usually require a short time to complete and are normally conducted on a regular schedule. Typical routine upkeep tasks on motorized equipment can include: 1) lubrication, 2) filter/strainer change/cleaning, 3) cleaning and painting and 4) vehicle service.
- **Major Preventative Maintenance Tasks and Overhaul** - The final category of activities is fixed and variable interval major preventative maintenance tasks. Major mobile equipment is routinely removed from service for extended periods for inspection and overhaul. The frequency and duration of such overhaul periods varies with the equipment.

So as to establish the control and management accountability required in a good preventative maintenance program, checklists and records of task performance should be used to maintain a database of all work done. Maintenance staff and equipment operators should be required to complete checklists of the tasks that they perform.

**Standby equipment** - Solid waste collection is a difficult process and equipment used within the collection system will often break down. To maintain a proper level of service, standby equipment may be required so that collection can still occur even when primary equipment is broken down with minimal disturbance to the pattern and schedule of collecting solid waste. In

industrialized countries, the target level of standby equipment is to provide at least one standby vehicle for every five vehicles used daily.

#### **4.6 Monitor System Performance and Adjust Collection System as Necessary**

Reducing collection costs by improving collection efficiency must begin with a thorough understanding of the activities that occur during the collection day. The collection day can be divided into two broad categories for purposes of analysis:

1. Time spent on nonproductive activities when the collection crew is not occupied with collecting waste from collection routes or communal containers
2. Time spent actually collecting waste along the collection routes or in servicing container locations.

Allocation of the work day among all the productive and nonproductive activities can be determined by recording the amount of time personnel spend on each activity from the moment they start work in the morning to the moment when they leave work at the end of the day. For the purpose of an example that relates to curbside collection, primary collection day activities can be subdivided into:

- Time at the yard at the beginning and end of the day
- Commuting time to the route at the beginning of the day and back to the yard at the end of the day
- Vehicle unloading time at the transfer, processing or disposal facility including travel to and from the facility
- On-route time performing collection activities

The following areas of unproductive time deserve particular attention in monitoring the performance of a collection system:

- Collection routes should be assigned in advance of the collection day so that each crew knows where they're going for the day. Contingency plans for sick days or other absences should also be planned in advance.
- Where possible trucks should be assigned to a single driver over an extended period of time, so that time is not lost changing mirrors getting personal items out of trucks and rechecking engine fluids and equipment. Note that this also makes it easier to track driving habits to assign blame and praise for high and low maintenance on individual vehicle.
- Routine maintenance should be accomplished at the end of the collection day preferably by maintenance crew rather than the driver.

- The number of trips off route to empty a full truck should be reduced by increasing truck size or compaction of materials than can be compacted.
- Weighing and unloading bottlenecks at the materials processing or disposal facility should be eliminated either through redesign of these areas or through staggered scheduling of truck deliveries.
- Routes between the yard delivery point in the collection routes should be evaluated to minimize off route travel distances into assure that, to the extent practical trucks, are routed around slow-moving traffic areas.

By regularly monitoring the time spent on various activities, a collection program can be effectively monitored to assure maintained productivity. After a while, a level of performance productivity will be obvious to solid waste managers so that it can be monitored. If the system is designed properly and sufficient resources are available, evidence of system failure (solid waste accumulation outside of containers, inconsistent service, complaints, etc.) will be an indication of productivity slippage thereby warranting closer investigation of system productivity and asset management.