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The deterioration of the life support base: the perceptions of people in informal settlements towards limiting pollution in their environment

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CHAPTER ONE

1. INTRODUCTION

1.1. Background

Pollution is a broad concept and appears in different forms. From a broader sense, pollution can be described as "the result of the release to air, water or soil from any process or any substance which is capable of causing harm to humans or other living organisms that use the environment" (The Enviropaedia, 2002: 145). In the context of this proposal, pollution will be limited to the contamination of air water or land as a result of day to day activities in informal settlements.

From a global scale, pollution in dense informal settlements present one of the most serious scourges confronting urban areas. The changes in consumption patterns admixed with overburdened and ineffective solid waste management present a serious concern for developing countries (Jonathan, 2005). What transpires within the literature is that the high rates of urbanization in developing countries results in the formation of unplanned and poor settlements condition, thus further complicating the problem of pollution. Sivam *et al*. (2001) echo this line when he says that the increase in urban population of developing countries undermines any efforts of dealing with the challenges services and housing provision. According to Satterthwaite (2003), the fastest growing cities are in Africa, Asia and Latin America, thus implying that these areas are challenged by high levels of informal settlements. This is further affirmed by Perlman (1976) who holds that the phenomenon of urbanization is inextricably linked to an expansion of informal settlements.

Uytenbogaadt and Dewar (1992) blame the problem of rapid urbanisation in developing countries to a reliance on the conventional planning approach. The latter planning paradigm encouraged exclusive and central development, which effectively was about maintaining the central bureaucratic control, rather than supporting the interest and welfare of the people. Along this line, Huchzermeyer (2005) asserts that informal

settlements reflect social and economic exclusion from the formal urban environment. For Perlman (1976) they (informal settlements) are a result of a situation whereby urbanization surpasses the rate of industrialization. According to Perlman (1976) informal settlements came into being as a result of urban population grown exceeding cities' capacities to provide jobs, infrastructure and other facilities. Backlogs in terms of service provision in urban centres of the developing countries, reveal the extent of the challenge of informal settlements, and reflect an increasing problem of pollution.

High rates of urbanization in sub-Saharan Africa has led to the formation of mega cities in Africa (Fekade, 2000 and Hardoy, et al., 2001; cited in (Demanya, 2006). This clearly would demand expansion in terms of infrastructure and service provision and management systems, in order to maintain the desired standard of urban life. Consequently, as Demanya (2006) points out, rapid urbanization leads to impediments in respect of formal management and results in environmental harm which is caused by "uncollected and poorly disposed off refuse in streets, open areas, and urban drainage systems that have become clogged by indiscriminately dumped refuse, and the pollution of water resources near uncontrolled dumping sites" (Demanya, 2006:3).

Satterthwaite (2003) makes the same point as Demanya (2006) by conceiving that increases in urban population contribute towards environmental degradation, but emphasizes the fact that pollution resulting from the urban poor is less significant compared to industrial and consumption patterns of middle and affluent groups. While I acknowledge this fact, there is a need to note the fact that Satterthwaite (2006)'s position is firmly grounded on a comparison between consumption patterns between poor people and affluent groups in urban areas, and thus does not concentrate on pollution in dense informal settlements. Because of the observable pollution in informal settlements, Huchzermeyer (2005) refers to them as "visible squalors".

More than 600 million people in urban areas of developing countries are challenged by inadequate supply of water, poor sanitation and drainage systems, and minimal or no garbage collection (Satterthwaite, 2003). Stren and White (1989), cited in Demanya

(2006), estimate that about 30 to 50 percent of the solid waste in developing countries remains uncollected, and thus become available for scavengers much as it can rot or be washed away and contaminate water resources. In their report, Thomas *et al.* (1999) concur with this observation, when they say that in the squatter settlements in Port Elizabeth, garbage is not collected and thus become a site of "rodent infestation, fly breeding and bad smells (Thomas *et al*., 1999: 78). The significance of these observable findings is that, inadequate collection of solid wastes in urban areas does not only impact negatively on the lives of those affected, but also, as pointed out by Jonathan (2005), destroys the aesthetic nature of cities and leads to unsanitary conditions.

Drawing from the above arguments, by and large, informal settlements are afflicted by waste accumulation and poor sanitation systems, which obviously raises issues of health concerns. Since informal settlements are largely found in developing countries, they could be viewed as drawbacks to development, and thus reflecting a situation of ongoing environmental harm. This raises concern regarding pollution minimisation, and this should be aspired by the fact that the costs of not taking action against the continual damage could outweigh the costs of developing and implementing environmental management strategies and programmes. The adoption of major texts like Agenda 21, Rio Declaration on Environment and Development etc, during the Earth Summit in Rio de Janeiro were based on this understanding (van Der Merwe, 2002). The Rio Earth Summit was geared at protecting the natural environment from human activities. It marks a transition from the notion that growth could happen indefinitely without causing environmental harm or depleting resources (De Beer and Swanepoel, 2000).

Strong (1989: 44)) views the natural environment as "the earth's capital". Living off the earth's capital is akin to living off the capital of a business. Such a business will effectively go bankrupt and crumble. The same would happen to the environment if people do not find solutions to the problem of littering, the use of non-renewable energy sources, and engaging on unsustainable practices and activities. This puts the environment (life support base) at risk and it will gradually deteriorate. It is in this light that one would be concerned about the accumulation of wastes, ponding of grey water

and the use of coal as a source of fuel for cooking in dense informal settlements. Jonathan (2005) posits that in order to deal with the imbalances between population growth and the ever accumulation of wastes in urban areas, local initiatives could play a very crucial role

1.2. Local challenges

The arrival of the new democratic government in South Africa not only brought political changes, but also opportunities to rethink policies. Most of the policies are directed towards equitable distribution of resources, with the focus being on "communities in dense informal settlements" (DWAF Inception Report, 2002:4). In fact as stated in the DWAF Inception Report (2002), one of the mandates of local government is to provide services and pollution control to local communities. This required a need to pass governance down to the lowest level, so as to appropriately respond to the specific needs of communities. However local governments have been faced with the discrepancies of having to respond to demands beyond their resource capacities. For this reason backlogs, which are also compounded by little or no payment for services are forever increasing.

There are however examples of good local practices, for instance, a study by Jonathan (2005) on The Integrated Urban Environment Initiative for Sahakaranagar Layout (IUEISL), located in the northern periphery of Bangalore, India, took on a holistic approach for improving the existing solid waste management programme. Local government in the latter settlement carried out community awareness and education programmes. Jonathan (2005) highlight that in order to deal with the problem of accumulation of wastes, local initiatives could play a very crucial role.

1.3. Aim of the study

In light of the above arguments, the aim of this research is to explore the role of communities in dense informal settlements in limiting pollution in their environment. Informal settlements as already discussed, are increasing in South Africa and the world. Considering this fact, the research will focus on the accumulation and the aftermath of

pollution at community levels, and at the same time maintaining a holistic view of the public sector service provision in informal settlements. This would thus require a careful consideration of the institutional conditions to which communities in informal settlements are subjects. These institutional conditions entail the capacity of local government to supply and manage services in dense informal settlements as they are also at the heart of the pollution problems**.**

1.4. Rationale and problem statement

The rapid flow of people in a finite urban space, without proper housing, and minimal service delivery leads to the accumulation of informal settlements. The environmental stress resulting from pollution in these areas exacerbates the already poor quality of life of the inhabitants. The Department of Water Affairs and Forestry's (DWAF, 2002) conception is that pollution from densely populated settlements poses one of the most complex problems. Failing sanitation and waste removal systems pollute water resources and lead to poor living conditions in poor communities (DWAF, 2002). The prime motivation of the research is that, if pollution in dense informal settlements can be reduced, the quality of life of the inhabitants in these areas can be improved, and will also impact positively on the sustainability of the broader environment.

In his report on the World Summit on Sustainable Development (WSSD 2002) Van der Merwe (2002), argues that solution to environmental challenges requires responsibilities and commitments of individuals and communities in their local environments. It therefore suffices for every individual in dense informal settlements to participate in making their environment safe by limiting pollution. The current environmental state as a result of pollution in dense informal settlements calls for public support or assistance. This means that a holistic view, as already stated, is most appropriate when dealing with pollution problems. What transpires within the report produced by DWAF (2002) is that the manner in which services are used and maintained lie at the heart of pollution challenges. This suggests that one of the remedial prescriptions of this problem would be tied to the capacity of local government to provide and maintain services (van der Merwe, 2002).

The rise in population numbers and the high rates of urbanization put pressure on the capacity of the natural environment to support life. With the problems of pollution and the dependence on unsustainable practices for survival by people in dense informal settlements, the natural environment which of course is the base upon which all life depends will be harmed beyond any form of rehabilitation. Intervention strategies have always been undermined not only by urbanization but by poor municipal service provision and perhaps also by the lack of commitments by communities to take care of their environment.

The study is therefore also driven by an urgent need to improve the environmental performance in dense informal settlements, as the repercussions of not responding at the right time would be felt by everyone. Establishing the underlying social implications to the problem of pollution will enhance intervention processes and thus will significantly benefit those who are directly affected, much the same way as those living outside the affected areas.

1.5. Research questions

The research will seek to address the following questions,

1. What are the perceptions of communities in informal settlements towards their responsibility in limiting pollution in their environment?
2. What measures have the local municipality taken to help reduce pollution in the study area?
3. What can be done about limiting pollution?

1.6. Conceptual framework

Conceptual framework is a set of theories or ideologies that guides and situate the study within a particular context (Creswell, 1998). Theorists highlight that we understand problems better when we view them through appropriate philosophical lenses. Like a

fabric woven from a variety of material, qualitative enquiries can be based on a variety of frameworks which are described by using terms such as positivists, postmodernists, feminists, etc, which might be integrated within a single study (Creswell, 1998). The first step towards understanding the reality of people's perception on pollution in dense informal settlements was to view it as a problem that directly affects marginalized groups in society. Taking this as an overarching assumption, there is a need to draw planning theories that are concerned with issues of marginalized groups. Planning theories would have no substantive meaning if they are not supported by policy development. In this respect, South African policies and legislation that seek to support and empower marginalized groups were also assessed.

1.6.1. Advocacy and the ontological philosophy

According to the ontological philosophy, reality is what is constructed by people involved in a research setting (Creswell, 1998). The reality of the problem of pollution would be reflected by the voices of informants. I acknowledge, from an ontological stance that there are multiple realities, those of the researcher, the people being studied, and the reader. What I deem important in this study is the reality as it is seen through the eyes of informants in dense informal settlements.

Davidoff (1965) argues that problems of social classes and resource distribution cannot be solved by technical skills. Solutions to such problems must arise from an understanding of the social attitude of the people. Pollution bears elements of social class, and it means therefore that technocratic procedures are not enough in so far as they are not informed by an understanding of the attitude of those affected. For instance, the conventional top down approach, led to policy prescriptions that did not respond to the needs and demands of the recipients. For this reason, any technocratic prescription that is not aligned with people's attitudes would be an outright failure.

The capacity of planners to make significant contributions in city planning is hampered by the adoption of social goals set by politicians. For this reason planners can implement

what they do not approve. Since they do not want to be seen as bad, planners tend to prescribe planning actions from positions of value neutrality. Davidoff (1965) asserts that planners are aware of the desired objectives and therefore should advocate what they deem to be proper. Politicians, ideally subscribe to the notion of public interest. In this way services and infrastructure are provided in the public interest, and within the limits of resource constraints.

Davidoff (1965) views the idea of "public interest" as very elusive, because society contains diverse interest groups. It is therefore vital for planners to advocate the interest of people affected by government policies. The central bureaucratic control imposed by governments, is associated with comprehensive plans being produced by one agency discourages community participation. According to Davidoff (1965), plans aimed at addressing the same issue should be produced by different agencies. This way, communities would be able to support specific plans representing local needs and priorities. This would then relieve planners of the burden of having to portray the so-called inclusive plans. Davidoff's (1965) view still falls within the conventional paradigm of service provision, i.e. plans are still predetermined by experts and people are just called in to support or choose the once they like. It is crucial to make a radical shift from this thinking and hear directly what people perceive to be the right course of action. This was one of the aspirations that set this study rolling.

1.6.2. Postmodernism and multiculturalism

Sandercock (2000) argues that planning operates within a landscape of power and prejudices. It is clear from this assertion that the planner's task should be about transforming power relations amongst different groups, so that the desirable outcomes can be obtained (Fainstein, 2000). Sandercock (2000) delineates the role of the planner in multicultural societies. In Sandercock's (2000) view the environment within which planning operates reflects the implicit societal differences. Pollution and informal settlements are a reflection of societal differences. According to Sandercock (2000), unless these differences are articulated and dealt with, prejudices will be reproduced,

wars will continue, and city fragmentation will be perpetuated. Planning should go beyond the Habermasian collaborative mode as advocated by Healey, (2002), Innes (1998), and Forester (1999). It is thus imperative, in the view of Sandercock (2000), for planners to adopt planning models that are more transformative and integrative. Sandercock (2000) is a proponent of the multiculturalism philosophy which is about social and cultural tolerance. Multiculturalism falls within the postmodernism paradigm.

This theoretical perspective focuses on changing the ways people think as opposed to a calling for action based on the changes. It prescribes that knowledge be set within the context of today and must celebrate different classes, race gender etc (Sandercock, 2003). Sandercock's (2003) personal conviction is that cities should tolerate diversity and should promote the creation of communities that live in harmony. Every group is important regardless of their social condition. This means that marginalised people are important in society (Creswell, 1998). There is therefore a need to dismantle hierarchies that lead to hegemony and oppression of other groups.

Both the critical theory and feminism falls within a postmodenist perspective (Creswell, 1998). The feminist and critical theories are hinged upon the problems of domination, social struggle and alienation (Marrow and Brown, 1994, cited in Creswell 1998), but however the feminist theory focuses on the alienation and domination of female individuals by males. The latter theories seek to bring about changes about how people think. Informal settlements are a manifestation of social struggles and therefore a critical position can enhance an understanding of pollution in these areas.

1.6.3. Ideological perspectives

An ideological perspective helps in drawing the needs of people as well as identifying appropriate social action. One might use a particular perspective based on a personal conviction to lift the voices of marginalized people (Creswell, 1998). Vulnerable groups should be a priority in terms of meeting socioeconomic challenges. In my view, the ideological perspective implies that the implementation and application of government

policies should be approached from an advocacy perspective. A cocktail of appropriate ideological perspectives would lead to more responsive planning. Thus advocacy planning should be aligned with multiculturalism, feminist, postmodernism and critical theories. The ideological perspective differs from the postmodernist thinking because it advocates the substantive socio-economic needs of people as opposed to promoting tolerance among socially and economically stratified groups.

1.6.4. Legislation and policy directives in South Africa

The new democratic dispensation in South Africa passed a Constitution which is the highest Law of the country. According to this Constitution (Act 108 of 1996), one of the values upon which the Republic of South Africa is founded is: "human dignity, the achievement of equality and the advancement of human rights and freedoms" (Section 1(a)).The achievement of rights for low income groups were expanded in the Grootboom case where it was pronounced that: a society based on human dignity, freedom and equality must ensure that the basic necessities of life are provided (Case of the Grootboom v SA, 2000). The value of equality is further strengthened by section 9(2) of the Bill of rights in the South African Constitution (act 108 of 1996); section 1(a) which provides that:

> "*Equality includes the full and equal enjoyments of all rights and freedoms. To promote the achievement of equality legislative and other measures designed to protect or advance persons, or categories of persons, disadvantaged by unfair discrimination may be taken."*

The values set out by the South African Constitution bears the hallmark of the contemporary planning paradigm which is concerned with issues of marginalized groups. Policies and legislations (discussed in chapter 2) must be within the Constitutional Framework, thus they should be informed by and must seek to advance the Constitutional values. The most important section relating to pollution in the South African Constitution (Act 108 of 1996) is the one pertaining to the environment, Section 24 states that:

" (a) everyone has the right to an environment that is not harmful to their health or wellbeing, and (b) to have the environment protected for the benefits of the presence and future generations, through reasonable legislative and other measures that:

i. *Prevent pollution and ecological degradation*
ii. *Promote conservation, and*
iii. *Secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development"*

It is important to note that the duty imposed by section 24 of the South African Constitution (Act 108 of 1996) is of general nature, and applies to everyone. The state is singled out as the one that must enact legislation to prevent pollution and promote sustainable development. It therefore implies that wherever there is pollution and environmental damage, the state must mitigate this. Ironically, informal settlements are plagued with the problem of pollution, even though the constitution places a duty on government to ameliorate this through reasonable policies and legislations. Hence this study set out to take a holistic view that will put communities at the forefront of alleviating the challenges of pollution in dense informal settlements.

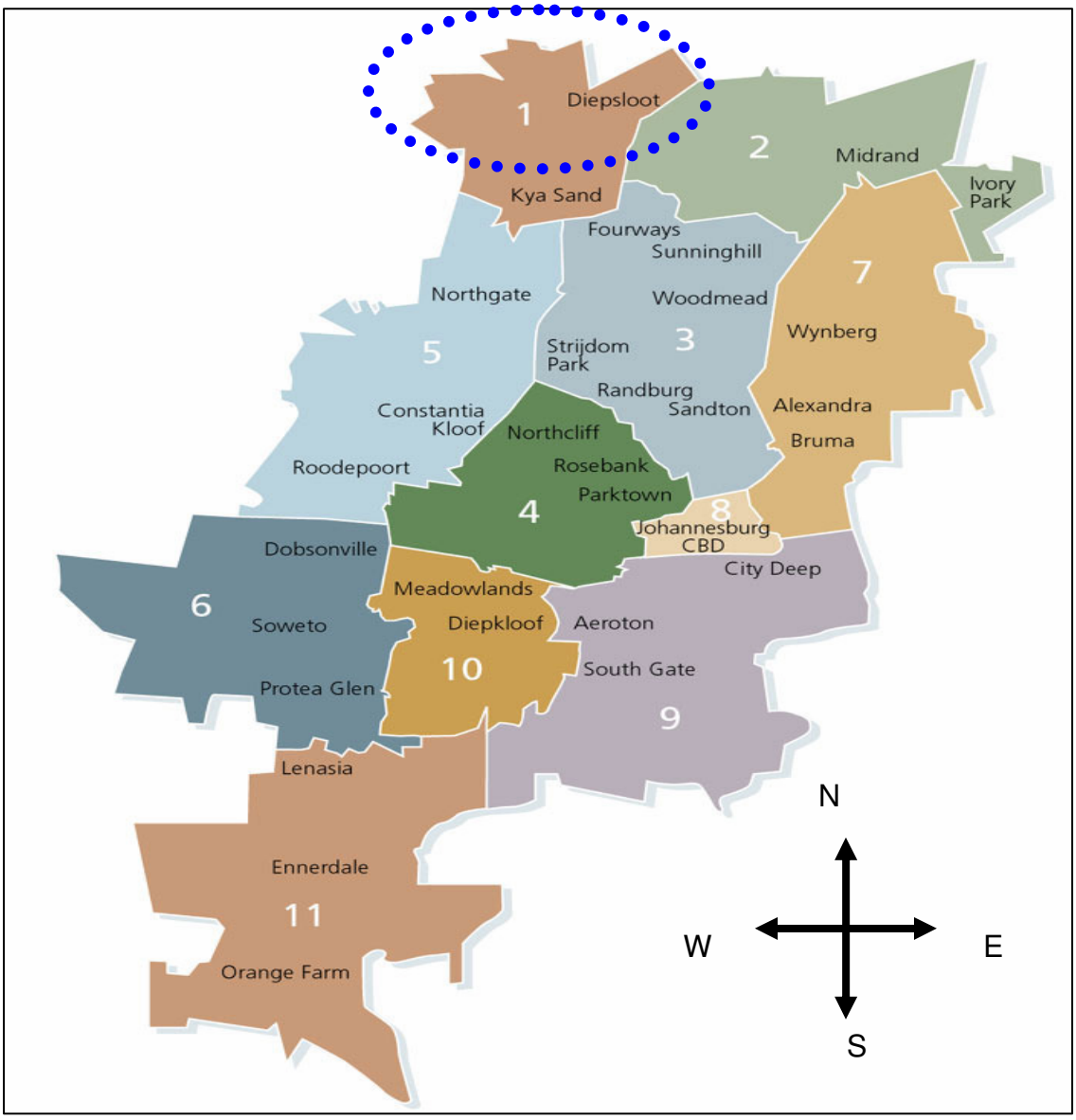
1.7. The study area: Diepsloot

1.7.1. Geographic location and historical background

Diepsloot is a township located to the south of the R28 (Mogale / Tshwane highway) in the northern perimeter of the city of Johannesburg, and covers an area of 30 square hectors (Gauteng Provincial Government, 2007; Johannesburg SDF, 2006/07)) see Map1. The emergence of squatter settlements, and their resilience in the face of the influx control laws of the apartheid dispensation prompted government to earmark part of the Diepsloot farm, near Midrand, for the development of a new township in 1986 (Handler, 1986). What is seen as the Diepsloot Township today, is a small part of a big farm known also as Diepsloot. The then Transvaal Provincial Administration developed the

Township, and originally accommodated people from Zeverfontein who had no tenure security and therefore were faced with eviction.

Map1: Map of Johannesburg City showing the 2004 administrative region and location of Diepsloot in relation to other administrative regions in the city.

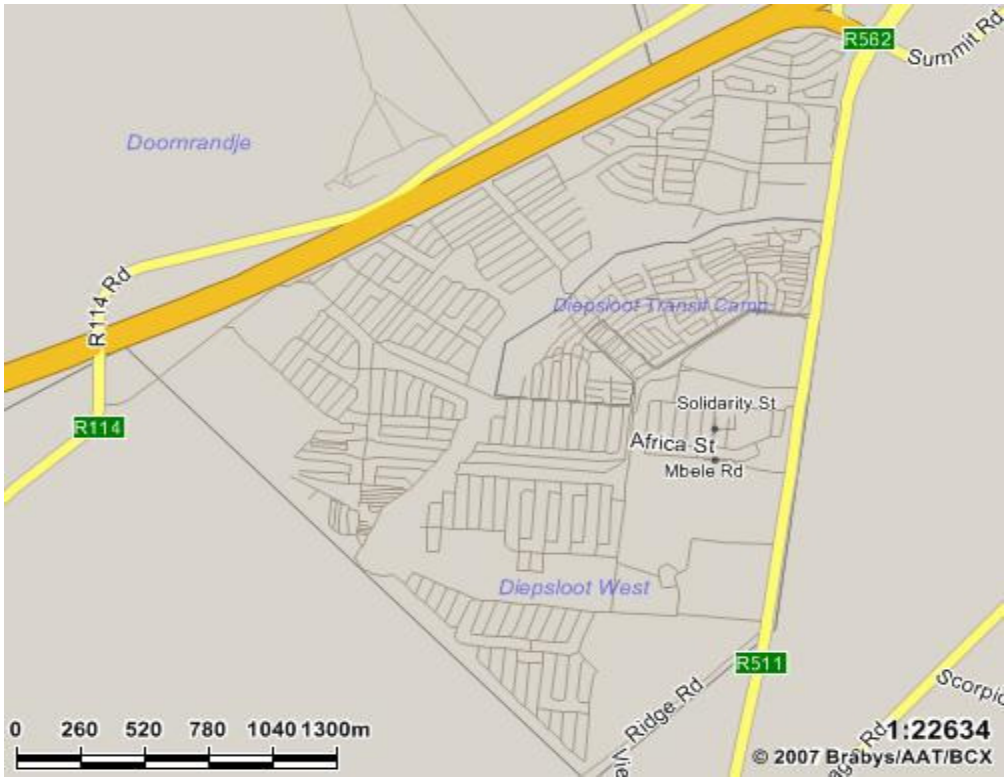


Source: http://www.joburg.org.za/2004/nov/nov11_eco.stm Retrieved 15 May 2007

1.7.2. Administrative region of Diepsloot

Diepsloot falls within Region 1, one of the eleven demarcated regions constituting the city of Johannesburg (Region 1 RSDF, 2006/07). According to the Regional Spatial Development Framework (RSDF) (2006/07), Diepsloot is a marginalised residential area and therefore needs to be integrated into the broader urban framework. Amongst some of the neighbourhoods in Region 1, there are affluent groups of the gated suburbs of Dainfern Ridge, Kaya sands, Fourways, and small holdings near Witkoppen, See Map I for the Diepsloot informal settlement. The City catalogued a community needs profile, and according to this, the community of Diepsloot needs education; employment opportunities and local retail opportunities (Region 1 RSDF, 2006/07). With regard to employment, the most prominent areas that provide employment include Fourways and the North Gate Node (in Region 5, but readily accessible to the people of Diepsloot).

Map2: The Diepsloot transit Camp (2007)



Source: Mail and Guardian on line: 06 July 2007

1.7.3. Physical characteristics and demographic information

Diepsloot is a highly fragmented township comprising of eleven sections. Some sections like 4, 5, 6, 8, 9, 10 and 11 comprise Reconstruction and Development Programme (RDP) houses. Section 3 alone has bond houses, while sections 2 and 7 have informal brick houses and shacks. Section 1, an informal settlement, also referred to as the reception area, comprises of almost exclusively shacks, made of corrugated iron and wood. Generally, the settlements has 6 020 formal residential units and 17 000 informal structures (Johannesburg SDF, 2006/07).

According to the Johannesburg Spatial Development Framework (SDF, 2006/7), Diepsloot reflects a high residential density. It is estimated that more than 17000 people are located within less than 100 ha of land (Johannesburg SDF, 2006/07). According to the 2001 census data, there are 82 341 people living in Diepsloot (http://www.statssa.gov.za). From this figure, more than 17 000 people live in informal settlements, faced with poor living and precarious conditions (Gauteng Provincial government, 2007). Fifty nine percent of the population in Diepsloot is unskilled and 46% of the potential labour force is currently unemployed (Midrand administrative Region, 2003/04). Seventy three percent of the households live below the poverty line i.e. earn monthly incomes of R1 001 to R1 500 (Midrand administrative Region, 2003/04).

1.7.4. Infrastructure in Diepsloot

Infrastructure in Diepsloot is generally poor. The Township has very poor road networks, poor sanitation and insufficient street lighting (Gauteng Provincial Government, 2007). Researchers in the Gauteng Provincial Government (2007) have noted that some streets in Diepsloot are too narrow and thus block access of vehicles. Infrastructure problems in Diepsloot however, might be better in other sections, but then worse in the informal settlement, which have no street lighting and is characterized by poorly maintained bumpy streets. With regard to sanitation, the informal settlements are suffering because bucket toilets are still in use and the few flush toilets are constantly out of order due to

the blockage of drains. Regarding energy for cooking, the community generally relies on paraffin and sometimes wood.

1.7.5. Economic activities in Diepsloot

The residents of Diepsloot are largely engaged in informal trading as the major economic activity. Most of the informal trading activities happen in the informal settlements and these include hair salons, illegal liquor trading outlets, barber shops and mini grocery shops (locally referred to as 'Spaza shops') (Gauteng Provincial Government, 2007). Along some of the narrow streets of Diepsloot there are also numerous informal traders using coal to cook and fry food for selling. Informal trading is very important in Diepsloot, particularly when one takes into account the high level of unemployment. It is however, important also to note the fact that some of the economic activities in Diepsloot contribute towards pollution, especially the use of coal by some informal traders.

1.7.6. Conclusion

This chapter introduced the study as a qualitative enquiry based on Diepsloot. The aims, research questions, and the principal rationale were stated. A glimpse of how a plethora of information including both the primary data and secondary data would be linked to research questions was also provided. The chapter proceed by outlining a set of concepts or theories upon which the study can be better understood. These would later be used to adjudicate between diverse viewpoints waiting to be probed in the fieldwork from key informants. Theories would also be used to tie together different lines of arguments in the study, and this would lead to a coherent conclusion. The chapter close by a brief description of the study area, including discussions on the geographic location and physical characteristics, administrative region, and have also provided demographic context of Diepsloot.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

The first step in attempting to resolve the proposed research questions is to go through literature (Booth, 2003; cited in Demanya, 2006). It is also through engaging literature that researchers are able to identify gabs or holes showing that data collection is needed. This chapter would help build theory that would latter inform and guide data collection, analysis and interpretation (Strauss and Corbin, 1990). Such data would help in answering research questions and thus bring reality to bear (Blumer, 1969; Diemsing, 1971; Glaser, 1978; cited in Strauss and Corbin, 1990). The theory established in this chapter would not only be used to explain the reality regarding people's perceptions on pollution in dense informal settlements, but would also be used as a tool for developing a framework for action or formulating a policy statement.

2.1.1. Theoretical sensitivity

The literature review also enhance the researcher's insight in respect of giving meaning to data and the ability to extract, within a background of large information from the field study, what is important (Strauss and Corbin, 1990). This means therefore that by using literature one can adjudicate as to which passages to transcribe and which ones to leave out. Along this argument, Strauss and Corbin (1990) assets that theory must represent the everyday reality. A view from this position is that, extensive literature review is important to make sense of the field data.

2.2. Environmental pollution: a global perspective

The environment is polluted when it is loaded beyond its natural capacity to convert complex matter to simple units (Fuggle and Rabie, 1992). Under normal ecological

conditions, substances would be processed through biochemical cycles like the nitrogen and the carbon cycles (Noble, 1992). In principle, pollution occurs when these cycles are over worked, and therefore fail to process all biodegradable substances (Fuggle and Rabie, 1992). The accumulation of harmful substances in the environment becomes harmful to human beings and animals using it. Pollution comes in different types and these are discussed below.

2.2.1. Air pollution

The atmosphere as an environmental support base of all terrestrial life forms is polluted by various substances. Air from the atmosphere is not only important for breathing; it is also important in determining the atmospheric temperature and also contributes to the soil composition (van Rensburg, 2002). Before the 20th century air pollution [1]has been a localised problem (www.ourplanet.com). It emerged as a global problem with the dawning of the 20th century leading to pervasive changes in atmospheric conditions. Lehrer (2004) mentions that it is difficult to track and prevent air pollution because of the free movement of particles from their source, and they travel over miles to cause climate changes in other countries. This is however contrasted by NASA's innovation, the Terra Satellite, a device that is able to track major sources of air pollution and how substances combine in the atmosphere (http://www.nasa.gov). This innovation would enhance an understanding of pollution at a global scale, and thus would lead to better policy making and practices regarding pollution globally. This however would require cooperation from countries around the globe. For now, it is important to have an overview of the scale and the impacts of air pollution worldwide.

Air pollution causes breathing problems; promotes cancer and harms plants and animals in the ecosystem (Encarta, 1993). The major polluting sources are human activities like burning natural gas, coal[2], and oil to power industrial processes and motor vehicles. The

[1] Air pollution is the discharge of matter (solids, liquids or gases) to the atmosphere at levels which have undesirable effects on the humans, natural and physical environment. The main contributors of air pollution are dust and gases (Harris and Harris, 2001).

[2] The burning of coal as an energy source produces both carbon monoxide and Sulphur dioxide. Both these substances are implicated in global warming and the formation of acid rain. Acid rain damages crops and forests (Encarta, 1993).

six most polluting gases are carbon dioxide, carbon monoxide[3], sulphur oxide, Nitrogen Oxide, and Hydrocarbons[4], Particulates (Kaufman and Franz, 1993). Industries are by large the major polluting sources of air (Kaufman and Franz, 1993). They (industries) emit large amounts of Carbon dioxide (the principal greenhouse gas) in the atmosphere, and thus enhance global warming (Conner, 2007, Hoogervorst, 2002, Kemm, 2002).

Satterthwaite (2003) argues that air pollution is one of the mot serious chemical hazards. In this respect, globally, scientists acknowledge that there is an urgent need to curb and reduce the emissions of greenhouse gases (Hawks, 2006). This should be an action based response rather than a whistle blowing exercise. Global warming as one of the aftermath of air pollution has been implicated in many environmental disasters. In Alaska for instance, global warming has been linked with forest death (Egan, 2000). It is reported that a certain species of insect, i.e. spruce bark beetle, which was naturally controlled by the cold weather, flourished as a result of hot temperatures caused by global warming (The National Assessment Synthesis Team, 2000). These beetles infest and destroy forests. Egan (2000) asserts that temperatures in Alaska have risen about 7 degrees over the past thirty years. This rise in temperature is attributed to air pollution, and having to respond to this problem means mobilization of state funds. Beetle infestation as result of air pollution has also been reported in countries like British Columbia (Yang, 2002).

What transpires within the literature around air pollution is that the decline of forests has been recorded in countries like Czech Republic, Britain, and the United States of America (Brown, 2001; Little, 1995; Stastna, 2002). In some countries the declining of forests is caused by acid rain while in others it is caused by beetle infestation. For instance in the Czech Republic, some parts of Africa, Europe and Bangladesh the declining of forests is attributed to industrial release of Sulphur dioxide in the atmosphere (Khan, 2006; Statsna, 2002). The same is feared to be happening in the Eastern part of Canada, and also threatening the Redwoods in California whereby forests have been declining rapidly as a result of acid rain resulting from industrial release of sulphur

[3] Carbon monoxide, also produced by fuel combustion in motor vehicles has direct causal effects of drowsiness and headaches.

[4] One of the hydrocarbons, methane, also called natural gas is produced from rubbish dumps. It is highly flammable and like carbon monoxide, enhances global warming

dioxide (Yoon, 2002; www.news1130.com). This paragraph demonstrates the devastating impact of air pollution on forests.

Since Africa is largely not industrialised, Connor (2007) asserts that it does not produce much of the pollutants leading to global warming or the declining of forests. Ironically though, scientists have established that Africa would be significantly affected by global warming (Connor, 2007). This surely is in line with the fact that some African countries depend on their forests as economic resources (van der Merve, 2002). According to Verrengia (2000) the food shortage crisis in Africa is ascribed to smoke pollution. Scientists claim that this famine could have been caused by the fact that particles produced as far as North America, Europe and America could have caused the drought in Africa (Verrengia, 2000). From the lens of a developing country, the decline of forests has a serious economic impact.

Certainly the discontents attendant upon by air pollution goes beyond the loss of forests. It has both the economic and the health dimensions to it. For instance, Hertgaard (1997) reports that in Beijing and Xi'ang, Cities in China, the air is polluted with thick smoke such that, even sunny days look foggy. Likewise, it was found that air pollution impairs visibility in the atmosphere in the Kings Canyon National Parks, California (www.euromab.org/brprogram). It is known that the state of the atmosphere with regard to air pollution has an impact on the health of people. Indeed studies show that there is a direct causal link between air pollution in California and the increase in lung dysfunction in Children (www.euromab.org/brprogram). This study correlates with Satterthwaite (2003)'s assertion that high levels of pollution causes inflammation of the respiratory tract. Satterthwaite (2003) further points out that air pollution "reduces resistance to acute respiratory infections" Satterthwaite (2003: 79). In support of this, Brown (1991) reports that Britain has a mortality rate of 10 000 reported annually as a result of air pollution.

This discussion demonstrates that air pollution is a pervasive problem leading to a global crisis. The discussion however, may seem to have veered out of the thrust of the enquiry, as it sets out to understand pollution attributed to dense informal settlements. Essentially one should understand pollution from a broad perspective, and how it could lead to the

collapse of the natural environment. The literature seems to ignore air pollution as it is contributed by informal settlements. Perhaps because industrial pollution is so much that it muffles any significant or measurable impact of pollution from informal settlements. It is reported though that rapid urbanization in Asia has led to the accumulation of sulphur dioxide in the atmosphere (Kirby, 2002). This means that rapid urbanisation should not be overlooked as one of the potential polluting factor, simply because pollution would be attributed to industries. Literature on the global scale impact of pollution from informal settlements is very limited. Some authors approach pollution from dense informal settlements as a localised phenomenon, mostly resulting from the use of coal as a domestic fuel, for instance Satterthwaite (2003); Hardoy and Satterthwaite (2007). This way of looking at pollution negates the principle of sustainability, which states that "nothing stands alone" as set out in the book by Haughton and Hunter (1990).

In order to attain sustainable development globally with regard to air pollution, it is important to look at all sources of pollution and how they could be limited at their locality. Kofi Anan, the then Secretary General of the United Nations (UN) stated during the World Summit On Sustainable development 2002, that "we live on one planet, connected in a delicate intricate web of ecological, social and economic relationship…and therefore if we are to achieve sustainable development we need greater responsibility" (van der Merwe, 2002:193). The same is the vision shared by Nelson Mandela who put forward that every community must be involved and find solutions to their environmental problems if sustainable development is to be attained (van der Merwe, 2002:193). The visions held by these leaders imply that all sources of pollution are important and therefore should be taken seriously by those who produce it. Within this context I find it very relevant to consider air pollution in dense informal settlements as somehow contributing to the global crises and therefore should be limited. The next main theme after considering air pollution is land pollution, which largely covers the issues of solid waste.

2.2.2. Land Pollution

Land forms part of life's support systems. Human activities have always been major sources of land pollution [5](Demanya, 2006; Enviropaedia, 2000, 2002). Within the thrust of this study land pollution would be limited to solid waste generated from domestic human activities. According to Leao, Bishop and Evans (2001) the dawning of the twentieth century brought about an appalling increase in the production of solid waste. From Demanya (2006)'s position, historically cities have been experiencing a perpetual challenge of solid waste management. The problem of solid wastes varies from country to country and also differs between developing countries and developed ones. On average developing countries generate less solid wastes than developing countries. Contrast to this, is the fact that developing countries have more solid waste problems than developed countries (Zerbock, 2003).

In order to understand the latter paradox, it has to be noted that urban populations of third world countries have been rapidly increasing in recent years (Cairncross, Hardoy and Satterthwaite, 1990; Radzicki, 1995). In developing countries most of the people moving to urban centres are the poor, migrating from rural areas. Most of these people are unemployed and therefore cannot make any significant contribution to municipal revenues. Municipalities respond to this by providing minimal services thus perpetuating the problem of solid wastes. According to Doberstein, 1992 cited in Závodská and Knight (2002), between 30% and 75% of waste in the cities of developing countries goes uncollected. Zerbock (2003) points out that solid waste management in developing countries will always be a problem.

From the literature it is found that waste generation increases in proportion with population growth (the World Bank Report, 1999; Zerbock, 2003). Notable is the fact

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[5] Land pollution is the action of environmental contamination with man-made waste on land (http://www.polity.org.za).

that governments in third world countries have failed to balance the rapid urban growth with investments in infrastructure (Cairncross, Hardoy and Satterthwaite, 1990). This has resulted in people living in overcrowded informal settlements with minimal services. Because of the problem of inadequate collection, for instance, countries like Guyana, in the northern coast of South America waste is burned, dumped into vacant land, drains or even ditched into waterways (Závodská and Knight, 2002). According to Zerbock (2003) less than 30% of urban populations in developing countries have access to proper and regular garbage collection services.

Notwithstanding the problem of solid wastes, Cairncross, Hardoy and Satterthwaite (1990) assert that until equilibrium is reached with regard to urban and rural populations, the trend of movements towards urban areas will continue. De Beer and Swanepoel (2003) point out that rapid urbanization results from centralization practices that concentrate opportunities in a limited geographic area. Lack of opportunities and social amenities in rural areas drive people towards urban areas. Government policies that favour more investments in cities cause an uneven development. Unless these policies are changed governments in developing countries would need to improve and beef up urban infrastructure in order to keep up with the increasing demands of services. Indeed there is a need to go beyond physical planning and thus, Wilson (2007) holds that dealing with the problem of waste management in the face of rapid urbanisation requires two underpinning drivers, which are institutional arrangements and public awareness.

The problem of solid waste management can perhaps also be ascribed to the fact that in the past the management of solid wastes received very little attention, as people were dependent on natural processes. Only recently, has the problem of solid wastes management gained significant attention. The focus on solid wastes stem from two sources, herein being, and the concern about environmental degradation and health issues (Demanya, 2006; Leao Bishop and Evans, 2001). According to Wilson (2007) the concern with environmental protection came to the fore in the 1970s. It was acknowledged that natural processes do get over capacitated, and for this reason Leao Bishop and Evans (2001) argue that in a sustainable environment, “pollution must not be

generated faster than the rate at which the system can absorb it" (Leao Bishop and Evans, 2001:290). Since it is now known that natural processes are failing, formulation of waste management programmes is needed.

Dealing with solid wastes requires an integrated approach that includes all relevant stake holders and the identification of potential limitations ("Stumbling blocks"). In this regard recommendations could be made on the basis of available information with emphasis been put on human and environmental health (Zerbock, 2003). As discussed previously environmental health issues were capitalized as levers to focus international attention on limiting solid wastes. Communities have to be aware of the health impact of the accumulation of solid wastes and formulate strategies to minimize them. It has to be acknowledged that, initiatives and collective organisation by individuals in poor communities is not enough to solve problems of drains and sewers and the collection of garbage (Cairncross, Hardoy and Satterthwaite, 1990).

Another fact that could be used as a lever to limiting solid wastes is the fact that the absence of such wastes would enhance the good performance of drainage system (Cairncross and Quano, 1990). This is because solid wastes block drainage systems, causing floods during rainy seasons. The community has a key role regarding the maintenance of drainage systems, by reducing the amount of waste thrown into drains. One resident, who blocks water flow by putting rubbish in a drain, works against the interest of the whole community (Cairncross and Quano, 1990). The community should therefore set local standards regarding the dumping of solid wastes. For this to happen there is a need for institutional arrangements at the community level to ensure that residents adhere to certain codes towards limiting waste accumulation in drains. Most important also is a cooperative attitude between, community leaders, educators and health workers, as well as the collaboration with municipal departments in limiting pollution (Cairncross and Quano, 1990).

One of the motivations of this study was the fact that the costs of not responding to pollution at early stages would precede the costs of having to formulate strategies and

programmes to clean up. Zerbok (2003) suggest three methods for reducing the production of wastes in an urban setting. These are: awareness campaigns to reduce waste, "promotion of consumer responsibility for post consumer waste" (Zerbok, 2003:11), and the use of recyclable material for packaging. Governments are better positioned to enforce or carry out the latter strategies. Jonathan (2005) asserts that in an integrated system, communities should be involved to effectively limit the levels of solid wastes. This requires community based waste management programmes to be introduced to supplement municipal waste management. It is therefore important to understand the international context of community involvement in solid waste management.

2.2.2.1. Community involvement in solid waste management

Over the years studies on public perceptions have advocated the need for community involvement within the broader notion of integrated waste management (Demanya, 2006; Kironde and Yhdego, 1997; Mubaiwa, 2007; Petts, 1995; Mull, 2005). In his article Petts (1995) highlights the need for cooperative governance on development issues. Therefore, reiterating the fact that views of communities are of paramount importance in respect of what is deemed to be the best practices. This should be reinforced by governments through actively supporting the decision made by communities as being the best that could be achieved within a given situation (Petts, 1995).

2.2.2.2.Case studies of effective community practice

In a case study conducted in Dar es Salam, the capital city of Tanzania, Kironde and Yhdego (1997) highlighted that the Tanzanian government failed to perform its duties on the area of solid waste management. This then brought to light the need for effective alternative measures, and thus a new model for the reduction of waste generation was formulated in Dar es Salam. The crux of the model was community involvement in the limiting the overflowing of wastes, and hinged upon the principle of waste reduction from source. According to Kironde and Yhdego (1997), waste reduction in the new model capitalized on the mobilisation of youth groups to be involved in the recycling of

household wastes. A cooperative deal between households (waste generators) and youth groups was made and a group of scavengers was selected to go about collecting waste. This not only improved the waste management programmes in Dar es Salam but also created opportunities for unemployed people.

The case study in Dar es Salam demonstrates that conventional municipal waste management can be made more effective if active participation of communities is given support. Indeed studies have been conducted to assess public perceptions regarding their role in waste management. For instance in Hampshire, a County in the South coast of England, broad based public support on a strategy for dealing with household solid waste was obtained through public involvement (Petts, 1995). The latter country was plagued with the problem of overflowing domestic wastes, and the conventional municipal waste collection did little to overcome the problem. According to Petts (1995) the main structures that were formulated to facilitate community involvement in Hampshire country was the community advisory forum (CAF), which held meetings with community members and provided them with information on the importance of taking responsibility to reduce waste and live in a clean environment. The project was a success and waste accumulation was reduced as people got involved in limiting waste for their own benefit. An impact of the project was that the authorities had to rethink their conventional processes of waste collection, and geared towards procedures that allowed opinions of people to be heard (Petts, 1995).

From the lesson on the Hampshire case study, Petts (1995) asserts that, while the concern of professionals is to limit the potential impacts of pollution on the environment, members of the community are more concerned about their lack of personal control and how decisions are being imposed on them. The conventional path of dealing with wastes has been deteriorating over the years. This is demonstrated by the Zimbabwean case whereby the collection of wastes has dropped from 80% in the 90s to 30% to date (Mubaiwa, 2007). This was in part caused by rapid urbanization (Mubaiwa, 2007), which burdened municipal service provision, causing a cumulative backlog in solid waste management. According to Mubaiwa (2007), due to insufficient collection of waste,

people in Zimbabwe have resorted to illegal open dumping and the burning of refuse in their back yards. This is affirmed by Jonathan (2005) who assets that the problem of illegal dumping comes when there is no other disposal with minimal service provision. Open dumps in Zimbabwe created a habitat for house flies, rodents, mosquitoes and other disease vectors, and smoke from the regular fires in such dumps have been linked with acute respiratory infections (Mubaiwa, 2007)

The mushrooming of illegal dumps in Harare, Zimbabwe, indicated the need for programmes beyond conventional practices, and thus instigated a practical action on the implementation of community based waste management initiatives (Mubaiwa, 2007). In line with this thinking, Jonathan (2005) highlighted that in order to deal with the imbalances between population growth and the ever accumulation of wastes, local initiatives could play a very crucial role. In a similar situation to that of Dar es Salam, in Harare, community mobilisation to limit pollution was hinged upon the formation of community based organisations (CBO) (Mubaiwa, 2007). In this regard the management of solid wastes was not just about reducing environmental harm and the resulting health impacts, it was viewed as a business venture (Mubaiwa, 2007). Each CBO had to produce a business plan to demonstrate that they would be capable of providing the service consistently and reliably (Mubaiwa, 2007). CBOs were formed by a group of informal waste collectors whereby, house holds paid for door to door informal waste collection services. This led to a reduction in illegal dumping practices, which further benefited the community through the reduction of vector related diseases like malaria and diarrhoeal diseases (Mubaiwa, 2007).

2.2.2.3.The role of education on pollution

Education on pollution has been one of the levers through which community involvement was mobilised, as was demonstrated in the case of the discussion on the Hampshire case study. Likewise, in Chitungwiza, Epworth and Mbare, neighbourhoods in Zimbabwe, waste handling has improved profoundly through the use of education on community health and pollution (Mubaiwa, 2007). In these neighbourhoods, beside informal

collection practices similar to those in Harare, community based trainers were deployed to teach people on a range of diseases arising from pollution (Mubaiwa, 2007). Mubaiwa (2007) asserts that the project was a success and many households in Epworth, Chitengwiza and Mbare not only benefited from the informal waste removal services, but also the reduction of vector related diseases.

A much similar situation to the one above is that of the neighbourhood of Sahakaranagar , located in the northern periphery of Bangalore, India. In this neighbourhood a holistic approach to improving the existing solid waste management programme was achieved by carrying out community awareness and education campaigns (Jonathan, 2005). Jonathan (2005) state that inadequate collection of solid wastes destroys the aesthetic nature of cites and leads to unsanitary conditions. As a proactive step towards a better solid waste management strategy, in Sahakaranagar, community education aimed at limiting unsustainable disposal practices (mostly illegal dumping) was adopted. Community education was further enhanced by the door to door informal waste collection services (Jonathan, 2005).

Overflowing patterns of solid wastes and the mushrooming of illegal dumping have been reported in the cities of Khulna and Dhaka, in Bangladesh (Khulna series, 2000). In response to this problem, in Kalagaban, a neighbourhood in Dhaka city, in Bangladesh a community waste initiative was launched in 1986 (Khulna series, 2000). Households were required to pay for a house to house waste collection. This benefited the community in that the neighbourhood became significantly cleaner and there were no more frequent drain blockage as a result of waste problems (Khulna series, 2000). This case echoes the situation of the Zimbabwean neighbourhoods as discussed in the previous paragraphs.

In the case of Khulna city, what transpires within the report produced by Khulna series (2000) is that while wastes are being disposed in open drains and around wastes containers and on open land, trucks collect wastes only from the street side bins. This problem was exacerbated by the fact that most poor neighbourhoods in the city of Khulna have narrow alleys that impede municipal trucks from passing to collect wastes. This

results in most of the wastes ending up in drains, thus causing appalling water congestion during rainy seasons (Khulna series, 2000). In this light, a community based waste initiative was launched in 1997 (Khulna series, 2000). This was a community based initiative in partnership with municipality, and it worked effectively. While the community was involved in managing the primary house to house collection of wastes, the local government focussed on institutional support and linkage with municipal systems.

In summary all the case studies discussed above focussed on reducing the overflowing levels of solid wastes through the use of community based approaches. It has been demonstrated that in the face of rapid urbanisation, the conventional methods of waste management need to be supported by a conscious contribution from people generating wastes. Drawing from the case studies, one can inductively argue that a reliance on the conventional methods has led to the mushrooming of illegal dumping in all developing countries. The impact of these practices led to severe environmental harm, unsanitary conditions, ugly spatial views, bad odours, and outbreaks of vector based diseases, and as Kirande and Yhdego (1997) point out, work against the civic commitment of those affected, and has social implications. From a social stance, areas that are characterised by overflowing of waste and bad odours are inferior, and therefore it should be natural for people inhabiting such areas to feel as if they are also inferior. Though this was not exploited as one of the approaches for community involvement in the discussed case studies, I believe it could make a stronger connection with community education on environmental health as a lever to mobilise community involvement.

Informal waste collection services have been shown to be very effective as a supplement for the conventional methods. This however does not happen without drawbacks, for instance Jonathan (2005) highlights the problem of exploitation on informal waste collectors, whereby the compensation from communities was less than the job done. This problem was further compounded by the social stigma that informal waste collectors were dirty and therefore inferior. I think it is important for governments to support informal waste collectors in this regard, perhaps through formulating institutions that

would protect them from community exploitation. In this regard each informal waste collector would have to register as a member for the institution, and therefore exploiters would be sanctioned by the institution. Regarding the stereotype that informal wastes collectors are inferior, as highlighted by Jonathan (2005), there is a need for community education to impart changes on the way these people are perceived. Communities should know that informal waste collectors are fellow individuals reducing the burden for households to disposing their wastes illegally, and at the same time making a living. Thinking along these lines would optimise community involvement in waste management especially in rapidly growing cities of developing countries.

2.2.2.4. Recycling

Recycling[6] has many benefits, for instance the shortage of available land for waste disposal has always been a physical constraint pertaining to the problem of waste management (Bai and Suntanto, 2001; Leao, Bishop and Evans, 2001). The lack of land fill sites has instigated a paradigm shift in some UK neighbourhoods like in Hampshire and Essex (Petts, 2001). This was about waste management that put an emphasis on incineration and recycling. Some landfill sites have been associated with environmental health problems and for this reason, some national environmental groups in the UK have led anti-landfill protests (Petts, 2001). This makes recycling a very sought after approach regarding waste management in any urban setting.

Within the context of informal settlements, a lack of waste disposal sites presents a compounding factor to the problem of accumulation of wastes. This is because poor communities receive minimal attention from authorities with regard to waste management. In such communities recycling should come as a local initiative not for environmental benefits, but also for employment opportunities and poverty alleviation (Jonathan, 2005). Case studies have shown that many people from informal settlements around the world have benefited from waste recycling (Demanya, 2006; Jonathan, 2005;

[6] Recycling refers to the process of collecting waste material and subjecting them to a system that makes them become useful again. This has benefits not only with regard to better environmental management but also in terms of preserving raw materials (Hopper *et al*, 1993).

Závodská and Knight, 2002; Zerbock, 2003). Bai and Suntanto (2001) are of the opinion that, for poor people in most African countries and India recycling could improve opportunities for better livelihoods. Zerbock (2003) confirms this assertion by pointing out that many people in developing countries scavenge solid wastes dumps in search for recyclable material. Zerbok (2003) further cites Johannessen (1999) who reported that in Durban, South Africa, scavenging on solid wastes was found to support as many as 200 families. This lines again echoes and reiterates the importance of recycling as an approach for solid waste management and economic support. Having considered solid waste as a form of pollution in informal settlements, the discussion now shifts to water pollution.

2.2.3. Water pollution

Water is an environmental source of life and without it, there would be no life. It is the ultimate medium of all pollutants; even particles in air would eventually come down and contaminate water resources. An article produced by UNESCO warns that the dawning of the 21st century brought with it, global water crises (UNESCO, 1996). This is affirmed by a report produced by UNEP (2000), which highlighted the fact that the 21st century has been marked by the scarcity of water supply. Within this context, literature has highlighted that providing adequate water to satisfy the demands of people has been a problem for many cities in the world (Allen, Davila and Hofmann, 2006).

Notwithstanding the global water shortage crisis, in areas like India and Africa, the withdrawal of surface and ground water has been exceeding natural processes for replenishment (UNEP, 2000). This problem is further augmented by water pollution, which can be as a result of sewage contamination or organic compounds. It has been observed that most poor people particularly those at the peri-urban interface have no form of drainage systems and tend to discharge their waste water into roads and open spaces. This has been observed in some cities of countries like Venezuela, Mexico, India, Tanzania and Egypt (Allen, Davila and Hofmann, 2006). It has been established that the major sources of water pollution are industrial, agricultural and municipal (UNEP, 2000).

For Allen, Davila and Hofmann (2006) solid wastes from human settlements constitute one of the most pressing sources of water pollution world wide.

Within the context of informal settlements, literature has demonstrated that water pollution comes as a result of faecal contamination, solid wastes disposed into streams of water, and waste water from bathing and washing (Cairncross, 1990, Cairncross and Ouno, 1990; Sinnatambly, 1990). Solid wastes also impact negatively on underground water resources through natural leaching processes that take down residual wastes to underground aquifers (Allen, Davila and Hofmann, 2006). Throughout the world, informal settlements are characterised by observable streams of water running down the roads and sometimes forming stagnant puddles near dwellings (Huchzermeyer, 2005). This is a pressing issue that is associated with inadequate means to dispose of waste water, and also blocked sewers which indeed have become a norm in poor neighbourhoods (Cairncross and Ouano, 1990). The ever running streams of water has also been linked with the fact that informal settlements leave no open spaces to absorb runoffs of waste water (Holden, 2001; Sinnatably, 1990). During rainy seasons, the polluted streams of water run into rivers and other sources of surface water.

In light of the background provided by the two paragraphs, it becomes clear that all forms of pollution are tightly linked, and therefore a holistic view should be adopted in dealing with them. Strategies for waste management should bring about benefits for both air pollution and water pollution management. No neighbourhood is an island, just the same as no community or country exists in isolation. The discussion on pollution has shown that this statement is true, and therefore there is no need for collaborative planning at the global level if pollution is to be effectively managed. It suffices at this point to look at the pollution initiatives from a global position.

2.2.4. A global vision on the prevention of environmental harm

Pollution falls within the broader notion of sustainable development. Sustainable development is a concept that emerged with the global concern with environmental protection. Agenda 21, also referred to as the United Nations Conference on

Environment and Development held in Rio de Janeiro in 1992, has been at the forefront in terms of guiding the formulation of strategies for sustainable development. According to UNCED, sustainable development was defined as "meeting the needs of the present generation without jeopardizing the ability of future generations to meet their own needs" (van der Merve, 2002). This definition is however narrow, as the concept sustainable development or sustainability has three major dimensions that are mutually dependent. These are economic development, social equity and environmental protection. For better environmental performance, the latter three areas should be balanced, and therefore a broader view of sustainable development will seek to strike trade offs between economic development, social equity and environmental protection.

The 1992 summit held in Rio de Janeiro was motivated by the fact that the costs of not acting at the right time would precede the costs of developing programmes (van der Merve, 1992). Within this line of thinking the following text were adopted by UNCED (van der Merve, 2002):

- **The Rio declaration on environment and development-** this was a set of principles for guiding practices and defines the rights and responsibilities of States on issues within this area.
- **Agenda 21-** this was the crux of the idea of sustainable development**,** a six hundred page text guiding all areas of sustainable development.
- **The forestry principles**- this was a global consensus regarding the conservation of all types of forests.
- **The biodiversity convention**- this was a global consensus on the reduction species loss in **throughout the world.**
- **The climate change convention**- this was a consensus aimed at limiting human activities leading to climate changes, and thus leading to global warming. This convention was legally binding and aimed at reducing the concentration of green house gases on the lower atmosphere. Green house gases include CFCs, HFCs, nitrates, Carbon dioxide etc, and are involved in global warming (Kemm, 2002)

Not all of the above texts were adopted as binding laws, but were rather intended at highlighting the need for international action on each specific area of sustainable development. Indeed most of the texts are not more than mere voluntary international

codes of conduct for countries to start implementing sustainable development. From the Rio Earth summit there was another summit, referred to as the World Summit on Sustainable development (WSSD) held in the Sandton convention centre, South Africa in 2002. The preamble of the WSSD was to record progress of issues discussed in the Rio summit (Osborn, 2002).

Effectively the Johannesburg WSSD was informed by the lessons learned from the Rio Earth Summit. It was acknowledged by the delegates who attended the WSSD that much remained to be done, because social problems and poverty persisted (Osborn, 2002). Environmental harm and resource degradation remained serious scourges that require extensive effort to arrest. A range of issues were discussed during the WSSD 2002, and these include the convention on climate change, which was given essence by the Adoption of the Kyoto protocol[7]. Millennium Development Goals were also discussed with intent to set international milestones of achieving them.

In order to attain sustainable development, Agenda 21 says that local authorities should formulate their own policy directives and programmes and align them with international perspectives (Freeman, 1996; Selman, 1998). What this means is that People at the local level must try and provide sustainable solutions to their developmental problems. Within this ideal, the relevance of this study is brought to bear, since it focuses on how people at the community level can reduce pollution right where they live. By understanding pollution from people's perceptions would allow one to link local strategies with the objectives of agenda 21, and therefore demonstrate an adherence to international orthodoxy regarding sustainable development.

[7] The Kyoto protocol was based on the idea of "clean development mechanism (Willis, 2005). It (Kyoto protocol) was concerned with the reduction of the high concentration of green house gases in the lower atmosphere (Midly, 2002). Ironically though, is the fact that such powerful countries as the USA, Canada and Australia argued that there should be no limit to the emissions of green house gases to the atmosphere. The latter countries argued that a county's emissions should be measured against the level of support it has afforded countries of the global south to reduce their emissions.

2.3. **The South African context**

South Africa as a developing country is, likewise, burdened by pollution from informal settlements around major cities. According to the draft White Paper on Integrated Pollution and Waste Management for South Africa, sewage pollution of water from informal settlements constitutes one of the major pollution problems in the country (DEAT, 1998). Informal settlements are also identified as sources of air pollution as they are mostly non-electrified, and thus use open fire for cooking, and also their notorious practices of burning domestic waste release gases into the atmosphere (DEAT, 1998). In light of this information, informal settlements can be viewed as threats to South Africa's ideal visions towards sustainable development. Sustainable development is effectively undermined by rapid urbanisation which resulted in excessive waste generation and inadequate waste disposal (South Africa Year Book, 1999). This is an emerging major cause of urban pollution and is viewed as a threat to the quality of the environment in South Africa (DEAT, 2005).

2.3.1. Institutions for environmental management in South Africa

International views and directions tend to set orthodoxies with regard to policies and practices adopted by countries. This means that South African policies and practices on pollution and environmental management should be influenced by international standards and conventions. At the level of central government, the Department of Environmental Affairs and Tourism is the central coordinating institution for environmental management in South Africa (South Africa Year Book, 1999). DEAT looks after South Africa's interest regarding the promotion of sustainable development and conservation of natural resources (Van der Merve, 2002). At the national level, DEAT however is not the only institution responsible for environmental management in South Africa. An institutional concoction for environmental management in South Africa comprises of the Departments of Environmental Affairs and Tourism, Water Affairs and Forestry, Health, and Agriculture (South Africa Year Book, 1999).

The relationship exhibited by the government institutions above shows that in South Africa environmental management is a shared exercise. From a governance perspective, environmental management involves a complex institutional arrangement. The South African Constitution (Act 108 of 1996) requires that all spheres of government operate in a cooperative manner. This means that the plans and programmes adopted by local and provincial government must be aligned with policy directives and practices adopted by the national government. According to the South Africa Year Book (1999), South Africa adopts a holistic approach to environmental management. This means that all stake holders including state agencies, private institutions, and communities should be involved in environmental management.

2.3.2. South African policies and key legislation for pollution management

In the post apartheid South Africa, new laws are currently being developed and implemented to reduce environmental damage and pollution. In 1999 South Africa had no effective and coordinated system for the regulation and the control of waste generation and disposal (South Africa year Book, 1999). As a proactive step towards integrating the fragmented area of environmental management, DEAT passed the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998). NEMA was introduced to repeal the Conservation Act 73 of 1987, and its primary function is to promote South Africa's environmental interests (for instance promoting environmentally sustainable development) by laying down institutional structures and legal mechanism to protect and conserve the environment (Glazewski, 2005). The state institutions discussed were laid down as part of the requirement of NEMA (Act 108 0f 1998). Within NEMA there are two principles that pertain to environmental risks and pollution and these are the polluter pays principle [8]and the duty of care principle[9]. These two principles are used to minimise pollution through law enforcement.

[8] Polluter pays principle: NEMA: this principle holds that the costs imposed on society and the environment by pollution must be borne by the polluter.

[9] Duty of care principle: *NEMA, Section28 (1):* Every person who causes, has caused or may cause significant pollution or degradation of the environment must take responsible measures to prevent such

Having identified pollution as a common problem across various government institutions, the departments of Environmental Affairs and Tourism, Water Affairs and Forestry, Health, and Agriculture, launched a project for developing a National policy on integrated pollution and waste management (South Africa Year Book, 1999). The joint project by the latter departments culminated in the launching of the draft White paper on Integrated Pollution and Waste Management for South African 1998 (DEAT, 1998). This White paper on Integrated Pollution and Waste Management seeks to consolidate pollution management laws into an easily accessible statute (DEAT, 1998). The Draft White paper on Integrated Pollution and Waste Management further seeks to address the negative impacts of pollution on poor people (South Africa Year Book, 1996).

South Africa subscribes to the idea that "Controlling pollution is fundamental to protecting human life-support systems" (http://www.wildlifesociety.org.za). The South African context with regard to pollution prevention is informed by the goals of Agenda 21. For instance the South African policy on Integrated Pollution and Waste Management is part of South Africa's effort to demonstrate that they are committed to meeting the objectives of Agenda 21. The policy further maps out South Africa's direction with regard to meeting the international agreement like the Framework Convention on Climate Change. Beyond policies and legislations, South Africa has a Constitution, which forms an overarching law for pollution on waste management. Within the constitution the most relevant clause pertaining to integrated pollution and waste management is section 24, also referred to as 'the environmental right' (The Constitution, Act 108 of 1996). This was mentioned in chapter3 in the section on the conceptual framework. This clause imposes a duty on the state to ensure that pollution is prevented. It is along this line that, section 24 forms a lens through which pollution and waste management in informal settlements can be better understood.

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pollution or degradation from occurring or insofar as such harm to the environment is authorized by the law or cannot reasonably be avoided or stopped to minimize such pollution or degradation to the environment.

2.3.3. Environmental management and pollution initiatives in South Africa

South Africa has since identified pollution in dense informal settlements as a complex problem. DWAF (2002) follow Cairncross, Hardoy and Satterthwaite (1990)'s argument when they say that pollution is recognized as the leading cause of death in developing countries. DWAF saw a need to intervene in this regard and therefore approached the Danish Co-operation for the Environment and Development (DANCED) programme to fund a study to "Develop a Strategy to Manage the Water Quality Effects of Dense Settlements (DWAF, 2002a). The project was initiated in 1997 with both DWAF and DANCED as the principal financing institutions. The project linked pollution, community perceptions and local government with local government capacity.

The focus of the project was on poorly serviced densely populated settlements. The approach adopted in this project focused on stakeholder participation, prevention and minimization (DWAF, 2002). DWAF aimed at supporting communities in improving their waste management systems. In order to do this, DWAF engaged with local authorities and communities in deliberate efforts to identify causes of pollution and how these could be addressed (DWAF, 2002). This was a national strategy but has its implementation at the local level. In each region, priority polluting settlements were identified and were used as test cases for the project. This was done through participatory approaches that trained people so as to improve their understanding of pollution (DWAF, 2002). This way people were able to identify core causes of pollution problems, and sustainable solutions were worked out according to problems in each settlement.

The DWAF project enhanced service provision in many neighbourhoods through training communities and supporting local authorities in providing better services. DWAF (2002) released an awareness booklet titled, working towards a Clean and Healthy Community: an Information Booklet to Support Community Efforts to Minimise Water Pollution from their Settlements. Communities became more aware of the links between pollution and health in their area. The indicators of success in many cases included (DWAF, 2002)

- Littering in storm water was reduced

- Sewage pollution was reduced and this led to a reduction in diarrhoeal diseases
- Communities were mobilised to look after their own services.
- Increased payment of services

In my view, the DWAF project capitalized on local capacity to improve the situation in informal settlements. It is important to also consider the role of local government in South Africa, as they are at the forefront of service privation. A discussion on the context of this sphere of government is provided below.

2.3.4. The context and role of local government

Local government is bound by the Constitution to provide services for people in its area of jurisdiction in a sustainable and equitable manner (DWAF, 2001). In order for local government to fulfill their Constitutional mandate, there is a need for capacity. Capacity in this regard referrers to skills and the available finances to provide services. This should be matched with the amount of services required so that efficiency can be attained. A common mismatch in local government capacity in South Africa is that of available finances, whereby the budget does not cover all the costs for service provision (McDonald and Pape, 2002). For this reason municipalities cut back on maintenance in order to stay within budget constraints. The problem of mismatched budget by local government is compounded by the lack of payment from the recipients of services (McDonald and Pape, 2002). It is known that while many households in poor communities cannot afford services there are those with income, but deliberately opt not to pay (DWAF, 2002). Local government can reasonably provide services within their available resources, and the community is expected to pay for the services they get. Lack of support from National and Provincial spheres, and poor cost recovery, makes service delivery challenging task for the local sphere. The community does play a role in augmenting pollution problems through their unwillingness to pay for services admixed with other factors. A discussion on this is provided below.

2.3.5. The role played by the community in exacerbating pollution

DWAF (2002) emphasizes that pollution in settlements is caused by a lack of awareness, deliberative misuse of services and failure of the service provider to provide and maintain services. It has to be noted here that pollution in settlements has social (misuse of services) and institutional (failure of service provider to provide services) dimensions.
In most neighbourhoods, communities are engaged in deliberate dumping and littering, even when waste dumping facilities are being provided (DWAF, 2002). There are also practices of vandalism (for instance the destruction of sewage pipes especially during protests) and the use of trash cans for other purposes other than dumping refuse. In some cases sewer systems are used to hide crime evidences and these lead to blockages and destruction (DWAF, 2002). Political issues have also been implicated in the vandalism of services, for in stance youth affiliated to an opposition party may destroy facilities as a way of showing dissatisfaction (DWAF, 2002). Such practices are linked to a lack of awareness and education on the importance of acting responsibly. People therefore need to be educated in this regard to be responsible and enhance the maintenance of services.

2.3.6. Peoples responsibility to find solution to pollution problems

In South Africa, the Cape Town Member of executive committee (MEC), Tasneem Essop, was reported saying that poor people, who mostly are the ultimate victims of unsustainable practices, are seldom heard (Bua News, 2005). This means that there is a need to allocate affected people the responsibility to find solutions to pollution problems. Education and awareness on the connection between pollution and diseases has been identified as some of the factors leading to communities being uninterested in limiting pollution and its effects. According to Petts (1995), local authorities have a responsibility to consult with citizens to get information needed for formulating the best practices and strategies. This is emphasized by Chapter 28 of Agenda 21 (Petts, 1995). In South Africa, an integrated approach to pollution management is needed. For this reason South Africa formulated an Integrated Pollution and Waste Management Policy.

2.3.7. Why is there is a need for an integrated pollution and waste management policy in South Africa?

South Africa is emerging from planning that was fragmented and for this reason the country is undergoing multiple institutional transitions. According to the White Paper on Integrated Pollution and Waste Management some of these transitions include, a move towards equitable provision of services with a focus on improving the situation of most of the impoverished people. Theory has shown that internationally, waste management was not getting enough attention in the past (Demanya, 2006; DEAT, 1998) This was the same in South Africa as there was no effective system for protecting public health and the environment. This has led to an escalating lack of capacity and effective legislation for waste management. Moreover, problems in managing solid wastes in South Africa come as a result of: fragmented, unfocussed and ineffective legislation and lack of national minimum standards for the provision of waste collection services in different neighbourhoods. Service provision in many poor urban neighbourhoods has collapsed as a result of non payment and poor municipal budgeting. This is true for most (if not all) informal settlements around major cities (DWAF, 2001). Such neighbourhoods are characterized by environmentally unacceptable standards like,

- Ineffective or non-existent waste collection
- Non existent street cleaning systems.
- Illegal dumping and littering.

The above background points to the need for the adoption of an integrated approach to pollution and waste management in South Africa. International case studies have shown that waste management has always been a problem in urban areas of developing countries. For this reason various organizations like the United Nations (UN) and various non-governmental organizations (NGOs) advocate an integrated approach to managing solid wastes (Zerbock, 2003). This is also a view held by the Brudtland commission which emphasized the need for countries to formulate local pollution management strategies (Van der Merve, 2002).

2.4. The Johannesburg context

2.4.1. Geographic location of Johannesburg

Johannesburg is located within the Gauteng province in South Africa. It is the economic hub of the country, the largest city with a population density of 3.2 million people (Joburg, 2005), and covering an area of 1 625km² (http://www.joburg.org.za). The city's population is increasing at a rate of 14% per year. Some studies have shown that the cumulative percentage is attributed to people migrating to informal settlements in Johannesburg, for instance (Staff, 1994). This figure indicates a bifurcated situation in the sense that, while on the one hand it represents economic growth, on the other hand it implies challenges in respect of service provision.

2.4.2. The state of the environment in Johannesburg

Like any other city in the developing world, the city of Johannesburg is confronted by a variety of challenges which includes waste management, provision of adequate sanitation, urbanization and service delivery (Joburg, 2003). There is an inextricable link between developmental challenges like the compounding effect of urbanisation n the challenge of waste management. This means that dealing with pollution in informal settlements should be aligned with strategies or programme for managing the rate of urbanisation. To set the context, the Director of Environmental Management in the city of Johannesburg stated that the poor quality of the environment in Johannesburg is of great concern, especially with regard to the poor state of rivers and poor air quality (van Rijswijk, 2007).

With regard to the state of the environment, informal settlements are tagged as one of the major sources of land pollution in Johannesburg (GJMC, 1999). According to the report produced by Greater Johannesburg Metropolitan Council (GJMC) (1999) lack of knowledge by the residents leads to littering, illegal dumping and broken sewerage systems. Illegal dumping has been observed in areas such as Palm Springs west of

Orange Farm (South of Johannesburg), Ennerdale and Lenasia, Freedom Park, Bushkoppies area, Southeast of Soweto. With a cost of R80 million (http://www.joburg.org.za), illegal dumping becomes one of the serious problem faced by the city. The location of rubbish bins has been identified as one of the problems leading to illegal dumping in most informal settlements. In the Northern informal settlements of Diepsloot and Zevefontein it has been observed that little or no waste removal services are provided (GJMC, 1999). Land pollution in these areas is a serious problem and rings the bells for better and effective service provision.

Most of the environmental problems are virtually concentrated in informal settlements. Sewerage systems in informal settlements have been poorly designed and constructed and for this reason they are often blamed for the deposition of faecal matter into water and places where food is grown (GJMC, 1999). With regard to smoke and air pollution, It is estimated that 20% of the informal settlements around Johannesburg are experiencing severe air pollution, and in some cases the ambient air pollution in such areas exceed the accepted standards by more than 20% (van Rijswijk, 2007). In winter the levels of air pollution can actually exceed the World Health Organisation Standards by more than 250% (van Rijswijk, 2007). This is the time when most of the people are using coal for cooking and warming their houses. A consequence of this is a medical observation that there is an increasing level of the number of people suffering from respiratory diseases (van Rijswijk, 2007).

As a proactive step towards addressing the state of the environment in Johannesburg, the Environmental Management Directorate, formulated Environmental management frameworks to guide sound environmental management. These frameworks are aligned with the objectives of the World Summit on Sustainable Development, which was held in Johannesburg in 2002 (van Rijswijk, 2007). This is done through providing people with environmental information as well as promoting an equitable supply of services for all the people of Johannesburg. The Johannesburg city Mayor support the latter line by making a firm commitment that every household will have access to efficient removal of services (Masondo, 2007).

2.4.3. Johannesburg city policies and strategies for pollution management

It was discussed that, at the national level pollution is minimized by the Integrated Waste Management Policy and the National Waste Management Strategy. In the city of Johannesburg the major planning tool is an Integrated Development Plan (IDP) (Harrison, 2001). The preparation of an IDP is set out in the Municipal systems Act 32 of 2000, and this statue stipulates the minimum contents of an IDP. An IDP is a comprehensive five year strategic plan that set out a municipality's developmental direction through sectoral plans and procedures (Joburg GDS and IDP, 2006/11). Issues of Environmental management or pollution management in Johannesburg are administered in the environment sector. According to the IDP document (Joburg GDS and IDP, 2006/11), the underpinning notion of all environmental programmes is the role of education to enhance environmental sustainability.

One of the documents produced by the environment sector is the State of the Environment Report. What transpires within the state of the environment report produced by the city of Johannesburg is that, the primary aim of the city is to formulate policies and strategies that seek to promote sustainable development (van Rijswijk, 2007). It is in this regard that the city seeks to understand the cases of environmental changes. Some of the identified cause of pollution includes

- Population growth or rapid urbanization
- Lack of law enforcement
- Service delivery backlogs
- Increased waste generation

One of the strategies to optimise the efficiency of waste management service delivery within the area of waste management in the city was to outsource the service of waste management. This service was officially contracted to the company called Pickitup, which collect 1.4 tons of waste generated by the 3.2 million people every year (http://www.joburg.org.za). To effectively manage the waste, the city established 33 garden refuse site, four landfill sites and one incinerator (http://www.joburg.org.za).

Landfill sites are not the first preference with regard to waste management, in fact within the directorate of environmental management in Johannesburg, recycling is of the utmost importance (van Rijswijk, 2007). The directorate has been instrumental in setting up the Zondi Waste Buy-back Centre with the help of donor funding from the Denmark Development Agency. This is a recycling centre that collects recyclable waste from waste collectors and process material for reuse.

2.5. The Diepsloot context

Legislations and policies at the national and provincial level should inform local perspectives, and should therefore be contextualised in ways that represent local needs and priorities. The local government should interpret and apply National and Provincial policy perspectives at a local level, in ways that ensures that the fundamental goals set by provincial and national spheres, are progressively attained through the use of local capacity.Both the provincial government and the City of Johannesburg have since realized that the conditions in informal settlements (including Diepsloot) reflect serious health risks, and for this reason commitments have been made to intervene (Johannesburg SDF (2006/07).

An ever increasing population in Diepsloot prompted the city to commission a study to expand the policy of Urban Development Boundary in the area (Johannesburg SDF, 2006). This was to ensure that the settlements does not develop and encroach out of the urban boundary. Some development initiatives in the pipeline include de-densification of the existing settlements by the city. The plan in this regard involves the use of land on the east of the settlement, which has been undeveloped Johannesburg SDF, 2006/07). A closer look at these initiatives suggests that they are aimed at improving environmental conditions in the settlement. The ability to arrest further development of the settlement means that population growth would be static and therefore the burden of environmental management would have been reduced. De-densification would also impact positively on the broader environment of the settlement. Furthermore the part of the land located south of the N14 highway, near Diepsloot has been earmarked for landfill site. Recently

Diepsloot has been afforded an environmental centre, the Northern Farm Environmental Education Centre (Sowetan Reporter, 2007).

Economic differentials between the settlements in Johannesburg are evident. In order to attain a balanced growth, the city has committed to bridging the first and second economies by prioritizing the development of marginalized areas like Diepsloot (Johanneburg SDF, 2006/07). The proposed intervention programme to achieve this is referred to as The Upgrading of Marginalised Areas Programme (UMAP). In terms of figures, Diepsloot gets R 75 078 900 from the programme, and part of the money goes to the upgrading of infrastructure and electrification of the settlement (Johannesburg SDF, 2006/07). Electrification of the settlement is part of promoting a safe environment in Diepsloot. The Johannesburg SDF (2006/07) also highlight the fact that improving the conditions and surfacing roads in informal settlements may help address some environmental and health issues.

2.6. Conclusion

In an effort to demonstrate that the level of pollution in informal settlements deteriorate the environment, international theories and case studies about pollution with particular focus on informal settlements were discussed. An international perspective on the three mainstream forms of pollution, i.e. land pollution, water pollution and air pollution were discussed. More emphasis was on land pollution which is about waste generation and the immediate and long-term aftermaths. Some practices that worked, (e.g. informal waste collection strategies), in other countries with regard to waste management have been discussed with hope that they can inform South African norms and practices regarding the management of pollution in informal settlements. The international perspective was then followed up by the South African perspective, which was further narrowed down to the Diepsloot context. The idea in the following this line of argument was to demonstrate that pollution requires commitment of all the main players in a governance system, i.e. international, national and local governments.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Methodology for data collection

This academic study has reviewed, generated and analysed data in an attempt to understand perceptions of communities informal settlements regarding their role in limiting pollution in their environment. What transpires from literature is that, the research methodology is driven by the nature of the research problem (Straus, and Corbin, 1990). The methodology followed in this research, i.e. understanding perceptions and the role of communities, was grounded within a qualitative inquiry (Schwandt, 1997). According to Creswell (1998: 15) "qualitative research is an enquiry process based on methodological traditions of enquiry that explore a social or human problem". It is any kind of research that is not arrived at through statistical procedures or quantification of data (Strauss and Corbin, 1990). Researchers subscribing to this paradigm, study things in their natural settings and attempts to interpret phenomena based on how people perceive them (Creswell, 1998). For Denzel and Lincoln (1994, cited in Creswell 1998), such an enquiry should be based on an interpretive and a neutralistic approach. Pollution in informal settlements is a complex observable phenomenon, "rooted in the socio-economic, political and institutional conditions in settlements" (DWAF, 2001), and thus in this study it was thought that probing people's perceptions regarding their role in limiting pollution could be done by following a qualitative approach.

According to Mouton (2001), cited in Fourie (2003), in qualitative research, the researcher uses data in order to answer questions. It is important to build a complex holistic picture of the problem under study through words and views of informants (Creswell, 1998). Drawing from these lines, in this study, data was primarily collected through one-on-one interviews and focus group interviews to answer the questions as they appear in Chapter 1. This was a single case study based on Diepsloot (the section

that constitutes a dense informal settlement). The secondary sources of data involved Journals on pollution and service delivery, books, relevant internet websites, newspaper articles. According to Strauss and Corbin (1990) the secondary sources of data help build theory that would latter inform data analysis and interpretation. Since the research responds to the research questions as set out in Chapter 1, it is important to asses how the adopted approaches link with them. See below, Table 1 linking Research Questions and the approaches of answering them.

Table 1: Research questions and the alternative approaches of answering them

Questions	**Approach**
1. What are the perceptions of communities in informal settlements towards their responsibility in limiting pollution in their environment?	Two focus groups of six people each. This involved discussions and probing questions to capture people's viewpoints and opinions. The focus groups were followed-up by one-on-one interviews with key informants to get more detailed view points.
2. What measures have the local municipality taken to help reduce pollution and environmental hazards in the study area?	Qualitative interviews with the municipal councillor and the environmental health officer, review of available records of intervention initiatives like awareness campaigns
3. What can be done about limiting pollution?	Extensive literature review and synthesis and analysis of results from all the questions above

The primary sources of data involved several steps to establish a comprehensive data bank. A field study using focus groups discussions (comprising of adult people,

employed and unemployed, male and female alike), one-on-one interviews with residents of Diepsloot, and interviews with Environmental Health Officers (EHOs) and Ward Councillors. The participants were chosen based on a purposive sampling procedure. The information obtained from Ward Councillors and EHOs was reviewed against information provided by residents in focus groups.

The reason for collecting and cross examining data was to assess the validity of the information (Frey and Fontana, 1993). Collecting information in this way (i.e. multiple methods) is referred to as data triangulation (Schwandt, 1997), and it deepens understanding of the problem. Schurink (2000) asserts that the method of multiple data collection helps in gaining a holistic understanding of the interconnectedness between the local municipality and the people in their area of jurisdiction. In this respect, Creswell (1998) suggests that if the evidence is enough, and drawn from multiple perspectives it would substantiate the conclusions. It is in this light that I embrace a holistic approach to undertaking research to minimising pollution.

3.2. Case study

This research was based on single case study in Diepsloot, introduced in Chapter 1. A case study is an exploration of a bounded system bounded by time and place (Creswell, 1998). In this study the strategy of enquiry is based on an instrumental case study. According to Mark (1996: 219), an instrumental case study is used to elaborate on a theory, for the purpose of gaining an in-depth understanding of a social issue or an issue under study. The issue herein, being the 'challenge of pollution in dense informal settlements', and Diepsloot is used as an instrument to understand this problem.

The reason why Diepsloot was chosen is because it is a typical informal settlement and thus could be used to illustrate the problem of pollution and how people might be involved. By typical I mean that the level of pollution as a result of day to day activities in Diepsloot is critical to understanding pollution in informal settlements in a South African context. The level of pollution in this settlement is known to be extreme enough

to illustrate the problem. A typical informal settlement would be characterized by a lack of proper housing, overcrowded homes, poor health and educational services, poor ablution and waste collection services, inadequate social amenities, unemployment, high levels of poverty and poor infrastructure (Evangelides, 2004). I am also familiar with the study area and this afforded me an advantage in terms of entering the area for the field study. Being familiar with Diepsloot also means that, choosing it was based on prior knowledge of the area and not random selection. Furthermore, the study is based on a single case study, and the reason for this is explained below.

In most studies researchers would use more than one case study in a qualitative enquiry, but in this case, in order to keep the study simple and straightforward, and also due to time constraints, a single case study was used. Cresent (1998) argues that the motivation behind researchers choosing multiple case studies is the idea of generalisability. In my study, limited time was a constraint that would weaken the depth of data collection if more than one case was to be explored. Creswell (1998) points out that collecting enough information to provide a convincing discussion on the case relegate any need for more case studies. Along this line, Strauss and Corbin (1990) agree with Creswell (1998) when they assert that collecting diverse data and carefully inducing it, should lead to theory that is abstract enough to be applicable in similar settings.

3.3. Description of data collection and analysis

The sampling technique employed in probing people's perceptions in this study was purposive, and therefore made use of key informants (Bryman and Burgess, 1999). Since the methodology is exclusively qualitative, the size of the sample did not matter in so far as the information was rich enough to draw conclusions. The key informants in Diepsloot were residents, the EHO and the Ward Councillor. Key informants are people who are very familiar with the area under study (Schwandt, 1997: 78). The key informants were used as channels through which to gain access and gathering information. The data collected herein was analysed using the thematic analysis technique. In this technique people's ideas are transcribed from audiotapes and either paraphrased or taken as direct

quotes (Aronson, 1994). Likewise, ideas from informants in this study were either paraphrased of taken from direct quotes which were then put in tables.

3.4. Focus groups interviews

A focus group interview involves a group of about 6 to 10 people with a common interest, engaging in a purposive discussion, guided by a moderator who facilitates the discussions in order to extract information from participants (Schurink, *et al.*, 1998). The term 'focus' denotes the fact that the discussions are limited to specific themes (Stewart and Shamdasani, 1990, cited in Schurink *et al.*, 1998). According to de Vos *et al.* (2005), a large group would require higher level of facilitator involvement and thus requires an experienced moderator to control participants. In this study, due to the researcher's lack of experience in facilitating focus group interviews, three groups of 6 participants were invited to participate. According to de Vos et al. (2005), the number of focus groups needed is 4, though the greatest amount of information is gathered on the first two sessions. According to Shurink *et al.* (1998) two sessions should be enough because both the third and the fourth sessions would bring in no new information, and thus a saturation level would have been reached

Ferreira and Puth (1988, cited in de Vos, 1998) emphasize the fact that focus groups should be small to afford everyone a chance to speak. The researcher should make a decision not to invite close friends and family members to take part in the focus group. This would affect the neutrality of the moderator (Schurink, *et al*, 1998), and discussions might be biased since friends or relatives might "pair" (de Vos *et al*, 2005). Care should be taken to deal with dominant participants who might mask the interaction of other participants or otherwise cause of the discussion to veer out of the thrust of the selected theme (de Vos *et al*, 2005). Masked participants (those who keep quite during discussions) should be encouraged to participate by stressing the fact that participants need not agree with each other and that participants' opinions are equally important (Frey and Fontana 1993, cited in Ferreira and Puth, 1988). It is also important for the moderator

to take note of any community incidents or any comment from participants, which might divert or disrupt themes in a focus group (Shurink *et al.,* 1998).

Information in a focus group is collected through open-ended questions, where participants are allowed to answer freely from a variety of viewpoints (de Vos *et al.*, 2005) i.e. no wrong or right answer. In this study, open ended questions were formulated based on the research questions as they appear in Chapter 1. See Appendix B, for the questionnaire (interview schedule). The interview schedule was piloted with six students at Esselen Residence, University of the Witwatersrand. Selection of the students was based on area of study, with three from the school of politics, two from environmental studies and one from social work. Adjustments were made and the questionnaire was ready for the field work. The time spent collecting data using focus groups was one month, including recruitments and interviews. This was the time starting from the 22nd of June to the 25th July 2007.

3.4.1. Recruitment of participants in focus groups

According to de Vos (1998) recruiting participants in focus groups is a challenging exercise. Invitations should be personal and it should stress the fact that the participants have the expertise and insight needed in the study (Schurink, *et al*, 1998). In this study, I recruited participants having the same background, because they understood each other. In this regard, recruitment was done by the researcher personally through meeting with prospective participants and introducing the study to them. I introduced the subject of the study, what I need from them, as well as the available incentives for participating, which included refreshments and lip balms. I also gave prospective participants letters for extra information about the purpose of the study. All interviews took place at my brother in-law's house in Diepsloot Section 3, because it was closer to the informal settlement (participant's homes), quiet and free from disturbances. I tried to balance the proportion of employed and unemployed participants. In total there were eight employed and ten unemployed participants. Out of these, ten were women and eight men, in the age group

ranging from eighteen to fifty two. All discussions in the focus groups began at two ‘o clock in the afternoons and each lasted for one hour.

3.4.2. Dealing with conflicts in focus groups

Focus group interviewing requires knowledge of group dynamics (Schurink, *et al*, 1998). The moderator should be prepared to deal with disruptive behaviour (Schurink, *et al*, 1998). For this reason I had to scan through the literature on how to handle group dynamics. Differences in characteristics like age, education, occupation and religion would work against the cohesiveness and co-operation of individual in the group, and thus make it difficult for the research objectives to be obtained (Schurink, *et al*, 1998). It is therefore important to consider differential attributes of individuals to avoid putting other participants under group pressure. de Vos *et al* (2005) maintain that the right composition of the group is important to allow the flow of discussions. In the case of arguments, participants should be encouraged that in a focus group the point is not to reach an agreement, but rather to say as much as they possibly can, about how they feel about a specific topic (de Vos *et al*, 2005). It is within this background that I resolved some of the conflicts that came during the focus group interviews. Some of the challenges that emerged in the three focus groups are outlined below

3.4.3. Challenges during focus group discussions

Two types of challenges were experienced during focus group interviews. The first set of challenges pertained to the recruiting of participants, and they involved:

- Residents not willing to take part due to an earlier incident that led to key informants being arrested for providing researchers with confidential information. This involved research by UNISA on whether the decision making process at the local level was inclusive or not. Local politicians who took part in the study were later arrested for divulging confidential information.
- People not showing up as agreed, and even after having phoned them to confirm their attendance on the day of the discussion

- People arriving late at discussions

The second set of challenges is those experienced during the discussions with people. In this regard, there were conflicts between men and women regarding the manner in which waste was disposed in Dieplsoot. While on the one hand men claimed that women were responsible for the mushrooming of illegal dumps, women maintained that deliberate dumping was done by everyone. I managed such arguments by emphasising that they do not have to agree on any thing, but rather they should speak as much as they feel about the problem of pollution in their environment.

3.4.4. Advantages of focus groups

Focus group interviewing has grater potential of enhancing participatory action planning (de Vos, 1998). This data collection technique has the potential to empower communities to take charge of their own lives, and was used to validate data obtained through other qualitative methods.

3.4.5. Disadvantages

Focus groups are blamed for being biased and subjective because the comments of participants have to be interpreted. It was financially costly because, I had to provide participants with snacks and lip balms as incentives for participating. Regarding incentives I provided 18 participants in the focus groups with lip balms for the cost of R10 each, and snacks or meals for R60 for each focus group. There was no specific reason for buying lip balms, other than providing an extra incentive for participants. The total cost was R360, and the money was provided by my brother and my brother in law.

3.5. One-on-one interviews

The one on-one interview is also referred to as an in-depth interview. They are used to probe more in-depth perceptions about a particular issue (Smith *et al*. 1995, cited in de Vos *et al.* 2005). It means therefore that, the questions are designed not to dictate, but

rather to guide the interview. In this regard semi-structured one-on-one interviews are appropriate in answering the questions as they appear in Table 1. For this purpose, I formulated an interview schedule to serve as an instrument to engage participants. According to de Vos *et al.* (2005) this schedule is a questionnaire to guide interviews. This is attached in appendix B, and like the focus group before, was piloted with the students at the University of the Witwatersrand's Esselen Residence.

The purpose of the one-on-one interview stems from the need to cross examine information so as to establish validity. This view is in line with Creswell's (1994) concept that the bias inherent in a certain source of data can be dismantled by combining it with other sources. The information from the one-on-one interviews was cross-examined against data generated through focus groups interviews. This is also referred to as data triangulation. In this study one-on-one interviews relied on purposive sampling. People were selected based not only because they are affected by the problem of pollution, but also by the fact that they have the potential to provide valuable information that would help in attaining the objectives of the study. Six people were interviewed between the 17th of July and the 22nd of July 2007. There were two women and four men. Amongst these two people were unemployed and four were employed and their age group ranged from thirty two to sixty six

3.6. Interviews with the EHO and Ward Councillors

Environmental health officers and Ward Councillors have rigid daily schedules. For this reason scheduling interviews with them was a challenging task. I met for the first time with the Ward Councillor on the 22nd of June 2007 to present a letter requesting permission to talk with the residents of Diepsloot. I invited him to participate on a one-on-one interview in the study, and the interview was scheduled for Friday the 29th of June. Due to his tight schedule however, this interview was cancelled and in fact two more interviews were planned for two consecutive weeks without success. The 25th of July was the day when I manage to interview the Ward Councillor. Regarding the EHO, an interview was scheduled for the 25th of June 2007, which was three days after meeting

with the Ward Councillor. The interview with the EHO occurred on the latter date. Data generated with the Ward Councillor and the EHO were compared with both the focus group and one-on-one interviews. This is the last step on primary data gathering, and having finished with it, data was transcribed and analysed. The time taken for data gathering in this category of data gathering was five weeks.

3.7. Limitations of the study

A *prima facie* limitation of the study was the fact that it is my first study, and I have minimal experience in the subject being studied. My planning was disrupted by the timing of the availability of the EHO and the Ward Councillor, and therefore I had to keep on changing and readjusting. Another limitation was associated with lack of literature regarding smoke pollution attributed to informal settlements. While this might be a limitation, it provides an opportunity to contribute to knowledge regarding air pollution in informal settlements. Furthermore the study relies largely on people's viewpoints and opinions thus would include personal subjectivity which would affect the final outcomes.

The study was an exercise bounded by time and thus required careful time management. Since the study was only focusing on one case study, it would not generate generalisable results, but Creswell (1998) does not see this in the same light, for he argues that, collecting more data from multiple sources is enough to nullify any need for more cases, and thus allow application of the results in any similar context.

3.8. Ethical considerations

Schurink (2000:256) asserts that "field work is riddled with moral and ethical dilemmas." It important in this regard that information gathering be balanced with fair treatment of the people who themselves are information sources and to whom the very information is going to be distributed (Erikson, 1967). Schurink (2000) posits that problems associated with moral and ethical dilemmas are not easy to identify beforehand, and for this reason

they have the potential to alter the research design at a later stage. It is therefore important that the researcher remain on guard for confronting ethical issues in the field. If ethical dilemmas are not accounted for at the outset, they will potentially derail the study, and thus results in outright waste in respect of financial expenditure and misguided efforts. At the outset of the research I sought to resolve ethical problems related to the following issues, (which according to Dane (1990) are most crucial):

3.8.1. Researcher's identity

To all participants, I clearly identified myself as a student from the University of the Witwatersrand carrying out an academic study on people's perception regarding their role in limiting pollution in their environment. Participants were participating out of their own volition, regardless of the fact that the study may not bring about any substantive change in their neighbourhood. Participants were treated with the utmost consideration and were reminded of their right to withdraw from the interviews at any time if they so wish.

3.8.2. Voluntary participation

Participants, out of their own free will allowed me to engage them. According to Dane (1990) participants should not be bullied to participate or be offered incentives that are more than reasonable. I only engaged participants who were interested in participating within the limit of (or without) the incentives I intended to provide.

3.8.3. Informed consent

In order to be able to make an informed decision whether or nor to participate in the study, people would require the necessary information about the study (Dane, 1990). I provided all information that might affect people's decision to participate in the study. This included introducing the purpose of the study, what I needed from the participants and the fact that I am just carrying out an academic study, and it is unlikely that it might

bring about any change. In this regard each participant had to sign a consent form to show that they were informed before hand about their rights and the purpose of the study. See copy of consent form attached in Appendix C.

3.8.4. Physical and psychological harm

I was bound to protect the participants from physical or psychological harm that might come as a result of participating in the study. Pollution is a problem rooted in socio-economic conditions of people, it is true therefore that some people might be embarrassed by the enquiries, thus they were informed that the purpose of the study was not to assess people's socioeconomic backgrounds but rather to understand their views regarding their commitment to reducing pollution in their environment. The study amounted to no psychological harm such as the loss of self esteem and or embarrassment in anyway.

3.8.5. Self determination

Given all relevant information about what the study intended to achieve, and what was required from the participants, they were assumed to have the ability to make decisions for themselves. Everyone therefore participated out of their own freewill.

3.8.6. Anonymity

Participants were assured that the information was intended for an academic exercise and thus would never be distributed to third parties. A letter (printed on the University of the Witwatersrand letterhead) (see appendix A), signed by the Ward Councillor to show that I was permitted to conduct the study, was provided to participants as proof that the exercise was only for academic purposes. No person's identity was recorded in this study.

3.8.7. Confidentiality

In order to ensure confidentiality, particularly with regard to those participants whose identities were known to me, a consent form was signed to assure them that all taped discussions and raw information taken during the interviews would be destroyed after they have been transcribed into an academic document. For this reason all the recordings have been destroyed to protect participants' identities.

3.8.8. Reporting research results

One of the academics at the University of the Witwatersrand, Prof Alan Mabin, said (during the proposal presentations of this study) that "the purpose of this exercise is not to solve the problems of Cities, but rather to demonstrate students' ability to conceptualize and produce a lucid document that can be published". It is within this line that accuracy in reporting is demanded in order for the researcher to be able to contribute to knowledge (Dane, 1990). I therefore avoid reporting untrue information, and ensure that the report is clear for the assessor and contains necessary information supporting my line of argument and the conclusion and the study's recommendations.

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CHAPTER FOUR

4. FINDINGS

4.1. Introduction

This chapter presents the findings of the research on the perceptions of communities regarding their roles in limiting pollution in Diepsloot. The results are a collation of the field survey conducted in Diepsloot, also including the findings on municipal service provision obtained through interviews with the municipal councillor and EHO. Since the research method allowed for triangulation, this chapter also contains view points from focus group and key informant's interviews. In a situation where interviews are conducted with people having different roles in society (i.e. leaders and residents), contrasting view points are likely to be obtained. The method of triangulation helps in verifying data, and therefore curbs the problem of having to follow blindly the views of a particular group without being critical about what was said. The results would follow the objectives of the study, and this regard the heading themes in this chapter answers particular the question upon which the study was based.

4.2. Perceptions of people towards limiting pollution

This was the central theme of the study, and therefore draws from all participants, including, focus group discussions, one-on-one discussions and interviews with both the Ward Councilor and the EHO. A departing point towards probing people's perceptions regarding their role in limiting pollution was to record what they thought were the major environmental problems and why. In this regard each participant or a group of participants were requested to rank a set of given themes (see Appendix B), including water pollution, flooding, air pollution, smoke, solid wastes, fire hazards and pests and flies. In all, there were 24 participants in the study, including three focus groups comprising of six people each. The results of the discussions around the major environmental problem are recorded in Fig1.

Fig.1: Perceptions as to which is the major environmetal problem in Diepsloot

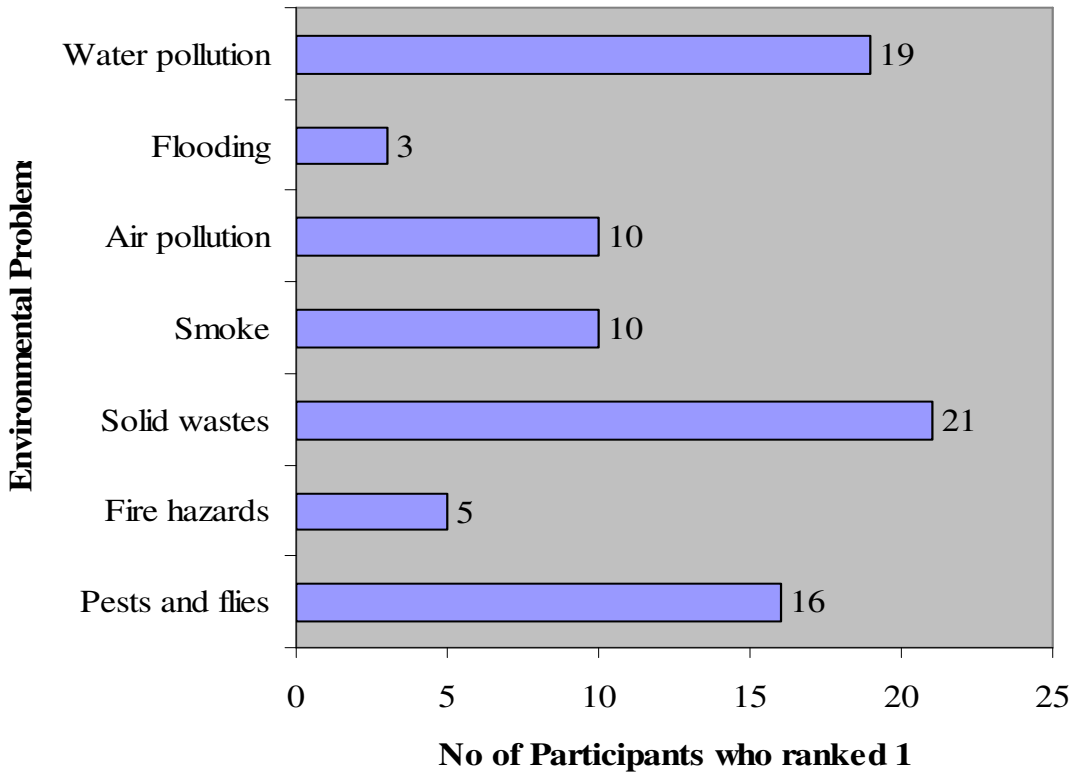

Figure 1 above depicts people's perceptions as to which are the major environmental problems in Diepsloot. Each bar indicates the number of participants out of twenty four who ranked a particular aspect as the more problematic. This means that a certain number, out of the same twenty four participants, ranked something as being more problematic. From an analysis of viewpoints from all twenty four participants, it follows that 21 people tagged solid waste the more problematic than others. The second and third most problematic environmental issues are water pollution and pests and flies respectively. Most people demonstrated and indicated an understanding of the fact that all environmental problems are webbed together and cannot be isolated.

Accumulation of waste was seen as a trigger for a cascade of events leading to problems such as:

- Bad odours: wastes decompose in dumps releasing bad odours.

- Pests and flies: the bad odours coming from decomposing organic waste and the fact that it is permanently dumped attract flies and other harmful insects like mosquitoes. These then find their ways to people homes.
- Attract rodents and domestic animals feed from them: solid wastes provide a viable environment for mice and they find their way into people's homes.
- Smoke: People burn waste, and as they do so "mice run away from the burning heat and into our homes" (a female informant from the focus group).
- Go into water ways: the environmental officer pointed out that solid waste is the major source of water pollution because people dump into streams.

It is clear that most environmental problems are the aftermath of solid wastes, and most people were aware of this fact. Generally people did not establish a clear link between fire hazards and flooding with solid wastes and other environmental challenges. A few of the participants highlighted that sometimes the burning of wastes were implicated in inadvertent burning of many shacks. For most of the people however, shack fires were not inextricably linked with solid wastes, and the former problems were mostly a results of ignorance, for instance leaving a paraffin stove or a candle burning when one is going away.

4.3. Responses by local government: perceptions of EHO and Ward Councillor regarding the environmental health problems

From the interview with the EHO based in Diepsloot, it follows that the major environmental problems are attributed to solid wastes, a view also held by the Ward Councillor. This means that both the Environmental Health Officer and the Ward Councillor are of the same opinion as residents who participated in the focus groups and one-on-one discussions. According to the Environmental Health Officer, there are 76 'hot spots' where people are littering. In actual fact these hot spots are illegal dumps and are located very close to people's shacks. For the Ward Councillor, waste is problematic because it leads to an 'ugly' spatial view, blocks water ways and creates a habitat for insects and rodents. He further emphasised that "*waste is a problem because people may*

know the right things to do, but would deliberately dispose waste at their door steps". The EHO rationalised his opinion regarding waste by pointing to the fact that it is central to health problems, and government is not doing enough to manage it. He reinforced this line by focussing on the pollution hot spots, and pointing to the fact that government intervened by providing communal waste containers in some but not all of them. Below are figures of two pollution hot spots in Diepsloot. In Image A, a trash container has been provided and in Image B, people are just dumping on an open space.

Fig 2. Two of the 76 pollution hot spots in Diepsloot.



A **B**

Source: Field Work Conducted by Mporetji S. (2007)

From Image A , we note the fact that rubbish remains a persistent problem even when the refuse container is not full. This provides some evidence as to why solid waste is deemed the major environmental problem in Diepsloot. Solid waste in Diepsloot is also a source of water pollution, and the Environmental Health Officer noted that most of the waste dumped into water courses includes plastic bags and papers. At a glance, the presence of solid waste in water may be attributed to the wind. From the findings, wind appears not to be the only factor leading to solid wastes in water, and according to the Environmental Health Officer people deliberately dump their wastes into stagnant or running water. See figure 3 which shows water contaminated with plastic material and papers.

Fig 3. Stagnant water containing solid waste in Diepsloot



Source: Field Work Conducted by Mporetji S. (2007)

The two images1 and 2 reflect an appalling environmental situation in Diepsloot. From observation during the field work it was noted that some people defecate in plastic bags, which they throw in stagnant water. It is clear that the people themselves have a better understanding of the reality of pollution and perhaps why it would remain a perpetual problem. It is important at this point to assess people's perceptions regarding the way they dispose their waste.

4.4. People's perceptions regarding waste disposal

Discussions with informants, both one-on-one and in the focus groups have shown that the disposal of domestic waste at the community level follows a simple path. Firstly domestic waste is placed in small grocery bags, which are then disposed (according to informants) either in communal containers, which are sometimes located more than 400m away, on the streets, and in streams and water ways in certain streets. Generally people

found their ways of disposing waste problematic and unsustainable and many problems associated with their disposal practices were discussed: these include,

- Bad odours.
- Flies and rodents infestation.
- Anaesthetic spatial views.
- Health problems and.
- Social implications.

For the people of Diepsloot unsustainable disposal practices are not accepted, and in this regard people suggested some key community based approaches that could be followed to stop or minimize such practices. Approaches as suggested by informants include informal waste collection, recycling and an effective reporting system. These approaches reflect people's feelings about the state of their environment. The three approaches mentioned above have been deemed the most sort after by some of the informants and for this reason, a detailed discussion about people's thoughts on each have been presented below.

4.4.1. Informal waste collection

Most adult women in the focus group thought that waste could be minimized by an 'informal waste collection approach'. For the informants informal waste collectors would be unemployed community members collecting waste from households on a regular basis. In this regard each household could pay a flat monthly rate which would serve as compensation for informal waste collectors. While some people (mostly males) did not go with this line, for reasons that informal waste collection should be a responsibility of local government, the vast majority thought it would keep unemployed people busy and provide them with a stipend at month end. The issue of exploitation did not escape people's thoughts, for they pointed out that informal waste collectors should be protected by local government. This means that if informal waste collection is to be adopted, local government should assist in forming a community based institution to protect informal waste collectors.

4.4.2. Setting up a reporting system

Some informants suggested that waste could be minimized by reporting people who deliberately disposed of their waste inappropriately, for instance on the street or in streams. In order to do this, there was a need for initial conditioning, like forming a policing structure that would focus on pollution rather than issues of crime. This could be in the form of street committees that are aligned with a formal unit in the local council to ensure that polluters are sanctioned. There were several limitations to this including:

- Fear of being hurt by polluting culprits.
- People did not know each other well, therefore there is a need for people to be allocated individual plots, so reporting could be based on the stand number rather than the name of an individual.
- Polluters could be people from far away going to deliberately pollute somewhere else.
- There is always corruption, even at this level people can solicit bribes and let polluters get off the hook.

With its limitations, the approach of reporting was viewed by many as an effective way to reduce waste as long as local government was willing to work with the community to put the right structures in place.

4.4.3. Recycling

Some people have since realized that some of the waste in Diepsloot could be sold back for money. One man in his late twenties had this to say,

> *"Most puddles of stagnant water in Diepsloot are filled with plastic bags and bottles. If you go to almost all the dumps around, most of the waste would be plastic and to a less extent papers and cans. If only recycling companies were not too far, whereby I would require a car to transport recyclable waste, I would have long collected the plastics and sold them".*

This was supported by some, and of course there those who firmly disputed it. The latter group held that most of the waste in dumps and in streams of water is like a mesh of

many substances, and it would be almost impossible to extract or separate plastic from other material. At this point one person suggested that waste should be separated at the level of households if recyclable material is to be collected without causing any harm to those who handles them. A brief discussion on this view proposed that local government provide colour coded refuse bags.

When local government was failing to provide black refuse bags regularly, how can they provide color coded refuse bags? I challenged the informants with this question to to be aware of ambitions that might be far beyond their reach. Suggestions were rolled out in focus groups discussions. One interesting point along the line of waste separation was provided by a key informant in a one-on-one interview. This was a woman in her mid forties, and she highlighted that those who want to collect waste for recycling can provide households with different plastic bags or containers to help in separating garbage. She further said that *"Perhaps waste collectors can make deals with recycling companies to provide them with such plastics or containers"*.

Most informants had a very simple understanding of the idea of waste recycling and therefore seemed not to have been aware of the complex web of issues around it. Some people suggested that recycling could be made easy if the government could turn some of the illegal waste dumps into formal waste fill sites. These could be fenced up and people could get permission to go in and scavenge for recyclable material. By coming up with such a suggestion, it appears that health issues are not been taken into account. People were not looking at the problem in an integrated and holistic manner, they only focused on the benefits, thus ignoring the aftermath of a waste dump that is very close to dwellings. With all its complexities and elusiveness, waste recycling was celebrated by many as an effective community based approach.

Some people's perceptions regarding their roles in limiting pollution are summarised in Table 2. These reflect some of the norms and practices followed by the community of Diepsloot as ways of limiting pollution. Tables 2, 3 and 4 present summaries of people's

perceptions or norms and practices approved by the broader community as ways of limiting pollution.

Table 2: Summary of people's perceptions regarding their role in limiting pollution in Diepsloot.

Participant (s)	Views
Residents (Focus Group) (people's perceptions regarding their role in limiting pollution)	▪ In some streets there are organised street committees which discuss issues of common concern, especially littering, accumulation of wastes, stagnant water, and water running from blocked sewage pipes. ▪ Regarding the accumulation of wastes, the residents would agree to voluntary pick them up and put them in grocery bags and dump them in a nearby refuse container. The problem is that the container gets full and it is not collected. ▪ The rubbish in the bin flows out and is hauled by the wind back to the streets. For this reason some people pick them up and burn them. When this happens the rubbish in the container gets burned as well. This causes smoke, but it the best option that can be done to reduce the accumulation of wastes on the streets. ▪ Collective agreement when dealing with rubbish is not always the case, as some people hold perceptions that they came to Gauteng to look for jobs and not to look after rubbish. Such people dump waste near other resident's shacks. Complains in such situations, always lead to squabbles and people might become forever in conflicts. ▪ One of the informants had this to say regarding the role of community, "I believe that one way of addressing the problem of wastes at the community level is to select people in the community who will be responsible for picking them up. These people would be compensated by the community. Indeed it would not be an easy exercise to work without compensation, therefore the waste pickers

	should be treated like informal employees and thus the compensation should be reasonable and fair."

Table 3: Ward Councillor's perception towards limiting pollution: Ward Councilor's perspective

Participant (s)	Views
Ward Councilor (People's perception towards limiting pollution)	▪ Pollution is a common problem to the people of Diepsloot. People therefore need to be organized into street committees if they are to deal with pollution problems as a community. This requires co-operation from everyone in any particular street so that everyone will be committed to what is deemed to be proper in dealing with pollution. ▪ In areas were street committees are strong, there is hardly any water running on the streets, nor heaps of stinking wastes. In areas where there are observable heaps of decomposing waste and stagnant water, residents are less co-operative and there is poor community coherence in solving common crises. ▪ At times people litter deliberately, because they want to draw the attention of government. He said "*This way it is hoped that if the environment is filthy, officials would attend to our settlement crises*". The Ward councilor further states that "*while this might be true, government operates within a certain bureaucratic environment, and therefore responds very slowly."*

Table4. EHO's perception towards limiting pollution: EHO's perspective

Participant (s)	Views
Environmental	▪ In order to understand the behaviour of people regarding pollution, it

Health Officer (EHO) (People's perception towards limiting pollution)	is crucial to understand the township culture. The EHO highlighted that life in Diepsloot is more about survival than any other thing. Pollution is not an important issue in so far as it does not enhance survival. In this way, people are less likely to be committed to reducing pollution where they stay. Pollution is also viewed as a way of showing the state that people are living in poor conditions and therefore should be provided with proper housing and better services. ▪ The people of Diepsloot tend to come together when there are crises of eviction. For instance in 2005 they destroyed Council offices because someone told them that government was planning to move them to Brits. Community cohesion in dealing with pollution is very minimal. ▪ There is a need for workshops aimed at transforming peoples thinking. The street committees do not care much about the environment, perhaps for the reason that they want to draw the attention of local government to their environmental problems. Another problem pertains to the fact that the people of Diepsloot demand a paternalistic kind of service provision from local government. This is a problem because this community hopes that by littering they create job opportunities for people to be hired by the local government.

4.4.4. Evaluation of Table 2, 3 and 4

The three tables recorded various perceptions regarding their role in limiting pollution in Diepsloot. As noted, the perceptions have been drawn from residents, the political leader (Ward Councillor) and the EHO. From Table 2 it follows that most of the people support the idea of street committees in limiting pollution. While this opinion is also held by the Ward Councillor, the EHO believes that street committees somehow encourage people to litter. The environmental officer does have a point when he supported his view by saying that street committees sought to draw government attention by encouraging people to

litter. This however is an oversight from the street committees, as the Ward councilor points out that government responds very slowly.

Still on the issue of street committees, the residents and the Ward Councillor have the same ideas when they emphasise that where there is no cooperation, the street committees are weak and residents are not only living in a filthy environments, but they are constantly in conflicts. The EHO who apparently did not go with the idea of street committees, stressed the need to understand what he referrers to as '*the township culture'*. In this regard township culture referred to how people live. To understand this notion better, theory says that individuals are products of social structures and processes (Abercrombie et al, 1998). Social structures include families, schooling, religion, economic systems and sets of norms and values (Abercrombie et al, 1998). This means that whatever is done by the community would be carried through and be propagated by individuals. Individuals are shaped in part by social structures, and therefore the EHO might be pointing to the fact that pollution would always be there in townships as long as there are organised structures using it as a way of highlighting problems with service delivery (e.g. street committees in the case of Diepsloot).

The EHO's opinion seems to have been influenced by standard theories of the interaction of people and their environment. His views and the invocation of '*the township culture'* are theoretically sound, but this should not blind people to the fact that there is always a gap between theory and reality. By this I mean that the EHO's view follows theoretical debates regarding the interaction of people and their physical environment, for instance the structure and agency debate (see page 98, section 5.8.2). An understanding of the way 'township people' live or interact with their natural environment would enhance an understanding of the complex problem of pollution in their environment. Pollution in Diepsloot is more intimate in people's lives and therefore their view should take precedence over theoretical orthodoxies or frame works. I believe that, Insofar as the views of residents are not practicable, fair trade-offs between normative practices and resident's perceptions should be struck.

4.5. Perceptions regarding the role of local government in refuse removal

This study takes a holistic approach that includes the role of residents as well as the role of local government in reducing pollution in Dieploot. Assessing the role of government would lead to better understanding in respect of striking responsive trade-offs with community roles. Being dispassionate or impartial is crucial when analyzing results, therefore a holistic approach would help in improving objectivity in the analysis chapter. This means that no party would be blamed (when necessary) without evidence. Like the presentation of results on people's perceptions, the three Tales 5, 6 and 7 below, present what is perceived to be the role of government by the residents, the Ward Councillor and the EHO.

Table5: The role of local government: residents' perspectives

Participant (s)	**Views**
Residents (Focus groups and one-on-one discussions) (what has Government done to limit pollution in Diepsloot)	▪ On individual stated that *"We are aware that the municipality has a mandate to collect waste in all sections in Diepsloot, but the reality is that, Section 1 (the informal settlement) is largely ignored"*. ▪ Informants in the focus group said that Environmental Health Officers do not come to Section 1, and therefore most of the residents have never seen them. Even people who are trained to teach the community about environment and health do not come to section 1. ▪ People emphasised the need for local government to arrange workshops to educate people about environmental health problems arising from pollution. Environmental health officers were said to spent most of their times working in areas that do not have as much pollution as Section 1. As already stated in the previous discussion, it has been noted that some people defecate in plastic bags which they throw on the streets where children play. From this one can conclude that environmental health education can be very crucial to refocus the thinking of such people and to bring about a collective benefit,

	because unless such practices are stopped they would always backfire in the form of disease outbreaks. ▪ Some people pointed out that, sometimes littering is a conscious and deliberate choice. This point to the fact that people who litter, do it everywhere, even in clean shopping malls where trash cans are located within easy reach. Training people can therefore bring about a more sustainable solution in Diepsloot. ▪ The density of shacks is increasing in Diepsloot, and for this reason streets have become narrow such that the municipal refuse trucks fail to pass through to empty some of the refuse containers. Most of the containers that are not collected are surrounded by shacks and thus become a problem to the residents, especially with regard to bad odours, occasional fires as people try to reduce the overflowing rubbish and rodents and fly infestation. ▪ Since the refuse truck cannot go through some of the streets in Diepsloot, people suggested that it could be more appropriate if the municipality would hire workers who will collect rubbish from streets or shacks. They would then be dumped in some kind of a waste station, and latter be picked up by the truck for the final destination. ▪ During the focus group one informant said, "*On one occasion I saw a municipal truck passing and I stopped it to show the workers waste that has not been collected for more than three months. To my disappointment, the municipal workers in the truck literally refused on the ground that the waste was too much to be handled*". Reflecting on this view: if one can establish the truth about this, a conclusion can be drawn that poor service provision is a deliberate choice by the municipal workers themselves. ▪ Residents held that it would also be important if the government provided them with black refuse bags so that they could stop using small grocery bags for putting household refuse in. Instead what is happening is that people get plastic bags once every three months.

	▪ The one way that government can help in easing the problem of waste accumulation in Diepsloot is to dedensify the area, so that there are fewer people living on a small piece of land. This would be possible if there could be law enforcement, especially geared at preventing people from erecting shacks on areas where some people have been relocated to formal housing units. ▪ Dedensification can lead to the benefit of a long-term reduction of littering. People maintained that even if a law on littering was passed, it could only be effective when everyone has their distinct home. Whenever someone throws rubbish on the street, they would be reported, and then sanctioned according to the law. It is difficult to report someone you do not know, but if their house is known, then the house number can be used in reporting them. In this way government would have assisted in reducing pollution in the Diepsloot informal settlement

Table 6: The role of local government: Ward Councillor's perspective

Participant (s)	**Views**
Ward Councilor (What has local government done to limit pollution in Diepsloot)	▪ In dealing with solid waste the local government serving Diepsloot received funding from The Gauteng Department of Environment and Agriculture (GDEA), and trained 35 youth on waste management. These youth then came back and pass on these skills to the people in Diepsloot. The government then helped youth to register with Section 21 Company under environment. This was a non profit organisation that works very close with Pickitup, which ensures that the area is clean from waste. The trained youth started a business for recycling in partnership with a local business man. The youth would go around scavenging for bottles and other recyclable wastes. These would then

	be taken to the businessman who would pay the youth who brought them. ▪ In Diepsloot, cleaning campaigns involving all stakeholders were launched this year. Stakeholders in this regard include Johannesburg City Parks, Department of Environmental Affairs and Tourism, Department of Water Affairs and the Department of Health. It is planned that three cleaning campaigns be held in Diepsloot every year. Reflecting on this view: it is ironic that the leading politician speaks of cleaning campaigns, but yet the community knows nothing about them. ▪ With regard to smoke, in Diepsloot, there were training campaigns that were conducted last year (2006). The programme was aimed at reducing the release of harmful gases as a result of burning coal. The name of the programme was *Basa njengo Magogo*, and it was targeting street hawkers who use coal for cooking and frying food on the street. These people were identified as the major causes of thick smoke in the transit camp because they use coal everyday and there is no alternative viable energy source that can be provided in the area, owing to the fact that electricity would be dangerous because of the shacks that are in close contact. In the programme, *Basa njengo Magogo*, people were trained on how to start a fire that would release minimal smoke. The technique capitalised on the arrangement of the material to be burned in order to make the fire. The normal or traditional way of burning coal was to start the fire first with wood and then putting the coal on top. This way, the fire start at the bottom and goes up, thus burning the coal on top. It has been observed that this way of starting the fire, results in the release of too much smoke into the surrounding air. In the project, *Basa njego Magogo* people were trained to start the fire with coal at the bottom and the wood on top. ▪ After the training programme was completed there was a need to

	monitor progress and environmental performance with regard to air pollution in the area. The Ward Councillor says that to do this a group of youth was trained to observe the way people make their fire and to also observe the amount of smoke being released into the atmosphere. This is an ongoing process and the results would be evaluated in due course. ▪ There are also bylaws that have been formulated to ensure that people do not burn coal on the pavements. Since this is a binding provision, anyone found burning coal on the pavements would be fined R50.

Table 7: The Role of Local Government: EHOs Perspective

Participant (s)	**Views**
EHO (the Role of Government)	▪ According to the EHO, the main custodian for environmental management and pollution control in Diepsloot is Pickitup. Pickitup has been contracted by the city of Johannesburg to deal with issues of waste management. This company releases three trucks per day to collect waste in the whole of Diepsloot. This is not very effective. Pickitup subcontracted *Thuthukani*, a group of people who goes picking up rubbish on the streets. ▪ The rubbish containers supplied by local government are not enough, and for this reason, people living near streams tend to dump their waste into the water, thus causing water pollution. The problem is that even the subcontracted company is unable to clean the waste that has been dumped into rivers. The EHO emphasised that in Diepsloot there are seventy six hot spots where people are littering. Ironically there are no rubbish bins in some of the hotspots, and therefore there is no control regarding waste accumulation. ▪ Pick it up employed 20 young people who go out everyday providing plastic bags to people living in shacks. This is done so that when the plastic bag is full, people could put it on the side of the road and would

	then be collected by the municipality. *"This however still is not enough. I think that one of the solutions to the problem of pollution is dedensification. By this I mean that people should be afforded free standing plots with at least a brick structure. This way everyone would be able to control their rubbish and therefore illegal dumping would be reduced*." The 20 people who have been trained to teach the community about pollution in Diepsloot, focus specifically on waste management. These people work only during the day from nine o'clock until 12 o'clock. Notable is the fact that most of the people living in shacks would have gone to work at this time. This poses a challenge because the very people who are supposed to be informed with regard to how they are supposed to act in order to protect the environment are unavailable. ▪ There are environmental management projects called *Akanani* and *Botho ke Bontle*, which are aimed at cleaning up Diepsloot through recycling practices. These projects have been initiated by the government and do not get the attention or support they deserve. These projects are not performing well also because of the scarcity of land for waste disposal. There is also a need for an official operational site that could be used as storage for collected recyclable waste that awaits collection by a recycling company. ▪ On the issue of sanitation and water running on the street, there has been a lack of foresight regarding the pipeline system for running sewage. This is because they have a diameter that was designed to cater for a small number of people. A mammoth influx of people in Section 1 has burdened the pipeline system, and therefore the pipes are forever blocking and releasing sewage into the streets. There are two solutions to this problem: one is de-densification and the other is to put a pipeline system with bigger diameter to cater for the high number of people. Another problem is the fact that people put material like fabric, plastic or even stones in toilets and these block the drains. These have been

	observed during the unblocking of drains. ▪ With regard to air pollution from the use of coal, in 2005, the Department of Minerals and energy (DME), initiated a project referred to as *Basa njego Magogo*. People were trained on how to start a coal fire that releases the minimum amount of smoke. Trained people were deployed on corners where informal traders burn coal for cooking so that then can demonstrate an effective way of starting the fire that releases less smoke than the convention way. Notable is the fact that since the programme was conducted there has not been any monitoring as to whether people are following the new way of burning coal. There has been cases whereby people died because they inhaled carbon monoxide released during the burning of coal.

4.5.1. Evaluation of Tables 5, 6 and 7

The tables present discrepancies and congruity regarding what government is doing, as can be seen in Table 5 and 6. The differences drawn from the latter three tables are summarised in Table 8 below.

Table 8: Differences regarding the role of government

Residents	**Ward Councillor**	**EHO**
▪ No refuse bags provided		▪ Refuse bags provided everyday (each household get one)
▪ One truck collects waste once a week		▪ Three trucks collect waste everyday
▪ No education on pollution		▪ Trained twenty five youth and deployed them to educate people about pollution

		everyday
▪ Never saw or heard about EHO in Diepsloot	There are three EHO based in Diepsloot	

From Table 8 it follows that, while on the one hand people say that there is only one truck that comes to Diepsloot once a week, the EHO on the other hand articulate that three trucks are released everyday to collect refuse in Diepsloot. Though there is a serious disagreement regarding the waste collection, both parties concur when they say that waste collection in Diepsloot is very ineffective. This means that the scale of service provision in Diepsloot is very limited. Another notable disagreement involves the distribution of black refuse bags. On this issue, the residents' claims were that government provided no refuse bags, and the EHO 'contended' that people were getting refuse bags every day.

The residents of Diepsloot also claim that they have never seen an EHO responsible for their area. This claim however was contrasted by the EHO who argued that there were 20 trained youth who conduct awareness campaigns and education on pollution every day in Diepsloot. There were many other discrepancies for instance the EHO claims that the people of Diepsloot want a paternalistic government, while the residents made it clear that they can do everything for themselves but they just require support from local government.

The residents, EHO and the Ward Councillor concur when they note that there is a need for de-densification in Diepsloot Section1, if pollution is to be properly managed in the future. Another line of congruity amongst the three involves littering as a conscious choice by some people in Diepsloot. From residents' views, government can curb this problem by constantly engaging with people through awareness campaigns and education on pollution as well as providing better services.

4.6. Reflecting on the findings

The management of pollution in Diepsloot involves an engagement of different actors. These actors include: Individuals, households, street committees, the community, politicians and government agents (like the EHO), corporatised units like Pickitup and community based organisations like *Botho Ke Bontle* and *Akanani*. In one way or another all the actors seek to address the problem of pollution through intervention in two areas: behavioural activities and physical activities. No particular actor can provide the whole solution, but together they can contribute towards a better solution or understanding of the problem. The latter two areas of intervention would be discussed briefly to reflect what is happening in Diesloot, and to further explain what is deemed appropriate

4.6.1. Motivating behavioural changes

Behavioural change is a theme that was articulated by the EHO. This is a complex idea, which was also discussed in almost all discussions, but using different terms. Primarily it requires education and knowledge on the phenomenon of pollution. It should be made clear as to who bares the burden of poor environmental health, what the roles of each actor or group of actors are, and the levels of responsibilities allotted to each actor. This requires a good system that is well coordinated, so that each actor becomes conscious of their behaviour in light of their role and level of responsibility.

The fact is that the whole community bears the burden of poor environmental health. For this reason environmental campaigns and training on pollution are required. In fact all actors should be work-shopped to modify their behaviour with regard to their interaction with the environment. This could also bring about reform on community based structures with regard to '*the township culture'*. The ultimate reality is that the way people think reflect on the way they will interact with their physical environment. Like in some developing countries, there is a need for forums to discuss environmental problems in Diepsloot. These should be organised by community leaders, the EHO and the Ward Councillor in Diepsloot.

4.6.2. Physical activities

There is an inextricable linkage between behavioural activities and physical activities. Getting the behavioural changes right will enhance a better physical performance. Some of the problems that can be teased out from the findings include:

- High density of settlement blocks access of refuse truck.
- Illegal dumping.
- Deliberate dumping.
- Lack of communal dumping containers.
- Unavailability of black refuse bags.
- Failure of municipality to provide a sustainable waste collection service.

Regarding the environmental problems; all actors should be drawn in, again each actor must have a distinct role and level of responsibility. If people are aware of the awaiting burden of poor environmental health, they might stop deliberate and illegal dumping. Proper planning of the settlement is very crucial to widen the streets for better access of the refuse truck in the settlement. Perhaps, in the interim, loaned small refuse trucks could be used until such time when the streets have been widened and properly planned. Also perhaps when there is commitment from the community and other actors, government would provide an incentive through better services, like providing black refuse bags, and collecting waste regularly.

4.7. Conclusion

This chapter has presented important themes emphasised by the Ward Councillor, EHO and the residents of Diepsloot. These include the role of street committees in reducing or exacerbating pollution', 'the importance of dedensification', the 'role of awareness and education on pollution', and the importance of recycling. Some more important themes would be discussed in detail in the next chapter, (Chapter 5) which analyses findings and reflect on case studies discussed in Chapter 2.

CHAPTER FIVE

5. ANALYSIS OF FINDINGS: REFLECTING ON CASE STUDIES

5.1. Introduction

This Chapter reflects on and is structured around the research questions. It builds on findings discussed in Chapter 4 reflecting on case studies discussed in Chapter 2. In this regard to tease out key themes that could be used to analyse findings, and these, would be used to answer the main research questions. Maintaining this view, the main headings in this chapter are conceptualisation of people's perceptions, institutional arrangements for solid waste management, people's perceptions on solid waste, people's perceptions on water pollution, people's perceptions on air pollution, and finally what can be done.

5.2. Conceptualisation of people's perceptions

The case studies of Hong Kong and Canada, regarding people's attitudes towards adverse air pollution (Susan et al., 1999; Ho, 1997) (see Chapter 2), have shown that people's perceptions can have a strong influence in informing policy making. In the case studies, people's concerns on air quality influenced the formulation of more responsive policies and standards that were enforced by governments. People's perceptions as a way of informing policy are therefore very important in this study. The findings about perceptions presented in Chapter 4 could influence policies and practices regarding pollution and management. Underpinning the problem of pollution management in informal settlements is the issue of the institutional arrangement. The form of institutional arrangement at the local level therefore requires a closer look.

5.3. Institutional arrangements of pollution management in informal settlements

Approaches for waste management would always be influenced by the institutional environment within which they operate. Before looking at the approaches to waste

management, it is crucial to consider the community based institutions that are needed for proper pollution management. Chapter 4 has demonstrated that waste management in Diepsloot is sometimes a shared effort between local government and the residents themselves (through street committees). Technically, this means that the management of waste depends not only on government's operating scale, capacity to promote recycling or educate residents, but on institutionalization at the community level. Other case studies have demonstrated that local institutions are very important in managing waste in informal settlements (Demanya, 2006; Kironde and Yhdego; 1997; Mubaiwa, 2007; Petts, 1995; Jonathan, 2005) (see chapter 2). An assessment of the research findings and literature regarding waste management lead to the view that, in Dispsloot community level involvement is minimal and not well organised.

From an institutional perspective, in Diepsloot, community involvement depends almost solely on the cooperative establishment of street committees. A snapshot of international case studies, for instance in areas like Sahakaranagar (in India), Dhaka and Khulna (in Bangladesh), Accra and Kumasi (in Ghana), Harare (in Zimbabwe), and Dar es Salam (in Tanzania), was used to show a more advanced institutional arrangement for community involvement. For instance the institutionalization of informal waste collectors, involvement at household level, involvement in the form of CBOs and the establishment of forums for deliberations on better practices (Khulna Series, 2000; Kironde and Yhdego, 1997; Jonathan, 2000; Mubaiwa, 2007; Demanya, 2006, Petts, 1995). In Khulna (see Chapter 2 for more details), local government provided institutional support to communities and further aligned community based institutions with municipal systems (Khulna Series, 2000), a practice that is absent in Diepsloot. In light of the literature, it is clear that a lot needs to be done by both local government and the community of Diepsloot regarding setting up appropriate institutional arrangements for waste management. The idea of institutionalization is very crucial and would therefore be further developed and suggestions as to what can be done will be provided in Chapter 6 (recommendations and suggestion for policy making). For now, having assessed the institutional environment for pollution management in informal settlements, it is

important to look at people's perceptions regarding their role in limiting pollution, starting with solid waste.

5.4. People's perceptions towards solid waste

The problems of solid waste in informal settlements stems from the manner in which people dispose their domestic rubbish. In Chapter 4, a discussion on the manner in which the people of Diepsloot dispose of their rubbish was provided. Deliberate disposal of waste in waterways and on the street is a common crisis in informal settlements around the world. Some of the problems resulting from waste raised by the residents of Diepsloot in the study like, bad odours, flies and rodents infestation, unaesthetic spatial views, health problems and the social implications have been presented in many articles, for instance (Kironde and Yhdego, 1997; Cairncross, Hardoy, Satterthwaite, 1990; Cairncross, and Ouano, 1990; Khulna Series, 2000). To the people of Diepsloot, one of the causes of these problems is illegal dumping. The problem of illegal dumping was repeatedly echoed in discussions with informants as well as in literature as one of the most disturbing factors leading to the mushrooming and overflowing of solid waste. A more detailed discussion on the problem of illegal dumping is provided below.

5.4.1. People's perceptions on illegal dumping

Solid waste was tagged as the most problematic environmental problem by the informants in Diepsloot. This is also supported by the EHO, who identified seventy six hotspots where waste accumulates without control. The waste hotspots are the actual illegal dumps (see figure 2 in Chapter4). The problem of illegal dumping has been recorded in a variety of case studies, for instance in the Tanzanian capital, Dar es Salam, Dhaka in Bangladesh, and the Zimbabwean neighbourhoods of Chitungwiza, Epworth and Mbare (Kironde and Yhdego, 1997, Mubaiwa, 2007; Khulna Series, 2000). The extent of the problem of illegal dumping varies from neighbourhood to neighbourhood depending on the commitment of communities and local government's capacity to handle it. Backtracking on this issue, and zooming in on the origin of illegal dumping, we gather

from findings (in Chapter 4) that it is caused by lack of municipal service provision, and lack of communal dumping containers (or otherwise refuse containers being located far away from people). Part of this line follows an 'orthodox' situation of developing countries, i.e. that illegal dumping is the aftermath of the failure of the conventional municipal waste collection system, for instance in Harare and Dar es Salam (Mubaiwa, 2007; and Kironde and Yhdego, 1997).

During the fieldwork in Diepsloot, it was noted that most of the waste that remained uncollected was that accumulating in illegal dumps. In Diepsloot most illegal dumps are located very close to shacks, in communal spaces that could be used for socializing. Beside the spatial view being dull and unaesthetic, it creates a habitat for harmful disease carrying vectors for both animals and people. Image 3 below shows one of the illegal dumps that is located not more than three metres from people's shacks.

Fig 4. An illegal dump located very close to dwellings in Diepsloot



Source: Fieldwork conducted by Simon Mporetji, 2007

A dog seen in the above figure (fig. 4) is feeding in a dump which most likely contains harmful substances. This reflects a serious health hazard to domestic animals in Diepsloot, and might impact on people since they are in close contact with domestic animals. From a health perspective, this image should raise concerns for an effective community based waste management system. Theory indicates that focussing on the health benefits as a lever for reducing pollution has been a very effective approach, for instance in the case of Epoth (in Zimbabwe) and Dhaka in Bangladesh (Mubaiwa, 2007; Khulna Series, 2007). In fact Chapter 4 has presented some of the practices and approaches viewed by the people as suitable within the context of Diepsloot. Literature as well, suggests different theoretical approaches for pollution management, most of which were tailored to particular contexts Kironde and Yhdego, 1997; Mubaiwa, 2007, Jonathan, 2005; Demanya, 2006). A discussion of the three levers (approaches) including the health approach; informal waste collection and recycling are discussed below.

5.4.2. The health approach

A variety of theoretical levers for solid waste management have been catalogued in the literature. One of these involves the use of health as a lever for mobilising people to reduce littering in their environment. Information from key informants in the focus groups demonstrated that the people of Diepsloot have a good understanding of the health impacts of waste in their environment. Some people claimed that children who regularly play around dumps usually present with diarrhoeal diseases and sometimes develop wounds that take time to heal. This was not surprising, since a mere look at the dumps reflected a viable habitat for infectious organisms. The bad odour coming from dumps attract flies and this works against the comfort of everyday living. Because of the smell, most of the people reckoned that they preferred not going outside unless it was necessary.

Outbreaks of diseases such as cholera, dysentery, and skin irritations (to which solid waste has direct causal links) were not referred to in a range of grey literature in the research area. This perhaps explains why, even though people are aware of the possible dangers of dumping on their door steps, very little is done to arrest the impending

problem. In other case studies, education on pollution has been used to curb diarrhoeal infections resulting from pollution, for example in some neighbourhoods of Zimbabwe and Bangladesh (Mubaiwa, 2007; Khulna Seria, 2000) (see Chapter 2). In the case of Diepsloot, information from the Ward Councillor and the EHO, highlighted that people get regular education and awareness inputs on pollution. A similar situation like the latter articulated by both the Ward Councillor and the EHO, is highlighted by Mubaiwa (2007) in the case study of Zimbabwe where people were trained and informed about the health impacts of solid wastes. In the latter case, a project was launched to educate people on pollution, and success was attained as people enjoyed the benefits of the reduction of vector related diseases.

The reason why the residents of Diepsloot claim that government is doing nothing regarding awareness campaigns is the fault of government, owing to their poor communication with residents. From the EHO's side, the educators on pollution work from nine o'clock until mid-day during the week. This is the time when most of the people are at work, thus raising the question as to who were they educating? Within this background it is clear that if proper planning is done to ensure that education is targeted, the times for awareness campaigns in Diepsloot should be adjusted so that the vast majority of the people, not at home during the week can be informed. Having considered health as a lever for pollution management, it is now appropriate to asses the idea of informal waste collection.

5.4.3. The importance of informal waste collection

Informal waste collection has been practiced in informal settlements of many developing countries including India, Bangladesh, and Zimbabwe (Jonathan, 2005; Khulna Series, 2000; Mubaiwa, 2007). Interestingly, the practice of informal waste collection has a different face depending on the context. For instance in Bangladesh there is a coordinated interplay between informal waste collectors and government (Khulna Series, 2000).In contrast, in a small Indian settlement of Sahakaranagar the form of informal waste collection has no clear linkage with government, and for this reason there are problems of

exploitation of informal waste collectors by the community (Jonathan, 2005). In Zimbabwe informal waste collection was treated as a business venture and there was a need to produce a business plan (Mubaiwa, 2007). While there are clear differences with respect to how informal waste collection is practiced in different neighborhoods, the fact remains that a contribution by the community is required, therefore making people always aware of the implications of waste generation.

In Diepsloot there were suggestions from the community regarding informal waste collection as an approach to limit waste. From the discussion (see Chapter 4), informal waste collection in Diepsloot would have its own unique face. Since people suggested that government should be involved in protecting informal waste collectors from exploitation, it means that the Diepsloot model would be similar to that of Bangladesh's Dhaka city (see Chapter 2), where the formal waste collection service was linked to informal waste collection. The important thing to consider with regard to informal waste collection is that it brought about good results in countries that have adopted it. This discussion highlights that if informal waste collection can be adopted with the help of local government in Diepsloot, it would bring about good results as it did in some neighbourhoods of Zimbabwe and Bangladesh. Adopting informal waste collection practices would require some preconditions, which largely depends on local institutions. The last approach for waste management in informal settlements is recycling, and a discussion is provided below.

5.4.4. Recycling in informal settlements

The idea of waste recycling has been raised in almost all the discussions conducted with the people of Diepsloot (community, Ward Councilor and EHO). Likewise, local and international debates with regard to waste management emphasized the need to promote recycling practices (Urban Green File, 2005; Bai and Suntanto, 2001; Leao, Bishop and Evans, 2001; Demanya, 2006; Jonathan, 2005; Závodská and Knight, 2002; Zerbock, 2003; DEAT, 1998). It is also one of the central themes held in high regard by the proponents of sustainable development. In South Africa, recycling is included in some

legislation and policy pertaining to environmental management e.g. NEMA (Act 107 of 1998) and the White Paper on Integrated Pollution Management, 1998.

The residents of Diepsloot did not know where to go to sell recyclable material, or otherwise claimed that recycling companies where located long distances away that would render any recycling venture financially unviable. In South Africa recycling is supported by institutions such as Collect-a-Can (for recycling tin cans), Plastics Federation (for recycling plastic) and the Glass Recycling Association (for recycling glass) and SAPPI (for recycling paper). Beside these institutions, some of which are not well publicized, the people of Diepsloot have a right to ask the EHO for information on recycling. Ironically, the EHO and the Ward Councilor highlighted that there are in fact recycling initiatives taking place in Diepsloot (See Chapter 4). Clearly this means that there is no proper communication between the residents and leaders or civil servants.

Having considered the institutional context of Diepsloot with regard to the management of solid waste and how these compare with case studies, it is necessary to take a holistic view and consider problems of air pollution and water pollution in much the same detail. The theory in Chapter 2 provides some direction regarding the analysis of data in this regard.

5.5. People's perceptions regarding smoke and air pollution

Air pollution in informal settlements comes largely from smoke from cooking and the burning of refuse. Literature has shown that informal settlements do not contribute much to the international crisis of global warming resulting from air pollution (Satterthwaite, 2003). The concern with smoke in informal settlements has largely to do with the indoor air pollution. Literature in Chapter 2 mapped out some of the problems of air pollution at an international level. For the people of Diepsloot air pollution has been largely blamed on informal traders using coal for cooking as well as the burning of refuse. The main energy source for domestic cooking in Deipsloot is paraffin. According to people burning paraffin releases invisible fumes that block the chest and leads to long lasting headaches.

There is therefore a need to look for alternative viable energy sources for cooking. A discussion regarding alternative energy sources is provided below

5.5.1. Alternative forms of energy for domestic cooking

People in Diepsloot pointed out that there are no financially viable alternative forms of domestic energy sources for cooking. Regardless of this, two source of energy sources were raised in the focus groups, and these are biofuel and electricity. Commercially biofuel energy is sold in the form of a green gel in one litre plastic bags. This is ideal for people in informal settlements because it produces no smoke and has fewer risks for fires. There are however two problems that discourage people from using it. The first one is that it is too expensive. In fact one litre of biofuel costs more than twice the price of one litre of paraffin. The other problem is that biofuel gel also burns much faster than paraffin, thus meaning that one would have to buy more biomass gel than paraffin for cooking the same amount of food. Electricity on the other hand was deemed by most participants in the focus groups as undesirable because it would lead to shack fires as a result of overcrowding. Not withstanding its inherent problems, paraffin became the most financially viable energy source for the people of Diepsloot. Regarding energy sources for cooking, the most health compromising source is the use of coal. It is therefore crucial to discuss people's perception regarding the use of coal for cooking.

5.5.2. People's perceptions on burning coal and refuse

In Diepsloot coal is mostly used by informal traders on the streets, and also by most residents in winter for space warming in shacks. Informal traders mostly burn coal in the afternoons, in preparation for cooking. At this time, when most people have lit their coal fires, a thick cloud of smoke is released into the air. Some of the informants said that so much smoke is released such that it becomes almost impossible to see people walking within five metres from you. Attributing blurring vision to air pollution is a concern that is experienced by some cities. For instance, in Chapter 2 it was discussed that air pollution impairs visibility in California and Beijing and Xi'ang (the two Chinese cities)

(Hertgaard, 1997; www.euromab.org/brprogram). Kirby (2002) argued that in Asia rapid urbanisation has led to the accumulation of sulphur dioxide in the atmosphere. The situation in Diepsloot seem to be similar to the concerns in broader developing countries regarding air pollution.

The burning of refuse has been identified as one of the problems leading to air pollution in Diepsloot. Literature has also shown that refuse burning is a problem to the people in informal settlements (Satterthwaite, 2003; Cairncross and Quano, 1990). In Chapter 4 it was recorded that people burn refuse as a way of trying to control its accumulation. Smoke, regardless of whether it comes from burning coal or refuse has been shown to have serious health impacts like respiratory inflammations (Satterthwaite, 2003; Thiambiwi, 2007) Discussions with the people of Diepsloot on the health impacts of burning coal and refuse identified a variety of conditions that people thought were linked to the release of poisonous gases into the air (See Chapter 2). A more detailed discussion on the health impacts of pollution is provided below.

5.5.3. Health impacts of air pollution

Establishing a direct causal link between smoke from coal or refuse with certain diseases might be difficult. This is because diseases might be the result of a complex of physical and social problems. The people of Diepsloot however, were quick in linking different diseases or physical conditions with smoke in the atmosphere. According to the people some of the health problems ascribed to smoke include, headaches, coughs, chest pains and blockages, nasal pains; and it also makes people vulnerable to chronic respiratory infections. The literature review (in Chapter 2) has demonstrated that air pollution does have serious health implications including breathing problems; promotion of cancer, lung dysfunction, e.g. in California, and inflammation of the respiratory tract (Encarta, 1993; Satterthwaite, 2003; www.euromab.org/brprogram). Satterthwaite (2003) specifically points to the dangers of indoor air pollution in informal settlements, and in this regard,

argues that it reduces resistance to acute respiratory infections. The correlation of findings and literature indicate that the situation in Diepsloot has to be taken seriously. Considering this, people's perceptions on how to reduce the burning of refuse and coal were probed out.

5.5.4. People's perceptions on reducing air pollution

Most people have shown less interest regarding their role in limiting the burning of refuse or coal in comparison to limiting solid waste on the streets of Diepsloot. Since coal was largely used by informal traders, some people sought to exclude themselves from solutions of reducing it. The reason why residents distance themselves from solutions to the problem of air pollution when they use coal in winter for space heating might be because informal traders use coal on a daily basis. For this reason the burden to the air pollution problem is shifted towards informal traders. Some informal traders who participated in the focus groups held that there was no financially viable alternative to the problem of burning coal. The argument of some of the informal traders was, 'If one is not allowed to burn coal, they will not be able to do business.' Education and awareness on the impact of pollution were seen as some of the approaches that could help reduce the use of coal and burning refuse. This however, would not be enough, insofar as it does not come with any substantive support from local government. According to literature education on pollution worked very well on solid waste (see case studies of Zimbabwe, Bangladesh and Dar es Salam in Chapter 2), but not as much on the reduction of the use of coal, because the latter has economic implications. I believe that people can cease using coal through deliberate support from local government like, restructuring the settlement and providing electricity, or any financially viable source of energy. Having considered both solid waste and air pollution, the chapter now considers water pollution.

5.6. People's perceptions regarding their role in limiting water pollution

Almost all substances, whether tiny particles in the air or plastics and paper on land, may collect in water resources, unless measures are taken to stop them. In Chapter 2 it was

discussed that water pollution in informal settlements is mostly in the form of faecal contamination and organic compounds, due to a lack of proper drainage systems (Cairncross, 1990, Cairncross and Ouno, 1990; Sinnatambly, 1990). Examples of countries experiencing such problems include Venezuela, Mexico, India, Tanzania and Egypt (Allen, Davila and Hofmann, 2006). Diepsloot presented with similar problems as some of the key informants pointed out that there was a mismatch between the size of the pipes for the reticulation system, and the number of people who are supposed to be served. Local government provided pipes that are too small and burdened by population growth, and consequently they are forever blocking, thus causing sewerage to bubble out onto the streets.

Most of the people in Diepsloot dispose their domestic waste, including residual food, plastic containers and cans etc. in streams and water ways (See Chapter 4). It has been shown that most of the waste is disposed into streams included plastic and paper. The EHO pointed to the disposal of waste in streams as one of the most disturbing practices leading to water pollution in Diepsloot. The disposal of solid waste and waterways has been observed in Khulna City, and Guyana (in the northern coast of South America) (see Chapter 3), and this resulted in blockage of drains (Khulna Series, 2000; Závodská and Knight, 2002). Diepsloot Section1 has no proper drainage system, thus the waste would not only lead to blocked drains, but would have serious negative impacts on the downstream users of water resources. This problem, in Khulna was curbed by informal waste collection (Khulna Series, 2000). In Diepsloot the solution, from people's views included street forming committees to get people to control dumping and the possible formation of informal waste collection system. For the residents, it was important also that local government provide support in terms of planning and institutionalization. In the view of the people, unless local government was consciously involved there would constantly be squabbles and no sustainable solution would be obtained. A discussion regarding the role of government in limiting pollution is provided below.

5.7. Residents' perceptions regarding the role of government on limiting pollution

Local government plays an overarching role in proving services to the people in its area of jurisdiction. Within the area of waste management, local governments in many countries have shown substantial failures. In Chapter 2 for instance, it was shown that there was a substantial decrease in waste management in Zimbabwe (Mubaiwa, 2007). The same were the cases of India, Bangladesh, Ghana and Tanzania (Khulna series, 2000; Kironde and Yhdego, 1997; Jonathan, 2000; Demanya, 2006). Regarding air pollution, at an international level there are policy frameworks and practices that could be adopted by countries at the local level. At the international level however air pollution can be a political issue. Affluent nations have the powers to commit or not to commit to the reduction of harmful substances in air. A good illustration in this regard is that of President Bush, who upon been elected American president announced that the United States would no longer support the Kyoto Protocol (van Rensburg, 2002). In many countries however local governments have deliberately committed to the implementation of local Agenda 21.

Results from the fieldwork have indicated that some people were aware that local government does have a role to play regarding interventions to reduce solid wastes in Diepsloot. While for some people, the role of government was about providing pollution management services without any input from the community, for some government was only expected to do certain things like, unblocking of sewerage pipes and collecting heaps of waste around dwellings. Though discussions with different people showed contrasting views regarding the role of government, people's perceptions concurred as almost all of them held that local government in Diepsloot has done almost nothing to reduce pollution. From Chapter 2 it follows that municipal waste management services have been declining over the years in many developing countries, for instance in Zimbabwe (Mubaiwa, 2006). These support views of the people who claimed that local government in Diepsloot has done nothing.

In support of their views that government was doing nothing, the people of Diepsloot emphasised that waste collection was minimal and very ineffective. The situation in Dieplsoot follows the hallmark of common practices in other developing countries (see Chapter 2). There is also a discrepancy between what government agents claimed to have been done by government, and what is known by the residents. This means that there is a lack of proper communication between local government and the community of Diepsloot. The residents of Diepsloot Section 1 require that local government come down to their level at appropriate times to discuss plans and strategies for pollution management. Local government was also expected by the residents to carry out environmental health education to ensure that pollution is minimised.

The intervention tool for local government in South Africa is the Integrated Development Plan (IDP). In Johannesburg this has been customised according to particular Regions so that it represents local developmental aspirations. Diepsloot falls within Region 3, and plans and programmes planned by Region 3 have been outlined in Chapter 3. The plans transpiring within the Region 3 Regional Spatial Development Framework (RSDF) would have a very good impact with regard to minimising pollution in Diepsloot. These programmes however, need to be supported by an administrative system that communicates properly with its people. In this regard it is tenable to argue that unless proper public participation processes are followed to ensure that people are aware of the planned developments, there won't be any significant improvements in Diepsloot. Chapter 4 of Municipal Systems Act (32 of 2000) set out procedures for local government to engage with people in developmental programmes. The problems of pollution in Dieplsoot are exacerbated by poor communication between people and local government. Local government is spending resources and training people for no substantive reason, because they do not achieve the desired goals or objectives. In order to be more responsive, there is a need for local government to rethink their intervention strategies. For instance environmental health educators should align their times to ensure that the vast majority of residents are aware of the intervention. Local government should moreover support community waste management institutional arrangement at the local

level and align these with administrative systems. Such a practice worked well in Dhaka, (Khulna Series, 2000), and therefore might work in Dieplsoot.

5.8. What can be done?

The research questions of this study as spelt out in Chapter 1 are:

1. What are the perceptions of communities in dense informal settlements towards their role in limiting pollution in their environment?
2. What measures have local government taken to help reduce pollution and environmental degradation in the study area? And;
3. What can be done?

Chapters 2, 4 and 5 focussed on finding answers to the first two questions. The response to the third question draws from a collation and analysis of findings and literature as they appear in the latter chapters. The ultimate and most important question in this study was to use the first two research questions to find an approach for minimizing or eliminating pollution and its resulting problems in informal settlements.

5.8.1. The role of planner

In Chapter 1 a set of theories (conceptual framework) that served as a lens for understanding the study have been set out. In order to explicate what is deemed appropriate from a planner's perspective, the conceptual framework would be revisited. A planner's responses are guided by sound theoretical frameworks and not personal subjectivity. In this study theories that would guide a more responsive approach included (see Chapter 1)

- Advocacy and the Ontological Philosophy.
- Collaborative planning.
- Postmodernism and Multiculturalism.
- Ideological perspectives.
- Legislation and policy directives in South Africa.

The above theories have been discussed in Chapter 1 and therefore any further discussion would be an unnecessary reiteration of the key concluding points at the end of Chapter 1. From an advocacy perspective, a planner should communicate the interest of marginalised groups in society. In this study the perceptions of people reflect their priorities. For instance in Chapter 4 people were more concerned about:

- Poor waste removal services, and inadequate service provision in general
- Lack of support in establishing community based institutions
- Lack of education on pollution
- Need for de-densification of the settlement
- Inadequate supply of communal trash containers and their relative location
- Poor supply of black refuse bags

The above are deep seated concerns that the planner would have to communicate on behalf of the community of Dieplsoot. In order to do this the planner can invoke the notion of public participation. According to theory, the notion of public participation draws from, or is influenced by the concept of collaborative planning. The big theory behind collaborative planning is communicative rationality, whose forerunner is Jürgen Habermas, the German Philosopher (Ray, 1993). Within the planning domain, communicative rationality is interpreted in the form of collaborative governance or communicative planning. In this regard the truth is established through engaging in discourse and reaching a consensus. According to communicative planning, a decision is rationally justifiable insofar as it was achieved through fair and inclusive dialogue (Fraser, 1985).

In light of the above theoretical background, one sees a need for a radical shift in terms of how things are done in Diepsloot. The current Diepsloot local government approach reflects the 1970s model whereby government operated like a “bureaucratic machinery” which was struggling to do everything for the people. A more desirable local governance structure should be about building connections and ties with communities to address challenges. Community participation becomes very important in this regard.

There is a need to establish more complex structures like community based organisations (CBOs) in civil societies and NGOs that can work with the local government to achieve goals with regard to pollution management in Diepsloot. CBOs worked very well in connecting residents and government on issues of waste reductions, for instance in Hampshire, a County in the South coast of England; Zimbabwe and Bangladesh (Petts, 1995; Mubaiwa, 2006; Khulna Series, 2000) (see Chapter 2). In Diepsloot the setting up of specific networks between government and residents through organised structures would help in guiding efforts and financial expenditure into responsive programmes. The local government should start off by setting up community based institutions. This should be a fundamental decision that could be followed up by incremental decisions like education on pollution, informal waste collection and the promotion of recycling practices. There also needs to impart change in the way people do things on a daily basis.

5.8.2. Changing the way people think

In Chapter 4 the idea of changing the way people think was alluded to. Changing the way people do things is complex and requires their deliberative and conscious choice to change. From a sociological perspective, individuals can either be the products of social structures[10] or they can act upon social structures (Abercrombie *et al.* 1988). The underpinning debate in this regard is referred to as the Structure/agency[11] debate. According to Lemert (2002) individuals shapes society based on their actions or otherwise society teaches individuals how to behave based on the patterns of social structures and societal norms. In the context of Diepsloot one can argue that individuals are shaped by society. This was observed in the case of illegal dumping whereby, individuals do it because everybody does so. When individuals come together (in the form of street committees), problems of illegal dumping are solved, again evidence that in Diepsloot society shapes individuals. In this regard the establishment of community based institutions should be an approach that is highly sought after with regard to

[10] Social structures include families, schooling, religion, the state, economic systems and sets of norms and values (Abercrombie et al, 1998) (See Chapter4)

[11] Agency "refers to every individual's ability to act, make choices and plans, and to make senses or interpret their surrounding" (van Huyssteen, 2003:29)

changing the way people think about waste disposal practices and minimization. Community based institutions should have a vision of a clean environment in Diepsloot. This way people can internalize the vision to live in a clean environment and pollution would be minimized.

5.9. Conclusion

In this chapter people's perceptions presented in Chapter 4 have been scrutinized against theory to asses their relevance, not only within the Diepsloot context but also how they were applied in other contexts of informal settlements. Some of the perceptions that I deemed more appropriate, and that were discussed in this chapter include themes like, informal waste collection, the setting up of a reporting system, recycling and street committees. A holistic view of municipal service provision and how people perceive such services has been provided. Most important is the conclusion that there is a serious communication breakdown between local government and residents and this needs to be corrected. The chapter closed by exploring answers to the third question which was, 'what can be done?' In answering this question the role of planner was delineated with the use of the conceptual framework that was outlined in Chapter 1.

CHAPTER SIX

6. RECOMMENDATIONS AND SUGGESTIONS FOR POLICY MAKING

6.1. Introduction

This study has shown that pollution in informal settlements leads to the deterioration of the living environment. For instance, the environmental health problems raised by the people in Diepsloot indicate an environment that is deteriorating. This study can provide information to decision makers with regard to policies and practices regarding pollution in informal settlements. It presents the importance of people's perceptions regarding practices that could guide policy makers, basic service providers and environmental managers regarding pollution in informal settlements. In the previous chapters, the study has demonstrated that poor environmental conditions are exacerbated by a communication gap between local government and residents. Another factor impacting on the environmental quality is the lack of financial resources for interventions by local government in South Africa. This reflects the South African norm whereby there is a mismatch between development challenges and the available resources needed to respond to them. This Chapter reflects on the research questions as set out in Chapter 1 and the extent to which the study managed to answer them. Suggestions for policy strategy regarding the way forward and how some of the problems raised by key informants in chapters 4 and 5 can be addressed, is provided.

6.2. Summary of answers to research questions

Regarding people's perceptions on their role in limiting pollution in Diepsloot, it was found that residents had varying commitments to take part in working together. Generally, people acknowledged the importance of their commitment to reducing pollution in their environment. Residents' commitments were strengthened by coming together in the form of street committees. This could also be thought of as a way through which residents' code of behaviour was been shaped. Street committees encouraged

people to stop littering and to engage in proper practices like taking rubbish into refuse containers. By doing this, residents were able to manage the overflowing levels of solid wastes in their streets. In some streets however, there were heaps of solid waste and visible puddles of stagnant water. Street committees in the latter streets were very weak, and there was no social commitment regarding the reduction of solid waste and water pollution. For this reason, the level of pollution in Diepsloot varies from street to street.

6.2.1. What measures has local government taken to limit pollution in the study area?

There are various government initiatives aimed at reducing pollution in Dieplsoot. Both the Environmental Health Officer and the Ward Councillor outlined local projects and programmes that were carried out to reduce or manage pollution in Diepsloot. According to the EHO and the Ward Councillor, there were programmes for waste minimization (e.g. recycling, and street pickers), education on pollution, the reduction of air pollution (e.g. Basa njengo magogo), and water pollution were operating in Diepsloot. In contrast to this view, residents were not aware of any government initiative for reducing pollution in their area. Ironically, people did not even know about the existence of the EHOs in Diepsloot. Residents therefore, were of the view that local government in their area had not done enough to reduce pollution. In light of this, I have concluded that although local government has made efforts to reduce pollution in Diepsloot, they are rendered ineffective as there is no proper connection with the recipients.

6.2.2. What can be done to limit pollution?

Regarding the question, 'What can be done with limiting pollution?' an analysis of findings and literature in Chapter 5 has suggested the way forward. There was a need for local government in Diepsloot to form partnerships with communities so that problems of pollution can be effectively managed. Moreover it is important for the government to enforce legislation pertaining to pollution and environmental risks, for instance in the

prevention of illegal dumping. There is a need to implement the two NEMA principles; the polluter pays principle and the duty of care principle (see Chapter 2).
Some of the sound views that could be followed included, the promotion of recycling practices, establishing institutions for informal waste collection practices, as well as de-densification of the settlement. Establishment of local institutions like CBOs would help in making good connections between the community and the local government. I view the formation of local institution as the bedrock for facilitating programmers and plans for interventions regarding pollution management in Dieplsoot.

There is a need to beef up the capacity of local government, especially with regard to skills and finances. In order to de-densify the settlement, for instance there a need for financial injection in Dieplsoot. Both the National and Provincial governments must improve the conditions of informal settlements through helping in striking a balance between development needs and the available budgets. In Diepsloot the Ward Councillor was concerned about lack of funding, an indicator that there is a need for fiscal transfer from National to local government.

6.3. How has study contributed to planning knowledge?

The study has significant implication for the planning profession. Theories pertaining to planning have been discussed in the study, for instance planning theories have been invoked as lenses to understand pollution practices in informal settlements. Such theories focus largely on positioning the planner in the midst of contesting interests and view points. Some of the potential contributions to the planning profession drawn from the study include:

- The need for better comprehension of people' perceptions and how these could be used to influence policy formulation.
- Understanding the constraints and opportunities of people in informal settlements with regard to minimizing pollution in their environment.
- Ability to identify the causes of failure of local government initiatives in limiting pollution in informal settlements.

- Understanding the distance between local government and communities in their area of jurisdiction.
- Highlight the importance of informing people about plans and programmes being implemented or still in the pipeline.

People are affected by administrative decisions and plans. The above themes can help in ensuring that administrative decisions take into account people's objections and concerns. The conventional planning practices whereby the state was the sole provider of services has shown to be ineffective in many developing countries. Contemporary planning should be complex and inclusive. It should involve all actors who would be affected by plans and programmes. The bulleted themes are modelled around a central idea, which says that planning should be an exercise that deliberately involves people. The strength of communities in informal settlements largely depend on their ability to come together and solve problems of common concern, the weakness would be the direct opposite of this. Local government can capitalize on the strength of communities to establish ties and networks that could lead to better planning. If planners could understand and work within this latter important fact, more responsive interventions would be adopted.

With regard to Diepsloot, the themes outlined above provide an opportunity for local government to make a transition regarding the way pollution interventions are being administered. Clearly pollution interventions in Diepsloot exhibit elements of a bottom up approach. In this regard I suggest bottom up approaches that are informed by the people's perceptions and aspirations. This might be an opportunity for other municipalies who are also faced with the problem of pollution in their local informal settlements. It is important in this regard that interventions are informed by international case studies and theoretical debates regarding good practices for pollution management. This would not only lead to justifiable planning decisions, but could also improve local skills capacity with regard to effective service provision.

6.4. Suggestions for policy making

Service delivery in informal settlements generally requires improvement. In the study some of the constraints that hamper effective service delivery include:

- Lack of communication between government and communities.
- Poor institutional arrangements at the local level.
- Lack of law enforcement.
- Poor street layout allowing no access for refuse trucks.
- Lack of funds for effective interventions.
- Poor cost recovery for municipal service provision in informal settlements.

In order to formulate more responsive policies for pollution management, it is essential that local government address these constraints.

The need for effective communication between local government and communities has been emphasized in this study as one of the approaches to improve service provision in Diepsloot. Policies would be more effective if they were formulated via an inclusive mechanism. This would help in addressing the problem of social apathy, often experienced by poor people in informal settlements. Good communication would afford local government the confidence of taking rational inclusive decisions and formulating effective policies.

Policies work effectively within certain institutional arrangements. Without the right institutions in place interventions for minimizing pollution would always be outright failures. The ideas of strengthening local institutions are very sound in this regard. As discussed, these should be consolidated with local government systems and programmes. People would be more willing to take up responsibilities when they operate within an ordered environment. This could give local government more power to enforce legislation or bylaws pertaining to pollution and environmental risk.

Law enforcement is hampered by the clumsy spatial form in Diepsloot. This impedes the local municipality's ability to fulfil its constitutional mandate of an equitable supply of

services within an urban space. Therefore, it becomes difficult to impose binding duties on people to stop polluting the environment. These lines point to the fact that there is a need to restructure the informal settlement in Diepsloot so that local municipality can provide waste removal services more effectively. Law enforcement would be more effective when local government is taking its share with regard to minimizing pollution in Diepsloot. Thinking about effective law enforcement should go hand-in-hand with the idea of de-densification of the settlement.

6.5. Areas for further research

From the study a variety of gaps that require further research are suggested. From an institutional perspective, literature suggests that local institutions are context dependent. From a general view, a study that could suggest a set of universal institutions that could be applicable in any context of informal settlement is needed. Such a study could be guided by the questions:

1. What institutional arrangements would be most effective in reducing pollution in informal settlements?
2. What strategy could be used to consolidate and link elements of such arrangements with the overall local administrative structure?

Such a study would be more effective if backed up by studies that would record reduction in pollution related diseases. This way, a more pragmatic approach to addressing the problems of pollution would have been adopted, and would therefore impact positively on the environment and society at large.

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APPENDIX A

Permission to interview people in Diepsloot

Dear Sir/Madam

Request for permission to interview people in Diepsloot

I am a student from the University of the Witwatersrand, Johannesburg, working on my Masters dissertation on perceptions of communities in informal settlements towards their role in limiting pollution in their neighbourhoods. I have chosen Diepsloot as my study area, and I am hereby asking for permission to talk with people regarding their perceptions towards their role in limiting pollution in this neighbouhood. This is an academic study whose final deliverable would be a dissertation that would serve as a partial fulfilment of a Masters Degree in Development Planning for me, Simon Mporetji. The study is carried out with no intention to make profit, and has been approved by the University of the Witwatersrand.

It is hoped that the information collected in this study may enhance researchers and academics within this academic area, to understand the reality of pollution from people's perceptions, and also help in improving intervention strategies. The study may further enhance the current pollution management in the study area through highlighting the importance of communities to take charge of their environment. If you have any Concern regarding the study you can contact my Supervisor Dr. Liz Thomas at (011) 242 9919 or email her at lizweinjapan@yahoo.co.uk

Thank You

Simon Mporetji (Mr.)

APPENDIX B

Consent Forms for participants

Consent form for participating in one-on-one interviews

Name of Participant _____

Date of focus group discussions: _____

I (signature at the bottom), agree to participate in the study conducted by Mr. Simon Mporetji, a student at the University of the Witwatersrand, Johannesburg, which seeks to understand the perceptions of residents of Diepsloot regarding their role in limiting pollution in this neighbourhood.

My participation in this study is hereby acknowledged as voluntary, and I concede that the researcher assured me full confidentiality, and therefore will protect my individual identity. I am also aware that I can withdraw from participating at anytime during the session. Raw information collected in this study will only be used for academic purposes and will not be given away to any person that might use it against participants. No individual names will be linked to any information whether the results of this study are published or not. On this note:

- I consent to the use of tape recorders during the focus group interviews:
  YES___ NO___
- I consent to the use of direct quotes in the final document, in so far as my identity is **NOT** linked to them: YES____ NO ___

Raw information from the study would be seen by Mr. Simon Mporetji, and the research supervisor Dr. Liz Thomas at the University of The Witwatersrand. Participants who have concerns regarding the study can contact **Dr. Liz Thomas** at **(011) 242 9919** or email her at liz.thomas@nhls.ac.za

Signature of Participant: _____ **Date**: _____

Researcher s Signature: _____ **Date**: _____

Appendix B

Consent form for participating in focus Group interviews

Name of participant: _____

Date of focus group discussions: _____

I, the undersigned, agree to participate in the study conducted by Mr. Simon Mporetji, a student at the University of the Witwatersrand, Johannesburg, which seeks to understand the perceptions of residents of Diepsloot regarding their role in limiting pollution in this neighbourhood.

My participation in this study is voluntary, and I concede that the researcher assured me full confidentiality and therefore will protect my individual identity. I am also aware that I can withdraw from participating at anytime during the session. Raw information collected in this study will only be used for academic purposes and will not be given away to any person that might use it against participants. No individual names will be linked to any information if the results of this study are published. On this note:

- I consent to the use of tape recorders during the focus group interviews: YES ___ NO___
- I consent to the use of direct quotes in the final document, in so far as my identity is not linked to them: YES___ NO ___

Raw information from the study would be seen by Mr. Simon Mporetji, Thabitha Matladi, who will assist in facilitating the focus group interviews and the research supervisor Dr. Liz Thomas at the University of The Witwatersrand. Participants who have concerns regarding the study can contact **Dr. Liz Thomas** at **(011) 242 9919** or email her at liz.thomas@nhls.ac.za

Signature of Participant: _____ **Date**: _____

Researcher s Signature: _____ **Date:** _____

Appendix B

Consent form for participating in one-on-one interviews (Ward Councillors/Environmental Health officer

Name _____

Date of focus group discussions: _____

I (signature at the bottom), agree to participate in the study conducted by Mr. Simon Mporetji, a student at the University of the Witwatersrand, Johannesburg, which seeks to understand the perceptions of residents of Diepsloot regarding their role in limiting pollution in this neighbourhood.

My participation in this study is hereby acknowledged as voluntary, and I concede that the Student assured me full confidentiality, and therefore will protect my individual identity. I am also aware that I can withdraw from participating at anytime during the session. Raw information collected in this study will only be used for academic purposes and will not be given away to any person that might use it against participants. No individual names will be linked to any information whether the results of this study are published or not. On this note:

- I consent to the use of tape recorders during the focus group interviews: YES___ NO___
- I consent to the use of direct quotes in the final document, in so far as my identity is **NOT** linked to them: YES____ NO ___

Raw information from the study would be seen by Mr. Simon Mporetji, and the research supervisor Dr. Liz Thomas at the University of The Witwatersrand. Participants who have concerns regarding the study can contact **Dr. Liz Thomas** at **(011) 242 9919** or email her at liz.thomas@nhls.ac.za

Signature of Participant: _____ **Date**: _____

Student's Signature: _____ **Date**: _____

APPENDIX C

DISCUSSION SCHEDULE FOR ONE-ON-ONE PARTICIPANTS

Place of interview: _____

Date of Interview_____

Consent form signed: YES_____ NO _____

Introduction:

Thank you for participating in this study, I am a student from the University of the Witwatersrand, Johannesburg, working on my Masters dissertation on perceptions of communities in informal settlements towards their role in limiting pollution in their neighbourhoods. This is an academic study and it is hoped that the information collected may enhance an understanding of the reality of pollution from people's perceptions. This may therefore inform policy and practice regarding pollution. The outcome of this study is a dissertation that would serve as a partial fulfilment of a Masters Degree in Development Planning, for the Student, Mr. Simon Mporetji. The study may further enhance the current pollution management in the study area through highlighting the importance of communities to take charge of their environment. In this regard, I am interested in knowing what is viewed as pollution (air, water, and land), and how these could be minimized through the commitment of the community. My interview with you would take 30 minutes. Should you have any questions, please feel free to ask. I would like to reiterate the fact that this is just an academic study and is carried out with no intention to gain profit. With your consent, I would like to use a tape recorder so that I can collect your view points without missing important facts. Again I assure you that your name would not appear in any recording, and in appreciation, and if it is in your interest, I will provide you with a short version of the study upon completion.

As a way of understanding your views with regard to a collective commitment of the people in Diepsloot regarding their role in limiting pollution in this neighbourhood, I would be asking you some questions.

Appendix C

A. Pollution and the environment in Diepsloot.

1. I would like to gather from any of you, what is the significance of the natural environment.

   _____
   _____
   _____

2. Which of the following constitute the major environmental problems experienced in Diepsloot? Rank using a scale from 1-7, whereby 1 depicts the major problem and Seven the least

   Water Pollution___ Flooding___ Air Pollution____ Smoke____
   Solid Wastes_____ Fire hazards____ Pests and flies____
   Other: _____

3. Is there any need to protect the environment from pollution? How best do you think this could be done (a community based approach)?

   _____
   _____
   _____

4. Do you think there are any opportunities that could be derived from pollution in your neighbourhood?

   _____
   _____
   _____

B. The role of Government

5. What is government doing in your area to limit pollution and environmental harm (environmental awareness campaigns, workshops and education on pollution and management, etc)?

   _____
   _____
   _____

6. Do you know of any EHO responsible for your area? What are their roles? Are they effective?

_____
_____
_____

7. How frequent do municipality collect garbage in your area? How effective is this method of waste removal? How can people enhance municipal waste collection?

_____
_____
_____

C. Solid Waste

8. How do people around you dispose their wastes?

_____
_____
_____

9. Do you find it problematic?

_____
_____
_____

10. What appropriate measures could the community take to limit this? What limitations could arise when administering these measures?

_____
_____
_____

11. What about the municipality? What are they doing?

_____
_____
_____

D. Water Pollution

12. Do you find stagnant water a serious problem where you live?

_____
_____
_____

13. What do you think the community should do about it? What could stop them from doing this?

_____
_____
_____

14. What is municipality doing about it?

_____
_____
_____

E. Air Pollution

15. What energy sources do people in your area use for cooking? Is burning coal a problem?

_____
_____
_____

16. Could you elaborate on any problems associated with burning coal?

_____
_____
_____

17. Are there any viable alternative energy sources that could be used?

_____
_____
_____

F. Health impacts of pollution

18. Do you know of any health problems associated with pollution (smoke, stagnant water, accumulation of wastes)? Could you tell me some?

_____
_____
_____

19. Regarding these health problems, what do you suggest people should do to minimize them? What could limit this?

    _____
    _____
    _____

20. What is government doing to mitigate these impacts?

    _____
    _____
    _____

This question brings us to the end of the interview, Thank you again for participating!

Appendix C

INTERVIEW SCHEDULE FOR WARD COUNCILLORS OR EHO

Place of interview: _____

Consent form signed: YES_____ NO _____

Introduction:

I am a student from the University of the Witwatersrand, Johannesburg, working on my Masters dissertation on perceptions of communities in dense informal settlements towards their role in limiting pollution in their neighbourhoods. This is an academic study and it is hoped that the information collected may enhance an understanding of the reality of pollution from people's perceptions. This may therefore inform policy and practice regarding pollution. The outcome of this study is a dissertation that would serve as a partial fulfilment of a Masters Degree in Development Planning, for the researcher, Mr. Simon Mporetji. The study may further enhance the current pollution management in the study area through highlighting the importance of communities to take charge of their environment. In this regard, I am interested in knowing the role played by local government in limiting pollution and environmental hazards in the area. My interview with you would take 30 minutes. Should you have any questions, please feel free to ask. I would like to reiterate the fact that this is just an academic study and is carried out with no intention to gain profit. With your consent, I would like to use a tape recorder so that I can collect your view points without missing important facts. Again I assure you that your name would not appear in any recording, and in appreciation, and if it is in your interest, I will provide you with a short version of the study upon completion.

G. Pollution and the environment in Diepsloot.

21. Which of the following constitute the major environmental problems experienced in Diepsloot? Rank using a scale from 1-7, whereby 1 depicts the major problem and Seven the least

Water Pollution___	Flooding___	Air Pollution____	Smoke____
Solid Wastes_____	Fire hazards____	Pests and flies____	
Other: _____			

22. I would like to gather from you, what is the situation in Diepsloot with regard to pollution.

_____
_____
_____

H. The role of Government

23. How do you as government, manage pollution actives in Diepsloot? (i.e. littering, smoke, and water pollution)

    _____
    _____
    _____

24. What are the major challenges with regard to pollution management that you face in Diepsloot

    _____
    _____
    _____

25. How frequent do you collect garbage in Diepsloot? How effective is this method of waste removal?

    _____
    _____
    _____

26. Are there differentials in respect of the manner in which waste in the Squatter settlements is managed in comparison to other areas, (i.e. Formal units)? Could you elaborate on that?

    _____
    _____
    _____

27. How can people enhance municipal waste collection?

    _____
    _____
    _____

I. Solid Waste

28. What would you say are the major challenges with regard to solid waste management in Diepsloot

_____
_____
_____

J. Water Pollution

29. How is the situation in Diesloot with regard to of water pollution?

_____
_____
_____

30. What appropriate measures have government taken to mitigate the impact of water pollution in the area?

_____
_____
_____

31. What do you think the community should do about it? What could stop them from doing this? What approaches have you taken to r

_____
_____
_____

K. Air Pollution

32. What energy sources do most of the people in the informal settlement use for cooking? Is burning coal a problem?

_____
_____
_____

33. Could you elaborate on environmental problems associated with burning coal in Dieplsoot?

_____
_____
_____

34. Are there any viable alternative energy sources recommended by government for the people in Dieplsoot?

_____
_____
_____

L. Health impacts of pollution

35. What are the most common environment and health issues that you face in Diepsloot with regard to pollution management? (smoke, stagnant water, accumulation of wastes)? Could you briefly elaborate on those?

_____
_____
_____

36. Regarding these health problems, what do you suggest people should do to minimize

_____
_____
_____

This question brings us to the end of the interview, Thank you again for participating!

Appendix C

DISCUSSION SCHEDULE FOR PARTICIPANTS IN FOCUS GROUPS

INTERVIEW SCHEDULE FOR FOCUS GROUP INTERVEIWS

Date of Focus Group Interview: _____

Place of Focus Group Interview: _____

Consent forms signed: YES_____ NO_____

Introduction:

I am a student from the University of the Witwatersrand, Johannesburg, working on my Masters dissertation on perceptions of communities in dense informal settlements towards their role in limiting pollution in their neighbourhoods. This is an academic study and it is hoped that the information collected may enhance an understanding of the reality of pollution from people's perceptions. The study may therefore inform policy and practice regarding pollution. The outcome of this study is a dissertation that would serve as a partial fulfilment of a Masters Degree in Development Planning, for the student, Mr. Simon Mporetji. It is hoped that the study may further enhance the current pollution management in the study area through highlighting the importance of communities to take charge of their environment. In this regard, I am interested in knowing what is viewed as pollution (air, water, and land), and how these could be minimized through the commitment of the community. This session would take 45 minutes. Should anyone in the group have any questions, please feel free to ask. I would like to reiterate the fact that this is just an academic study and is carried out with no intention to gain profit. With your consent, tape recorders will be used to collect people's view points regarding pollution in the neighbourhood. Again I assure you that your names will not appear in any recording, and in appreciation, and if it is in your interest, I will provide you with a short chapter of the report findings.

M. Pollution and the environment in Diepsloot.

37. I would like to gather from any of you, what is the significance of the natural environment.

38. Which of the following constitute the major environmental problems experienced in Diepsloot? Rank using a scale from 1-7, whereby 1 depicts the major problem and Seven the least

Water Pollution___	Flooding___	Air Pollution____	Smoke____
Solid Wastes_____	Fire hazards____	Pests and flies____	
Other: _____			

39. Is there any need to protect the environment from pollution? How best do you think this could be done (a community based approach)?
40. Do you think there are any opportunities that could be derived from pollution in your neighbourhood?

N. The role of Government

41. Who is responsible in your area for addressing Pollution problems?
42. What is government doing in your area to limit pollution and environmental harm (environmental awareness campaigns, workshops and education on pollution and management, etc)?
43. Do you know of any EHO responsible for your area? What are their roles? Are they effective? Do you know how to contact them?
44. How frequent do municipality collect garbage in your area? How effective is this method of waste removal? How can people enhance municipal waste collection?

O. Solid Waste

45. How do people around you dispose their wastes?
46. Do you find it problematic? What is the problem?
47. What appropriate measures could the community take to limit this? What limitations Subject:could arise when administering these measures?
48. What about the municipality?

P. Water Pollution

49. Do you find stagnant water a “serious” problem where you live?
50. What do you think the community should do about it? What could be the limitations to this?

51. What is municipality doing about it?

Q. Air Pollution

52. What energy sources do people in your area use for cooking? Is burning coal a problem?
53. Could you elaborate on any problems associated with burning coal?
54. Are there any viable alternative energy sources that could be used?

R. Health impacts of pollution

55. Do you know of any health problems associated with pollution (smoke, stagnant water, accumulation of wastes)? Could you tell us some?
56. Regarding these health problems, what do you suggest people should do to minimize them?
57. What is government doing to mitigate these impacts?

Thank you very much for participating, Enjoy your day!