

WASTE MANAGEMENT
WASTE TECHNOLOGY ✓

**INVESTIGATION ON SOLID WASTE
MANAGEMENT IN TOWNSHIPS: CASE STUDY OF
UMLAZI, DURBAN**

BY

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Declaration

I, undersigned, hereby declare that the dissertation hereby submitted by me for the Magister Artium at the University of Durban Westville is my own independent work and has not previously been submitted by me or any one at another university or faculty

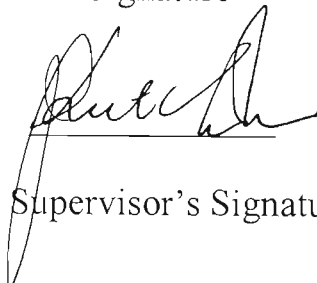
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Abstract

Today environmental degradation is perceived to be a global phenomena, since the Earth Summit of 1992 gained phenomenal interest among the international community. Consequently there was a major interest among conservationist, environmentalist and other disciplines to write about the alarming rate at which natural resources are being polluted and over utilized and eventually depleted. This is evident when one looks at land, air, water pollution, and deforestation and soil erosion. Human dependence on these resources, most of which are non-renewable, compounded by growth in population numbers will inevitably impact the quality of life of the global community.

Most developing Urban areas in South Africa and formal residential areas where waste removal services are supposed to be available, are characterised by solid waste being illegal dumps on open spaces, streets etc. The heaps of waste have become breeding grounds for insects and pests. The odour emanating from these sites together with potential for diseases can have serious implications on the health of residents as well as aesthetic nature of the environment. It is not yet understood why such situations exists within formal serviced areas. This provided the motivation for the investigation.

The purpose of the study was to investigate solid waste management practices in a formal residential area of Durban namely Umlazi and its negative impact on the human and natural environments. The effect of the social dimensions of households on solid waste practices was investigated in order to examine relationship between socio economic and

current waste practices. Current perceptions, attitudes and solid waste practices of households were assessed to explain the influence of socio economic factors in the planning and operations of solid waste management systems in townships.

Questionnaires relating to the problem were administered to the residents of Umlazi. The results indicated that the waste collection system is characterised by inefficiency. The study revealed that attitudes and perceptions, educational status and income are significant factors that contribute to effective waste management processes. The analysis of data for domestic solid waste showed that the evaluation of both the social demographic and solid waste generation rates is crucial in understanding why such inefficiency in formally serviced areas exists. This in turn could provide guidelines on the possible roles that households can play in the planning and implementation of domestic solid waste. Amongst others the consumption patterns, knowledge about waste management practices and preferences for service provision were interpreted.

Based on the findings of this study and the review of related literature, it is concluded that attitudes and perceptions of residents need to change. Residents need to become responsible for caring for their environment and a different mind set towards solid waste is needed. Appropriate policy backed by legislation and enforceable regulations must underpin the strategic alternatives selected to deal with waste management in the Durban Metropolitan Area (DMA). Policy legislation and regulations at the local level must be fitting with those set at national and provincial levels of government. The planning of integrated waste management should be a consultative process in which partnerships are

encouraged between the DMA authorities and communities who will benefit from the waste management plan. The public and private organisations that handle waste in the municipality should be seen as part of the solution, not a problem, of waste management. Effective waste management should be appreciated as a public good from which benefits such as opportunities for employment, resource recovery, safe disposal of hazardous waste, reduced pollution and community development projects can spring.

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CHAPTER ONE

Introduction and Contextualisation of problem

1.1 Preamble

Environmental conditions are directly related to human health since people interact with the environment on their daily activities. Environmental problems should not be viewed in isolation but within a social and economical context. Economical factors are relevant in that poor communities, often without basic services impact negatively on natural resources. This can include things like cutting trees for fuel wood or house construction and polluting water resources. Due to population growth (social factor) more reliance is on the environment where by people require more resources for their survival. (www.cmc.gov.za)

Most countries are faced with different environmental challenges, which need close and adequate consideration. Environmental problems facing most countries include depletion of natural resources, deteriorating infrastructure and social amenities. These problems are caused by factors like destruction of protected areas, poverty, exploitation of natural resources, inadequate and lack of law enforcement and population growth. These factors are inextricably linked to each other. (www.cmc.gov.za)

Environmental issues impact on communities in the developed as well as developing world. Developing countries are focusing much on development and ignore environmental protection. Environmental problems can start locally but cross-national borders and affect the whole world. For example one group of people dump waste in rivers, which has a negative impact on communities living downstream. Also gases emitted by industries can cause health problems to those people being

away of the area. Environmental problems can be seen or not seen, felt or not but still is there to stay if people don't act before it's too late. It's the responsibility of the government to act on issues affecting the environment or people will suffer. People need to be involved since its their activities that cause such problems. Awareness on the relationship between the environment and human health requires immediate action so as to protect the present and future generations. (www.unido.org)

In the past ignorance on environmental management in South Africa (SA) has caused the state to give less priority to the environment. Although laws are passed to protect the environment they are not correctly managed or administered and are fragmented. Based on the South Africa's Environment Conservation Act, 78 of 1989, people have a right to an environment that is healthy and protected to benefit present and future generations. But this is not the case in SA where most areas are faced with situations where the environment is not correctly managed. The main problem when it comes to the SA environment is the lack of planning, lack of information and lack of appropriate legislation. (Government Gazette, 1998)

Amongst the problems in KZN facing the environment are deforestation, solid waste, pollution, desertification, soil erosion and many more. Deforestation is environmental in a sense that it is the destruction of indigenous forests. Forests are removed for different reasons such as agriculture, commercial purposes to provide timber, also for household uses like firewood or house construction. Deforestation can lead to alteration of local and global climate through disruption of water and carbon cycle, and can cause extinction of species (www.botany.uwc.ac.za)

Pollution destroys the environment in different ways depending on where it is concentrated, and it can be viewed as any substance that the environment cannot handle having an effect on human beings and other living things. This can include

substances that are not biodegradable. Pollution types can be classified based on the ecosystem that it affects, for example air, water and land pollution. The best way to deal with pollution include focusing basic things like point source pollution, non-point pollution and polluters-must-pay principles. (www.botany.uwc.ac.za)

Desertification is the process that occurs due to the poor management of the land making productive land become non-productive. This is mainly caused by overgrazing, cultivation of marginal land, and destruction of vegetation, poor grazing management and incorrect irrigation practices. The process affects land; wildlife, domestic animals, agricultural crops and even people at large. Soil erosion is a natural problem but human activities speed up the process. Wind and water speed up erosion with plant cover as one of the influential factor. Plants are important in a sense that they slow down over land flow, whereby its roots prevent soil from being washed away, and water is absorbed by plant leaves before reaching the soil (www.botany.uwc.ac.za)

Most people are concerned with solid waste management in developing countries. The main causes of these problems are people's activities that affect the environment. According to the ECA (1989) activities that cause environmental problems need to be identified and that includes water use and disposal, waste and sewage disposal, recreation, industrial processes, renewable resources and many more activities. People are not allowed to engage in these activities unless authorized by the Department of Environmental Affairs and Tourism. Activities have an effect on people's health and the environments they live in. Some resources that people overuse are those needed for economic development. On the other hand as population increase pollution increases causing change in the environment, and this leads to vulnerability of the urban settlement and infrastructure. Therefore, not everyone can be catered for when it comes to services provision, and people end up

occupying areas that are vulnerable to natural disasters or areas that are not favorable for living. Basic needs like water, housing, sanitation, solid waste collection and disposal services, education etc end up being scarce because of the increase in population. Due to this people need to have other means to substitute these needs, which lead to environmental degradation. (German Committee for Disaster Reduction, 2002)

Solid waste management seems to be the biggest challenge that confronting South African authorities. Since waste is a serious issue affecting the environment and people living in it in these days, there are three things that can be done to eliminate the problem viz reduce, reuse and recycling. Reduce-includes shopping carefully, avoids over-packaged products, buy what can be recycled, use your own plastic bags for shopping, and many more. Re-use includes returning goods that have deposit capabilities, use papers writing one side for rough work, reuse plastic containers for food storage, give cloths or any related things to charities and repair things instead of throwing away. Recycle material with an aim to reduce waste to the landfill and this can include glass, tin, paper, plastic and copper (www.botany.uwc.ac.za)

The community, due to solid waste being disposed off in the streets, back yards and open space, encounters problems. People end up being faced with bad odors and diseases carried by small insects like mosquitoes, ants, cockroaches etc., which breed on this dump sites. The four steps that are used appropriately to eliminate illegal dumping problem includes source reduction, recycling, conversion to energy and land filling. Through recycling as part of waste management energy can be saved by displacing virgin materials (Jackson and Jackson, 1996).

1.2 Waste management

Solid waste management can be defined as "the discipline associated with control of generation, collection, transfer and transport, processing and disposal of solid waste in the manner that is in accord with the best principle of public health, economics, engineering, conservation, aesthetics and other environmental considerations," (Tchobanoglous et al., 1993). Objectives of waste management are: avoidance of waste production at source; use of degradable packaging material; sorting of household waste to encourage disposal and recycling; and reuse and recycling of waste; dispose residual in an environmentally acceptable way. The problem might be that there is no policy that helps in the achievement of these objectives, no incentives that help in waste reduction; legislations are fragmented, no uniform set of by-laws for waste management at a local level (Fuggle and Rabie, 1994)

Solid waste can be divided into different categories based on where it is being produced. **Household waste** can include domestic property, residential home, educational establishment etc. This is referred to as garbage produced during preparation of or storage of meat, fruit, vegetables etc. and usually contains moisture content of about 70%. **Commercial waste** usually is generated from premises used for trade or business of sport, recreation and entertainment (Bahu et al, 1997).

Industrial waste includes "chemicals, plants, sand, metal ore processing, fly ash, sewage treatment sludge, etc," (Rao, 1991:). **Hazardous waste** includes chemical that are highly toxic to most life forms. Biological waste sources are hospitals and biological research facilities. Its characteristics are that it has an ability to infect other living organisms and produce toxins. Flammable waste is potentially hazardous in storing, collection and disposal, and may be in liquid or gaseous or solid form. Can include organic solvent, oils, plastisizers, and organic sludge. (Rao, 1991)

Although there are different types of waste this study focus on household waste. An inadequate provision of refuse collection services and disposal of both solid and liquid waste seems to be a classified environmental problem. This inadequacy can be viewed as the basic problem to environmental health, as unmanaged collection and disposal of waste have impact on human health and productivity. The United Nations Development Programme that the most serious problems in urban areas include insufficient solid waste collection and insufficient solid waste disposal sites. (www.unido.org)

Solid waste dumped on the streets or any other open area can percolate the soil and contaminate the ground water. In Accra (Ghana) the Waste Management Department collects only two third of the generated waste and only 10% of households have home- collection services. In Kinshasa (Zaire) most of the waste is dumped in open spaces or roads of the cities. The inadequate collection and management of waste lead to illegal dumping of waste that can cause breeding areas for mosquitoes, flies, and insects that are good transmitters of diseases. (www.unido.org)

South Africa, alone, generates a total solid waste stream between 340 and 480 million tones per year with 15 million tones from municipal waste (Macozoma, 1999 cited from CSIR, 1991). From municipal waste generated every year in South Africa a very small amount of it is recycled. A large amount of waste is subject to illegal dumping. This is due to the fact that about 40% of SA people don't have access to waste collection services these communities resort to illegally dump on open spaces resulting in degraded environment which affects people's health and their living area. (www.sajhc.org.za)

The poor functioning of municipalities is due to issues like deteriorating financial situations and political interferences. In trying to address the problem of environmental degradation the planning of regulation should not be at central government level but rather be at a local and institutional level. At the same time the local interested and affected parties must be involved in all decision-making. It is also important for communities to take initiatives to manage solid waste. A group of nine people from Khayelitsha in Cope Town serves as the best example for their involvement. This group was contracted by City of Tygerberg refuse collection scheme to collect refuse for five years. This opened employment opportunities for local people. The community has stated that the current service is far better than when the municipality was collecting waste. (www.cmc.gov.za)

Waste crises in KZN have been a problem ever since the Bulbul Drive, Durban collapse in September 1997. The closing down of this landfill site left the province with no hazardous waste disposal sites. Due to this dangerous waste such medical waste and other waste generated from industries need to be transported longer distances for disposal. This causes a lot of money for producers to transport and dispose in another province. (www.miiu.org.za) Another issue can be traced from Mhlathuze sub-region with its sites decreasing in number and sites available are faced with capacity decrease. For those existing sites it is difficult to expand due to the fact that its waste pollutes groundwater or surface water and/ or can have a negative effect in the residential areas. (www.miiu.org.za)

Most cities are faced with a solid waste crisis where by there are no land to dispose waste thus causing an increase in illegal waste dumps. This is due to NIMBY (Not In My Back Yard) syndrome that most people and even communities have. People dump their waste in open areas increasing breeding grounds for mosquitoes and causing odor problems. Landfills face the problem of leachate (liquid seepage from

landfill) due to water, liquid by-products and rain. This also needs to be controlled or to be treated since water from landfill contaminates groundwater or surface water. (Sara, 1990)

In Durban Metropolitan Area (DMA) there are both formal and informal settlements, and problems experienced by these settlements are almost the same. Informal settlements involve those areas where people occupy land illegally with an aim to be close to work places. These areas lack services and their lives deteriorate each and every day. Durban has several townships like KwaMashu, Clermont, Umlazi, Inanda, Chesterville, Chatsworth, Lamontville and many more. These townships are formal settlements that are expected to have all services including sanitation; refuse removal and collection services, water, electricity and many more. Life in formal townships is supposed to differ from that in informal areas. This is not the case because most people don't have access to waste and refuse collection services. People face different problems due to the fact that services provided are inadequate and insufficient. (www.durbansolidwaste.org.za)

During the apartheid era black communities were not catered for in the provision of enough collection and disposal services, and this was the reason that people dump waste on any open area. The existence of the problem can be supported by the fact that in 1999 townships like Umlazi and other townships were included in the Durban municipality. The aim of this incorporation was to make sure that these townships have waste management and refuse collection services that are similar to other Durban areas. (www.durbansolidwaste.org.za)

The Durban Solid Waste (DSW) is responsible for the provision of waste management services in the whole of the Durban areas. The DSW collects commercial, industrial, and domestic waste and dispose it on their own disposal sites.

There are different landfill sites under the DSW but among them the busiest is the Bisasar Road Landfill (Springfield) that was established in 1980 receiving an average of 3000 tones daily. Both plastic bags and containers are used to store waste before collection day. In areas where bulk waste is produced two-wheeled containers are used to make it easier to transport waste to the collection station. The responsibility of the DSW is also to sweep and clean the streets of Durban, this happens mostly in cities with the townships left unattended with respect to waste. In some areas tenders are given to contractors to provide collection and disposal services. These contractors work with DSW to ensure that people receive services necessary for their lives. (www.durbansolidwaste.org.za)

1.3 Contextualization of the problem

There are different townships in Durban and they are all faced with different problems. Part of these problems includes that of solid waste management. The main reason for this was the issue of racial discrimination where people were separated according to their race, with different townships for Blacks, Coloreds, Indians and Whites. Black townships were situated on the outskirts of town with whites close to the CBD. Due to the uneven distribution of services and resources, townships were left at risk with much attention being paid on those in cities.

Sustainable management can be successful if both community and management approaches be involved. That is, communities need to clean and collect waste while the management approach works in transfer and disposal of waste. The success of solid waste management lies on the acceptance of community-based contractors whereby people become more involved. Based on the Environmental Conservation Act (ECA) no. 78 of 1989 people have a right to clean environment but looking at the situation in townships it's really difficult to accept that the state government cares

for people's health and environment. Waste minimization (reduction), recycling, reuse, and recovery are also considered as important elements in solid waste management. So the question that arises is that if the government is concerned about health of the people and the environment why is the situation of illegal dumping increasing in Umlazi township? This question raised the motivation for the study to be done in this area.

1.4 Aims and objectives

1.4.1 Aim:

- ❖ The aim of the study is to investigate the solid waste management practices in Umlazi Townships.

1.4.2 Objectives:

- ❖ To compile the socio-economic profile of the community
- ❖ To determine the different types of waste disposed by the community.
- ❖ To investigate about waste removal services provided to the people
- ❖ To look at the role of the stakeholder in trying to eliminate waste.
- ❖ To investigate the causes of illegal dumping in the area.
- ❖ To look at how waste affects human health and environment

1.5 Chapter sequence

Following on the motivation for this study as outlined in this chapter a comprehensive review of waste management and practices will be presented in chapter two. The focus in the third chapter will be on a description of the study area as well as on the methods or techniques used to execute this study. The data gathered from the implementation of the methods described in chapter three will be depicted

graphically and in tables in the forth chapter. In the fifth chapter the emphasis will be on discussion of the results and recommendations. The final chapter of this study will dwell on an overall conclusion of this investigation.

1.6 Conclusion

The findings on the study will make it easier to conclude on how some, if not all, urban areas under Durban Metropolitan Area practice the solid waste management. This will also give the full insight on whether the authorities play any role in the management of waste or not. This will also help to assess if the society is aware of the impact that their activities have on the environment.

CHAPTER TWO

Solid Waste Management: A Theoretical View

2.1 Introduction

There are many problems facing the environment in whole world, whether developed and developing country. Most problems cause impact to human lives, and these problems are either seen or unseen, felt or not felt. Urbanization, increase in informal settlement, discharge of pollutants, environmental degradation, depletion of natural resources, deteriorating infrastructure and social amenities cause change in the environment. Before elaborating much on the topic of solid waste management it's important to give brief definition of terms. These are not the only definitions but everything depends on the how one sees something to be. (www.cmc.gov.za)

2.1.1 Definition of terms

Environment is the “living area for people, and other organisms like animals, plants and insects. The environment is made up of renewable and non-renewable resources (air, water, land etc), natural ecosystem, and natural habitats that are made or changed by people living in it,” (Environmental Management Policy, 1999)

Waste is "an undesirable or superfluous by-product, emission or residue of any process or activity that has been discarded, accumulated or been stored for the purpose of discarding or processing". (National Waste Management Strategy, 1999)

Municipal solid waste is any “refuse from household; non-hazardous waste from industrial, commercial and institutional establishment; market waste; yard waste; and street sweepings”, (World Bank and Agenda 21, 2002).

Solid waste management can be defined as "the discipline associated with control of generation, collection, transfer and transport, processing and disposal of solid waste in the manner that is in accord with the best principle of public health, economics, engineering, conservation, aesthetics and other environmental considerations," (Tchobanoglous et al., 1993).

Pollution includes air, waters and land pollution, and cannot be seen, cannot be smelt and cannot be measured but contaminate now and leachate cause effect to future generation. The waste that is found on the environment affect either land or water, so due to this the brief definition of waste can be given based on the what was given by the National Waste Management Strategy (National Waste Management Strategy 1999).

Definition of waste varies from country to country making it impossible to compare one country to the other. In less developed countries 50-70% of urban waste is collected (1992 figures) and the rest is left on streets and open spaces. These areas end up being the breeding grounds for vermin and then lead to the spread of diseases (Jackson and Jackson, 1996). Nations with higher standard of living and productivity generate more municipal solid waste compared to those in less developed countries. This led to scarcity of land for waste disposal, which cause disposal to be costly and increases the demand for the new expensive ways of disposal. On the other hand some of the existing landfill close down because they don't meet regulations or they have reached their capacity. Due to the lack of geographic suitable site and the NIMBY syndrome it's difficult to relocate these landfills. At the same time politicians are unwilling to take strong position that might alienate their constituents, and this is due to what is termed NIMEY (Not-In-My-Election-Year) (Fuggle & Rabie, 1994)

Solid waste management and problem experienced in developing countries differs from that of developed countries due to some reasons. This includes the socio-economic and political issues that exist. Developed countries focus more on recycling, environmentally acceptable disposal methods. Developing countries have an inadequate waste collection and transportation with few environmentally friendly disposal sites. Developing countries use the informal sector solid waste recycling (ISSWR) mostly in informal settlement areas where the government fails to provide refuse collection services. (Enger & Smith, 2000)

Main aim of managing municipal solid waste is to protect health of the population, promote environmental quality and sustainability, and support economic productivity. In most countries the municipality is responsible to manage municipal solid waste. For most low- and middle-income countries solid waste services are not effective and sufficient for human use and they end up having negative impact on the urban environment and public health. In dealing with solid waste management an integrated system is needed which calls for minimizing waste, promote reuse and recycling, promote sound disposal and treatment of waste, and extend coverage on waste services. (World Bank and Agenda 21, 2002)

2.1.2 The status of the environment in the society

Environmental management is the only available solution to the existing environmental problems. For this management to be effective and efficient legislation and policies are needed to give guidelines and rules on how things should be done. The word environment can mean different things to different people but at the end everybody has a responsibility to care for the environment. Based on the definition of environment given above it is clear that people interact with the environment and they are the ones responsible for the sustainability of the environment. (EMP, 1999)

The activities, culture, politics and social systems, and economic activities affect “how people interact with the natural ecosystem and habitats, how they use natural resources that are available, and the meaning they give to different forms of life, ecosystem, physical landscape, cultural landscape and places,” (EMP, 1999). This is the reason why environment need to be managed in a way that will give clear understand to the people forming part of the environment, but there are some obstacles that hinders environmental management.

Obstacles to environmental management are financial resources, governmental fragmentation and staff expertise. Financial resources-are greater obstacle on the management of the environment and this usually face the local government. At the same time scarce resources compete with environmental needs. Cities or towns with proper funding have extensive environmental management programs and other cities are left suffering. Government fragmentation-governments have a responsibility in the management of the environment but this seems not to be the case for most countries where by the responsibility is shifted to private sector. The main problem is that the government entities cannot share responsibility on the environmental matters (Macozoma, 1999).

Lack of funding leads to the lack in staff expertise, which is required for the environmental management. Large cities hire consultant for waste collection while small cities have no choice but to rely on environmental groups, state officials, etc. The insufficient staff is caused by the lack of information about management techniques, which makes it impossible for local governments to adapt to new programs since there are no sources (Magazine, 1997)

The management of solid waste, which includes collection, removal and transportation, treatment, recycling and resource recovery, and disposal, is the core in all countries. Disposal could be in form of landfills, surface impoundment, land application, deep well injection etc. So by recycling old town dumps and the backyard dumps having detrimental effect to human health can be reduced or eliminated. Residential and commercial wastes are most common forms of waste in the municipal landfills consisting of “food and garden waste, paper products, plastic and rubber, textile, wood, ashes and the soil used as cover material,” (Owesis & Khera, 1990).

The insufficient and inefficient resources in the society promote the increase in open dumping in most areas, which end up putting public health in danger and increase environmental degradation. So the local authorities has a responsibility to improve services provided to people and at the same time upgrade the environment. (World Bank and Agenda 21, 2002). Burning of municipal solid waste cannot be the solution to the last end since fly ash and bottom ash are produced during this burning. The fly ash absorbs the metals, dioxin and other compounds.

For sound and successful management of solid waste local authorities need to focus on affordability, participation and demand, which are important measures in the provision of waste services in poorer communities. Most poor communities are situated next to open dumps, so improvement to be successful these dumps be closed. In that way the sanitary landfill could be the only choice available for the disposal of solid waste. In minimizing the amount of waste that reaches these landfills recycling, reuse, composting and waste-to-energy are complementing systems necessary for this. These systems could only be successful if education campaigns are organized and incentives are used to encourage people to reduce waste. Participation of private sectors in decision-making and implementation of any

project should be encouraged mostly in micro- and small-scale enterprises. In this manner the cooperative measures would help municipalities to share solution when it comes to collection and disposal. (World Bank and Agenda 21, 2002)

2.2 Types of solid waste

Waste includes all those materials banned by the law from being used or those not appropriate for use. This waste includes household, industrial and commercial waste that can be disposed via licensed disposal sites or with necessary consents. For all this waste there are special and hazardous waste in them. **Household waste** includes domestic property, residential home, educational establishment etc. This is referred to as garbage produced during preparation of or storage of meat, fruit, vegetables etc. and usually contains moisture content of about 70%. (Bahu, et al, 1991)

Commercial waste usually is generated from premises used for trade or business of sport, recreation and entertainment. **Industrial waste** includes “chemicals, plants, sand, metal ore processing, fly ash, sewage treatment sludge, etc.” (Rao, 1991:). Industrial waste is waste generated in areas occupied by scientific research association, from degrading operations, arising from tunneling, arising from aircraft, vehicle or vessels which are not occupied for domestic purposes poisonous or noxious waste arising from mixing or selling paints, etc. All this waste could have effect on the environment and to human health.

The **hazardous waste** are those waste that have a hazard to human health or living organisms. It can be classified into radioactive substance, chemicals, biological wastes, flammable waste, and explosives. The radioactive substances emit ionizing radiation and are hazardous because their exposure to radiation results in damage to living organisms. It persists over long period of time. Sites of disposal for radioactive substances cannot be used for disposal for other solid wastes. Chemicals are

hazardous because are highly toxic to most life forms. Biological waste sources are hospitals and biological research facilities. Its characteristics are that it has an ability to infect other living organisms and produce toxins. In this hazardous waste malignant tissues taken during surgical procedures are included and contaminated needles, bandages and outdated drugs. (Bahu at al, 1997)

2.2.1 Strategies for the improvement in solid waste management

- *Strategic service planning*- in implementing the solid waste management system in a metropolitan area demographic and industrial growth should be considered. Services are provided based on the people's demand and affordability, mostly focusing on urban poor people. At a national and provincial level the policy framework should link public health, environment and decentralization. Incentives is the best measurer that can be used by local authorities to deliver sufficient services, gain more costs from users, and work hand in hand with other municipalities.
- *More efficient operational management*-both private and public sectors should be involved in decision-making mostly facility siting and design service delivery. Allowing people to participate in taking decisions will exacerbate the success of any proposed project. On the other hand participation will limit the NIMBY (Not In My Back Yard) syndrome, which usually hinder development in urban areas. On the other side private sectors participation lower costs and improve efficiency and are used to mobilize investment funds and give new ideas and skills needed.
- *More efficient financial management*-in most countries generators of waste and the government share the cost of waste collection, transfer and disposal. Charges imposed to those who generate waste can be used as incentives

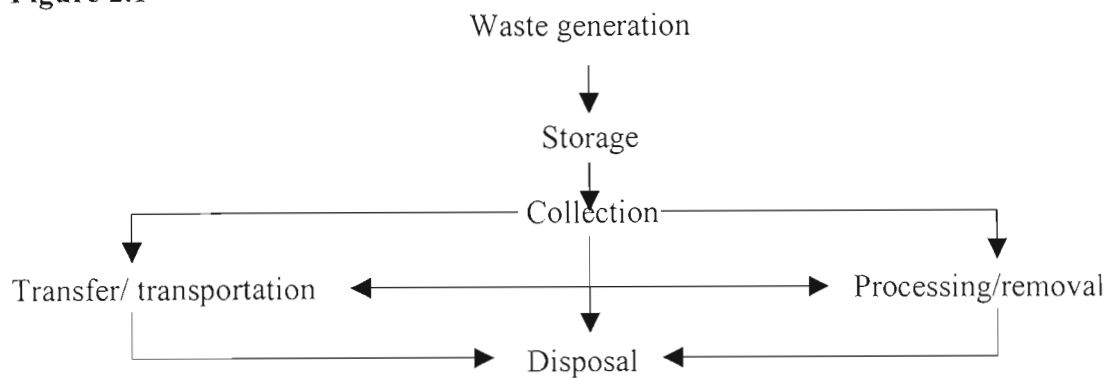
whereby people who generate more are to pay more, and this help to recover the portion of costs for solid waste management. In some instance people are willing to pay for collection but not for disposal in landfills. The management capacity of municipal authorities and corresponding municipal finance system should be improved as a way to improve solid waste management.

- *Improved environmental management*-the sanitary landfill is the only choice left to be used for waste disposal, so there is a need to close dumpsites and finance the operation of landfills. The lack of experience and financial resources hinders management of the landfill, so there is a need for financial and technical assistance to the lower- and middle-income countries. Municipalities also have a responsibility to help each other because environmental problem in one area can affect the other. (Fuggle and Rubie, 1994)

2.3 Waste Management Processes

There are six waste management process involved in the waste stream and each process will be discussed in details in the whole section of 2.3.

Figure 2.1



Source: Fuggle and Rabie, 1994

2.3.1 Waste generation, handling, and separation

Storage of waste in a container is not the only activity in handling waste but other activities include the transportation of a container to the collection point and return the container to its point. Different people responsible for the handling of waste generated on different onsite sources. Different handling and separation methods are used at residential and the commercial sources. Separation methods are used at residential and the commercial sources for purposes of recycling waste materials (Bradshaw et al, 1992).

The generation of waste in any urban area depends on the time of the day, day of the week, week of the month and month of the year. For example during month ends people generate more since they have more money to buy compared to the beginning of the month. Also during Christmas or vacation times people receive bonus and they generate more waste. Weather conditions, especially moisture content can impact

size of waste generated or waste to be disposed off. In the development of the solid waste management solution moisture, particle size, chemical makeup, density, and composition should be taken into consideration. (Bradshaw, 1992)

There are four levels involved in the handling of municipal solid waste, those are source reduction (where manufacturers has to produce what contains fewer toxins and less packaging, and people have to buy what is durable and non-disposable products); recycling and reuse (where recycling helps to prevent useful material from being placed in landfills, reuse save energy and natural resources); waste combustion (to provide benefit of energy production); and landfill (used to keep waste that cannot be recycled or combusted, and this included even the residues from waste combustion). The waste handling in the residential dwelling differs from the commercial facilities and the brief overview of this will be done below. (Bradshaw et al, 1992).

2.3.1.1 Residential dwelling

At this source houses with more than one floor are used to classify the methods used in handling and separation of waste. There are three different ways that can be used to classify methods at this source. Firstly, at low-rise detached dwelling that has floors less than four. In this dwelling it's the responsibility of the residents or tenant to place solid wastes, generated from different locations on the containers. And in most communities of US that fall under category are not expected to separation waste but instead to store mixed waste with little or no standardization.

At some stages people had to separate recyclable materials and store it on the separate bag or container, and then transport the container to the collection point. Secondly medium-rise apartment are those with floors between four and seven. In

these apartments, the residents had to place containers outside their doors and waste collectors pick up waste from each door. (Bradshaw et al, 1992).

According to Tchobanoglous (1993), storage location and collection methods vary with basement storage, outdoors storage, and compactor storage. In basement storage the owner of the building provides an area where people carry their recyclable and non-recyclable waste and deposit it on the right place. Then the maintenance staff transports containers to the curbside collection area, and return containers after collection. In the outdoor storage the container is outside and tenants had to carry their waste and recyclable material to the appropriate container, then the collection vehicle is responsible to empty the container (Tchobanoglous, *et al*, 1993).

2.3.1.2 Commercial facilities

Commercial dwelling wastes are collected from individual offices or work location and put on containers. But for most commercial building this is the problem since wastes are emptied from containers to burlap drop cloths. If these cloths are full before collection time there could be bad odors. Any onsite storage of solid wastes takes consideration of the “effect of storage on the component, type of container to be used, container location, and public health and aesthetics,” (Tchobanoglous, 1993).

The effect of storing wastes involves things like biological decomposition that result due to bacteria and fungi if food and other waste are placed in inside storage containers. If wastes are mixed together paper can absorb moisture from food depending on duration between the collections. The contamination of major waste components takes place if wastes are stored for long time. Therefore this reduces recycling possibility (Tchobanoglous, *et al*, 1993). Types of container to be used depend on characteristics of solid waste to be collected, collection frequency and the

space for placement. Low-rise dwelling in a commercial dwelling use light containers that are easy to handle since collection is manually. Highly loaded containers can cause injuries to collectors. These containers can be in a metal or plastic form depending on the homeowner. The metal container is noisy and can be damaged when emptied while ultraviolet rays can burn plastic containers (Bradshaw, et al, 1992).

Although individual containers are used for one apartment, in areas where apartments are close to each other people share containers. So if the container is full collectors have to pick it up otherwise people will litter anywhere. Medium-size and high-size apartments use chutes; separate storage containers are not used and wastes are stored in containers on the premises between collections. These containers include the large open-top containers, enclosed storage containers and special containers used in conjunction with processing equipment. Containers are located on the sides or near the house, in alleys where alley collection is used and in garage where available. (Bradshaw et al, 1992).

2.3.2 Collection and transportation of waste

High-income areas use hi-tech hydraulic compactor trucks for waste collection and transportation. Low-income areas use hi-tech hydraulic compactor trucks, open top trucks, tractors, trailers, animal drawn trailers, one person contractors, skip loaders, tricycle, pushcarts and so on. At last this waste can be hauled directly to the landfill or to the transfer station. As the waste increases the collection becomes more complex in most urban areas.

Complexity of waste collection is due to the reason that wastes are generated at residential and commercial industrial level, as well as streets, parks, and vacant areas. The other reason is that fuel and labor costs are high. Collection does not mean

only gathering solid waste from different places but also dragging solid waste forcibly. The dragging and unloading are similar for most collection system while facilities, activities or locations determines the gathering and picking of waste. (Bradshaw et al, 1992).

2.3.2.1 Collection of non-separated waste

In residential areas the collection services type varies depending on type of dwelling unit. In a low-rise dwelling the curb, alley, setout-setback, and backyard carry are mostly used collection services. In the curb services the homeowners have to empty containers at the curb and maintain their containers until next collection. Setout-setback service is where homeowner is responsible to take out the container and setback after being emptied. In the backyard carry service the crew enters the homeowners' property and removes stored waste. Most residential waste collection includes the direct lifting and carrying of containers, rolling of loaded containers or drop cloths. (Bradshaw et al, 1992).

In the medium-and high-rise apartment the curbside collection is used where the maintenance staff is responsible for transporting containers to the curbside collection, which is emptied by collection vehicles. In the commercial industrial facilities the manual and mechanical means are used for collection. Usually waste from the commercial facilities is collected in the late evening or early morning with an aim to avoid accidents on large cities. In manual collection wastes are collected from plastic bags or any other disposable containers and placed on a curb. One of the crewmember remains in the collection vehicle to control it. Movable containers or large-capacity open top containers are used on commercial industrial facilities, and at times containers are emptied mechanically depending on its size and type (Tchobanoglous et al, 1993).

2.3.2.2 Collection of separated waste at source

The separated waste is collected before disposal or recycling and for residential areas the curbside collection is used. In this method residents either have two containers to put recyclable and non-recyclable waste, or the crew has responsibility to separate wastes material. The recyclable wastes include waste like paper, plastic, glass, etc. Vehicles used for the collection of source separate wastes include open-bin manually loaded (where the crew has to load the bins), open-bin manually loaded mechanically emptied (where the crew load the bin then the vehicle is used to empty the bin), container mechanically emptied (where the vehicle emptied the container), and mobile container system. (Tchobanoglous et al, 1993).

At the commercial level the hauler has the responsibility to collect the source-separated wastes. Recyclables are stored at a separate container and collected by those responsible for it, and the city crew collects the contaminated municipal solid wastes. The collection system used can be viewed by looking at their mode of separation and be grouped into: -hauling container system (HCS) and stationary container system (SCS). The HCS is the system where the containers used for storage are hauled to the disposal site, emptied and taken to the storage point. SCS is system where containers are only moved for emptying in the curb otherwise remains at the waste storage location. The hauling container systems are used in areas where waste generation is high and usually large containers are used. These large containers save time during collection where workers don't have to collect many small containers, and these containers can be in different sizes and shapes (Tchnobanoglous et al, 1993)

There are three types of hauling container system:- host truck systems, which is used with stable compactors where waste is mechanically loaded in a collection vehicle; tilt-frame container systems which used by vehicles that have the capacity to haul

and unload the large containers usually use the open-top containers and the stationary compactors; and lastly trash-trailer system where the heavy rubbish can be easily collected by this system and is usually used to collect demolition wastes at constructions sites (Tchobanoglous et al, 1993).

The stationary container system can collect any wastes but usually vary in type and quantity of wastes to be collected. In systems with mechanically loaded collection vehicles the trip to the recovery facility or disposal area is done when the vehicle is full. This system is usually used for the collection of the residential wastes but cannot collect heavy rubbish and demolition and construction waste. A system with manually loaded collection system can be used for the collection of residential wastes or litter. This system of manual loading is used because most people could not have access to mechanized self-loading system. In the stationary container system labuors are needed. In the hauled container system only the collector driver is needed who is then responsible for all activities involved in the wastes collection (Tchobanoglous et al, 1993).

Due to congestion and narrow streets in most town and urban areas of small vehicles are used to collect wastes from homes then transfer it to larger vehicles loaded at ground level. Then large vehicles would transport wastes to the transfer station, which lead to the concrete platforms (Rao, 1991). According to Tchobanoglous (1993) transfer station are used for economic consideration and that can be proved when small manually loaded collection vehicles are used, when large quantities of wastes are hauled for long distance, and when one station is used by different collection vehicles.

There is a need to mull over the distance waste collectors spend going to and from the waste collector truck. So due to this there are different methods that can used in

trying to decrease the burden left on the waste collector, but all these methods have negative impacts. This can include garbage grinders that reduce the amount of waste but put extra load on the wastewater treatment. Pneumatic pipes where waste is transported through underground pipes and delivered to the plant. In larger communities the transfer stations can be used for daily waste intake. Thus resulting in workers spending more time collecting and less time traveling. The green cans on wheel are also widely used methods to transport waste to trucks and this can even be done by households themselves since there are hydraulic lift that help in emptying the can. (Bradshaw, et al, 1992)

In America the packer trucks are used to haul the wastes and are able to compress and reduce waste to volume of 60%. The drawbacks in collection waste are that it is expensive, whereby \$65.00 needed just for one truck. Trash collection is hazardous and cause detrimental effect to human being and the environment. Using the packer truck makes it impossible to separate one resource from the other e.g. glass, metal, paper etc. Large trucks used in metropolitan areas usually cause traffic congestion and noise or air pollution (Owen, 1989:447). Different methods can be used in the disposal of wastes such as open dumping, sanitary landfill, incineration and recovery and recycling.

2.3.3 Disposal methods

Waste stream need be identified before disposing any waste, where chemical and physical composition be considered. It is the responsibility of the producer to look at some environmentally sensitive contaminants like heavy metals, clinical waste. The nature of waste need be given more attention that is solid or liquid waste. The largest percentage of solid waste is disposed by landfill. Different reasons cause the increase in illegal dumping like insufficient collection services, ignorance of people on the environment, high rates that people have to pay for collection, and many more.

Landfills cannot be used for flammable solvents and heavy metals can be incinerated in order to reduce environmental impact. Location of disposal facilities can affect viability of some options. It is the responsibility of one company to visit the site in order to look at its management and records (Feates & Barrett, 1995).

The average municipalities need to avoid the future problems when selecting the solid waste disposal methods. The waste disposal practices are hindered by the increased scarcity of land that is suitable for the landfill site. This is due to the fact that more land is used for other land uses such as development related issues. At the same time the informal settlements increase in urban areas, and are clustered together. These settlements are characterized by inadequate, insufficient refuse removal services making the waste collection impossible. The lack of awareness increases waste volume such that people don't know about waste minimization or recycling (www.cmc.gov.za)

Any chosen method needs to meet the present requirements and care for the future situations. The waste disposal can be either on public or private sector depending on the decision of that country. In the United Kingdom (UK) in 1996, "the disposal of industrial wastes was undertaken either by the waste producing company itself, often simply dumping the waste within its own cartilage; alternatively a small local quasi-specialist hauler would be contracted to collect the wastes generally no more precisely defined than 'chemical wastes', and left to his own entrepreneurial skills to find suitable place at which to tip," (Henstock, 1983). Therefore due to lack of legislation thousands of sites for waste disposal were created, which at the end of the day needed special consideration.

2.3.3.1 Open dumping

Open dumping involves the low-lying areas and outskirts of the town. It is mostly used in most countries because it is cheap and requires no planning. In some instances wastes are burnt causing health problems to humans and can encourage breeding of flies, rats, mosquitoes and other pests. Usually this kind of disposal lead to the increase of infectious diseases like cholera, since during rainy days the water from these areas run to the open surface water used by people (Rao, 1991). Due to the increase of waste problems in India different projects were started with an aim to close the open dump areas. It is important for communities, states or local governments to work in partnership to address solid waste issues. This can help one nation or city to share the information and experience with another. Also the success of one nation can act as the incentive to the other.

Thus different tribes in India engage to different waste management plan programs. Some nations can be used to demonstrate these problems faced by most countries in the world and also the success of management. Most, if not all, projects were done under the funding of the United States Environmental Protection Agency (EPA). *St Regis Mohawk Tribe (SRML) to Expand Solid Waste Program*-the municipal waste management program of SRML made a great success in trying to reduce waste. Best used technique to reduce waste was through educational projects and community outreach. Under the EPA SRML funds were received where people were taught about the good disposal means and about the impact of burning municipal solid waste on backyards. Different things were done under proposed nations integrated solid waste management program. Also funds were used to clean up all open dumps and to prevent the future dumping. (www.epa.gov/epaoswer)

These dumps (40 in all) were ranked according to their impact on the environment and human health. Environmental Education and Outreaches were used whereby

posters were used to display the negative impact of improper waste management practices. It was deemed important to reduce wastes at source, recycling, and energy-efficiency issues. By using the media information on waste management it was easier to reach other nations (www.epa.gov/epaoswer).

The main aim of the program was to identify similar solid waste issues and share them with other nations in order to get successful approach to address. *The Yurok Tribe of the Yurok Reservation* in India was the first nation that received attention and in this area different illegal dumps were found and for the project in Yurok the elimination of these dumps was important. One best example is Weitchpec dumpsite in Northern California, which existed 40 years before the project, and it grew to about 1.200 cubic yards extending even to the highways. The extension of this dumpsite and impacts motivates the community to stand and wish to make a change (www.epa.gov/epaoswer).

The Yurok tribe government did not want participate since the site was located on the privately owned land but Yurok Tribal staff and on-reservation communities tried to convince the government. That was a success, and then California Integrated Waste Management Board (CIWMB) awarded \$600.000 to the project that Weitchpec be used as state clean-up project. Clean-up crews were trained and other regions of EPA were used to get the campaign know to the public. The problem rouse on what could be the legal dumpsite for Yurok. Then the Indian Health Service (IHS) gave \$150.000 to create the transfer station where waste could be stored before hauled to a landfill. The land used by California Department of Transport was used the for transfer station (www.epa.gov/epaoswer).

The success of the Yurok cleanup project lies on the responsibility of the people, community, state, and country. Therefore the community was educated about

reduction methods that could be used to dispose waste. Funds from HIS were used to develop recycling and source reduction education programs. Just because of clean-up project people no longer drove through garbage. Burning periodically was reduced, vectors diminished, and the wildlife returned to the area. According to Self Murguia the Planning Director for the Yurok project, the cleaning of visible larger sites make it easier to clean other nearby illegal sites (www.epa.gov/epaoswer).

Based on the problem of open dumpsites the tribal council, Indian Health Services (HIS) and Bureau of Indian Affairs (BIA) came together and in 1993 an aggressive solid waste management plan was adopted with an aim to close dumps in order to reduce volume of solid waste streams. Approximately 140 tons of waste was generated in Bois Forte reservation per year, and different elements were used to manage waste. Transfer stations where recycling took place were built. The used oil, tires, scrap metal, plastic, paper, and aluminum were recycled in these stations. People had to pay \$5 for five bags in which they may be able to dispose their wastes. Also for the implementation of the solid wastes management program people had to pay \$12 per month and businesses \$100 per month (www.epa.gov/epaoswer).

The funding facility came directly from the local authorities. Education is a most important way of passing information to the people, and this helps to get the community involved in the community programs. In Bois Forte people were educated about waste source reduction, recycling and proper trash disposal. The main concern of the tribe was to continue sustaining the program even if the grant from EPA expired. The best way was to have their way of selling recycled material to get money then allowing other countries to collect material and sell for sale. Since the implementation of the program only one illegal dumping site was found (www.epa.gov/epaoswer).

2.3.3.2 Landfills

Landfills are economically feasible and environmentally acceptable. In this method, waste is covered with a thin layer (8-10 feet deep) of soil to prevent blowing, keep away from insects and rodents, and to minimize odors. The final earth cover should be two feet and be placed over the complete land. The reason landfills are not accepted by most communities is that fact that they are not properly sited, not well managed and not efficiently operated. By considering siting, management and operation of landfills the best solution for urban waste disposal could have been found. Landfills are suitable for disposal because they take all types of waste and can be used for recreation purposed on closure. The “serious environmental impact linked with landfills is their potential for polluting nearby surface stream or underlying aquifers with leachates” (Nadakavukaren, 1978).

Landfill is the major disposal method used in the whole world and it accommodates waste that cannot be recycled or combusted. Municipal solid wastes are disposed in landfill sites, and the siting of these areas has become the serious problem due to some reasons. Such reasons can include the technical problems that are in accordance with hydrological sustainability, and the attitude of people towards waste next their homes or in their lands. (www.durbansolidwaste.org.za)

According to Owen (1989) landfills are beneficial since they can be used for any other important purposes, for example, recreational facilities and educational parks to educate urban children about wildlife and ecology. For these purposes to take place waste is stabilized, unearthed, sorted and usable items removed, and then unwanted waste materials left after this process is re-landfilled. In areas with high population more land is needed to cover wastes. Landfills have negative impacts if soil is permeable making it possible for disease causing organisms to be transported

downward and percolate groundwater. The landfill method usually takes place on spoiled areas or any other land that needs restoration (Owens, 1989).

In most countries landfill sites are full and have reached their capacity and will close down soon. The reason is not the absence of land for filling waste but the NIMBY (Not-In-My-Back-Yard) syndrome caused by different aspects. This includes things like noise pollution associated with the loading and emptying of trucks, and effect on property values. Waste on landfill might have the impact on the future generation if not properly managed. In some instances landfills are situated next to squatter or poor communities. There is no way in which waste can be eliminated but instead can be reduced. Reuse and recycling occurs to some materials but metal is recycled until letting up. The residue from recycling and non-recyclables still need other ways of disposal that means landfill is the choice at a long run. (Hill, 1997)

The reduction of waste leads to the planet protection and at the same time providing financial and social benefits. For effective management of solid waste the prevention, reduction, reuse, recycling, and recovery are the initial integrated methods to use. If waste on the landfills is not properly managed the leachate can cause contamination of the ground water, which causes less productivity on the soil. The air that comes from the landfills has methane and carbon dioxide that contribute to the greenhouse effect, and can also represent the loss of energy. At the same time dust and gas from landfills cause health problems to the people living next to the landfills (Hill, 1997)

Areas suitable for landfill sites are those that at least are of benefit to the community and the environment at large, not just any hole in the ground. Before designing the landfill different things need to be considered such as topography of the site, geology

of the site, water pollution, site preparation work, equipments, mode of operation, and health and safety. (Henstock, 1993)

The sustainable landfill can be defined as “one where air space, processes, use of products and residues are at an optimum, and where minimal negative effects on the environment are detected,” (Novella, 2000). In these landfills the goal is to treat waste without an environmental pollution or any harm to human health for a lifetime. Before the designing of the site for land filling its important to look at the characteristics of the waste that is to be disposed on the area. There are hazardous and non-hazardous wastes so any construction depends on the type of waste to be disposed. Non-hazardous waste includes both municipal and commercial waste whereby only leaching test and physical test can be performed (Novella, 2000).

Listing and identifying the characteristics can define hazardous waste. Those characteristics are corrosivity where waste is aqueous with pH less than 2 and greater than 12.5. Toxicity can be found on waste with equal or greater lead, barium, etc. Ignitability include waste that is liquid with less than 24% alcohol, and reactivity- the reactive waste are those that are unstable and undergo violent change. The hazardous waste should not be disposed on the landfill without pretreatment. Waste that need not to be disposed on the landfill has high violent organic content, aromatic compound, metallic, cyanide, liquid that generate too much leachate (Christensen et al, 1994).

For construction of a new plant the estimate waste volume should be made from waste generation rates of an industry. The landfill cannot be located with a certain distance of lakes, rivers and flood plain, highway, public parks, wetlands, airports, and water supply well, critical habitat area. Leachate quantity is influenced by the precipitation groundwater intrusion; refuse collection and final cover design.

Depending on geographical location the amount of rain and snow influence landfill location. In most cases the landfills are constructed below the groundwater table so that groundwater intrusion increase leachate quantity (Christensen et al, 1994).

The unsaturated waste absorbs water until it reaches water saturation rate, and then dry waste reduces leachate. Vegetation grown in topsoil of final cover reduces infiltratable moisture and permeability layer reduces percolation, and this reduces leachate after landfill is closed and finally covered. In the construction of landfill the liner and final cover depends on the correct choice of material and proper quality control (Christensen et al, 1994).

There are three different techniques for refuse placement currently; those are trench method, area method and ramp method. In the trench method a long narrow pit is made and soil removed is piled up to be used for covering. Waste is shallowly deposited in layers in a slope form and then compacted by the relevant equipment. At the end waste is covered with soil that was removed from that trench. In the area method waste is dumped on the intact ground and spread into layers and then flattened. At the end of the operation day waste is covered by soil transported from other locations. The difference between the two methods is that the trench is usually used on areas where groundwater is far from the surface while the area method is used on areas where groundwater is near the surface. The ramp method combine both trench and area methods. In this case soil is removed in front of the proposed face on the existing slope. Waste is deposited, flattened and covered using the soil that was removed from the pit. This occurs quite a lot of times at the front wall of the newly created slope. (Pavoni et al, 1998)

Landfill constructions can also include the subbase, berm, sand drainage blanket, leachate collection trend and many more. Subbase construction is where liner system

refers to the ground surface on which liner is constructed, and that can be easier if compaction and grading takes place. Berm construction uses the sandy soil for construction of landfill. In this construction the coarse -grained material such as rubber tire roller, smooth wheel roller, and a crawler tractor are mostly used. Berm is conducted on horizontal lifts, and its natural attenuation type landfill includes clay core and/ or riprap on the interior face.

Sand drainage blanket construction involves dumping sand on a final liner. The light cover is used in operation so that it does not travel directly on the liner. Due to heavy rainfalls construction may be eroded on the sideliner. The grading layer is constructed by using poorly graded sand, which is found below the low-permeability layer. Cover layer is constructed by finer soil mixed with sand if there is no silt soil. Then the topsoil layer is important and equipment that are heavy be used on the finished surface. After all this is done grass and bush type vegetation that are able to survive are planted, this is the landfill cover construction (Christensen et al, 1994).

According to Christensen et al (1994) for the construction of landfill barrier system either natural or synthetic material can be used. Natural material include clayed soil, and bentonite, which when mixed with sandy soil provides low permeability liner, the sand used to protect synthetic liner and increase filter stability and gravel which mostly used for filtering and draining. The synthetic materials are responsible for lining, separation, drainage, filtration and reinforcement. The advantage of using synthetic material is that they are available, have small consumption durable, and low cost and low maintenance.

Principles of landfill barrier system – the leachate control is difficult to control than the gas phase control. This is whereby soluble materials in the landfill are transported to the environment. Functions of the elements of the barrier system are

bottom barrier prevents escape of biogas to environment, provide impermeability, provide support for waste mass and avoid accumulation of leachate due to infiltration. *Side barrier* prevents lateral migration of biogas, provide resistance to water pressure and provide drainage of leachate. Lastly, *top covers* reduce rainwater infiltration through a combination of sealing and drainage function, and provide support for aftercare like vegetation and erosion control (Christensen et al, 1994).

Mechanical protection-synthetic liners are protected from puncturing by pressure of granular draining material, and by action of vehicles equipment. Layers of sand can achieve this mechanical protection or small sized rounded graze. Separation-penetration of one material into the other is avoided by providing separation layer when combining granular materials. Erosion control- a completely constructed landfill should be protected against water and wind erosion. Materials like genets and mats provide support for vegetation growth and gives solution to erosion problem. Water filtration-ground and surface water should not be allowed to infiltrate landfill, and this can be done through the utilization of granular material and geotextiles. (Christensen et al, 1994).

In Adelaide metropolitan area in South Australia, about 930 000 tons of solid waste were disposed on landfills during the years 1999 and 2000. This increase was due to the increase in economic activities and at the same time the illegal dumping decreased. In this area landfill waste was the building and demolition waste, followed by domestic waste then the commercial and industrial waste. Most of the solid waste disposed on the landfills of Adelaide is recyclable including glass, cans, bottles, plastic, paper and cardboards (www.adobe.environment.sa.gov)

2.3.3.3 Incineration

This process involves the “burning of solid wastes at high temperatures; leftovers ashes, glass, metal and unburned combustibles amounting to perhaps 25% of the original wastes,” (Rao, 1997). Incineration is both a form of waste treatment and waste disposal. “It is the controlled combustion of waste material to a non-combustible residue or ash, and exhaust gases such as carbon dioxide,” (National Waste Management Strategy (National Waste Management Strategy, 1999). Remains residue still needs to undergo a certain method of disposal. Incineration lead to air pollution but plants are designed and operated to cope with pollution standard. The non-combustible materials are moved using gravity or magnet separation. Combustibility of wastes determines applicable incineration process and is characterized by flammability limits, flash points and ignition temperature.

This method has both advantages and disadvantages. Advantages are that it requires less land space, waste collection is less expensive since incinerators are located close to the point of waste generation, and dispose both domestic garbage and rubbish without separation process. Disadvantages are that the consumption of waste by incineration is highly costly than landfilling, and high corrosive gases may be released during incineration (Owen, 1989).

The incineration can be described as strived air or directed combustion operation depending on oxygen amount available. The treated waste is burnt with excess air in the combustion chamber of the incinerator. Secondary combustion is used if solids are burnt in the primary chamber or difficult compounds are being burnt. Cooling of combustion gases depends on heat recovery used. Incineration has a poor public image increased by concerns over problems associated with dioxins in some cases (Bahu et al, 1997). Due to the fact that landfills are getting scarce the recycling can be viewed as the best solution for economical and environmental reasons.

2.3.3.4 Recycling and recovery

In recovering material such as steel, aluminum, copper and many other items can lead to reduction of to be collected for disposal on landfills, and the reuse could increase resale income. Recycling is only important if it increase social benefits over social cost by maximum amount. Recycling can yield the following benefits “saving in refuse collection and/ or disposal cost, depending on the form of organization and type of disposal adopted... reduction in most cases overall pollution impact, when recycled materials are used as raw material input in production processes; reduction in the quantity of primary material requiring extraction and processing, as well as consequent reduction in energy use,” (Bradshaw, et al, 1992 cited in Tuner, 1981).

The materials that mostly need recycling are packaging, which in developing countries represent 40% of municipal solid waste. For Europe by 2005 about 50% of all packaging material will be recycled and reused, and some countries have already change their packaging. For example, Denmark plans to ban the use of polyvinyl chloride container packs and had control use of aluminum cans and taxes on packaging (Feates & Barrett, 1999).

2.3.3.4.1 Paper and board content

In UK the whole process of paper recycling was on the issue of whether by recycling the natural forest are saved or not. The focus was that by recycling there would be no incentive for those who plant tree to continue since fewer trees would be bought for paper. The recyclable paper can include the computer paper, photocopy paper, envelopes, newspaper, cardboards, magazines, phone books, notepaper, and many more depending on the quality fibre on the paper collected for recycling. Papers produced for hygienic or sanitary purposes cannot be recycled. Waste paper contains grit, ink, tar, clip, coating; rubber bands etc. that needs the proper consideration before any processing or sorting takes place. The recycled papers can be used for

paper boards, insulation, paper bags etc. as they can't be turned to virgin papers because of what they contains. (www.unido.org)

In South Africa 720 000 tons of recyclable paper and board are collected annually. This cuts the demand for virgin timber where by there would be no incentives to produce more trees if more paper is recycled. About 38% of total consumption is being recycled which is nearly equal to 40% worldwide. According to Mondi Recycling Company, recycling benefits the environment so much even though there is no assistance to the industry to finance this benefit. About one third paper waste is from domestic waste and one tone takes three cubic meter of landfill, so this saves the land to dispose waste (www.unido.org)

In South Australia paper makes up to 25% of the waste stream and what is good about this waste is that it can be recycled. Different strategies can be used to reduce waste that is caused by paper and this could be on the responsibility of the consumer. People should use both sides of the paper for things like photocopying, printing, or faxing; reuse paper such as for wrapping, carrying things, cleaning windows etc; to give away unwanted books or magazine; buy and use paper with high recycling content; and remove all contaminants such as staples, string, paper clips and many more before recycling or taking to recycling stations.

2.3.3.4.2 Glass

Among the recycled material, glass is produced from cheap material and can be recycled in many ways since it is always clean. Glass used for packaging, and glass that can be suitable for recycling includes all clear, amber and green glass bottle, soft drink, mineral water, wine, beer; and all glass jars. These glasses can be reused both at home and in the office, used as food storage utensils at home and place to store paper clips, pencils, etc in the office. (Rao, 1991)

In India there is a market that collects waste glass for recycling and the cullet is used for new batch of glass produced. Accordingly “there is a 2% energy saving for every 10% of cullet introduced into the furnace. Green glass with a 90% cullet content yields an approximate energy saving of 25%,” (Bradshaw, et al 1992). Due to the difficulty in the separation of glass from other solid waste different methods can be used to do the separation, and here is the illustration of some methods that can be used.

Table 1 Glass separation methods

Method	Separation procedure	Comment
Froth flotation	Separate by surface characteristics	Potential for 95% recovery glass not color sorted.
Dense media separation	Material separation in stages	Particles are large enough for color sorting
Color sorting	After removal of stones, ceramics, and residual material by a transparency-sorting device a color sorter matches particles with the background for flint amber and green. Air jets deflect particles into bins.	Marketing of recovered glass increase unit, requires constant calibration, organic residuals may cloud readings.

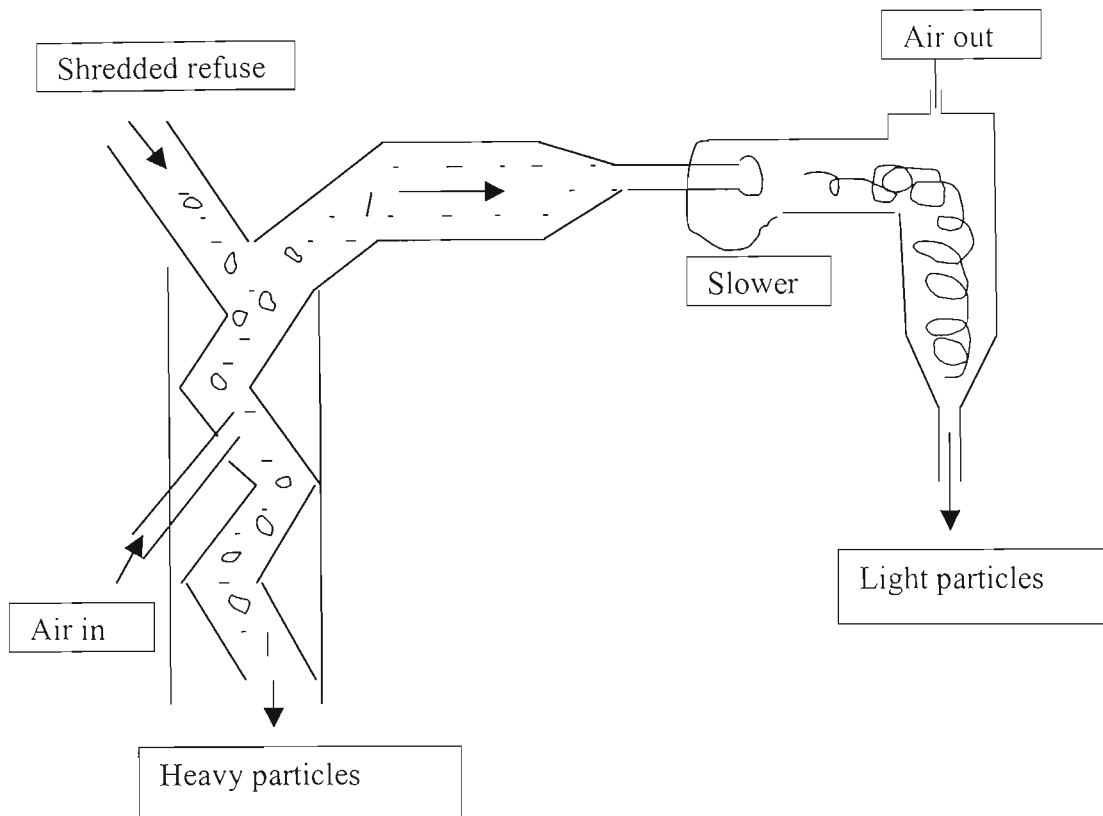
Source: Rao, 1991

2.3.3.4.3 Metals

Both ferrous and non-ferrous metals arise as scraps and the separation of these metals is important before any processing. Non-ferrous metals that can be recycled include aluminum, copper and lead. To recover aluminum from solid waste gravity, separation, magnetic separation and thermal separation methods can be used. In

gravity separation the zigzag separation is an ideal example, which allows high-pressure air to separate aluminum from heavier materials. The illustration of zigzag separation is shown below.

Figure 2.2 Metal separation method



Source: Rao, 1991

This zigzag operation separates the heavy particles from the light particles in the metal during the recycling process. As the process goes on, air either go out or comes in using different pipes. Light particles are the ones used for the recycling purposes while the heavy particles are those that cannot be used any more. The substitutes for pure virgin metals can be of high purity such recycled aluminum. The less purity

such as municipal solid waste recyclables contains metals like iron, zinc, copper and silicon adding strength to the end product.

2.3.3.4.4 Plastic

Plastic material consists of carbon, hydrogen and oxygen, and this material is non-biodegradable, this means that it can cause particular problems (uneven settlement or voids) in landfill sites (Bradshaw, 1992). Recycling of plastic occurs by mixing raw plastic during production of new plastic. The problem lies where by these mixed plastic cannot be recycled and plastic turns to be a major problem in municipal solid waste stream. Another idea is of decomposing plastic material. Chemical of plastic exposed absorbs light and release energy, which breaks polymer chain and plastic, loses its strength and be broken into pieces by wind or rain. Therefore the remaining pieces will mix with soil and be decomposed by bacteria. (Bradshaw et al, 1992)

Zimbabwe can be used as the example of a country that uses recycling as an alternative to landfilling. Zimbabwe used open dump as sites for solid waste but since these areas were unsafe, unsightly and lead to health and environmental problems other means were needed. Integrated waste management techniques were the only solution where different practices with less effect were to be used. The recycling initiatives are operational in Zimbabwe but there is no de-centralized cycling infrastructure by the local government. (www.worldtrek.org)

The first initiative was the Environment 2000's Recycling and Anti-Litter Program (RAP), which was established in 1995 with an aim to introduce recycling and reuse in Zimbabwe. The program had a committee that bring awareness about recycling, reuse and waste management. The RAP pads were formed which return recyclables in over 100 schools where recyclable waste was taken. These schools collect paper,

cans and plastic for reuse and recycling and generate income. About 32 of the RAP pads were sponsored with about \$105 000 by Canadian International Development Agency (CIDA). The sponsor was for the fact that schools were creating awareness about solid waste management problems. Women were involved in this recycling and reuse strategies whereby the brooches, bags, etc. were made from bottle tops and beverage cans since they cannot be recycled (www.worldtrek.org)

In Zimbabwe packaging depends on the recycled paper, since waste paper coming from industrial areas, commercial sector, supermarket and central business district was being sold to the National Waste Collection. The high deposit charging on bottles forced people to return bottles to the stores making the glass waste to be low and recycling was the core instead of producing new. Recycling of plastic increased in industry of Zimbabwe and these recycled plastics were sold even to other African countries. Waste plastics are sourced from Zimbabwe mostly from commercial and industrial enterprise. This recycling makes it impossible to recycle the recycled plastic then other alternatives are seen for plastics (www.worldtrek.org)

2.4 Solid Waste Management at different levels

2.4.1 International

When dealing with waste management the main focus is on the minimization of environmental effects and maximization of recovery and conversion of energy and materials. Options involved in solid waste management include source reduction, recycling, conversion to energy, and landfilling. The information is needed for any country to be able to make decisions on energy production and energy conversion good. That is the reason that in the *United States of America* the Department of Energy conducts a project through National Renewable Energy Laboratory (NREL) to enhance commercial development for all options on municipal solid waste. By managing municipal solid waste the amount of waste to the environment or to

landfill sites can decrease. About 140 plants in US that convert waste to energy, and they either combust waste directly or use refuse derived fuel made by reducing particle size. Other landfills are used to convert gas to energy. These plants were risky to human health since after four years waste begun leaching then ashes reaches the drinking water (Jackson and Jackson, 1996).

The municipal solid waste can be transferred in three types of processes: - material recovery and reuse, biochemical conversion and waste combustion. The NREL focus mostly on the method used for waste to energy conversion, and determines effect of emissions and ash residue. The construction of energy conversion plants often results in negative impacts such as emission and perceived risks on health and environment” (Jackson and Jackson, 1996).

Hazardous waste is considered as the serious problem in most countries but some people or countries don't look at garbage as the serious issue. This garbage can include waste that is next to homes, seen by people, smelt by people, and have to deal with it on a daily basis. It is easier to ignore deforestation or global warming but difficult to ignore what is always next to you and have an effect on you. So due to the effect of garbage on the environment it is the responsibility of the government, interested and affected parties to encourage waste reduction at the source and to apply suitable collection and disposal methods.

For the northern American municipal the incentives are ways to encourage people reduce waste. Those incentives can be social where people are to recycle material on their own commitment and this can easily happen on small neighboring townships; and other one is economic momentary or incentive where people receive something fro recycling, and this occur on areas where municipality is large and people are anonymous to each other (Jackson and Jackson, 1996)

At some stages the fact is that people don't view waste as the risk as it is, but look at one material as a large component of waste stream than other. There are four myths presented by Sara (1990) based on garbage. Firstly there is a belief that there is no space for landfills but this is not true. The problem is the result of the NIMBY (Not In My Back Yard) syndrome by most people that don't allow landfill sites next to their homes as they know some impacts that waste has on their lives. Secondly, plastics are bad; this one is not true because when comparing paper and polystyrene foam containers used by McDonalds, finding shown that polystyrene foam is the better packaging as it use less energy and produce small toxic waste that paper container. And lastly, recycling saves tree, this does not happen to the large extent since by recycling paper incentives to plant more trees decrease (Sara, 1990).

In United State Resource Conservation and Recovery Act is the only federal regulation that deals with municipal solid waste. It regulates the generation, transportation and disposal of solid waste. Based on this act it's the responsibility of the generator to look at waste generated whether it's hazardous or not/ solid or not. Solid waste can be hazardous if listed by the EPA to be so or if it has toxic, ignitable, corrosively and reactive characteristics. Even waste generated from disposal or treatment of hazardous waste or being mixed with it, is regarded hazardous. This is the reason why Rossiter (1995) state that the RCRA regulatory program is an 'all or nothing' and one 'size fits all' program. There should be a shift from federal regulations to allow human local interest. The incineration is not preferable used than recycling because health risks are involved and the incineration processes are expensive. But on the other hand incineration can be the better choice since it produce more energy per waste volume and can produce less ash materials when separated (Rossiter, 1995).

Waste management can be successful if policy recommendations are included to social mechanisms such as to teach about waste recycling, inform people about options and use neighbourhood organizations to know more about what people are doing. Education programs can help to draw attention of the people and get them to know that waste has an effect on their health and the environment in which they live in. There are few international agreements affecting hazardous waste management, and common one is between United States and the Soviet Union banning atmospheric deterioration of nuclear devices. More efforts to develop international criteria and controls on chemical waste discharged into the oceans are needed, and this could mean that land would be the only site available for future disposal. At federal level regulations concerning hazardous materials are formulated, and are designed to control packaging, storage, and movement of hazardous materials. (Rossiter, 1995)

Most important regulations for controlling hazardous waste at this level are related to waste discharge and air emissions. The emphases are towards the elimination of the disposal of waste in either the water or air environment. Local regulation on hazardous waste has narrow scope. Identified wastes are restricted by ordinance from local sewers and waste water treatment facilities. The restrictions lead to the removal and concentration of liquid hazardous waste for delivery to an acceptable solid waste disposal sites (Rossiter, 1995).

2.4.1.1 Solid waste management hierarchy

Most preferred
Avoid
Reduce
Reuse
Recycle
Recover
Less preferred
Treat
Dispose

Source: (www.ns.ec.gc.ca)

The above strategies can be used in the management and prevention of waste, where one category is viewed, as the preferred one while the other is not preferred. The brief overview on each strategy will be done based on how it can benefit or help in the reduction of waste in the society. Waste avoidance is the first and important option, which is cost effective, in that manner less or no waste means less or no cost involved in the management. It is the responsibility of the producers to make sure that in the production process they look at how waste can be reduced or eliminated. Same time, consumer have the responsibility to change their shopping behavior like reusing carrier bags and buying things in bulks (www.wastecom.sa.gov)

The reduction of waste can only happen if packaging can be designed with less material and cutting out the unnecessary packaging. Reuse of products help in avoidance of the excessive consumption of resources and waste generation can decrease. Products that can be reused involve cloths, books, old furniture etc, for the different purposes; and this includes the reuse of plastic bags for storage or any other thing. Recycling can be used to those products that cannot be reused any longer, and

recycled materials consume less energy and protect the environment from being degraded during production of virgin material (www.wastecom.sa.gov)

Recovery involves the incineration of waste and recovery of material latent heat, which can be converted into power and be used commercially and domestically. The treatment and disposal is the less preferred strategy in the hierarchy and it includes the residue waste that cannot be reused or recycled. This waste need be treated and disposed with more focus on the social health and safety, environmental risk, and any other related problems. Important benefits posed by the minimization of solid waste include the following:

- *It conserves valuable resources*-the non-renewable resources are most frequently and at the late stage will be depleted, so the use of less valuable resources can increase only if waste be minimized.
- *It saves money*- the reuse; recycling and reduction decrease costs used for the management of waste. So buying and consuming less means that there could be less waste to be disposed on the landfills. At the same time less money is being used for the collection, transportation and development of the landfill sites.
- *It reduces environmental harm*-due to waste minimization less virgin materials are needed, which in turn reduce the environmental degradation that occur during the resource extraction and processing. Less solid waste means less greenhouse gases and associated pollutants, and the less need for more space for landfill at the same time reducing leachate and groundwater contamination.

- *It results in social benefit*-the increase in concentration on waste management increase job opportunities. So the increase in employment serves as the incentive to people to care for environment by not consuming more than what they actually need (www.wastecom.sa.gov)

2.4.2 National

This big challenge facing South Africa is to provide basic needs to the daily growing population. In doing this the environment should not be threatened instead there should be good care of the natural resources. By caring for the nature and utilizing natural resources in an acceptable and environmentally right manner, the road to sustainable development is very easier. According to Yeld (1991) the most important thing is to have the society that is sustainable and that could only be achieved by applying some principles.

2.4.2.1 Principles of Sustainable living in South Africa

- *Respect for the community of life*: people have a right to stay on the protected area and be given a right to take decisions based on the area they live in. In doing this people have to care for all other forms of life like animals or plants and even make sure that they don't threaten habitats of this organisms.
- *Improve the quality of life*: this principle calls for people's access to education, land and resources required for living. For South Africa there is a need to take actions against gender disparities and give women a chance to have access and control over income, credit, land, education, training, health care, and information. After South Africa's democratic election Reconstruction and Development Programme (RDP) was introduced. RDP was aimed at providing services to people as a way to promote human health. These services include

electricity, adequate housing, and access to clean water, sanitation facilities and school feeding schemes. When looking at the status of people today it is easier to say that there is a long way to go before this principle is implemented.

- *Conserve the earth's vitality and diversity*: protect both renewable and non-renewable resources whether terrestrial, marine or atmospheric. Using the resources in a sustainable way will help such resources to renew themselves. It is important to prevent pollution that makes it impossible for the natural ecosystem to cleanse itself and also prevent land base sources from polluting the sea.
- *Minimize the depletion of non-renewable resources*: non-renewable resources include oil, minerals and gas and their exploitation in SA is high with an aim to accumulate more wealth. This exploitation needs to be minimized because that might lead to the depletion of resources that cannot be renewed. The only available option to extend the life span of these resources is by recycling, which needs improved technology.
- *Keep within the earth's carrying capacity*: the population number, energy and other resources that people use and dispose as waste determines the impact that people have on the environment. There are five things that the government and communities need to do in order to keep within the carrying capacity. Sustainable manage the environmental resources, deal with population growth and resources consumption collectively, minimize waste promoting activities, use formal and informal education to provide people with information on earth's carrying capacity, and link women empowerment with right health care and family planning services.

- *Change personal attitudes and practices:* among the things that cause much impact on environmental problems is poverty. Poor people exploit natural resources because those are the only free and available resources they can use. For example in rural areas trees are chopped down for firewood. People who do this are aware of the impact their activity has on the environment but they are forced by the circumstances they live in to do it. So for such activities to be minimized people's lifestyle should be changed and be encouraged to adopt the ethic of sustainable development.
- *Enable communities to care for their own environment:* communities should be given a chance to care for the environment they live in. This might lead them to use resources in a good and acceptable manner, and minimize waste and then encourage safe dispose. Different activities can be involved in caring for the environment where people can have a chance to conserve, control pollution, engage in rehabilitation processes and improve urban environment. This can only be successful if local communities are involved in decision-making on all levels, and be given relevant information on the environment. (Yeld, 1991)

For a long time waste management was not given the priority it deserves with an aim to prevent pollution that seem to be a problem in *South Africa*. Ignorance to environment resulted from the lack of information, planning and appropriate legislation. If the government capacity lacks any enforcement of legislation cannot be successful mostly with regard to waste disposal; and exportation and importation of hazardous and radioactive waste. Absence of integrated waste management options is the major problem of the waste system in South Africa. This is because there are no incentives imposed to people on waste reduction, and industries are not

asked to present their management plans when they apply for permission to establish new enterprise. So since the communities are the ones who are affected by the pollution they need to be involved in the implementation of any policy. Therefore community participation is the chief cornerstone as people are the ones affected by pollution, hazardous substances and waste in home and work environment (World Bank, 1998).

The waste problem affects the whole world either developed or developing country. The increase in waste leads to the increase in pollution on land, air, or water. This can be significant to the report by World Commission on Earth and Development and Rio Conference of 1992. Even South Africa is part of the world that is affected by waste and pollution, which led to the development of the policy on Integrated Pollution and Waste Management (IP&WM). By this IP&WM it could be easier to bring about sustainable development. When looking at the South African constitution the Act no. 108 of 1996 have issues relevant to pollution and waste management (White Paper, 2000)

Environmental Conservation Act No 73 of 1989 is of particular relevance to the waste disposal and the permitting of waste disposal sites under Section 20. The National Water Act No 36 of 1998 addresses the point that all water resources be protected, used, developed and managed in a way that takes into account protection of all ecosystem. This at the same time is supposed to look at the human needs, which will lead to the reduction and prevention of pollution. Section 21 of the Act states that water be used in the way that will have positive impact on the waste resource. (National Waste Management Strategy, 1999) The administration and enforcement of this acts can open authorities' mind's that they need to care for the environment they are in by putting legislation on waste generation, transportation and disposal.

According to Chapter 7 section 28 subsection 1 on the National Environmental Management Act, 1998 “every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or reoccurring, or, in so far as such harm to the environment is authorized by law or cannot reasonable be avoided or stopped, to minimize and rectify such pollution or degradation of the environment” (Government Gazette, 1998).

Based on this Act any individual, group of people, company or an industry engaging in an activity should make sure that the environment is not degradable. On the other hand if something happen that affect the environment the concerned party need to take actions to solve the solution. The Act does give people a way of doing things but the problem is with enforcement and compliance. Therefore it the responsibility of the local authorities to make sure that people engaged in activities that concerns the environment are made aware of their activities and they should comply with regulations of the country.

According to the Constitution on Environment Right (section 24) of the Bill of Right “every one has the Right to an environment that is not harmful to their health or well being, and to have the environment protected, for the benefit of present and future generation through reasonable legislative and other measures that prevent pollution and ecological degradation, promoting conservation, and secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development,” (SA Constitution, 1996). But when looking at the townships of SA this does not seem to be applicable whereby people are faced with high volume of waste found on illegal dumps.

The reason for this illegal dumps is that there are no efficient and effective collection and disposal services available to people, and where services are available are they expensive and people don't afford rates they are expected to pay. The increase in industrialization has resulted in an unequal distribution of resources and wealth among people, which causes an escalation of and practices that are harmful to the environment. It is the responsibility of the government to make sure that the rights of the people are taken care of.

Among the objectives of the White Paper on Environmental Management Policy is to find ways to reduce waste generation and pollution at the point of origin and promote the practices to reduce waste, and those are reuse, recycle and recovery with safe disposal. This objective is never met since the reuse and recycling are not considered the appropriate ways of disposal instead landfilling takes place with effects on the environment (White Paper, 2000).

Under the **Integrated Pollution and Waste Management** for SA (White Paper, 2000) about seven strategic goals were to be achieved and each goal has objectives.

- *Effective institutional framework and legislation*- the aim is on the framework and legislative system that is effective.
- *Pollution prevention, waste minimization, impact management and remediation*- the avoidance, prevention and minimization of pollution and waste could only be made possible if parameter and good house keeping for waste generating processes follow the good mechanisms. The laws to be followed when treating and processing the waste should not be harmful, and everyone should have enough waste and refuse collection services.

- *Holistic and integrated planning* is important to integrate government policies, strategies and programs with the pollution and waste management consideration. This planning looks at time and appropriate provision for adequate waste disposal facilities. Environmental management principles and methodologies in spatial development are important for the management.
- *Participation and partnership in integrated pollution and waste management governance*- it's the responsibility of the government to make sure that communication in all spheres address public participation needs. The institutional capacity in national, provincial and local government can be built through resource allocation with an aim to increase participation.
- *Empowerment and education in integrated pollution and waste management* in South Africa can be used as the way to create awareness of and concern for waste and pollution issue. The education programs are important to give clear understanding of interrelationship between pollution and waste, and of the economic, social, cultural, environmental, and political issues. Through the program involvement of women, youth, disabled, unemployed and all people according to their category was the main issue.
- *Information management system*-this need to be developed and maintained to provide good information to affected and interested parties.
- *International cooperation* was also important where at the national level the issues of pollution and waste is of great interest. (White Paper, 2000).

Although some of the Government's commitments to sustainable development seem to fail the focus is still on development that does not have a threat on natural and

built environment. The land pollution due to waste results because of inadequate management of waste disposal sites, leachates, illegal waste disposal and lack of suitable hazardous waste disposal sites. So to look at the integrated pollution prevention more consideration needs to be on things like impact of organic waste on surface and groundwater quality, and impact of waste and hazardous waste disposal sites (White Paper, 2000)

Both the provincial and local government have to play an important role in the implementation of national strategies based on waste and pollution management. They have a right to implement their legislation or strategies where they are needed. One of the responsibilities of the provincial government is “to develop a provincial environmental plan, develop and enforce provincial regulation, ensure that all industries have access to appropriate waste disposal facilities, quality assurance of the Waste Information System, etc,” (White Paper, 2000).

The local government’s responsibility in the municipality ensures that collection services and disposal facilities are available to people regardless of their status or the type of area they live in. Its function includes “compiling and implementing general waste management plans, implement public awareness campaigns, providing general waste collection services and managing waste disposal facilities within their areas of jurisdiction, etc,” (White Paper, 2000).

The **Constitution** in Chapter 7 section 152 (1) among the objectives of the local government is “to promote social and economic development; and to promote a safe and healthy environment” (Constitution 1996). For the achievement of one object the other should not be compromised. This is because Chapter 2 Section 24 of the same Constitution state, “everyone has the right to an environment that is not harmful to their health or well being; and to have the environment protected, for the benefit of

the present and future generation, through reasonable legislative and other measures: prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development” (Constitution 1996).

Briefly this implies that any development taking place in SA should take place without compromising the well being of people in this country. On the other hand it is important to note that in any development that takes place some creatures are disturbed either by relocating or exposing them to their enemies. For example if the deforestation is to take place for the development of residential area all animals dependent on that forest have to get another place to continue with their life otherwise they will be destroyed in one way or the other. In this case people will benefit but animals won't and the environment will be cared for but to a certain extent.

Different acts were passed focusing on the management of the environment for example **Environmental Conservation Act (ECA) no. 73 of 1989** and **National Environmental Management Act (NEMA) of 1998**. According to section 20 of the former act any site used for disposal of waste need to have a permit from the Minister of Water Affairs. But in most cases this seems not to be the case since in SA urban areas waste is disposed anywhere. Based on the ECA no one is allowed to leave or dump waste on land or water surface or any area that the public has access to. The problem of waste found on public area can be solved through local by-laws. At the same time due to the NIMBY syndrome the space for landfilling is not available and people experience an unhealthy environment.

Based on the Environmental Conservation Act any person or company that want to open a waste disposal site need to follow all rules by the Minister of Environmental

Affairs and Tourism and even provide the needed information concerning the site and activities involved. The minister is given the responsibility to direct issues pertaining to control and management of disposal sites, of certain disposal sites or handling of some types of waste, and steps to be followed in replacing sites for other purposes (Sara, 1990)

All activities that affect the environment need to be identified. This includes activities like waste use and disposal, waste and sewage disposal, recreation, industrial processes, resource renewal and many more. This does not seem to happen since in most SA urban areas the illegal dumping increase is putting people's lives and the environment at risk of degradation every day. Although it's the responsibility of the Minister to make regulations concerning the classification of different types of waste and how they should be handled, stored, transported and disposed based on section 24 of the act, people do things according to how they like or even how they afford. The latter act is based on the integrated environmental management, which focuses on integrated principles that will have significant effect on the environment, and all decisions should not have negative effect (Action Plan Development Phase, 1999).

For the waste management to be sustainable it had to involve both community and scientific facets. Sustainable can mean caring for the environment at today's problems considering the future generation that they might benefit from it. Communities should be responsible for cleaning and collecting waste while scientific approach work in transfer and disposal of waste. For any strategy followed at any level communities should be made aware of the effects and costs of waste they produce (Novella, 2000).

Different strategies and different action plans need be used to solve a problem of a community, and those strategies need to be achievable, acceptable and affordable. The collection and transportation of waste in urban areas should be ensured that they enter a waste stream. The illegal dumping needs to be stopped so people can be responsible for all their activities, and this can be done through awareness campaign to promote sustainability. Even though the Constitution provides rules on how to deal with waste disposal legislation can also influence the situation. For example, the Constitution gives right to the provincial and local government to control the landfill and solid waste disposal. On the other hand under the ECA (1989) only the Minister of Environmental Affairs has a right to provide a grant to anyone to operate or establish a landfill site. (White Paper on Environmental Management Policy, 1999)

Disposal cannot be successfully controlled if there are/is “no or poor waste manifest system, poor regulatory mechanisms or procedure in local authority, disposal or treatment fees are perceived to excessive, lack of transparency, lack of education, lack of reliable information to plan,” (Eichstadt, 2000). So at the same time it’s the work of the local authority to make sure that those producing waste, industries and companies follow set regulations. Also the issues of fees paid by people for refuse collection services need to be considered, as they can be the causes of illegal dumping by communities who cannot afford. (www.cmc.gov.za)

2.4.2.2 Models of waste collection in South Africa

There are three models of collection in South Africa; those are local authority collection, private contractor collection and community-based collection. On the local authority collection the compactor vehicles, non-compactor vehicles, roll up trucks and open top trucks are used to collect waste from door to door. In low income areas compactor vehicles are used to collect waste but this form of collection is expensive and does not qualify to be used in this areas due to the characteristics of

waste in these areas. So the roll-up truck and open top truck are the best solution to be used. Areas that are located far from the disposal sites are offered with the intermediate storage facilities. While on the high income areas the compactor vehicles are used for waste collection then the trucks haul that waste straight to landfill sites (Macozoma, 1999)

At some stage the local authorities can contract private sectors to collect solid waste and this can be done in three basic ways, that is either contractors use their facilities, contractors use local authority's resources to provide services, or contractors can use both their resources and those of the local authority. In this method waste is collected from door to door using the open top trucks to empty communal skips. Communal-based collection is used in cases where there are donors provided to remove waste from a certain area. At the end of the day collection services are provided, jobs created and awareness increased on issues related to waste. In this case waste is collected from household to communal skips and transfer stations, and then large trucks are used to transport this waste to disposal facilities (Macozoma, 1999)

Most governments have realized that solid waste has a huge impact on their countries but there are still some issues that need to be addressed in order to solve the situation to the right capacity. Education can be used to address the attitude of people towards waste and to make them aware of the impact that waste has in their lives. The lack of awareness leads to the lack of participation of the households and this is due to the fact that waste collectors are amongst the lowest paid employees.

Other problems includes the low political priority given to waste, and the fact that those people dealing with waste have a low status, which need to be solved (Macozoma, 1999) The shift in interest is due to the following reasons:

- *Urban growth*-increasing population mostly to the outskirts of cities makes it impossible for the local councils to provide all the service.
- *Public health and water resources*-waste degrade the environment and increase the health risks in the community. At the same time uncontrolled waste can cause blockage on storm water pipes mostly in urban areas.
- *Organization and management of solid waste* has been the problem for a long period because the government institutions and role players of solid waste management experience shortcomings, because refuse collection and disposal services are not provided to the communities.
- *The ignorance or lack of awareness* to those generating waste can exacerbate solid waste problem. The way to curb this unawareness is just through the introduction of by-laws and educational programs to people on waste to make them involved. In some instances pride or ownership can increase this so people should be made to love their place and care for it. (Macozoma, 1999)

Cost-services provision and recovery cost seem to be a problem because people end being faced with the situation whereby they have to pay charges for this. Funds allocated for recovery and maintenance are not sufficient, at the same time communities' outcries based on delivery increases every day. (Macozoma, 1999, cited from Sandec, 1996)

The solid waste problems also increase because of the informal urbanizations is made worse by development. People move to urban areas for jobs, and lack of income to pay for waste collection services force them to dump or litter anywhere. Thus the responsibility to recover and take that waste to the waste stream is created.

Since local authorities are responsible to provide waste storage and collection services, they found that its more expensive to collect and dispose illegally disposed waste than waste in the waste stream. (Fuggle & Rabie, 1994)

2.4.2.3 Waste management strategy for South Africa

Waste management strategy is the “holistic approach to waste management where waste is dealt with in an environmentally responsible way from its generation to its ultimate disposal” (Fuggle & Rabie, 1994). In the implementation of this strategy all sectors need to be involved and be responsible to find the concrete and definite environmentally acceptable way to dispose waste. The six functional components of waste management process used in South Africa like many countries are waste generation, storage, collection, removal/ processing, transportation/ transfer and disposal. (Fuggle & Rabie, 1994)

There are different waste disposal options but most of them at the end produce residue or discard that requires ultimate disposal, which is landfill. Landfill has minimal environmental impacts if it is designed and well managed. Landfill is the appropriate and inherent method that is used by the developing countries including SA. Nations with higher standard of living and productivity tend to have more municipal solid waste compared to those in less developed countries. This led to scarcity of land for waste disposal then scarcity cause disposal to be costly and increasing the demand for the new expensive ways of disposal. (Fuggle and Rabie, 1994)

One of the goals of the **Environmental Management Policy** is South Africa is that of Participation in Environmental Governance. In this goal it is stated that for the effective environmental management structures should be formed in all government spheres to make it easier for affected and interested parties to participate. Interested and affected parties are people such as women, workers, the unemployed, the

disables, traditional healers, the elderly and others. These structures will help to promote fair, transparent and effective mechanisms and processes of participation. As soon as interested and affected parties participate communication could be the only strategy to make sure that people participate effectively. (White Paper on Environmental Management Policy, 1999)

2.4.2.4 Legislation and enforcement in South Africa

In the enforcement of the legislation the government has different roles to play, such as making sure that the different roles at different levels of government are made clear so that there won't be any miscommunication. This helps to reduce the possibility of conflicts and competition instead to move towards the integrated and coordinated environmental function in all spheres. Institutions have different views on the roles and responsibilities of the local authorities as well as the provincial and national government based on the environmental issues.

Institute of Waste Management saw that there was a need to readdress issues related to industry in the legislation with more focus on hazardous waste. Increase in development demands crucial consideration when a landfill sites is selected since these areas have a detrimental effect on the lives of people residing in close proximity to site. Therefore due to the increase in waste industries are encouraged to reuse and recycle their production instead of dumping illegally. Although one percent of waste in South Africa is hazardous there are other tones not counted and are illegally disposed, causing environmental problem. This poses the greater challenge to the departments, mostly Department of Environmental Affair and Tourism, to follow all the stated rules from the constitution in focusing on the environment (World Bank and Local Agenda21, 2002).

The legislations in SA are only measures that can be used to address the problem of solid waste that increase daily. The stakeholders and the role players that are involved in solid waste management include industries, retailers, unions, NGO's, media, and consumers. When SA entered in the global economy there was more demand for the government and the industries to look at solid waste management differently with an aim to bring about change in its handling. Industries started to comply with the governmental and national regulations mostly resulted with the pressure from stakeholders.

In looking at all waste related issues the government has to focus on what people need and make sure that they have enough access to the information needed by the communities. This also transpired in the Constitution, since Chapter 2 section 32 (1b) states "everyone has a right to access any information that is held by another person and that is required for the exercise or protection of any right" (Constitution, 1996). Unless people have enough information on what they are supposed to do in order to protect the environment there won't be any change in the environment. At the same time it cannot be easy to enforce legislations on people who don't know what is expected of them.

For sustainable development to be successful globally the provincial, national and local levels need to be considered. At a local level this can be achieved by focusing on the Local Agenda 21 (LA21). Based on the LA 21 little has been done in the past in dealing with waste management in an acceptable and environmentally sound approach. This might be due to the fact that there are regulations, legislation, measures and incentives that are implemented to encourage minimization/reduction, recycling/reuse and incineration of waste. Industries and poor people trying to earn a living out of recycling drive the existing recycling schemes, therefore due to the lack of reduce and recycling projects waste stream is very high. For example according to

the 1991 estimates SA 's total waste stream was 460 million tones with 419 millions tones from industries and mining. The considerable regulations like ECA, WA, HA, and HSA are the ones that are used for the management of waste in different sectors. (www.casd.org.za)

Industries are reactive rather than being active in response to the environmental law, which does not provide long-term environmental planning. Absence of legal guidelines creates conflict between communities that are affected and industries and the developers. What is common is that the environmental laws do exist but lack enforcement and effective administration and management of environmental quality. (www.easd.org.za)

It's the responsibility of the Department of Environmental Affairs and Tourism to formulate general environmental policies and coordinate the administration and application of those policies. Other departments like Department of Water Affairs and Forest, Transport, Mineral and Energy are being involved since they are all interested on the well being of the environment. The powers to administer legislations and implement environmental laws fall under authorities of central government, and provinces. At the same time it's the responsibility of the government to take legislative steps to protect environment and make sure that those steps do not clash with other rights. For example, if the company disturbs a person's health, the affected should seek relief provided for in the Bill of Rights, then make sure that the company's rights are not infringed (World Bank, 1999).

The act passed by the government in any country is supposed to be supported by the by-laws from the local and provincial authority. In South Africa the legislation passed were incomplete up until 1980's and this means that although acts exist in the country it was not easy to apply them. Lack of knowledge and power made it

impossible to enforce the acts passed, and also the administration of the strategies from other countries can be a burden to the country. This is because the definition of waste in South Africa for the purpose of management excludes the radioactive, mine waste, and power plant waste. (World Bank, 1999)

2.4.2.5 Environmental management status

At the present moment there are different things that need to be considered for the management of the environment to be successful. The little attention given to the environment automatically cuts the integration of environmental issues into economic planning and decision making at all levels of the society. To achieve environmental management different things need to be looked, which are seen as the hindrances. This includes things like capacity building, participation and information, and pollution and waste. (Environmental Management Policy, 1999)

2.4.2.5.1 Capacity building

People should be encouraged to play a role for the effective environmental management. The main aim for this is to give more and relevant information on environment to everyone including the government employees. Encourage training in sectors that have some impact on the environment. Resources must be provided to all citizens to encourage participation in environmental management. (Environmental Management Policy, 1999)

2.4.2.5.2 Participation and information

People are part of the environment so they need to know what is environment, how does it operate and what is happening in their environment. This could only happen by providing people with information relevant to them and this could help in the environmental governance. At some stages information is made available to people but this information is “inaccurate, incomplete, contradictory, inaccessible, and

technical and scientific,” (Environmental Management Policy, 1999). At the end of the day it’s the responsibility of the government and environmental managers to make sure that all this is changing with an aim to make people participate in environmental management.

2.4.2.5.3 Pollution and waste

Most waste in South Africa is situated on land and water affecting the lives of the people who happen to be exposed to this waste. Lack of control on waste generation and disposal costs makes the situation even worse. In the long run the poorer communities are the ones who suffer since they are usually situated next to landfills. For the waste reduction to be effective and for producers to have enthusiasm to minimize there should be incentives. The available strategies are some public and commercial recycling initiatives. Waste that can be recycled includes glass, paper, metal, plastic and oil; but there is no place in the government policy where people are systematically encouraged to minimize, reuse and recycle waste. Therefore this goes down even to the local authorities that don’t motivate people to engage in recycling initiatives. (EMP, 1999)

In South Africa the collection of solid waste is the responsibility of the local authorities that are the providers of services in cities. Local authorities sometimes give the task to the contract to the private sectors. Waste is collected using the curbside, door-to-door, communal collection point and block collection methods. The first two methods use higher level of services and no or less household participation. The communal and block collection methods require households to locate waste containers in the collection point. Solid waste is collected of appointed days and there are specified areas where containers need to be placed. Intensive waste collection methods include both primary and secondary collection. In the secondary collection the equipments are used to collect waste while in the primary

collection the communities take responsibility for the collection process (Macozoma, 1999)

In about “95% of South Africa’s waste is disposed on land,” (Macozoma, 1999), and this is done using sanitary landfills. Some of the landfills in SA are illegal and uncontrolled so some thing need to be done to change this situation, whereby this landfills be or get them to comply with the set rules. At the same time collectors should be given the methods they have to use for the disposal not just any one that they like (Macozoma, 1999). In the Cape Metropolitan Areas between 738 183 t/a and 1 million t/a estimated to be produced per year, which is disposed on six landfills. These landfills are used to dispose both domestic and commercial waste with two of them based on sandy soils increasing the risk of groundwater pollution from leachates (www.cmc.gov.za).

Macozoma (1999) did a study in South Africa based on solid waste management and found that developing countries have serious problems when it comes to solid waste. That includes “uncontrolled dumping in green areas e.g. burrow pits, lack of practice of proper landfilling procedures e.g. covering with backfill after dumping, no compliance with landfilling regulations, lack law enforcement in solid waste practice, and unnecessary disposal of recoverable material,” (Macozoma, 1999)

2.4.3 Local

The population in the Durban Metropolitan Area (DMA) has different impacts on the natural environment due to the need of goods and services such as water, housing, electricity, waste collection services and many more. The increase in population in the city increases pressures on the environment. In brief it is clear that population needs are associated with environmental impact. Usually the informal and formal settlements are developed on areas that are valuable and can be used for recreational

activities. Economic activities, and transportation can result in air, water, land and noise pollution and also the destruction of natural habits. (www.durbansolidwaste.org.za)

The DMA produces over 1.8 million tones of waste per year and 1.4 million of this waste is disposed off in landfill sites, and the rest is disposed through marine pipes. The richer communities generate more waste compared to poor communities. In formal communities each person generate an average of 540 kilograms a year compared to 40 kilograms on formal communities. Affluent communities usually generate recyclable materials such as glass, plastic, and paper while poor communities generate high quantity of unrefined material. (www.durbansolidwaste.org.za)

Responsibilities of Durban Solid Waste (DSW) are as follows: plan, provide and operate waste disposal facilities; collect, transport and dispose all these waste generated in DMA, and provide streets cleaning service and manage illegal dumping; organize community education campaign focusing on recycling and waste minimization; and encourage waste diversion and source separation to customers. DSW operates three approved landfill sites situated in Bisasar road, Mariannahill and La Mercy. There are nine (9) garden waste sites situated in north and south central regions of Durban, and huge household items like old fridge, washing machines etc are disposed in these sites. These garden waste sites are situated in the following areas: Durban North, Chatsworth (2), Bluff (2), Montclair, Phoenix, and Redhill. (www.durbansolidwaste.org.za)

The success of waste management can come to existence only if the Integrated Waste Management (IWM) be introduced and this can be done through the triple R's (reduction, reuse and recycling). Reduction (avoid producing waste); reuse (reuse

material instead of throwing them away, e.g plastic containers can be used to store food) and recycling (return items like glass, paper, cans, plastics, cardboard and many more are collection after use to be recycled) are the approaches that can be used to deal with waste. (www.durbansolidwaste.org.za). Access for information and education on the impact of human activities on the environment are essential factors in including the interested and affected parties in good solid waste management.

2.4.3.1 Waste storage

For domestic waste DSW provides black plastic bags which are manufactured from high-density polyethylene (HDPE). These plastics should be 22 micron, high density, and size 760 mm x 910 mm in accordance with SABS-CKS/340. Each household receives one plastic bag every week but in some areas 26 bags are provided every three months. Any one in need of extra plastics can buy them or place an order for small fees. Garden waste cannot be stored on the same black bag as domestic waste but red plastics (provided by Parks Department) are used. These plastics are not free, and garden waste is collected on the same day as domestic waste. People can use their cars to transport garden waste to relevant sites where there are specific people to help in the disposal of such waste. An area with high population density generates more waste that is the reason why DSW provides specific facilities to store waste in such area. (www.durbansolidwaste.org.za)

These facilities can include things like skips and wheeled containers. **Skip** are steel containers usually located next to business area where there are high volume waste produced. Skips ranges from 5.5 cubic meter to 27 cubic meter, manufactured in rustproof stainless steel and with drain holes on corners to let rain or any other liquid to flow out. The 5.5 cubic meter skip is the only type that can be used to store heavy items like builders' rubble and glass to make it easier to lift. This is the system for the removal of dense high volume compactable dry waste. In such containers

domestic waste should be avoided with an aim to reduce odors, flies and all other conditions that can have effect on human life. The 8 and 14 cubic meters skips can be used to remove dense high volume non-compactable dry waste. As a way of avoiding waste from being blown away during transfer a tarpaulin cover is used for the above three skip types. The 27 cubic meters skips allows the convenient place for its storage and are used for the removal of dense high volume non-compactable dry waste. These skips have two doors for easy loading of bulk waste and these doors are fitted with chains and anti-loose clip to ensure site control of waste. (www.durbansolidwaste.org.za)

The other types of waste containers are termed **wheeled containers** that are made of strong plastic and green in color showing that DSW cares for the environment. These containers are in two sizes that is 240 liters with two wheels, lid and a handle; and 600 liters with four wheels, lid and a handle. The latter container is proper for customers who produce higher volume of waste or waste in bulks. Waste removal services are provided for special events such as marathons, school fates, fun runs, concerts, trade shows, etc. (www.durbansolidwaste.org.za)

2.4.3.2 Collection by the Contractor

In formal settlements the contractors have the responsibility to collect, remove and dispose waste that is in bags and/ or in any refuse placed on the streets or any open spaces. Collectors don't have to enter household properties to collect waste but have to collect waste on the street verge. All litter and refuse collected is placed in refuse bags and disposed it within 24 hours. The contractors have the responsibility to cut and clear vegetation in the road reserves in 3m wide strips on either sides of the road and on walkways.

The height of cut grass should not exceed 100mm and the cut areas should be raked immediately after cutting. On the long run rubble, and earth, animal carcasses and all large illegal dumps of waste should be removed as or when instructed. (Munitech: Durban Metro Water Services, 2000)

2.4.3.3 Legislation and enforcement

Durban Metropolitan Area's (DMA) *Environmental Management Policy (EMP)* aimed at influencing people about their own behavior concerning the environment looking mostly at their activities. This policy came into being after discussions between all interested parties like councilors, NGO's, businesses and industry, community organization, research institutes, KwaZulu Natal provincial government, etc. Among the principles of the EMP for the DMA is sustainability, environment as a resource, public participation and access, shared responsibility, avoiding negative impact and many more. All these principles need to be met for the management of the environment to be successful. Different goals, objectives and policy statements are involved in this policy of which under theme D of it is pollution and waste management (Environmental Management Policy & Durban Metropolitan Area, 1998).

The goal of this theme is to “contribute to a sustainable economy and a clean and healthy metropolitan environment through establishing an integrated system of pollution and waste management,” (Environmental Management Policy & Durban Metropolitan Area, 1998). The human health and environment quality can improve if activities of pollution and waste management can improve effectively. All interested parties could take part in problem solving and look at goals and standards for management. The policy wish to reduce the amount of solid, liquid and gaseous waste generated in and affecting DMA. Under this goal the industries that produce

waste should be encouraged to waste, reuse and recycle the waste instead of just dumping it.

Local government to establish economically efficient waste reuse and recycling systems shall support domestic, commercial and industrial waste producers. Effective solid waste management is the important issue for the environmental management policy whereby the illegal solid waste dumping is prohibited, planning for right sitting, management and decomposing of landfills continue to be important. All hazardous waste produced in the DMA have to be reduced since they have a detrimental effect to the human health and the environment at large. This can only be achieved if producers reduce production and transportation of such waste and substances (www.durbansolidwaste.co.za)

As part of the **National Waste Management Strategy** the activities of the hazardous waste industries should take place after the permit and approval are granted. All hazardous waste must be treated on site and disposed safely and mostly next to source. For the mere fact that hazardous waste is a problem the local government oppose the use of Durban Port as a place for hazardous waste import or export. This is because hazardous waste can sometimes be in a form of oil or liquid affecting the marine life. All in all it's the responsibility of the state to promote and fulfill social, economic and environmental rights of everyone and try to meet the needs of disadvantaged communities (www.durbansolidwaste.co.za).

2.7 Conclusion

Based on the case study on different countries it's easier to see that inadequate provision of refuse collection services and disposal of both solid and liquid waste are best classified environmental problems. This inadequacy can be viewed as the basic problem to environmental health, as unmanaged collection and disposal of waste can

have effects on human health and even productivity. (Rao, 1991) Environmental issues impacts communities in the developed as well as underdeveloped world.

The problem then is that developing countries are much focusing on development and ignore environmental protection. Environmental problems can start locally but at the end of the day it crosses national borders and affects the whole world. For example one group of people dump waste illegally on rivers can impact negatively communities living downstream. Also gases emitted by industries can cause health problem to those people next or away of the area (Bradshaw, 1992)

CHAPTER THREE

Methodology and Study Area

3.1 Introduction

This chapter looks at tools necessary for data collection and ways in which collection was handled. In data collection direct contact between the participant and the researcher is important. The main focus of the research is revealed in this chapter.

3.1.1 An early history of Umlazi a Reserve Mission

During the colonial era certain part of Umlazi location was separated into tribes and others parts into missions. One of these missions was Umlazi Reserve Mission making the whole of Umlazi Township today. There was also Cele tribal area and Umlazi Glebe. When the Reserve Mission was proclaimed a township both people united to fight against the development of the area. The Umlazi Mission Advisory Board was formed to deal with the situation in liaising with the government. The reason to change the mission to a township was to locate people who were evicted from other areas like Cato Manor and bring about development. The Advisory Board was formed to talk on behalf of the people on the issues. At the end it was announced that people of Umlazi had agreed that the mission reserve be turned to a township, but this was not true. Delegates were sent to talk to the government on the issues but all was in vain because in 1956 construction work began with Umlazi Section V comes into existence. (Townsend, 1991) The development of the township brought about confusion with respect to land ownership. Confiscation of land involves three actions, that is the land required should be declared as part of original tribal area; areas be declared as part of the new township and tribal owner be compensated financially or allocated in other areas. Based on the third action people were removed and not given enough money for their land. Tribal owners decide not to

leave the land but to rent the area as all other newcomers. Those removed from Cato Manor to Umlazi township decided to relocate on other areas other than to rent houses. The eviction of people increases the number of squatter settlement around Umlazi, which includes “Magabha-nge-Jubane” and “Malukazi” Some people from the informal settlements were given houses in Glebelands when construction was finished. (Townsend, 1991)

3.1.2 Description of the study area

Umlazi is situated on the south east of Durban with an area of 73 square kilometers. Umlazi have 28 sections from A to Z excluding O and then come back to AA, BB, and CC. The Map in Figure 3.1 shows the build up area of Umlazi. All highlighted sections are those that were involved in the study. Umlazi has population estimate of 350 thousand populations. Population in each section depend on the geographical areas of that section for example section P has a population of 12, 215 while section V has 23,097. Some of these sections have shopping complexes and other services and sections that are without services close to them. Most people work at Isipingo and Bluff because there are industries in these areas. The other huge group of people works at Durban central and includes mostly professional people. (Townsend, 1991)

When Umlazi Township was developed roads were not named but Sections were used. Sections were named in an alphabetic order starting with section V then back to begin with A. All facilities were adequate for the people of that time but due to urbanization everything changed where more people moved from rural areas to urban areas. The increase in population gave the official tenants the opportunity to build shacks on their backyards and rent them. This situation changed in 1986 when influx control regulations were repealed and people had a right to be in townships then they were able to use the vacant land to build their homes increasing the informal housing construction. (Townsend, 1991).

UMLAZI



SCALE 1:37000

PRODUCED BY SURVEY DEPARTMENT
DECEMBER 2000

Figure 3.1 Umlazi Township

3.2 Methodology

3.2.1 Research question

The research question and the societal setting guided methods are used in this study. The Main aim of the study is to investigate solid waste management practices in the society with storage, collection, transportation or removal, disposal and recycling being areas of great consideration. More focus is on techniques used to manage solid waste in the manner that will give the pollution-free society. The reason to focus on this is that the South African Constitution, in the Bill of Rights states that people have a right to clean and protected environment. So by having good solid waste management practices it could be easier for people to enjoy the above right.

3.2.2 Primary Data Sources

Survey research, pilot study and observation are methods used corresponding with the structure of the society and the way, in which it functions, moreover, focuses on the affected and interested parties of the community. These parties included people next to the disposal landfills, people responsible for the solid waste management, government departments, municipalities and any other involved parties. The researcher at first hand through documentary, survey, interview, and observation collects primary data. In observation the researcher has to look at events, behavior and artifacts in the social setting. (McNeill, 1990)

3.2.2.1 Documentary

This is data available from other sources and in different forms like personal documents, public documents, media, newspaper, books, company publications, journals, etc. This information was used to compare and contrast the results obtained from the study areas. (McNeill, 1990) These documents includes:

- Overview of Solid Waste Management in Developing Urban Areas in South Africa by D. Macozoma.

- National Waste Management Strategies and Action Plans South Africa. 1999.
- White Paper on Integrated Pollution and Waste Management for South Africa, 2000
- Industry and Environment in South Africa: Environmental Management and development in an Intercultural Context, 2001 and 2002.
- Government Gazette on National Environmental Management Act, 1998.
- Background Information on Local Agenda 21.
- White Paper on Environmental Management Policy, 1999.
- Munitech, 2000, City of Durban Metro Water Services: Refuse Collection and street cleaning in Lamontville.

Limitations to this kind of data is that they only approximate the kind of data that the researcher would like to have for testing hypothesis; inaccessibility to the variables that one is interested in; and insufficient information about the collection of the data to determine potential source of bias, errors or problem with internal or external validity. (McNeill, 1990)

3.2.2.2 Survey research

Survey research was used to get direct information from the population of the area of interest. To do this the respondents were carefully chosen, using the random sampling technique that will be explained in details later, to represent the whole population. Thereafter the standardized questionnaires were administered to gain access to the information that people have or know about solid waste management practices. In this regard both households and the authorities in charge of waste management were interviewed. The cover letter was used to give detailed aim of the study and what is going to be done with the information. At the same time respondents were promised of the confidentiality of the information they gave. (Rubin & Babbie, 1997)

3.2.2.2.1 Sampling

Before deliberating more on sampling its important to give a brief definition of what does it mean and how is it used. In conducting the study the whole community cannot be involved but the certain group is selected to represent the population at large. This group is referred to as the sample, which is a certain number of people used as respondents representing the entire target population of the study. This group is used to generalize the results. In a general term population can refer to the group of people in the community or a place where the study is to be conducted.

Sampling includes probability and non-probability sampling with different types of sampling methods under each. This study employed the probability random sampling method, which involves the sampling frame where the list of concerned population is organized into units. After that a certain number of names is selected using random numbers that are mathematically arranged. In the random sampling each person has an equal opportunity to be included for the sample. For example if the sample of 100 respondents is needed everyone has 100 chances of being selected, that 1/100 chances. (Bailey, 1994) Sampling frame can be referred to as a list of approximate elements in the population, for example, telephone directory, tax records, drivers license records etc. (McNeill, 1990).

Random sampling is very reliable and simple to use. Limitation arise from its reliance on existing complete list of all elements of the population, may be incomplete and biased, and in larger population randomization may be quiet time consuming. What is important is “not the proportion of the population included in the sample but the absolute size of the sample and how variable the population is,” (Cole, 1980). More variation in the population means that the larger sample is required to reflect the population.

In the description of the study area it was stated that households at Umlazi is recognized by numbers and these numbers are the ones that were used in the selection of the sample for the study. The sampling frame that is the list of units was made for the selection. In this case household numbers were listed down and verified with the stakeholders in charge. Every household had a chance to be chosen since the random sampling was used for the selection of the sample. Even though Umlazi as a township has both formal and informal settlement the formal settlement was of great interest as stated above. So due to this only households with numbers were included to make it easier to identify the already visited household.

Umlazi have 25 sections so not all of them could be included in the study so the random sampling technique was used to select sections to be involved. It should be clear that sections have different population numbers and the number of households to be involved in the sample depended on the number of population each section. That is the higher the population number in a section the greater the number of households to represent it. Sections were numbered and with the use of random numbers about eight sections were selected, those are section BB, R, P, V, U, W, F & J.

3.2.2.2.2 Questionnaire design

Questionnaire “set of questions on a form which is completed by the respondent in respect of a research project” (de Vos, 1998). Different things need to be considered when designing a questionnaire, this include looking at the length of questions and the necessity of having the question in the questionnaire. All questions represented the aim and objectives of the study to make it easier in interpretation and evaluation of results acquired. The sequence of question was considered to make sure that there is no confusion or discomfort to the respondents. There are different types of

questionnaire that is mail, telephonic, personal, face-to-face or other types; and they need a covering letter stating the purpose of the study and give researcher's details. In this study the personal and face-to-face questionnaires were used where both open and close questions were employed.

It is important to consider information needed and information to be obtained before deciding on the nature of a questionnaire. Questions were written brief and clear, not biased, not ambiguous, and be relevant for respondents to understand and be able to give relevant information. The survey research has both strength and weaknesses that give full description of how it works and in what situations is it suitable for use. Strength: describe characteristics of a large population; make very large samples feasible; findings may be more general; enables to analyze multiple variables simultaneously; and flexible. Weakness: appear superficial in their coverage of complex topic; seldom deal with context of social life; and weak on validity and strong on reliability. (De Vos, 1998)

3.2.2.2.3 Interview

The interview method is the face-to-face interview. The interviewer either asked question and records answers or give the respondents to read questions and answer on their own considering literacy. The interview has both advantages and disadvantages.

Advantages: attain higher response rate than mail survey, people seems to be more reluctant to turn down the researcher in their homes than they are to throw a mail questionnaire. The researcher used probing in case the 'I don't know' or 'no answer' situation comes. It makes it easier to make any clarity if there is a need, and observation is much easier. Lastly it gives more time to look on a question that violates respondents' agreement to participate in the interview. Disadvantages: the

presence of the interviewer makes the respondent feel threatened to answer any question. (Rubin and Babbie, 1997) Added to this Neumann, 1997 stated that interview have high cost for training interviewers that will help, need more supervision, high cost of travel, and things like appearance, tone of the voice may affect respondents willingness to participate or even to give exact answers.

In conducting the interview survey more than one person was involved, whereby the student researcher had to get help from others. Therefore, due to this training was conducted to give the full explanation of what the research is all about. The questionnaire was looked at, and in more details the purpose of each question was given to the interviewers. Specification was considered whereby guidelines were given on how to tackle any problem that might come during interview. As soon as all interviewers were satisfied the researcher demonstrated the questionnaire by interviewing one if the interviewers. To make sure that interviewers understood, they were given a chance to practice interviewing people but not those on the sample.

There are different things that were avoided by the researcher during the interview, one of which is using the leading questions. This could have caused the respondents not to give exactly what was relevant to the question or how one sees the situation. Interviewers were supposed to appear in a way that will make respondents feel accommodated, this includes things like clothing, facial appearance and the way of speaking. Appearance was considered due to the fact that interviewers were students so any other things could have made the communication brake down. The interviewers were made familiar to the questionnaire so as not to waste time studying it during the interview. Lastly questions wording was exactly followed, responses record exactly, and probe for responses. (Bless & Higson-Smith, 1995)

Interviews are conducted with illiterate people, to overcome misunderstanding and misinterpretations of question. It ensures that all items have been considered and no question was omitted. Problem that can be encountered in conducted interviews are time and money, disparities might arise in the result and this will reduce comparability, and presence of the researcher might lead to dishonesty and embarrassment on the interviewee if personal questions are asked. In the interview different kinds of questions were used including the open-ended, close ended, dichotomous, multiple-choice question. Dichotomous questions use two responses like 'yes/no' or 'feel that way/don't feel that way'. Multiple-choice questions are question give different choices to select from. (de Vos, 1998) Both the open-ended and close-ended questions can be defined by giving their advantages and disadvantages.

- Close-ended questions

Advantages	Disadvantages
Answers can be compared from person to person.	Gives more room for guessing if the respondent does not know the answer.
Answers can be easily coded and analyzed.	Leads to frustration if the preferred answer is not in the provided categories.
Gives clear meaning of the question to the respondents.	Make it impossible to see if the respondent didn't understand the question compared to open-ended where the respondent gives the full idea of misinterpretation.
Gives relatively complete answer.	
Helps to deal with sensitive issues.	
Easy to answer since there are categories to choose on.	

Source: Neuman (1997)

- Open-ended question

Advantages	Disadvantages
Allow answering adequately.	Lead to collection of worthless and irrelevant.
Be used when there are too many potential answer categories to list on the questionnaire.	Data are often not standardized from person to person.
Preferable for complex issues that cannot be condensed into few categories.	Coding is difficult and subjective leading to low intercoder reliability.
Allow opportunities for self-expression.	Requires superior writing skills.
Enables the researcher to explore the variables better to obtain some ideas of possible response	Requires more of respondents time and effort and may engender high refusal rate. And make questionnaire look longer

Source: Neuman (1997)

3.2.2.3 Observation

Observation is an informal conversation interview where an interaction takes place between the interviewer and the respondent during the field observation. This includes the open-ended questions that are asked without the respondent noticing that he/ she is giving the needed information to the interviewer. During the interview the respondent's behavior was considered with an aim to find out if what they say was similar to their actions. More focus was of facial expression and body gesture as they answer questions. Simple observation looks at events as an outsider, people's behavior, people who know they are observed can change behavior and stop their activities. Participant observation hides real purpose by participating in an activity,

but the researcher might lose the objectivity and engage emotionally. (Bless & Higson-Smith, 1995)

3.2.2.4 Statistical analysis

Quantitative data can be analyzed manually or by computer depending on the researcher. Amount of data and types of analyses determines the way data is analyzed. (De Vos, 2001) So in this case the data obtained through both rigid and personal interviews leave the researcher with no choice but to use SPSS program for data coding. This program helped to analyze and validate the data. Bar graphs, pie charts, tables and grouped frequency distribution were used to present the results. These results are interpreted in a way that will make it possible for any reader to understand. Interpretation is done either by interpreting research study and its data or by comparing results to different documents and literature by other researchers.

3.2.2.5 Pilot study

According to the South African Pocket Oxford dictionary (1994) pilot study is an “experimental undertaking or test”. So in this case the pilot study was done to assess or test the questionnaire in order to make sure that it can be administered to people. People of similar characteristics to the target group of respondents were used in piloting. Purpose of the pilot study is to do “an investigation of the feasibility of the planned project and to bring possible deficiencies in the measurement procedure to the fore” (de Vos, 1998 citing Hysamen, 1993). In selecting respondents for piloting systematic sampling was used where every fifth entering the supermarket. This was conducted in V section, which is one of the sections involved in the actual study. In doing piloting respondents with same characteristics are used which was the reason that V section people were used.

3.3 Conclusion

The study area description and methods used in collecting data are presented in this chapter. Selected methods were useful in getting more information from respondents. Sensitive questions such as that of income needed the interviewers to probe so as to make respondents feel comfortable with the situation. For Rubin and Babbie (1997) the aim of the study should be given to respondents for them to decide whether they want to involve themselves or not. At the same time a guarantee was given that information given was confidential. The above-discussed methods provide the way forward for the analysis of the data, so the following Chapter (four) focuses on data analysis and data interpretation.

CHAPTER FOUR

Results and Data Analysis

4.1 Introduction

The activities, culture, politics and social systems, and economic activities affect “how people interact with the natural ecosystem and habitats, how they use natural resources that are available, and the meaning they give to different forms of life, ecosystem, physical landscape, cultural landscape and places,” (Environmental Management Policy (EMP), 1999). This is the reason why the environment needs to be managed in a way that will give a clear understanding to the people forming part of the environment, but there are obstacles to environmental management.

Through this chapter obstacles to environmental, with special attention on solid waste management will be revealed. The division between the poor majority and the rich minority in South Africa has an impact on the environment. Poor urban areas face inaccessibility to services, poverty and disempowerment, which is coupled with unsafe environments in which people live in. Environmental problems in SA have their root causes as lack of cooperation between regulatory institutions to work together on environmental issues, unequal access to natural resources, human migration and overcrowding, and many more. (Discussion Document: Towards a New Environmental Policy, 1996)

There are different terms used in the chapter that need to be clarified in order to get the meaning of using them in this context. A married child can be a male person staying with parents. An unmarried child can be a male or female or person staying with parents or alone because of some reason or based on some conditions. A single person can be any one who is not married and has no

children, while on the other hand a single parent represents an unmarried person but having one or more children.

The Durban Metropolitan Area (DMA) produces waste, which can account for 1.8 million tons of waste per year. Affluent communities dispose 13 times higher than that of poor communities by. Of this waste about 1.4 million tons are disposed on landfills, but this includes only 25% from informal settlements and excludes a large amount of liquid waste that is disposed on pipelines. (www.durbansolidwaste.org.za) Looking at the status of the environment at large and at waste status in Durban, this chapter describes municipal solid waste management in Umlazi, one of the townships in the DMA. The focus of the chapter is on socio-demographic characteristics of the respondents; storage, collection, illegal dumping, disposal, and recycling; and also the role of the community and the local government in changing the situation on the environment. Secondary data is used to compares and contrast findings from the study area.

4.2 Secondary Data analysis

Table 4.1: Role players in Solid Waste Management

Role player	Primary role
Government	Authority
NGO's	Advisers
Private sector	Experts
Donors	Financiers
Financial Institution	Financiers
Informal private sector i.e. scavenger	Assistors
Community	Beneficiaries
Research Institutions	Decision support

Source: Macozoma (1999)

Table 4.1 demonstrate that the involvement of all role players in solid waste management is important since solid waste is one of the most important pieces of the environmental ‘puzzle’. Every role player has an important primary role to play in the management of solid waste. These role players can have different views and contribute differently on the issue at hand. One role player can be effective in one level and the other on the next level. The three governmental levels involved here are national, provincial and local government levels and all can play an important role in ensuring the success of solid waste management. The NGO’s can be of great use because they are the ones next to the community that is affected by solid waste problems, compared to the government representatives. Also involving the community will increase involvement on the part of the people and will make it impossible for the local government to implement policies and enforce by-laws since people will be aware of what is happening.

Table 4.2: Quantities of waste produced per person per year in the Durban Metropolitan Area

Population and income level	Waste generation (m3/person/year)	Estimated average mass (kg/person/year)
Higher income	2.70	540
Middles income	0.75	150
Low income, formal	0.24	48
Low income, informal	0.20	40

Source: www.durbansolidwaste.org.za

All waste that is generated by people in Durban, including Umlazi is disposed off on landfills per table 4.2 and a very small amount is taken to recycling companies because people are not aware or are not educated about recycling. The noticeable issue is that rich communities produce more waste compared to poor communities that is up to 13 tones per person per year. The above table shows the quantities of

waste produced per person compared with the income that a person earn. (www.durbansolidwaste.org.za) According to the 1991 estimates about 460 million tones of waste is disposed off in South Africa. Of this waste 19 million tones are from domestic waste, and this varies from one area to the other depending on that socio-economic status of the community. (www.easd.org.za)

The richer the community the more wastes is produced and there might be different reasons for this. People who earn more income don't worry themselves with recycling projects so they throw away the waste they produce. At the same time they buy more and automatically produce more waste, which can end up affecting those in the low-income class. On the other side people on the low-income class produce less waste because they always save what they have so that they can survive even on the following day. Also some of these people mostly those engaged in informal trade take waste to recycling companies to get some money for their families. Solid waste generated in any area is disposed in landfill sites or taken for recycling. So the table below shows the amount that ends on landfills in Durban.

Table 4.3: Waste disposal on landfill and marine pipeline in Durban Metropolitan Area-1996

Type of waste	Waste quantity (tones per annum)	% by mass	Type of disposal facility
General dry waste	1 248 00	67.93	General landfill Low hazard (H:h) landfill
Lower hazard wet waste	130 000	7.03	Low hazard (H:h) landfill
Higher hazard waste	200	0.01	High hazard (H:H) landfill (exported)
Medical waste	+/_ 4 000	0.22	Incinerators
Industrial/sewage waste effluent (mostly water)	455 000	24.77	Marine pipelines
Total	1 837 200	100.00	

Source: www.ceroi.net

Table 4.3 exemplify that solid waste can be divided into different categories based on where it is being produced. General waste can include domestic property, residential house, educational establishment etc. This can be referred as garbage produced during preparation of or storage of meat, fruit, vegetables etc. and usually contain moisture content of about 70%. (Bahu et al, 1997). Industrial waste includes “chemicals, plants, sand, metal ore processing, fly ash, sewage treatment sludge, etc,” (Rao, 1991:). According to Bahu et al (1997) industrial waste can include waste generated in areas occupied by scientific research association, from degrading operations, arising from tunneling, arising from aircraft, vehicle or vessels which are not occupied for domestic purposes poisonous or noxious waste arising from mixing or selling paints, etc.

All this waste could have an effect on the environment and to human health. Hazardous waste can include chemical that are highly toxic to most life forms. Biological waste sources are hospitals and biological research facilities. Its characteristics are that it has an ability to infect other living organisms and produce toxins. In this hazardous waste malignant tissues taken during surgical procedures are included and contaminated needles, bandages and outdated drugs. Flammable waste has a high potential hazard in storing, collection and disposal, and may be in liquid or gaseous or solid form. Can include organic solvent, oils, plastisizers, and organic sludge.

From table 4.3 above its clear that general dry and lower hazard waste use the same landfill (H:h) in Durban. The reason might be that both these waste kinds have similar content and have short lasting properties compared to hazardous waste. Due to the danger that medical waste has incineration is the only solution to its disposal but the residue has to go to the landfill. Even though incineration increases the amount of pollution on the environment it does not require more area as landfill and it can be created in a way that will reduce pollution. The H:h landfill sites are the ones that people have access to in order to collect the products that they can recycle, and the table below demonstrate the amount of recyclable solid waste that was recovered from one of landfill sites in Durban.

Table 4.4: Recyclables removed from Bellair Garden Refuse and Recycling Center

Recyclables	Tons/ kg per month
Paper	2.6 tons
Cardboard	1.4 tons
Glass	2.8 tons
Plastic	Up to 1 ton
Cans	150 kg
Scrap metal	1 ton non-ferrous metal & 3 tons of ferrous metal ton

Source: www.durbansolidwaste.gov.za

Table 4.4 shows the approximate amounts of recyclable materials that are removed from this center shows that some people are aware of the facility provided for them. On the other side the fact that there are recyclable materials still found on waste shows that more still need to be done for people to start engaging on recycling. The reason that lesser amount of cardboards (1.4 tons per month) are removed from the center might be that most people focus on cardboard recycling than all others. Plastics are viewed as flowers in most communities where they are found in fences and streets but recently in some areas women use them for huts and mats. Households reuse plastics but because of their availability to any one they are always causing problems in the environment. Those plastics that are thin takes a long time to compost on the soil and this affect the productivity of the soil. The amount of cans has been reduced due to the fact that schools or organization have been engaged in Collect-a-Can campaign therefore people are aware of the income that can be generated from cans.

4.3 Primary Data analysis

4.3.1 Socio-demographic characteristics of the respondents

Table 4.5: Profile of the Respondents

Profile of the Respondents	Percentage
Head of household	27
Spouse of the household head	2
Married children	15
Unmarried children	44
Grandchild	4
Other relatives	8

n = 100

Table 4.5 shows that 44% of the respondents are unmarried children who stay with parents. The reason most of them participate is that they are not working and access to them was easy since they are always available in the community. About 27% of the respondents include house owners either male or female and some of these people left their parents due to family extensions. The married children making 15% are people who stay with their parents and their wives. Due to a high unemployment rate some of these people depend on their parents to provide for their families. About 8% of the respondents were other relatives that include aunts, uncles and all the in-laws.

Table 4.6: Age of the respondents

Age	Percentage
15-24	7
25-34	29
35-44	32
45-54	13
55-64	14
65-74	2
75 and above	3

n = 100

Table 4.6 demonstrates that people that were active and accessible are those in ages 35-44 (32%) and ages 25-34 (29%) and there are different reasons for this. Firstly the study was conducted during holidays and weekends and it was easier to get people who are working. The majority of these people saw the impact that waste has in their lives but at the same time they could not do anything on their own instead they thought that the municipality is responsible. People from age 15-24 were the most expected to participate but unfortunately that never happened because only 7% of the respondents were from this age group. The reason for this was that expectation that most people at this stage are aware of almost all things happening in their community and they are the “creative thinkers”. On the other hand they are future leaders so they are supposed to be aware of things affecting their lives and the environment at large. The 2% and 3% are pensioner or retired people. The period (holidays and weekends) in which the study was conducted made it possible to get people from different age groups.

Table 4.7: Sex of the respondents

Sex	Percentage
Male	48
Female	52

n = 100

From table 4.7 above it's easier to see that there is a slight difference between females (52%) and males (48%) who participated on the interviews. The variation might be due to the fact that women are always willing to participate and to see change in their communities. In both cases employed, unemployed and pensioners were involved. Those working were interviewed on weekends and holidays with an aim to get more information from different people. Even though males participated most of them didn't know about the impact that their activities have on the environment or their own health. Supposedly this might be due to the fact that females and males have different responsibilities in the community. Females care for the social life and well being of the family while males focus on economic part.

Table 4.8: Marital statuses of the respondents

Marital status	Percentage
Currently married	35
Single (never married)	41
Divorced	4
Separated and abandoned	4
Single parent	16

n = 100

Table 4.8 demonstrates that 41% of the respondents are single people including both males and females. Most of these people are no longer staying with parents

and are working. People from the age 35-75 make the married category (24%), at the same time some of this age group people are widowed. Even though the unemployment rate is high about 16% of the respondents are single parents which most of them were females. This shows that people continue with their sexual behaviors regardless of what their social status is. At the end of the day the population increases while the socio-economy decreases.

Table 4.9: Monthly income of the respondents

Monthly income (rand)	Percentage
Not applicable	10
300-499	3
500-699	16
700-899	6
1000-1099	12
1100-1299	12
1300-1499	7
1500-1699	4
1700-1899	4
1900-2099	5
Other income	21

n = 100

In table 4.9 it is illustrated that there is 21% of respondents that participated in the interview. This group is composed of professionals from all departments ranging from education to technical, and also self-employed people like taxi drivers or business people of the area. The 16% are people with a monthly income from 500-699 composing of pensioner, self-employed people and those who have retired from work and. Some people retired not because they were old but due to sicknesses that made them unable to perform their duties. The 12 % earning 1000-

1099 and 12% earning 1100-1299 include the labourers. This includes professionals who have never enjoyed their status because of unemployment rate and so have to take anything that comes their way. An increase in unemployment has opened the eyes of many people since among the respondents there were those who started their own business to get some income. These people fall under the 7% category getting 1300-1499 per month. There is an 8% which does not earn anything, which in a way they seem to be waiting for someone out there to hire them other than doing something while waiting.

Table 4.10: Employment status of the respondents

Employment status	Percentage
Professional	17
Technical /Managerial	8
Clerical/ Sales	2
Craftsman	1
Laborer	29
Retire/ pensioner	8
Unemployed	30
Self-employed	5

n = 100

Table 4.10 shows that 29% of the respondents are labourers who work for other people. This includes people who are from tertiary institutions and have decided to take any kind of a job coming their way. More people in this category are domestic workers working in different areas of Durban. Unemployment is a serious issue in the whole of SA and in Umlazi township 30% of the respondents is unemployed. Even those who are self-employed and labourers stated that they regard themselves as unemployed because in a long run what they are doing is temporary. Labourers, mostly domestic workers say this is because they are chased out of their jobs anytime since there is no written agreement. Even though

tourism is an issue in Durban very few people have knowledge or interest of craft and art, this is shown by only 1% of respondents working as craftsman. These person falls under the category of people, who earn income between 300-499, this is due to the lack of motivation in this field.

Table 4.11: Education level of respondents

Education	Percentage
No formal education	3
Preschool /nursery school	2
Primary	17
Secondary	44
Tertiary	34

n = 100

Table 4.11 gives an idea that not every one got a chance to study until tertiary, this is why 44% have secondary education, and this includes both old and young people. Among the young people are those willing to continue with their studies but due to unemployed parents they cannot do it. About 34% of respondents have tertiary education. It is surprising that people having a tertiary education is that most of them are not working as per their profession instead they take any job available to them. The 17% with primary education include males who had to leave school at an early age to feed their families, and also females who left school because of pregnancy. And 2% with preschool/ nursery school are mostly those in ages 65-75, who never got a change to go higher with education. This was mainly due to family problems and social structure where people were not allowed to further their studies.

Table 4.12: Work place

Work place	Percentage
Not applicable	30
Inanda	8
Isipingo	23
Durban / Durban North	18
Umlazi	10
Bluff	11

n = 100

Table 4.12 indicates that because unemployment is a serious problem at Umlazi. This is eluded when 30% of the respondents stated that they are unemployed. Twenty three percent of those working are situated at Isipingo and these are labourers. The 18% includes professionals working in different sectors in Durban/ Durban North. Distance between homes and work place increased the traveling cost. According to one of the respondents the travel costs leads to high accident rates in the area. Even though people prefer working outside there is 10% who work at Umlazi as self-employed, technical or laborers. About 11% work at Bluff industrial area and at Inanda, which is one of the closer areas of employment.

4.4 Characteristics of the dwelling

Due to the fact that the study focus was on the solid waste management in urban areas with only people on formal settlements, informal settlement were not involved. So the type of housing that people own is formal with water and electricity provided. People own the houses they stay in but they pay rates like in any other area. In some cases people don't have renters in the main building but only in the back rooms.

Table 4.13 Number of people living in the property or house

Number of people	Percentage
1-6	86
7-11	11
12-16	1
17 and above	2

n = 100

From table 4.13 it's evident that about 86% of the respondents have 1-6 people living in their property. This includes mostly young couples and those people who decided to leave their homes to start their own families. The 11% are those families with unmarried children staying with parents, which count to 7-11 people per house. The 1% (12-16) and 2% (17) are extended families and have other people renting their back rooms. All respondents stated that they own the houses they live. The number of people per house depends on the structure of the family. For example in some families there are aunts, uncles, and many other relatives.

Table 4.14: Duration of stay in the house or areas

Duration (years)	Percentage
Less than 7	12
8-13	23
14-20	13
21-30	13
30 and above	39

n = 100

Table 4.14 demonstrates that about 39% stated that their families have been in the area for 30 and above years. Some of these families settled in the area when the township was established. Twelve percent of respondents are from newer sections

of the area and they have stayed for less than 7 years. Most of the respondents are in the generation that was born in the area so they don't have enough information. Others only know that they have been in the area when the townships come into existence.

4.5 Solid waste status

Table 4.15: Waste removal and Street cleaning services provided in the area

Street cleaning services	Percentage
Yes	94
No	6

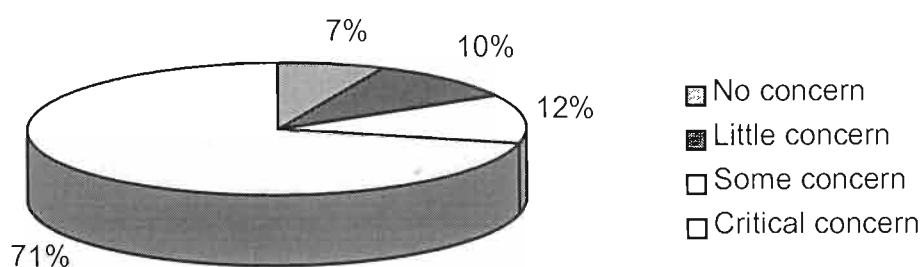
n = 100

Table 4.15 there is so much that is to be done to make sure that the environment that people they live in is clean. This includes the refuse collection and street cleaning. Ninety four percent (94%) agreed that there are street cleaners in their areas but there are problems that people encounter when it comes to street cleaning. At times cleaners sweep the street or cut trees and grass but leave the waste like that. This causes an increase of waste in the streets and affects the storm drainage. The 6% stated that they have never seen a street cleaner and street are always dirty.

For a very long time awareness programs have been used to make people aware of the impact that waste is having on their health and the environment. When this seemed to be in vain other options were used, which calls for hiring more street cleaners and road crews to collect waste. This is a powerful tool but then could not be used as the final solution because people are not only littering on street but in all other open spaces. Along the way voluntary participation was used as a strategy to clean streets and all other affected areas but this never solve the problem. (Bradshaw, 1992) In the case of Umlazi as much as 94% state that there

are street cleaners it does not mean that waste is reduced since there are dumpsites next to roads that need special attention.

Figure 4.1: How do people rate waste removal and street cleaning?



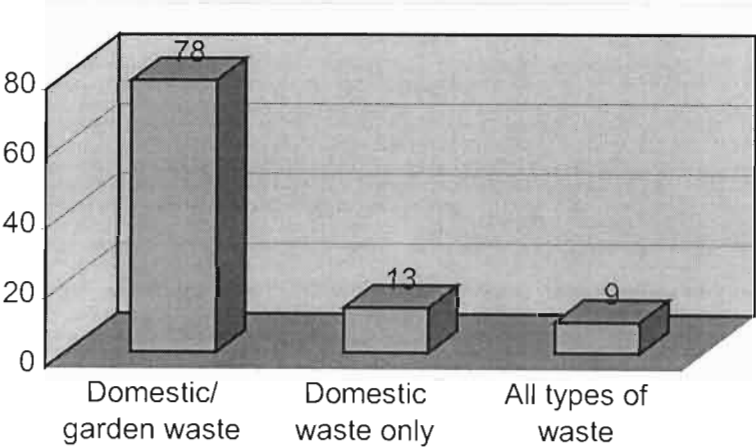
n = 100

Figure 4.1 shows that waste is a problem at Umlazi as in all other townships in Durban; this is due to the fact that about 71% of respondents stated that waste removal and street cleaning are a critical problem. This comprises of those people who are well aware of the impact that waste has on their lives. The amount of waste includes garden waste left lying in the streets by street cleaners and the waste thrown by people due to a lack of services. The 7% are those respondents only concerned about what is in their homes. They even stated that there are so many things to worry about including unemployment than to focus on waste that is on streets. Those people (12%) who are able to care for their environment despite what their community or waste removal services providers do view waste to be of some concern.

According to Sara (1990) there is less focus on waste compared to other environmental problems. Waste is felt and seen by people in their residential areas

but there is a large number of people who don't regard waste as a problem. The increasing amount of solid waste in the streets is worsening because Umlazi Township is characterized by large number of informal settlements inside. This is due to the fact that door-to-door services are not practicable because vehicles don't have routes to use to reach waste placed on the road for collection. So the depot system is the only available option to change the situation, and then dumped refuse can be removed on a normal basis. The depot system can only be successful if people are involved and are made aware of the system. On the other hand people need to be educated and be allowed to participate in any decision-making concerning the system.

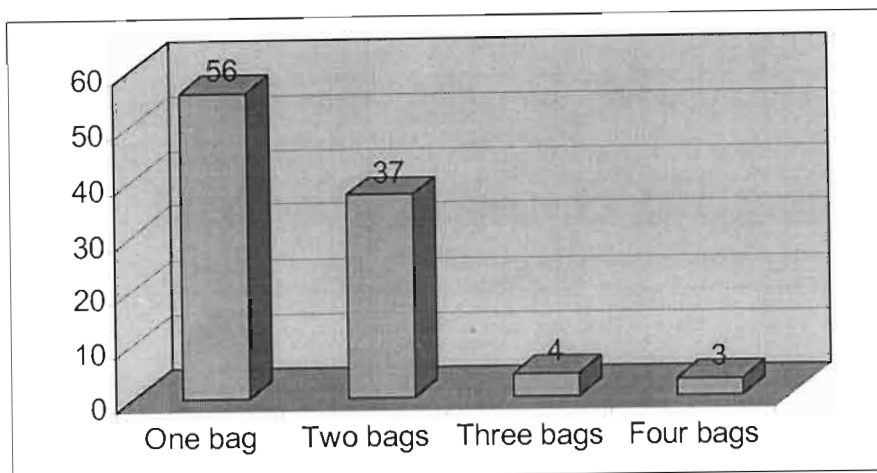
Figure 4.2: Type of waste that people dispose



n = 100

Figure 4.2 depicts that 78% of respondents dispose both domestic and garden waste in the same manner. Domestic waste includes food, paper and cardboards, plastics, tins, glass and all other refuse that is found in the house. Domestic waste is disposed off because it cannot be used anymore and is contaminated. Garden waste includes both grass and trees, and their way of disposal differs from that of domestic waste. The 13% that dispose only domestic waste are people with neither gardens nor lawn grass in their yards. In some instances people have other wastes such as scrap metal and building materials, so 9% of respondents dispose all kinds of waste including the two above.

Figure 4.3: Amount of waste generated per week per household



n = 100

Figure 4.3 shows that that 56% of respondents generate only one bag of waste every collection day. This includes people who are unemployed and those struggling for living so they don't have much generated. The number of bags provided controls some of these people in their generation of waste. On the other hand this consist of people who reuse some of their material other than throwing it away. They stated that they do this not because they care for the environment but because something can be reused like plastic or glass containers that can be used to store food. People who generate two bags, 37% and three bags, 4% rely on their own money to buy extra plastics to store waste since the municipality provides only one. And this includes people with large families and those who consume more. Garden waste is not included on the amount stated above. The reason for this is that people are not provided with plastics to store this waste so they don't even know the amount they generate. More to that garden waste is not generated everyday or every week but in cases where people cut tree or grass. The amount of bags that people generate depends on the number of people in a family.

Garden waste and domestic waste are not supposed to be stored in the same plastics, which is the reason why there are green bags reserved for garden waste storage. When people were asked about green bags most of them said that they don't know anything about them. Even those who know about green bags have never used them but they heard

of them from friends, suburbs or work places. People are not provided with these plastics instead they have to buy plastics for their garden waste. This is the reason why people dump garden waste on available open areas. At times they try to store this waste in black plastic bags provided for domestic waste but the collectors don't take black plastics with garden waste. That waste ends up lying in the street for long period of time blocking the storm drainage and cause unattractive conditions.

The generation of waste varies with time and day of the week, week of the month and month of the year. This simply means that on weekends people generate more waste than during the week. The reason for this might be that more family members are at home. In the first week of the month where people have money to consume more therefore generate more waste. This can vary from one family to another or from community to the other depending on the socio-economic status of the family. (Enger and Smith, 2000) This is the situation at Umlazi whereby people who generate more are those earning, more usually professionals and this varies with time even in their case. On different occasions such as a wedding, party etc people generate more waste than on normal days.

Table 4.16: Storage of domestic waste

Storage type	Percentage
Bury in trench	2
Refuse bag/ bin	98

n = 100

Ninety eight percent (98%) of respondents store and dispose their waste using refuse bags and bins. The municipality or any other contractor that might have a tender for waste removal provides plastic bags, and people are supposed to buy bins. The problem with the buying of bin is that not everyone can afford to buy them so people end up storing just on plastics which are then exposed to dogs. It's the responsibility of the residents to take their waste outside their homes during the collection day. For Macozoma (1999) it's the responsibility of the municipality to provide plastic bags and to households at regular intervals.

The two percent (2%) that bury waste in trenches are those people farming and they use their waste for composting. Although waste is used for compost some volume of waste is stored and disposed using bins and plastics. According to Tchobanoglous, et al (1993) burying of waste can be the best solution to avoid waste staying for a long period of time before collection. Storing waste for a long period has effects like biological decomposition resulting from fungi and bacteria. So for any storage the waste characteristics should be considered, in a way recyclable and non-recyclable materials should be separated.

Waste collection is only once a week under the contractor known as Munitech. Collection procedures stipulated are followed no matter what the situation is. In cases where people have more waste they have to wait until collection day or to dispose their waste in any other way possible. This might be another reason why the amount of waste increases in the area. In some areas where people stay next to roads or next to trading places waste is collected thrice a week to avoid waste lying in the area. People staying next to roads are affected by waste from stations where informal trading is high. The waste generated in informal trading is disposed off on the nearby water drainage.

Inefficient collection of waste has a negative impact on the community. This can lead to untidy and unhygienic conditions that can hinder development and improvement of people's lives. The possibility for people to dump waste is high in areas where waste collection is not effective, so its important not to look at community affordability of services but also at the impact that the uncollected waste has on the environment. People at Umlazi receive one black plastic to store waste and during collection day refuse is taken to the street for collectors.

Table 4.17: Disposal of garden waste

Disposal methods	Percentage
Dump	33
Burn	40
Bury in trench	27
Total	100

n = 100

From the above table it is evident that people are not provided with green or relevant plastics to store and dispose waste. About 40% respondents burn their waste since they don't have another choice. Even though they know the impact that burning of waste has on their lives, there is no other way to get rid of waste. Dumping of waste occurs only on those sections where there are illegal dumping sites. The 33% of respondents believe that until the municipality does something they won't stop disposing in this way. For them it's better to throw waste on the open space than keeping it smelling in their homes. Due to the increase in poverty and all other issues caused by unemployment vegetable farming has become the best alternative. Therefore 27% use garden waste for composting.

From the interview with the Munitech (DSW consultant) member it was made clear that DSW is not responsible for the collection of garden waste. Instead the Parks Department is responsible to collect this waste and dispose it in relevant landfill sites situated within the north and south central regions. Garden waste collection is not free which is the reason why people have to buy red plastics bags for the storage of this waste. The Parks Department doesn't collect garden waste if stored in any other plastic bag. People can use their cars to transport this waste to the site and the staff will give direction for the correct disposal of waste. These sites are situated in following areas: Durban North-Riverside Road, Chatsworth (2)-Sagittarius Street and Silverglen Drive, Bluff (2)-Tara Road and Travancore Drive, Montclair-Glenville Road, Phoenix-Canehaven Road, and Red hill-Malacca road. (Interview, 26 August 2002)

Table 4.18: Disposal of scrap metal

Scrap metal disposal method	Percentage
Don't have such waste	44
Dump it	21
Give it away to anyone who needs it	31
Store in the back yard	4

n = 100

Table 4.18 demonstrates that 44% of the respondents don't have cars and have never had scrap metal waste even before. Some of these people never regard this as waste or something they can use for their survival, so they don't even recognize the where about of such metals. For those (31%) who don't know what to do with waste and don't have time to sell it they give to those who need it. The recycling of scrap metal such as scrap car, tyres, batteries and many more can be used to create some income if people are informed about the benefits.

Table 4.19: Refuse skip provided to store waste before collection in the area

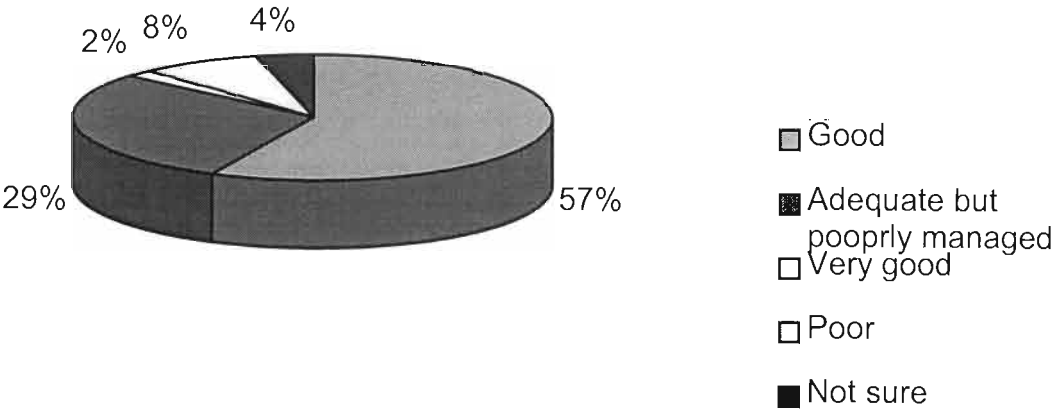
Transfer station	Percentage
Yes	10
No	90

n = 100

Skip is another means that the communities in townships can be provided with to store waste before collection day. Ninety (90%) of respondents state that there are no skips in their areas. This is also seen as the reason why some people dump their waste in open areas that can be used for other purposes. The 10% that have skips in their area are those next to informal sectors, and these stations were provided to store waste. The impact that these skips have is that at times collectors don't empty them, which cause odors and impact that might lead to diseases to people living next to these areas. The community that wishes to dispose their waste also uses the skip provided for informal traders. The problem with skip is that waste collectors empty it only on fixed days.

The large communities need skips to be stationed at a central location and services once a week. For large settlement skip of one cubic meter is sufficient for people to store their waste. While in small settlements a fixed drum can be used by ten houses. Skips should be at gathering points like communal standpipes or bus stops, or any place residents regularly use. (www.durbansolidwaste.org.za) In Umlazi informal settlements that are inside the township contribute to the amount of waste that is troublesome to motorists, developers and even the community. These skips can be used even in areas where there are informal traders like in section F, where people end up disposing their waste on storm water resulting in blockage and ineffective control of storm water.

Figure 4.4: Rating waste collection services provided in the area



n = 100

The way refuse collection is done seem to be somehow appreciated by half of the people in the area. This is the reason why figure 4.4 proves that 57% of respondents look at refuses collection service as being good. They say its good in a sense that collectors do their work in a way set by the department of solid waste. Twenty nine percent (29%) sees collection as inadequate due to poor managed.

Eight percent (8%) of the respondents regard waste collection as being poor with two (2%) percent stating that service is good. It's the responsibility of the municipality to bring change on the refuse collection services. The irony out of this is that if so many people rate refuse collection services, as being good why then are people dumping illegally. At the same time it is possible that people who view collection, as being good are those who don't dump but store waste in their homes until collection day.

Table 4.20: Scavengers during waste removal days

Available scavengers	Percentage
Yes	24
No	76

n = 100

Table 4.20 shows that about 76% of respondents stated that there are no scavengers in the area. These people have a concern that if there could be scavengers mostly focusing on recyclable material the amount of waste could be reduced. The 24% knows about scavenger who takes only cardboards from the waste that people dispose, but this is not an effective activity. The scavengers are those people who collect waste illegally from dumpsites, transfer stations or skips. In most countries scavengers are seen as unwanted figures in the waste management system since they collect waste illegally in the storage facilities. At some instances they leave the sites dirty by scattering waste all over the place. Even though scavengers are not accepted they can play an important role in the waste management system as a way of reducing waste. Some developing countries have changed their attitude towards scavengers and they use them as one of the waste reduction strategies. (Macozoma, 1999)

In Zimbabwe solid waste is a serious problem and there are many scavengers, at the same time they are viewed as outcast in the area. These people make a living out of scavenging but yet they are not recognized or not given initiatives on social empowerment as it happen in countries like Latin America. Banning scavenging was not a solution to

Zimbabwe since these people were able to break laws and have access to the dumpsites, transfer stations or skips. (www.worldtrek.org)

The number of scavengers in an area can help to reduce the amount of waste that is supposed to be disposed off since these people collect waste for recycling or reuse purposes. In some instances solid waste can be dumped on areas that are connected to sewerage systems and that can lead to blockage. The problem with sewers is due to an inadequate amount of water in streams. So since sewage increase the amount of waste and pollution in the environment, Sara (1998) suggest that construction of necessary sewage plants for proper treatment of sewage from households are important for the future.

Table 4.21: Last time in which sewer blockage happens

Year in which sewer blockage happens	Percentage
Never happen	49
Before 1994	6
1995-2001	30
2002	15

n = 100

Table 4.21 demonstrates that 49% of respondents stated that they have never come across a problem of sewer blockage and this includes those people who have less than ten years being at Umlazi. In some instances the municipality does not respond to the problems of the community, which is the reason why even this year (2002) about 15% had sewer blockage. These people stated that it took more than a week before any response, and at times they end up paying for private contractors instead of the municipality to do something.

Looking at solid waste collection and removal services its important to pay some attentions to sanitation as another service. Sanitation falls under human needs that are important to make a home comfortable. The lack of proper solid waste facilities be might

the cause that people dispose waste on storm drainage. Wastes that are most likely to be found on pipes are vegetable pieces, pieces of bones, bidi ends, waste cloth etc, which cause pipe leakage and thereafter blockage.

After the 1994 Democratic elections the Reconstruction and Development Program (RDP) was founded, focusing on the provision of infrastructure services to people mostly the disadvantaged blacks. At the same time when looking at the 30% of respondents who experienced sewer blockage after 1994 it's hard to believe that the aims and objectives of the RDP were met. Umlazi Township is a formal settlement (although there are informal settlement but were not looked at) that is supposed to have good managed services but this seems not to be the case.

There are different reasons that can lead to sewer blockage based on the study that was done by the Water Research Commission (1994) on six townships of Pretoria (Alexandra, Clermont, Kwa-Thema, Mamelodi, Nyanga, and Thabong. These townships used different facilities for sanitation that were either waterborne sewerage or the bucket system, and some of the interviewed households had more than one family. The reason for blockage is spillage from buckets. Due to overcrowding the system have to carry three times more than what it was designed for per flow and this lead to overflow. As it was stated before lack of services makes people dump solid waste and sands into manholes resulting to overflows. Operation and maintenance is a problem whereby people don't have ways to care for their services on their own but have to wait for a certain operator to help if a need arises. In cases where buckets are used collection is not frequent causing overflow and blockage. (WRC, 1994)

In the case of Umlazi the main reason that sewer blockage occurs is that of poor maintenance and operation problem. In some instances people report to the municipality as the service provider if they have sewage or any other problem but they don't get any response. At the end of the day people are supposed to find private contractor or companies to help them. These conditions lead to drinking contaminated water, flooding

of inhabitable properties with crude sewage, and equally unacceptable conditions affecting the environment.

4.6 Illegal dumping and its impact

Table 4.22: Illegal dumping as the problem in the area

Illegal dumping as a problem	Percentage
Yes	54
No	46

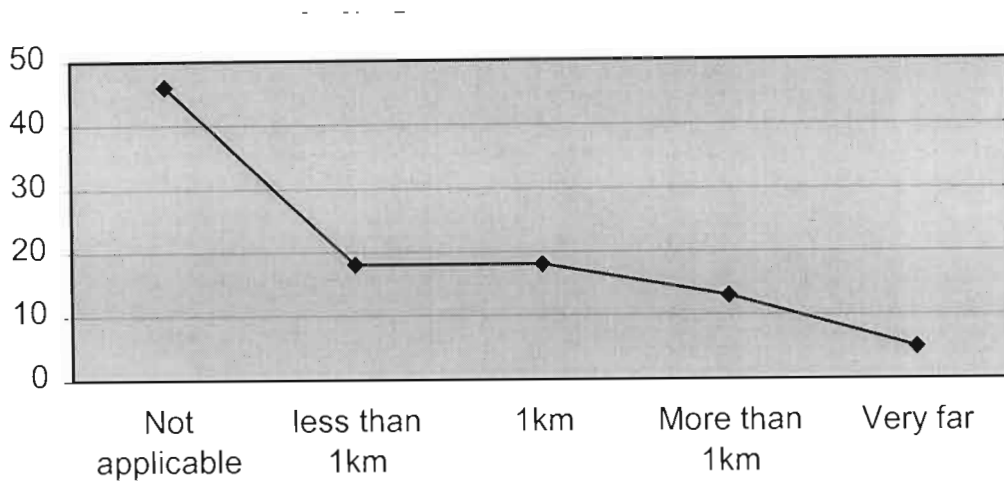
n = 100

Lack of refuse storage and collection services can be the reason that people dump waste on any green areas available to them. The increase in illegal dumping sites at Umlazi might be due to some reasons, such as limited plastics provided, collection being inconsistent, and many more. Fifty four percent (54%) of the respondents stated that there are illegal dumping sites in the area. Even though these people know the impact of these sites they don't have a choice since they cannot keep waste in the homes. Forty six percent (46%) are those respondents who don't see illegal dumping as a problem since these sites are situated far from them. Like in all other townships in the world Umlazi is experiencing illegal dumping of waste.

There are different health impacts that illegal dumping can cause. People living next to these sites don't have much knowledge and understanding of this. Illegal dumping can cause Asthma, Cholera and Tuberculosis since during rainy days water from dumpsites run to open water and contaminates groundwater. These diseases affect mostly children who play in these dumps and others eat anything they found dumped. There is a need for partnership between the government and the community at large to eliminate the problem of illegal dumps. (Rao, 1991) Due to the fact that one country has to learn from another even South Africa can learn from India that once had a problem of illegal dumping. Both government and community members took initiatives to seek the solution to the problem and one community in India will be used as example of how illegal dumping was faced. (www.epa.gov/epaoswer)

In Yurok Reservation there was a big dumpsite known as Weitchpec in Northern California, which existed 40 years before the project. This site grew to about 1.200 cubic yards towards the highway and extension motivates the community that they should do something to make a change. In the beginning the government seemed to be less interested but the community and the Yurok Tribal staff tried to convince the government. At the end the California Integrated Waste Management Board (CIWMB) awarded \$600.000 to the community, and this money was used for clean-up projects, and people were trained for the clean-up project. The question then was what could be the right place for people to dispose their waste legally? Due to the fact that different organizations and department were involved in this clean-up project, the Indian Health Service (HIS) donated \$150.000 for the creation of a transfer station where people could dispose their waste before it was collected to the landfill. It does not end there but people were educated on how to reduce waste at source, to reuse and recycle. Due this project garbage on the highway was reduced and vectors diminished. (www.epa.gov/epaoswer)

Figure 4.5: Distance to the illegal dumping site



n = 100

Eighteen percent (18 %) of respondents stated that an illegal dump is only less than a kilometer away from their homes. These people walk or use wheelbarrows to dump their waste. At the same time there is another 18% that stays only 1kilometer away from the illegal dump. Even though they seem to be a little bit far they have access to the areas if they need them. Thirteen percent (13%) and five (5%) of the respondents lives more than a kilometer and far away from the dumpsite respectively. These people use any form of waste to take their waste to the site. Illegal dumps are accessible to most people who are willing to use them. The shorter the distance means the area might cause more impact to human life and the environment at large.

There are different types of waste that people dispose illegally, this ranges from domestic, garden, scrap metals, and building materials. People dump garden waste because they are not provided with the relevant plastics to store waste before collection. Although others use this waste for composting there is still excess of waste from those who don't practice gardening. Domestic waste is not usually

dumped but there are exceptional cases where people have occasion and they cannot keep the large amount of waste for a long time. Scrap metal can be sold for recycling by different companies but those people who don't know about recycling dispose it. Building materials are only found in those sites where people are rebuilding or extending houses. This happens mostly in sections that are very old and people are renovating.

The South Africans are given so many rights by the Constitution of their country but its difficult to believe that these rights are met for the people. According to the Environment Right (section 24) of the Bill of Right "every one has the right to an environment that is not harmful to their health or well being, and to have the environment protected, for the benefit of present and future generation through reasonable legislative and other measures that prevent pollution and ecological degradation, promoting conservation, and secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development," (White Paper, 2000). This is a good right that people of this country deserve but not everyone in this country enjoys it.

When looking at Umlazi as a township its so difficult to believe that the Bill of Right does exist. The fact that people stay next to illegal dumps shows that there is no way it could be said that their health is not affected by waste. Even though people are the ones who dispose this waste the service providers are the cause of. If people don't have enough refuse storage and collection services the open space is the only available option. The increase in waste in these areas due to illegal dumping might increase pollution either on the land, air or water. Increase in illegal dumps is due to ineffective and inefficient refuse collection services. In situations where services are available they are so expensive that people cannot afford buying, this is the case of garden waste plastics that people are suppose to buy. Pollution can lead to environmental degradation that can limit social development and affect the lives of the people.

Table 4.23: Environmental impacts of illegally disposed waste

Environmental impact of illegal dumping	Percentage
Not applicable	44
Pollution	32
Unclean/ unattractive surroundings	24

n = 100

The impact that waste has on the environment is pollution; this can be land, water and air pollution. Thirty two percent (32%) of the respondents see illegal dumping as increasing pollution in the area. This includes people who watch news and are aware of what waste does in their areas and they are concerned that the same thing might happen. The same pollution is the one that cause health problem for people. For example air pollutants can cause asthma during the respiration process; waste can affect the land used by people for different activities and lastly contaminate groundwater needed for human survival.

In this era tourism is of great concern in all cities and townships but there are so many issues that can have a negative impact on tourism. This is the reason why 24% of respondents saw waste as causing an unattractive environment. This makes it difficult to promote tourism in these areas since there is more that still needs to be done including cleaning the areas. The 44% of respondents are those that live very far from illegal dumps and so they don't consider waste as having any impact.

Policies are made but the implementation and enforcement seem to be the problem. The DMA has a policy that is know as Durban Metropolitan Environmental Policy (DMEP) 2000 that consists of about six goals. Goal D of the policy focuses on pollution and waste management with five of the Goal's

objections dealing with protection of the environment and human being. These objectives are as follows:

- To improve the effectiveness of pollution and waste management activities in DMA in order to improve the quality of the environment and human health;
- To improve the quality of the environment and human health by minimizing the amount of solid, liquid and gaseous waste generated in and affecting the DMA;
- To improve the quality of the environment through effective solid waste management;
- To improve water quality by effective regulation of liquid effluents and storm water discharge into freshwater and coastal systems,
- To develop an efficient system of reducing and managing substances produced in the DMA, which are hazardous to human health and the environment. (DMEP, 2000)

The stakeholders responsible for solid waste management have a greater task of ensuring that this goal and its objectives are met. About 57% of the respondents stated that illegal dumping is associated with odors, unaesthetic environments and insects. This simply says that the second objective on the list above is not met at Umlazi where people are faced with unhealthy environment while the municipality strives for a waste free environment. The main reason that these objectives are not met is insufficient collection and disposal services needed by people. The critical solution lies on the issues that people should be provided with enough information on waste reduction and minimization.

Table 4.24: People responsible for the illegal dumping

People responsible for illegal dumping	Percentage
Not applicable	42
Residents/ workers	57
Don't know	1

n = 100

In areas where there are no industries around residents and street workers are the ones responsible for illegal dumping. Based on table 4.24 about 57% of respondents are the people who dump their waste in these sites. At the same time there are those who don't dump but know that residents are responsible for dumping. Street cleaner/ sweepers are included in a sense that they sometimes leave trees and grass after cutting. At the end of the day this waste block storm drainage or flow to rivers during rainy days.

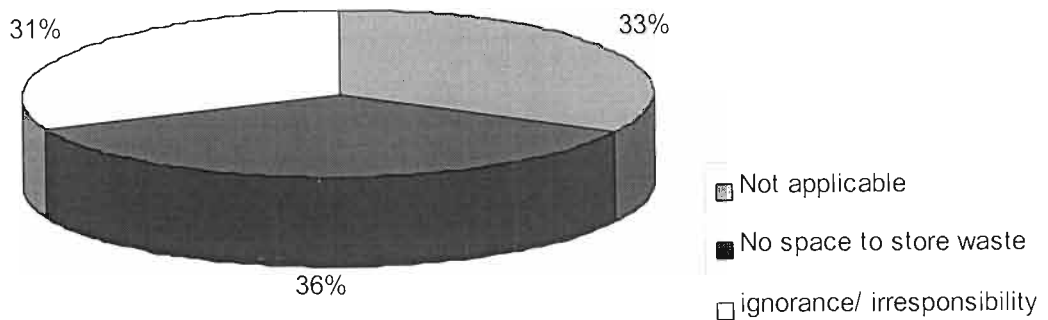
According to the Handbook for Coordinators on Keep KwaZulu Natal Beautiful Campaign (KKNBC), (1999) there are seven primary sources from which almost all littering comes from. These are homes, businesses and industries, loading and unloading areas, construction sites, uncovered trucks, pedestrians and motorists. Approximately 80% of waste comes from the first four types of sources. On the other hand the other three sources are moving and also need special attention because people responsible are not affected by. (KKNBC, 1999)

Based on the laws and regulations that exist in SA, compliance, enforcement and protection are important when it comes to environmental issues. According to Chapter 7 section 28 (1) of the National Environmental Management Act (NEMA) no. 107 of 1998 "every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorized by law or

cannot reasonable be avoided or stopped, to minimize and rectify pollution or degradation of the environment”.

Based on the NEMA it seem clear that any person responsible for dumping of waste has to be called liable of any negative impact that waste have on the environment. So due to this the DMA has to educate people about this act and then enforce compliance. Even though people are forced by the circumstances of insufficient services to dump waste, the municipality has to play its role and enforce state laws. This at the end of the day will help eliminate the amount of waste and change the conditions under which people live. Waste disposed off by people cause degradation on the environment they live in and even to the ground water table. In the Environmental Conservation Act no. 73 of 1989 section 21 subsections 21 (2) the list of activities that have a detrimental effect on the environment is given. These activities include “land use and transforming, water use and disposal, resource removal, resource renewal, agriculture process, industrial process, transportation, energy generation and distribution, waste and sewage disposal, chemical treatment, and recreation” (Government Gazette, 1998).

Figure 4.6: Reasons why people dump waste illegally



n = 100

Figure 4.6 demonstrates that 36% of respondents dump their waste because they don't have space to store waste. At the same time plastics provided cannot accommodate all the waste they have. Also the fact that waste is collected once a week makes it impossible for people to keep waste within their premises. Thirty one percent (31%) of the respondents stated that people dump waste because of their own ignorance/ irresponsibility.

For the KKNBC, (1999) there are other reasons that cause people to dump waste and then feel that it's acceptable for them to do so. These reasons go with the big one that people gave that they don't have services to store or dispose their waste. Residents dump waste because they feel no sense of ownership to the property they dump in. The other attitude is that residents know that someone is responsible to collect waste after they have dumped the waste. On the other hand people take the attitude that they dump waste in areas where waste is already accruing. People see waste as of no importance to their lives since people are not educated of how much waste can affect their lives and the environment they stay in.

The insufficient service provision cause people to get alternatives they can use. People do this without even considering the impact that their activities might have on their lives or on the environment. People are provided with only one plastic to store domestic waste. Those with large families are supposed to buy extra waste, if they can't afford illegal dump sites are places available to them.

For Councilor Vanto there are different things that cause people to dump but the prominent one is the ineffective provision of service. The biggest problem is with the company that was awarded a tender for refuse collection, which is called Waste Tech. Mr. Vanto says that the company has been working for years but is unreliable and inconsistent, and they don't seem to understand their job. In a situation whereby they come late for collection they don't bother to collect waste that was scattered by dogs. The other issue that Mr. Vanto highlighted was that plastics provided are not sufficient for people to keep their waste. People have to put together all their waste even that which can be recycled. Large families are left with no choice but to buy extra plastics if they can afford them or dump since their plastics get full before collection day. (Interview 16 May 2002)

According to Macozoma (1999) ignorance requires legislation and enforcement of by-laws to involve people. At the same time the lack of awareness is a serious problem that need to be addressed before it is too late. Lack of awareness can be associated with lack of education, socio-economic conditions of low-income communities, socio-political consequences that have left people with no sense of responsibility, and a lack of belonging in communities where people live. People dump illegally because the official dumping sites are far from them so they don't care who will be affected.

On the other hand people ignore the fact that their waste has an impact in their lives. The reason they don't store waste in their homes is that they care for their health but at the same time ignoring that those next to illegal dumps are affected

daily. The 4% of respondents wish that more plastics could be provided to people so that they wont dump everywhere.

People in the community see the municipality as being responsible for the elimination of waste. They stated that the best way to stop illegal dumping is by organizing cleaning campaigns and use the area for recreational activities rather than leaving the area like that. It is ironic that these people wish to see the area being clean but they don't see themselves participating in these cleaning campaigns due to other commitments. So the question is who will be engaging in these cleaning campaigns if people in the community are not willing? On the other hand others say illegal dumping cannot be stopped due to the reason that the government is not prepared to provide services to black townships.

4.7 Recycling and waste reduction

Table 4.25: Availability of Environmental Awareness Programs in the area

Environmental Awareness Programs	Percentage
Yes	4
No	96

n = 100

The whole focus is on environment which is the reason why there are conferences held all around the world. At the same time it is surprising that table 4.25 shows that only 4% of respondents from such a big township know about Environmental Awareness Programs available in the area. These people know because they are close to councilors or people in charge of these programs. Even though there are programs they have never participated in them due to work and family commitment. For them these programs can help somehow but only if people can change their attitudes toward councilor and the environment they live in. People are only aware of programs dealing with HIV-AIDS and ignore other issues including the environment. This is the reason given by the 96% respondents on

bases of why they don't have any program dealing with environment in their areas.

There are different tools that can be used to raise awareness on the impacts that waste has in people's lives. That can include media, exhibitions, visuals, pilot projects and entertainment. (Macozoma, 1999) From the Durban Solid Waste department it appears that their concern is that solid waste management of waste calls for the full involvement of people. People can be involved in different ways but before that they need to have access to the information necessary for solid waste management. So by organizing awareness campaigns people get enough knowledge and therefore it could be easier for them to know the need to avoid and minimize the waste they generate. Education and capacity building are important instruments for DSW in reduction and disposal of waste. (www.durbansolidwaste.org.za)

The environmental awareness campaigns can be organized in a form of informal and formal education that focuses on environmental issues. In short this is what is termed environmental education motivated by a need to alter the way people think and do, and in that way tackling environmental crisis facing the country every day. Environmental education also can uphold natural sustainability and self-understanding for sustainable living. On the other hand all learning institute have a responsibility to contribute to environmental awareness, understanding, skills and commitment. For environmental education to be successful teachers, community, parents, and students should all be part of the education transformation. In all disadvantaged communities structures and organizations should be more active in the process, and in this way it could be easier to take the information to people at grass root level who are also affected by the environment they live in. (Environmental Education Policy Initiative, 1994)

Table 4.25: Solid waste recycling projects

Solid waste recycling projects	Percentage
Yes	28
No	72

n = 100

From table 4.25 shows that 72% of the respondents says there are no recycling project available for the community but only for schools. They regard these projects as being dead because even children involved don't benefit but only schools. The 28% of respondents stated that there are Recycling Projects in the area but only target schools and not all community members. Only the school kids get in touch with what is happening in the environment. This percent appreciate the availability of these school projects because they help schools and give something that people can focus on rather than doing other things that might destroy their lives like drugs or alcohol. The increase of waste in most areas is due to the fact that people are not educated of alternative ways to dispose their waste.

The inaccessibility to information is a major obstacle that hinders all sustainable use of natural resources and that is the reason why 72% of respondents said they don't know any recycling projects in the area. Two of the recycling projects introduced by Keep Durban Beautiful Association will be used as illustration of success projects that are there for people to use, even though they are not located inside Umlazi. These programs were implemented under the DSW and can be used to dispose off recyclables rather than taking them to landfills or dumping it. In October 2000 the 'drop-off' facility was opened on Bellair Road. In this a skip was provided for people to dump garden waste, and drums are located for depositing beverages. A container for collection and separation of different colours glass for recycling is provided. Different skips for paper and for cardboards are provided.

(www.durbansolidwaste.gov.za)

In August 2002 the Brook St Buy Back Center was opened. This center was opened to buy waste like paper, cans, glass and cardboards from informal contractors and the public at large. This site is in partnership with Durban Solid Waste, Informal Trade and Warwick Junction Renewal Project and organizations like Self Employed Women Union (SEWU), Mondi Recycling, Glass Recycling, and Babs Waste Paper. Each of these offered something for the success of the center. For example Mondi Recycling provided 1,5 capacity bin and an officer container; DSW facilitated the whole process and is keeping a record of the volume that comes in and do the monitoring; Warwick Junction Urban Renewal Project provided fencing for the land; etc. All the material that is recovered here goes to the recycling companies. (www.durbansolidwaste.gov.za)

Recycling is important if it will increase social benefit over social cost by a maximum amount. Studies in different developing countries shows that there are different benefits of recycling. This includes “saving in refuse collection and/ or disposal cost, depending on the form of organization and type of disposal adopted, reduction in most cases in overall pollution impact, when recycling materials are used as raw material or inputs in production processes; reduction in the quantity of primary material requiring extraction and processing, as well as consequent reduction in energy use,” (Bradshaw, et al, 1992)

Even though there are these benefits communities don't know about them because they are never told, the local government does not pay much attention to waste and the recycling of this waste. There are different factors that might contribute to the little attention to solid waste by the local government. This can be low priority for solid waste, tight budget allocation, and lack of staff assigned to solid waste management (storage, collection, disposal and recycling). The problem with staff is that those who handle solid waste issues don't have enough technical and financial background. (Macozoma, 1999)

Recycling is important for financial benefits of the community but at Umlazi only schools are engaged in these projects, and how they benefit depend on how the project is run. About six women from different sections engage in recycling and they stand as individuals just to make a living in their families. For these women the reason they do this is not that they want to care for the environment but because they are able to get bread from the few cents they get from selling cardboards. They stated that they are willing to participate on bigger recycling projects that will give them more money, and then to care for the environment as they now have an understanding of the importance of their activity to the environment. Some of these women were found next shopping centers collecting while one of them was next to the 'smelling skip' in Umlazi section V.

One of the objectives of the White Paper on Environmental Management Policy is to get a way to reduce waste generation and pollution at the point of origin and promote the practices to waste reduction, and these practices are reuse, recycle and recover with safe disposal. (White Paper, 2000) It's easier to say this statement but without sufficient service needed for it to be achieved nothing can be done. All policies are formulated at a national and provincial level but the local authorities have a responsibility to ensure that implementation is happening. Even in this case the local authorities are the ones to provide people with information on process reuse and recycling. At Umlazi Township this objective is not yet met since recycling is not an option to reduce waste but instead illegal dumping and landfilling.

The overall aim of recycling is to reuse and reduce waste that is found in the whole world. Due to the fact that the world focuses on integrated waste management the DSW engage in this by forming the Waste Minimization and Recycling Division. The basic focus of this division is on waste minimization, composting, recycling and disposal. Different activities are performed by this

division and some of them are as follows: landfill site visit, Waste Minimization/Cleaner Technology Interested Group, business and industry waste management training programme, pilot studies on the feasibility of recycling schemes and composting plants, Let's Reduce and Recycle Manual for Solid Waste Awareness, community environmental education expos and road shows and many more. (www.durbansolidwaste.org.za)

Table 4.27: How do people dispose off recyclable material (plastic, paper and cardboard, metal, and glass)

How to dispose recyclable material	Percentage
Send to recycles	1
Reuse	23
Dispose/refuse bag	76

n = 100

Table 4.27 shows that about 76% of respondents stated that refuse plastics bags are used to dispose off their recyclable materials like glass, metal, paper and cardboard, and plastics. They don't see the need for alternative ways that they can use to get rid of this waste. The 23% state that they reuse only plastic containers to store food, otherwise they throw away the rest. This is the reason why the areas are littered with papers and plastic bags that people don't think of reusing or taking for recycling. The lack of information or knowledge can make people to perish or not to live life to the fullest as they are supposed to. This is due to the fact that people don't know about the importance of reuse and recycling.

Unemployment is a serious problem all around the country and this affect all spheres of people's lives. In general terms when people were asked whether they see the need for people to buy recyclable bags that are sold in supermarkets or not. An estimate of more than 60% of respondents said they don't see the need for people to buy the recyclable plastic bags. The major reason for this is that people

don't have money since they are unemployed. So in the new strategy it should be borne in mind that some people who are supposed to buy plastics are the customers. They prefer the old non-recyclable plastics that are free since they don't have money to pay. The other percent stated that they would like to buy these plastics since they can be reused. The main reason for this is that it will eliminate the amount of plastics lying all around the area. At the same time this will make people to be responsible for what they have bought other than what was given freely. The percentage includes mostly people who are working or those who have a way of getting income and can afford to buy these plastics.

In recycling solid waste, the whole community has a role to play and this shows a sign of responsibility. Most of the respondents stated that they are willing to separate household waste for recycling programs. For them this could be easier if they will collect waste door to door and be provided with specific plastics to do this work. Even though they are willing the attitude that community members have towards waste collectors can affect their love to the programs. Most of these people are unemployed so their willingness can be more effective if there will be some money involved. A few say they could do it out of commitment and willingness to see the area they live in being clean.

Separation must take place before recycling or disposal where two containers are needed one to store recyclables and another one to store non-recyclables. The collection crew or residents can be responsible to separate waste and different kinds of vehicles are used for collection. This includes the open-bin manually loaded (crew loading bin), open-bin manually loaded mechanically emptied (crew load the bin and the vehicle empty it) and container mechanically emptied (vehicle empty the container). (Tchobanoglous, et al, 1993) Working for the community is difficult and need people who have a heart for it, and this is why some of respondents say they are not willing to separate waste. They say that people don't respond in a way you expected them to and more than that they pass

remarks on people who try to help. At the same time they think those working for the community are after the money from the municipality.

4.8 Community participation

Table 4.28: Stakeholder responsible for complains based on solid waste related problems

Stakeholder	Percentage
Contractor	16
Municipality	71
Nobody	13

n = 100

Table 4.28 portrays that 71% of respondents report their waste related complaints to the municipality. Due to the fact that the municipality has to cover a big area not all complains can be tackled. This is the reason why more people see the municipality as not being successful in solving the problems of the community. At the same time people are not willing to work together with the municipality in the process of reducing waste at generation. The 16% of respondents depend on the contractor itself to report waste related problems, but due to the lack of resources things are not working well. The most surprising thing is that 13% of the respondents say that there is nobody to complain to. The reason for this is that all those in authority don't want to take responsibility, and they lack information. For the success of the stakeholders in solving people's problems access to information and understanding of the rights that the community has are important.

There are so many issues that people expect to see in the communities they live and the community workers like councilors or the municipality have a great job to do. Councilors cannot do things on their own therefore the community should assist them. When the community (from different sections) was asked about committees dealing with environmental problems they said that there are no

committees. Their reason for this is that the Councillor doesn't want to involve people in decision-making. At the same time people are concerned about other things than environmental problems. Others confirmed that there are committees and the reason people don't know about them is irresponsibility. At times people are invited to community meetings and they don't attend stating that they are busy. At the end of the day if decision are made they are the first ones to complain. Due to irresponsibility committees cannot work effectively since the people they serve always blame them. The lack of communication between the community and the available committees or organizations increases the responsibility of the municipality.

Even though solid waste is a problem most sections have organization dealing with solid waste. This caused a situation whereby people won't have someone to report to if they have problems related to waste. The only organizations they know are those dealing with HIV-AIDS, which is gaining more attention these days. Insufficient funds make it impossible for the available organizations to turn to other problems of the communities. These organizations also lack information on how to deal with waste even if they would like to.

In the government institutional arrangement at a national and provincial level policies and legislations are developed, but service provision and by-laws are enforced at a local level. This services provision include even the provision of refuse collection services in township and all other areas in need of the service. So at a local level the authorities have a responsibility to mobilize people to participate in the handling and control of waste. The reason for this is that people are the ones who generate this waste so they have to be responsible. Due to the fact that people don't want to participate and they ignore the impact that waste has in their lives, its impossible for the authorities to work effectively. (Macozoma, 1999)

The big problem at Umlazi other than waste is the poor level of communication between the community and the councilors. The experience of a Councilor in one section is nearly the same in all other sections therefore one Councilor was interviewed as a representative. Councilor Vanto of V section was interviewed on the 16th of May 2002. He said that there are committees in all sections of Umlazi but the problem is that people don't want to participate in any thing that is happening in the community. Each committee has 21 members linked to different government departments and they all have different issues to focus on depending on their department. For example if there is something to be done in schools there is someone representing the department of education therefore the person has to draw the Integrated Development Plan and inform other members for them to be involved.

Martha Khumalo who is a committee member in J section confirmed this. She said that people have a big role to play in improving their lives but the problem is that they don't want to participate. The situation in Umlazi increases due to the fact that people are always waiting for financial benefits otherwise they don't do any thing. Mrs. Khumalo stated that when committees were appointed people were excited but when they are suppose to work they always point figures to these committees. This shows that people want committees to work and them to relax, of which they end up complaining if things are not done in a way they want them to be done. (Interview, 10 May 2002)

The lack of communication between people in authority and the community makes it impossible for people to be involved in any activity that takes place. If policies are to be formulated workshops are held for people to know what is the role they can play to ensure to success. Surprisingly all respondents stated that they have never attended a workshop on policy formulation. Based on the National Environment Management Act (NEMA) No 107 of 1998 Chapter 5 section 23 one of the general objectives of the act based on subsection 1 (a) is to

“ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them; and (d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment,” (Government Gazette, 1998)

Even though NEMA gives people the advantage to take part in decision-making people don't know that because they don't attend meeting organized for them. Moreover they don't bother enquiring about their rights and what role they can play in issues related to the environment. At the end of the day the community is the one affected negatively or positively by this policy. Mr. Vanto, on this issue, stated that people are always invited to attend but they don't want to involve themselves on environment related issues. He says that the surprising part is that if campaigns are organized where people will be paid they do show support. This might be due to the unemployment rate but then its better to get some knowledge even if you won't be paid other than staying at home all day long

Table 4.29: Knowledge about the Solid Waste Management Policy

Knowledge about Solid Waste Management Policy	Percentage
Yes	5
No	95

n = 100

Table 4.29 shows that 95% of respondents don't know about the Solid Waste Management Policy or any other policy related to environment. Even those who know heard of it from a friend or media. This shows that the municipality authority still has a long way to go in educating people about this policy and how it works. Due to the fact there are no workshops organized for people or because people don't want to participate in the policy formulation only 5% know about the Solid Waste Management Policy. This has an impact in a sense that people cannot fight against any illegal act of the industry or any person polluting the area they

live in. At the same time people don't know how to care the environment and their own lives.

The lack of capacity to the staff assigned to solid waste management might be the reason why people are not informed of things that affect them daily. This is due to the fact that people in charge of solid waste have other things to do so they cannot educate people on environmental issues. On the other hand the fact that the policy development and legislation are done at national and provincial level forbid the community and local government to participate. Local government has the responsibility to enforce by-laws, implement policies and provide waste collection and disposal services regarding the manner in which policies say. (Macozoma, 1999)

There are seven strategic goals under the Integrated Pollution and Waste Management for SA and each goal has objectives. Among these goals only three will taken into consideration with an aim to look at the advantages that people are given when it comes to participation. The fifth goal is participation and partnership in integrated pollution and waste management governance. The sixth goal is that empowerment and education in integrated pollution and waste management in SA can be used as the a to create awareness of and concern for waste and pollution issue. The seventh goal is information management system that needs to be developed and maintained to provide good information to affected and interested parties. (White Paper, 2000)

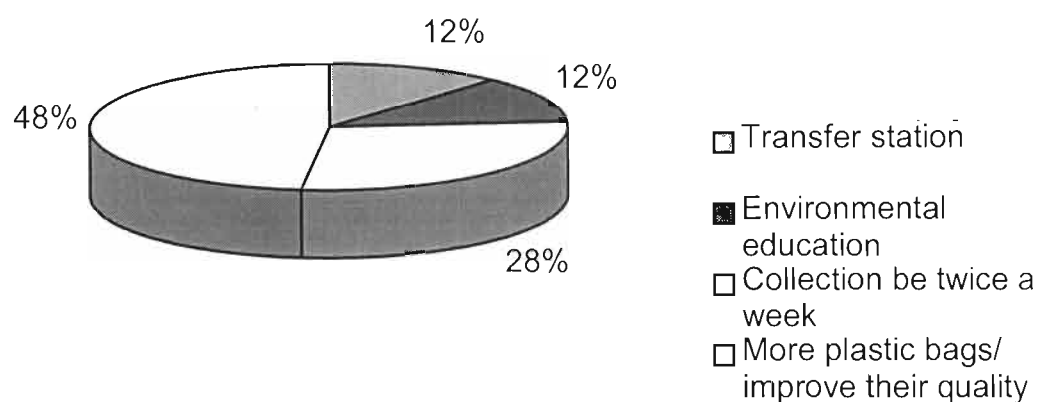
In this case it's the responsibility of the government to make sure that communication in all sphere address public participation needs. The public refers to national, provincial and local government (formed by the role player and the community at large). So at a local level it's the responsibility of the local authorities to make sure that people participate in dealing with all issues affecting their lives including waste and pollution. As for Umlazi area people are not made

aware of the impact that waste has on their lives and even those aware don't do anything to change or educate other due to insufficient services to do that. The affected party at Umlazi is the community and they must have access to information based on any things affecting their lives including waste and pollution. This is not the case since only those in authority seem to understand and have information about the solid waste management policy. The problem is that even though the policy is there they don't know anything about it, but the policy is just in their minds and on paper.

In any decision making people are supposed to be involved mostly when dealing with issues that touch their lives. A report on this was given on Groundwork's quarterly newsletter volume 4, no. 1 March 2002. This focuses on the conflict that existed because of the poor management and enforcement of regulations and permits that govern the landfill site. This newsletter report that when protests arise regarding the Umlazi IV Landfill site the government had to act with an aim to protect the environment and the community in which the landfill was.

Professor Valley Moosa, the Minister of Environmental Affairs and Tourism encouraged the community to participate in granting the permit to the landfill operation. For people to participate can only be effective if a grant of closure be issued. The reasons for this were that the landfill was not appropriately managed, enforcement was not according to the rules and regulations that have to be followed, and there was a negative impact imposed by the site on the community living nearby. The other sighted problem was that there was no gate that restricted access to the site and animals use the area as a grazing field. The ash disposed off by the company (Waste-tech now know as EnviroServ) was never covered or sprayed. All these conditions together with the community's participation helps in the closure of the site (www.durbansolidwaste.org.za)

Figure 4.7: Suggestions on the improvement of solid waste management in the area



n = 100

People have different suggestion on everything that exists next to them. Forty eight percent (48%) of respondents saw that there is a need for municipality to provide more plastics and even improve the quality of these plastics. The main reason for this is that plastics provided are few making it impossible for people to store all the waste they generate. At the end of the day people decide to dispose their waste illegally. At the same time 28% stated that collection should be twice to avoid situations whereby people have bulks of waste in their home and have to wait for collection day.

The solution to situation whereby people have bulks of waste in their homes can be transfer stations or a skip. About twelve percent (12%) of the respondents suggested that things would be better if there are transfer stations or skips since people were going to dispose their waste then the vehicle would take waste for final disposal. Transfer stations can be used in all larger communities where trucks can bring the refuse. These stations should be scattered around the area to avoid a situation where workers have to travel too much. The bulldozers are used to cram waste into trucks take waste for disposal in the landfill. (Bradshaw, 1992) Its difficult for people to care for something they don't even understand so 12% believed that environmental education could be the best solution. This can be done in partnership with awareness to get people to participate in the struggle to solve the 'small piece of the puzzle' of development, which is waste.

The status of the government levels makes it clear that there is a need for all stakeholders to be involved in environmental governance. This can help the society be involved in monitoring assessment and auditing. On the other hand access to environmental information can help in that affected and interested parties could know environmental policies, and also this can help reduce load on the budget. At the same time controlled self-regulation can be used for the NGOs, CBOs, trade unions, organized industrial and professional associations and can work towards a sustainable environment that does not have a negative effect on people. (Discussion Document: Towards a New Environmental Policy for South Africa, 1996).

4.9 Conclusion

Obstacles to environmental management can include financial resources, governmental fragmentation and staff expertise. *Financial resources*-this seem to be the greater obstacle on the management of the environment and this usually faces a local government. At the same time the scarce resources compete with

environmental needs. All cities or towns with proper funding do have extensive environmental management programs and other cities are left suffering. *Government fragmentation*-governments have a responsibility in the management of the environment but this seems not to be the case for most countries where by the responsibility is shifted to the private sector. The main problem is that the government entities cannot share responsibility on environmental matters (Macozoma, 1999).

For the DMA to be able to promote the integrated waste management people should have access to the necessary information so that they may participate. All stakeholders in solid waste management as given in table 4.2.1 should have access to information. This can help to equip people on waste reduction and recycling. The inaccessibility to information seems to be a worse problem in Umlazi because table 4.7.2 demonstrate that 72% of respondents stated that they don't know of any recycling projects in the area. On the other hand table 4.8.2 shows that 95% of respondents don't know anything about Solid Waste Management Policy and these people made it clear that they don't know any thing on policies dealing with the environment.

At some instances people are unlikely to do things for a large group or for unknown people, which is the reason why some people don't participate on awareness programs or any community related activities. The community and the environment are affective because people don't want to change their behavior and attitude. On the other hand ineffective and inefficient refuse collection and disposal services tend to be the big reason for people to dump waste on any open space that is around. So section 24 of the Bill of Rights that guarantees a protected and safe environment to the people cannot be easily achieved or fulfilled if people still view waste as not detrimental as it is.

For sound environmental management both genders should be made aware and be involved in the process. Women seem to be a little updated on environmental issues, mostly those pertaining to solid waste because they care for the well being of their families while man focus on the family's economic well-being. The only circumstance for men to participate on environmental programs is when there are incentives to it. It's clear that incentives-based strategies are the only remedy available to involve people in solid waste management. Then on large societies economically based incentives are appropriate and easy to implement. (Sara, 1998)

In the case of Umlazi people seem to need some motivation for them to participate on environmental management. The reason for this might be that the rate of unemployment is high in the whole of South Africa so people don't want to work if they wont get something. The strategy used by Collect-a-Can can be the way to go, that people will get money based on what they have done to change the situation in their area or in the spot adopted for betterment. So local government should stand up and give information to people and make them aware of the impact that their activities might have on the environment and on their lives.

CHAPTER FIVE

Evaluation and Discussion

5.1 Introduction

The purpose of this chapter is to evaluate and discuss the differences and similarities between findings in chapter four and the literature presented in chapter two. There are so many problems facing the environment in the whole world, whether developed and developing country. Most of these problems have impact on the humans, and these problems can be either seen or unseen, felt or not felt. Among the factors that cause change to environment include urbanization, increase in informal settlement, discharge of pollutants, environmental degradation, depletion of natural resources, deteriorating infrastructure and social amenities. (www.cmc.gov.za)

5.2 Evaluation

The management of solid waste can only be successful if all role players are involved in decision making, and these role players have different roles that cannot be done by any other person or company. For example table 4.1 shows that Government Acts as an authority figure that always provides rules and regulations, informal sector (like scavenger) minimizes waste by picking recyclables and any materials from dump areas to reuse or/ and sell for survival, and then the communities are benefit as the waste volume decreases. There are other role players that need to take an initiative in making sure that solid waste management is successful in urban areas or any other affected area.

Definition of waste varies from country to country in that way comparison is difficult. In less developed countries 50-70% of urban waste is collected (1992

figures) and the rest is left on streets and open spaces. These areas end up being the breeding grounds for vermin and then lead to the spread of diseases (Jackson and Jackson, 1996). Solid waste management and problem experienced in developing countries differs from that of developed countries due to some reasons. This includes the socio-economic and political issues that exist. (Enger & Smith, 2000)

People at Umlazi use black plastic bags as any other township in Durban. Effect of storing wastes involves things like biological decomposition that result due to bacteria and fungi if food and other waste are placed in inside storage containers. If wastes are stored together paper can absorb moisture from food depending on duration between the collections, thus appears that contamination of major waste components can take place if wastes stored for long time. This can then reduce recycling possibility (Tchobanoglous, *et al*, 1993). Types of container to be used depend on characteristics of the solid waste to be collected, collection frequency and the space for placement.

Table 4.2 shows that in Durban higher income areas (2.70m³/ person/ year) generate more waste compared to low-income formal area (0.24 m³/ person/ year). Nations with higher standard of living and productivity tend to have more municipal solid waste compared to those in less developed countries. (Fuggle & Rubie 1994) This seems to be the case in Umlazi as the low and middle-income formal areas. The evidence of this comes from table 4.9 when adding percentage of people earning nothing up to those earning R1 099 it appear that they make 47%. From this it is easier to see that people's income can have impact on what they produce/ generate. Even though people produce less waste illegal dumps increase because of insufficient and ineffective collection services proved to people

The amount of solid waste that people generate can lead to scarcity of land for waste disposal then scarcity cause disposal to be costly and increases the demand for the new expensive ways of disposal. It clearly appear in table 4.3 that general waste in Durban, including Umlazi makes up to 1248 00 tones per year and all this waste need to be disposed of on landfill sites. At the same time some of the existing landfills close down because they don't meet regulations or they have reached their capacity. For example the Umlazi IV landfill was closed in February 1997 and this was the largest low hazard landfill in KwaZulu Natal. (www.durbansolidwaste.org.za) Due to the lack of geographic suitable site and the NIMBY (Not-In-My-Back-Yard) syndrome it's difficult to relocate these landfills. The cause of this can be that politicians are unwilling to take strong position that might alienate their constituents, and this is due to what is termed NIMEY (Not-In-My-Election-Year) (Fuggle & Rabie, 1994)

Employment status and education level can have disadvantage on the way people look at waste they generate. Table 4.10 reveals that 30% of the respondents are unemployed and they don't worry of other things other than employment, not even the environment they stay in. This might be the reason why 54% in table 4.22 state that there are illegal dumps in areas they live in. Illegal dumps have both environmental and health impact. It is surprising that 34% from table 4.11 of respondents have tertiary education but they are ignorant of what is happening in the environment. These educated people also make high percentage of people who dump waste illegally as they claim that there is no other place to store waste.

Education is the only instrument to be used in creating awareness for people to see things differently, but this seems not to be the case. So from this it's clear that environmental education is the only solution to make change in the environment, which is, natural resources needed for human survival. Environmental education

“seeks to develop the necessary knowledge, understanding, values, skills and commitment to allow people to be pro-active in securing a healthy and properly functioning environment that is suitable,”

The longer the duration people stay in an area the higher the chances for the sense of belonging, including things that pertain to the environment itself. Table 4.11 illustrate that 39% of the respondents have stayed for more than 30 year in Umlazi. Some of these people seem to love the area but not that they have to care for the environment the live in. For most low- and middle-income countries solid waste collection and disposal services are not effective and sufficient for human use and that nd up having negative impact on the urban environment and public health. In dealing with solid waste management an integrated system is needed where it calls for minimizing waste, promote reuse and recycling, promote sound disposal and treatment of waste, and extend coverage on waste services. (World Bank and Agenda 21, 2002)

In DMA the DSW department is responsible for removing waste and cleaning streets. This can be done either by DSW or by any company given a contract. For example at Umlazi Munitech is responsible for all activities that relate to waste since they are consultants for DSW. The work done by Munitech is backed by 94% of respondents in table 4.15 who agreed that there is waste removal and street cleaning services in the area. Even though these services are available there are problems. For example in most cases people who cut grass and trees of the verge of the road usually rake and leave refuse for more than three days (from the interview with the committee member). Surprisingly, from the Munitech side it is stated that any waste collected from streets, street verge and walkways should be collected and disposed within 24 hours. (Munitech: City of Durban Metro Water Services: 2000) So its clear that this is only on paper or on the minds of waste collectors but they don't practice

it. If they do practice that means it is done in other areas or in certain sections of Umlazi.

The above situation cause the condition whereby in figure 4.1 about 71% of the respondents saw solid waste as of critical concern in the area and need special attention. On the other hand figure 4.4 indicates that 57% of respondents rate waste collection as being good. Figure 4.1 focuses only on the waste that is dumped on open spaces by people who don't have services for storage so the best way to solve this is through providing everyone with storage services. Then figure 4.5.4 deals with waste placed on the streets verge to be collected by on a specific day of the week. When comparing this two its obvious that there is less amount of waste that is collected by the contract on the collection day than waste dumped by certain community members, which at the end of the day causes problem to the whole community and the environment.

From figure 4.3 it emerged that most people of the area don't generate much waste. That is due to the fact that 56% of the respondents stated that they generate only 1 bag per week. This cannot be real amount of waste that people generate but the amount they manage to take out for collection. Some of the waste is dumped or burned due to the fact that plastics are not enough to store all waste generated. On the other hand generation of waste in any urban area depends on time of the day, day of the week, week of the month and month of the year. For example during month ends people generate more since they have more money to buy compared to beginning of the month. Also during Christmas or vacation times people receive bonuses and they generate more waste. (Enger and Smith, 2000)

There are different types of waste that people generate and dispose off, this range from food, garden, scrap metal, building material, unwanted furniture, broken

appliances and many more. From figure 4.3 its clear that 78% of respondents dispose both food and garden waste. Food waste can be referred as garbage produced during preparation of or storage of meat, fruit, vegetables etc. and usually contain moisture content of about 70%. Garden waste includes trees, grass, leaves and pruning. (Bahu, et al 1997)

In Durban garden waste is disposed of on nine disposal sites situated in north and south central regions, and Parks Department is responsible to collect this waste on the same day as domestic waste collection. Anyone with this kind of waste has to buy red plastic bags since they are not freely provided as it happen with black bags. This might be the reason why in table 4.2 demonstrate that 33% dump and 40% burn garden waste. People who cannot afford to buy plastics prefer dumping or burning garden waste, and this increase the amount of waste that does not go to the waste stream.

The burning of municipal solid waste cannot be the solution up to the last end since fly ash and bottom ash are produced during this burning. The fly ash absorbs the metals, dioxin and other compounds then when leachate occurs on landfills fly ash contaminates groundwater. So to recycle this material composting is the only solution and this could be achieved if agricultural communities support by using compost. Recycling yields the following benefits “saving in refuse collection and/ or disposal cost, depending on the form of organization and type of disposal adopted... reduction in most cases in overall pollution impact, when recycled materials are used as raw material input in production processes; reduction in the quantity of primary material requiring extraction and processing, as well as consequent reduction in energy use,” (Bradshaw, et al, 1992 cited in Tuner, 1981).

In Umlazi these benefits seem to be unknown by people and this is evident in table 4.3. From this table about 21% dump scrap metal waste and 31% give away scrap metal waste. On the other hand table 4.27 illustrate that 76% of the people said that they dispose their waste using refuse bags that are provided for domestic waste. Dumped waste increase the amount of waste that goes to landfill sites. People who give away their waste are those unaware that recycling has benefits stated above by Bradshaw et al (1997).

The increase in recyclable wastes that are dumped on open spaces or that are disposed through plastic bags increase the amount of waste that have to be recovered or removed from landfills of Durban. Table 4.4 provides measurement of recyclables that are removed monthly from Bellair Garden Refuse and Recycling Center. Based on this table it is easier to see that people are not aware or not willing to reuse materials such as paper for any other use like doing rough work or plastics for packaging. Although most countries participate in the recycling of waste, it can be successful in one country (for one company) and be unsuccessful in the other. And the help of the donors seem to play a role for the recycling of domestic waste but when this donor dries up ventures fails since they are not sustainable enough. For the success of recycling ventures need to learn to administer their projects even if donor dries up.

Zimbabwe can be used as the example of a country that uses recycling as alternative to landfilling. The first initiative was the Environment 2000's Recycling and Anti-Litter Program (RAP), which was established in 1995 with an aim to introduce recycling and reuse in Zimbabwe. The program had a committee that created awareness about recycling, reuse and waste management. The RAP pads were formed which return recyclables in over 100 schools where recyclable waste were taken. These schools collect paper, cans and plastic for reuse and recycling and

generate income. About 32 of the RAP pads were sponsored with about \$105 000 by Canadian International Development Agency (CIDA). The sponsor was for the fact that schools were creating awareness about solid waste management problems. Even women were involved in this recycling and reuse strategies whereby the brooches, bags, etc. were made from bottle tops and beverage cans since they cannot be recycled (www.worldtrek.org)

On a long term communities need to be provided with other means to store waste they cannot reuse or recycle for example skips. These skips can be used to store waste while waiting for collection day. To avoid the situation whereby paper and cardboard will be contaminated by food or any other wet stuff its important to provide separate skips. From table 4.18 about 90% of the respondents said that there are no skips that are available for their use. Ten percent (10%) of respondents stated skips that are provided only in areas where there are businesses so since they are close to these areas they are able to use such skips. In section V one skip was visited where a woman that engage in recycling usually collect cardboards and send them to recycling company. This is done not because there is some sense if caring for the environment but only with aim to earn some living out of the income received. The DSW provide different sizes of skips ranging from 5,5 cubic meter to 27 cubic meter. This skips are usually offered to large communities, and can be used for rubble, timber, glass, scrap metal, and garden waste. Skips are emptied on planned days and have drain holes on corners to allow rain or liquid to drain freely. (www.durbansolidwaste.gov.za)

The absence of enough services cause people to turn to other alternatives for the disposal of waste. This appears from table 4.22, which illustrates that 54% of respondents stated that there are illegal dumps, and from figure 4.6.1 about 18% of respondents walk less than 1km to reach the illegal dumps. The closer the illegal

dump the higher the possibility for people to dump waste if they cannot keep it until collection day. Community members are the ones who dump waste on this open area.

With reasons given in figure 4.22 its clear that 33% or even more of people dump because they don't have another space to store waste. This can lead to both environmental and health impacts regardless of the distance to the dumpsite. Usually this kind of disposal leads to increase of infectious diseases like cholera, TB, malaria and many more since during rainy days water from this areas run to the open water on the surface used by people.

The reason for illegal dumping is due to the fact that in developing countries waste collection and transportation are inadequate with few environmentally friendly disposal sites. Main aim of managing municipal solid waste is to protect health of the population, promote environmental quality and sustainability, and support economic productivity. In most countries the municipality has a responsibility to manage the municipal solid waste. (Rao, 1991) so in dealing with situation where illegal dumps are only solution available to people the municipality has to ensure that people are provided with enough storage facilities.

Other problems emerged because there is low political priority given to waste, and the fact people dealing with waste have the low status and don't have enough information on solid waste management. The shift in interest is due to ignorance or lack of awareness to those generating waste increasing solid waste problem. The way to curb this unawareness is just through the introduction of by-laws and the education of people about waste to involve them. At some instances pride or ownership can increase this. (Macozoma, 1999) Table 4.25 concurs with this in a sense that about 96% of respondents made it clear that there are no Environmental Awareness Campaigns arranged for people to gain information on issues related to

environment. At the same time people seemed to be willing to know more on environmental issues other than to be told of HIV-AIDS, which seem to be the important to people in authority.

In minimizing the amount of waste that will reach landfill sites complementing systems are needed like reuse and recycling, composting and waste-to-energy. These systems could only be successful if education campaigns are organized and incentives are used to encourage people to reduce waste. Participation of private sectors in decision-making and implementation of any project should be encouraged mostly in micro- and small-scale enterprises. In this manner the cooperative measures would help municipalities to share solution when it comes to disposal. (World Bank and Agenda 21, 2002)

Table 4.29 shows that 95% of the respondents don't know anything about Solid Waste Management Policy and that give an impression that people are not even given a chance to participate. More efficient operational management is needed whereby both private and public sectors are involved in decision-making mostly facility siting and design service delivery. Allowing people to participate in taking decisions will exacerbate the success of the proposed project. On the other hand participation can limit the NIMBY (Not In My Back Yard) syndrome, which usually hinders development in urban areas. On the other side private sectors participation lowers costs and improve efficiency. (Macozoma, 1999)

People always differ in what they need or see necessary for their survival. According to figure 4.28 it appears that 48% of respondents are not satisfied with the number of plastics provided to them. They request that more plastics be provided and also the quality of plastics be improved. This improvement should be in a way that plastics are made a little bit strong so that they won't be easily destroyed. Some people think

that the problem is not with plastics but the attitude that people have towards waste, that was the reason why 12% of the respondents saw it fit that people should be educated on environment related issues. This will increase sense of belonging and as soon as people understand they will know the impact that their activities have on the environment.

The above situation on education is what Macozoma (1999) referred to when talking of awareness. This can be ignorance or lack of awareness to those generating waste leading to the increase in the solid waste problem. The way to curb this unawareness is just through the introduction of by-laws and educates people of about waste to involve them. At some instances pride or ownership can increase this. Finally other believe that by collecting waste twice (28%) and by providing a transfer station (12%) there could be some change. This can only happen if people are responsible enough not to dump and take out waste on suggested days.

For Munitech representative (Mr. Mtshali) the problem is caused by the fact that in most townships children are responsible to take out the plastic bag once full. So as soon as the plastic is full it has to be out even if collection day has not yet come. In that way before deciding to provide more plastics and collecting waste twice or thrice a week parents or elders need be made aware of the change that their participation can make in reducing illegal dumps. The other serious issue is that people use storage plastic bags for other purposes other than what the plastic was provided for. At the end of the day the situation cause people to use any other available material to store waste. Then if this package is full they dispose it anywhere increasing chances of vermin that can lead to breeding areas for flies, mosquitoes and many other insects that increase infectious diseases. (Interview, 1 October 2002)

5.3 Conclusion

Waste problems at Umlazi are same to those of any other areas in Durban and different reasons cause the uniqueness. These reasons include issues like socio-economic characteristics of the population mostly income status, education level, number of people per household, duration of stay in the area and many more. From the suggestion that were given by respondents it is obvious that collection that is once a week have a greater impact on the amount of waste that is on open spaces. Therefore from this it is easier to give recommendation on what can be done to change the situation in the area and also to give the conclusion of the whole study.

CHAPTER SIX

Recommendations and conclusion

6.1 Introduction

Each country has its own way of dealing with waste and different policies, by-laws and ordinances are used to curtail the increasing dumps in urban areas, but this seem to be of no use. In this chapter recommendation will be given on what can be done to reduce illegal dumping and waste that reaches landfills. Thereafter the conclusion of the whole research will be given.

6.2 Recommendations

6.2.1 Access to information, and capacity building

Under the World Development Report: Knowledge for Development (1998/1999) information and knowledge have a greater role to play in advancing the economic and social well-being of people. So to improve lives its important to know how people acquire and use information, and also to understand obstacles that hinder people from reaching the knowledge needed for development and environmental issues. Although access to information and communication technology is important it is also essential that people have skills. Community development, learning communities and education networks are important to make it a point that people are encouraged to contribute from their experience and knowledge in improving areas they live in. (World Bank and Agenda 21, 2002)

6.2.2 More priority to be given waste and pollution

When the White Paper on Integrated Pollution and Waste Management for South Africa (2000) was drafted the idea was to deal with the fragmented and uncoordinated way in which waste and pollution is tackled in the country. Today the

need still stands for more focus to be paid on waste and pollution since waste cause pollution and this cannot be ignored.

For a long time waste management was not given the priority it deserves as a way to prevent pollution that seem to be a problem in *South Africa*. Ignorance to environment resulted from the lack of information, planning and appropriate legislation. Enforcement of legislation cannot be successful mostly with regard to waste disposal; and exportation and importation of hazardous and radioactive waste if government capacity lacks. So the integrated waste management is the major option in facing problem waste related issues in South Africa. Communities are the ones are affected by pollution there is a need to involve them in the implementation of any policy. Therefore community participation is the chief cornerstone as people are the ones affected by pollution, hazardous substances and waste in home and work environment (World Bank, 1998).

6.2.3 Informal sector solid waste recycling (ISSWR)

There is a need to integrate ISSWR with the formal systems of waste management mostly on squatter/ informal settlement that use any material lying around for their well being. Use them instead of advanced solutions like incineration and compacting trucks. ISSWR- reduces urban waste and creates employment and this can be used mostly in informal settlement areas where the government fails to provide refuse collection services. (Enger & Smith, 2000)

6.2.4 Socio-economic and political issues

Solid waste management and problem experienced in developing countries differs form that of developed countries due to some reasons, for example the socio-economic and political issues that exist. As with the case of Umlazi, looking at the socio-biographic characteristics of the respondents the reason for high amount of

waste is due to the following reasons. When focusing on table 4.8 it transpired that 16% of the respondents are single parents, so this can lead to the assumption that infant mortality rate is high. At the same time table 4.9 reveals that people who don't earn anything to those earning R899 makes 35%, which means survival is difficult in the area. Finally from table 4.10 the rate of unemployed makes up to 30%. So marital status, income and employment status are other things that increase/ decrease the amount of waste that people generate and waste that need to be disposed.

6.2.5 Environmental education

Environmental education “seeks to develop necessary knowledge, understanding, values, skills and commitment to allow people to be pro-active in securing a healthy and properly functioning environment that is sustainable,” (Anti-Litter and Environmental Improvement Program, 1992) By this definition its clear that there is a need to provide people with both formal and informal education on issues related to environment, which automatically include solid waste as it's the important piece of the environmental puzzle.

Empowerment and education in integrated pollution and waste management in South Africa is used as the way to create awareness of and concern for waste and pollution issue. The education programs are important to give clear understanding of interrelationship between pollution and waste, and of the economic, social, cultural, environmental, and political issues. Women, youth, disabled, unemployed and all people according to their category should be involved in the program.

6.2.6 Urbanization control

In less developed countries urbanization is less controlled. People flock to urban areas for jobs and the city turns to be over-urbanized with too many people looking for their resource base. Urbanization process leads to social (insufficient education,

health care, sanitation and many other basic needs) and environmental problems (people in informal settlements use natural resources like wood to construct houses leaving burden to the soil). At the end of the day the municipality cannot afford to provide services to all people in the community, therefore increasing the crime rate and rate of poverty is exacerbated in the city. The environmental problems can be associated with pollution and scarce services.

6.2.7 Change personal attitudes and practices

Among the things that cause much impact on environmental problems is poverty. Poor people exploit natural resources because those are the only free and available resources they can use. For example in rural areas trees are chopped down for firewood. People who do this are aware of the impact their activity have on the environment but they are forced by the circumstances they live in to do it. So for such activities to be minimized people's lifestyle should be changed and be encouraged to adopt the ethic of sustainable development.

6.2.7 Participation

The more informed people have higher are chances of co-operation and tolerance (Fuggle and Rabie, 1994) The involvement of the civil society in assessment and monitoring with free access to environmental information will increase effectiveness and decrease burden to the budget. Participation and partnership in integrated pollution and waste management governance means that the government is responsible ensure that communication in all spheres address public participation needs. The institutional capacity in national, provisional and local government can be built through resource allocation with an aim to increase participation. In increasing participation and partnership there is a need to organize workshops for those already in the recycling stream to encourage them and those who have not yet started in order to create awareness and employment.

6.2.8 Solid waste legislations and enforcement be revisited

The legislations in SA are the only measure that can be used to address the problem of solid waste that increase each and every day. Stakeholders and the role players (per table 4.1) have to be involved in solid waste management. When SA enters in the global economy there was more demand for the government and the industries to look at solid waste management with other eyes with an aim to bring about change in the handling. Some industries start to comply with the governmental and national regulations mostly resulted from the pressure from stakeholders. Even today stakeholder have a responsibility to put more pressure on community members on issues related to illegal dumps and anything related to waste.

The South African Constitution in Chapter 7 section 152 (1) is among the objectives of the local government is “to promote social and economic development; and to promote a safe and healthy environment” (Constitution 1996). The achievement of any objective should not impact one other objective. This is because Chapter 2 Section 24 of the same Constitution state, “everyone has the right to an environment that is not harmful to their health or well being; and to have the environment protected, for the benefit of the present and future generation, through reasonable legislative and other measures: prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development,” (Constitution 1996).

In looking at all waste related issues the government has to focus on what people need and to make sure they have enough access to the information needed. This also transpired in the Constitution since Chapter 2 section 32 (1b) states “everyone has a right to access any information that is held by another person and that is required for

the exercise or protection of any right” (Constitution, 1996). Unless people have enough information on what they are supposed to do in order to protect the environment change on the environment is difficult to achieve. At the same it cannot be easy to enforce legislations on people who don’t know what is expected of them.

6.2.9 Skips

There is a need to locate skips to be located in different areas where waste will be stored before collection. These skips are steel containers and are available in Durban with Durban Solid Waste, which range from 5.5 cubic meters to 27 cubic meters. The problem seems is that people don’t have access to skips because there are so many steps to be followed before receiving them. In areas where this skips are available people should be taught on how to handle them. In the case of Umlazi among eight sections that were involved in the study only one section had a skip. That was V section and the skip is situated next to the shopping complex and very few people have enough access to this skip.

The problem that arises in areas with skips is that people don’t place waste inside the skip but next to the skip. As it was stated before the reason for this is that usually in townships children are taking out waste from their homes, so if they cannot reach the mouth of the skip they dump waste in any accessible are. On the other hand people should be aware of the available transfer station in the area and be educated on the nature of waste to be disposed and transport to be use to the located transfer station.

6.2.10 Suggestions of what people can do to reduce waste and save money

- Buy things that can last and repair them if possible.
- Use the reusable and recyclable material.
- Buy beverage in refillable glass containers instead of cans or throwaway bottles.

- Don't take the store plastic bag if you can carry something by hand.
- Avoid using paper cloths, handkerchief, and dishtowels.
- Use reusable versions other than disposable items.
- Recycle newspaper, glass, aluminum, or any other material that can be accepted for recycling.
- Encourage waste separation processes in the community or in schools
- Use items with less packaging.
- Compost the yard and food waste, and encourage community-composting program. (Enger and Smith, 2000)

6.3 Conclusion

Organization and management of solid waste had been the problem for a long period of time because government institutions and role players of solid waste management experience shortcomings. Due to this sufficient refuse collection and disposal services are not provided to the communities. There are different services essential for human survival either in urban or rural areas that need to be addressed to bring about socially and economically sustainable development. For development its important in South Africa to overcome the greatest challenge remnants of apartheid that hinders development. This simple implies to peoples' accessibility to quality education, housing, sanitation and waste collection services, health care and many other services important as basic needs for people. Also its important to ensure that people have access to information for them to know what is happening and be given a change to policy formulation and development related issues.

Solid waste is one of the major problems in the whole world that needs attention as any other social service that people need. In the past waste management was not given much attention, which was the reason that there is high amount of waste that does not reach suitable disposal areas such as landfill sites Based on the NWMS

(1999) in the past focus was only on disposal, and steps that people/ companies should follow if they want to operate landfill. This neglected the fact that waste has a source where it is generated before reaching landfill and that source is supposed to be the starting point in waste management.

Today there are so many documents released by government to curb the problem of waste and the environment at large. This includes documents like Environmental Management Policy for South Africa (1998), White Paper on Integrated Pollution and Waste Management (IP&WM) (1998), National Waste Act (NWA) (Act 36 of 1998), National Environmental Management Act (NEMA) (Act 107 of 1998), National Waste Management Strategy (NWMS) (1999).

The problem with these documents is that they are accessible only to those in authority leaving the community in darkness. So, on that note it's important to ensure that information held by the state is accessible to people, as per Section 32 (1) of the Constitution. This section states "Everyone has the right of access to (a) any information held by the state, and (b) any information that is held by another person and that is required for the exercise or protection of any right," (The Constitution of the Republic of South Africa, 1996).

To make sure that information on environmental issues reaches the people different things should be done as some are stated in section 5.3 above. More focus should be on awareness where local authorities are formally educated of their role in the community. Also they need enough information that will help them to use allocated budget in a way that will save money for awareness campaigns to the community on waste issues.

Role players should be involved in decision-making as this will help in a sense that everyone will be aware of what is happening or of what is expected. These role players include government, NGO's, private sectors, donors, financial institutions, informal sector like scavengers, community, community-based organizations, and research institutions. (Macozoma, 1999) All these role players have different primary roles to play in dealing solid waste management and more information on this is in table 4.2.1 of Chapter four.

In the forth chapter of this research table 4.9, table 4.10, table 4.11 and 4.13 reveals that income status, employment status, level of education, number of people in a property or house have consequences on peoples' reaction or attitude to waste. People in low-income communities care much of their survival which is difficult than focusing on waste they don't even understand its detrimental impact to their lives. The fact that some people didn't get a chance to get formal education they are faced with a dilemma of informal or no jobs. As much as unemployment rate is high there is increase birth rate leading to increase in population, then at the end of the day this people have to share the four roomed house they own

At some instances solutions to solid waste management can be through transferring waste collection to members of the community. This can include community leaders, community at large being transparent to the process or selected contractors within the community that will liaise with the community in their operation.

There is a need for greater consideration on solid waste management at Umlazi. This should start from storage, collection and transportation and to disposal, and all affected and interested parties should be involved in decision-making of the area. Due to the fact that table 4.25 of Chapter four shows that 96% of people stated that there are no Environmental Awareness Campaigns in the area, local authorities still

have a long way to go in making people aware of the impact that their activities have on the environment. On the other side counsellors and community committee members that were interviewed said that there are campaigns that are organized for clean ups organized by Keep Durban Beautiful Association under Durban Solid Waste. So people who say there are no campaigns are those who ignore campaigns and don't participate or attend community meeting.

From this contradiction it's easier to understand table 4.29, which make it clear that 96% don't know anything about Solid Waste Management Policy or any other policy, by-law or ordinance dealing with waste or environment. Therefore, its high time that polices be not only good in paper but people who are affected by waste be informed. At the same time local authorities should be involved in policy formulation since they are the ones to implement these policies at the end of the day.

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D. Personal Contacts: Interviews

D.1 Mr Vanto, Umlazi Section V Councillor

D.2 Mr Mtshali, Munitech Manager

D.3 Mrs Khumalo, Umlazi Section F Committee Member

D.4 Mr Zondi, Waste Collector

Appendix

Used abbreviations

CBD	Central Business District
CSIR	Council for Scientific and Industrial Research
DMA	Durban Metropolitan Area
DMA's EMP	Durban Metropolitan Area's Environmental Management Policy
DSW	Durban Solid Waste
ECA	Environmental Conservation Act
EPA	Environmental Protection Agency
HCS	Hauled Container System
ISSWR	Informal Sector Solid Waste Recycling
KZN	KwaZulu Natal
NEMA	National Environmental Management Act
NGO's	Non-Governmental Organizations
NIMBY	Not-In-My-Back-Yard
NIMEY	Not-In-My-Election-Year
NIREL	National Renewal Energy Laboratory
NWMS	National Waste Management Strategy
SA	South Africa
SCS	Stationary Container System
SWM	Solid Waste Management
SWMP	Sold Waste Management Policy
UK	United Kingdom
US	United States
RAP	Recycling and Anti-Litter Program
RCRA	Resource Conservation and Recovery Act
IP&WM	Integrated Pollution and Waste Management

Questionnaire

1. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Family members	Relation household 1	Age 2	Sex 3	Marital Status 4	Monthly Income 5	Employment Status 6	Education 7	Place of employment 8
Person 1	Head							
Person 2								
Person 3								
Person 4								
Person 5								
Person 6								

CODES

1. Relation to head

1. Head
2. Spouse of head
3. Married child
4. Spouse to married child
5. Unmarried child
6. Grandchild
7. Father
8. Mother
9. Mother –in-law
10. Father-in-law
11. Sister-in-law
12. Brother-in-law
13. Other relatives

2. Age

1. 4-14
2. 15-24
3. 25-34
4. 35-44
5. 45-54
6. 55-64
7. 65-74
8. 75+

3. Sex

1. Male
2. Female

4. Marital status

1. Currently married
2. Single (never married)
3. Widow
4. Divorced
5. Separated
6. Abandoned
7. Single parent

5. Income

1. <300
2. 300-499
3. 500-699
4. 700-899
5. 900-1099
6. 1100-1299
7. 1300-1499
8. 1500-1699
9. 1700-1899
10. 1900-2099
11. Other (state)

6. Employment status

1. Professional
2. Technical
3. Managerial
4. Clerical
5. Sales
6. Craftsman
7. Labourer
8. Retired or Pensioner
9. Housewife
10. Unemployed
11. Self-employed
12. Other (specify)

7. Highest Level of education

1. No formal education
2. Nursery school
3. Pre-school
4. Primary
5. Secondary
6. Tertiary

2. DWELLING CHARECTERISTICS

2.1 What type of home are you living in?

Ownership	1	Flat/ duplex	4
Rental	2	Informal	5
Out building/ rental	3	Other (specify)	6

2.2 Housing/ Property Density)

During the week	At weekends	CODES
1	1	Number of people on the stand/ property
2	2	Number of people in Respondent's family
3	3	Number of buildings on the property
4	4	Number of families on the property

2.3 Respondents duration of Stay on the property or in the area

- a) How long have you lived here? _____
- b) Where did you live before? _____
- c) Reason for leaving to present location _____

3. ISSUES IN GENERAL

Indicate below the issues you regard as the most problematic and needing urgent attention. Please rate each issue on the following 5-point scale.

ISSUE	No concern 1	Little concern 2	Some concern 3	Strong concern 4	Critical 5
1. Electric supply					
2. Telephones					
3. Housing					
4. Waste removal/Street Cleaning					
5. Improvements of roads					
6. Development of a shopping Center					
7. Creation of jobs					

4. DOMESTIC SOLID WASTE

4.1 What kind of solid waste do you dispose? (Multiple Response)

Food waste	1
Garden waste	2
Sanitary waste (disposable nappies)	3
Paper, cardboard, plastic	4
Building material	5
Other (specify)	6

4.2 How do you store waste at your home?

Refuse plastic bags	1
Refuse bins	2
In a pit in the yard	3
Other (specify)	4

4.3 How do you dispose of the following waste (tick appropriate block).

Waste	Dump	Burn	Bury in trench	Flush in toilet	Refuse bag/bin	Feed animals	Contractor removal	Other (specify)
Food								
Garden								
Sanitary								
Paper								
Building								
Broken applia.								
Unwanted Furn.								

4.4 How you dispose of your scrap metal including scrap cars, tyres and batteries?

4.5 When did you have last have sewer blockage? _____

5. ILLEGAL DUMPING AND LITTER CONTROL

5.1 Do you regard illegal dumping as a problem in this area?

Yes	No
-----	----

5.2 If yes, give reason why you consider it a problem

5.3 What is the distance to the nearest illegal dumping site to your home?

5.4 Do you dispose of waste illegally? Yes/ No

5.5 If "yes" in Q5.4, what type of waste do you dispose off?

5.6 If “yes” in Q5.4; give reason for disposing waste illegally

5.7 If “yes” in Q5.4; how do you transport waste to these dumps?

5.8 What do you think are health impacts of illegal dumping?

5.9 What do you think are environmental impacts of illegal dumping?

5.10 Which of the following are present in your area? Please give a description of you choice

	Description
Odors	
Unaesthetic environment	
Insects and pest	
Hazardous	
Stream pollution	
Air pollution	
Drain damage	

5.11 Who do you think is responsible for illegal dumping? (More than one answer is accepted)

My garden worker	
My neighbors/ residents	
Municipal street cleaners	
Project contract workers	
A building contractor in the area	
Nearby flat dwellers	
Myself	
Squatters	
Factories and industries	
Other (specify)	

5.12 In you opinion what could be the reason for people to litter?

5.13 Do you think illegal dumping can be stopped?

Yes	How?
No	Why?

5.14 Do you believe that resident could play a role in stopping illegal waste disposal in residential areas?

Yes	1	How?
No	2	

6. RECYCLING AND WASTE REDUCTION

6.1 Are there any environmental awareness programs in your area?

Yes	1	Who runs programs? Describe the program:
No	2	

6.2 Do you have solid waste Recycling Projects in the area?

Yes	1	Explain type of project:
No	2	

6.3 If “yes” above, Do you think that these projects are working? (elaborate)

6.4 Do you think Recycling Projects should be expanded in your area?

Yes	1	Give reasons
No	2	Give reasons

6.5 How do you dispose off the following waste materials?

Waste	Send for recycling	Reuse	Dispose/ refuse bags collection	Throw in open space	Burn	Other (specify)
Plastic containers & packets						
Glass						
Tins						
Newspaper & cardboards						

6.6 Do you think that people should buy recyclable plastic bags stores?

Yes	1	Give reason:
No	2	Give reason:

6.7 Would you be willing to separate your household waste and participate in household waste recycling programs?

Yes	1
No	3

6.8 If “yes” above, which system would you prefer?

A drop off recycling program	1
A door to door collection program	2
Would you be prepared to pay for the program	3
To be supplied with special bags to pre-sort waste materials for collection	4
Other (specify)	5

7. COMMUNITY PARTICIPATION

Are there any committees in the area dealing with environmental management	1. Yes 2. No
If “yes” above, what type of committees are they?	Specify
Has the community mobilized to deal with solid waste issues in the area?	1. Yes 2. No
Are you or any member in the family a member of any environmental committee	1. Yes (specify committee) 2. No (reason for not participating)
Are there any organizations dealing with solid waste problems in the area?	1. Yes (Name of the organization) 2. No
Does the community work with these organizations?	1. Yes (How) 2. No
If the community has any solid waste related problem. Whom do they seek assistance from?	
Have they been successful in solving problems?	1. Yes (how?) 2. No (why?)
Was the community involves in workshops to formulate the present waste policies?	1. Yes 2. No (why?)

8. LEVEL OF WASTE MANAGEMENT SERVICES

8.1 What is the frequency of waste removal in you area?

Daily	1
Once a week	2
Twice a week	3
Once a month	4
No response	5

8.2 How much waste do you generate per week in bag/ kg? (approximate amount)

One bag	1	0.5kg	1
Two bags	2	6-10kg	2
Three bags	3	11-15kg	3
Other	4	>15kg	4

8.3 Do you know about the green bags used for collection garden refuse?

Yes	1	Where?
No	2	

8.4 Does your area have scavengers during waste removal days?

Yes	1	Are they causing any problem?
No	2	

8.5 How do you rate the refuse collection service in your area?

Poor	1	
Adequate but poorly managed	2	
Good	3	
Very good	4	
Not sure	5	

8.6 Do you have street cleaning services in your area?

Yes	1	Who provides services?
No	2	

8.7 Are you aware of the refuse transfer station in your area?

Yes	1	
No	2	

8.8 Is the transfer station adequate for solid wastes that generated in the area?

Yes	1	Give reasons:
No	2	Give reasons:

8.9 are you satisfied with the accessibility of the transfer station?

Yes	1	Give reasons:
No	2	Give reasons:

9. PRESENT ENVIRONMENTAL POLICY ON SOLID WASTE MANAGEMENT

9.1 Knowledge of Solid Waste Management Policy (SWMP)

Do you know about the present Solid Waste Management Policy	1. Yes 2. No
Where did you hear about SWMP	1. Media 2. Community meetings 3. Friends/ relatives 4. Environmental organizations in the area 5. Other (specify)
Do you know how does the policy works?	1. Yes 2. No
Do you think SWM system has improved or become worse?	1. Yes 2. No Give reason for your answer
What do you think is the status of the environment after the policy was introduced?	1. Improved 2. Remain the same 3. Not sure 4. Don't know
What suggestions can you make to improve the present SWMP?	Explain

9.2 What is your opinion on waste management in your area?

9.3 What recommendations and solutions do you have to the solid waste management services in your area?
