

**TOWARDS DEVELOPING AN ENVIRONMENTAL MANAGEMENT
SYSTEM FOR MICHAELHOUSE BOYS' SCHOOL IN KWAZULU-NATAL.**

By

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Submitted in Partial Fulfilment of the Requirements for the Coursework Masters
Degree in Environmental Management in the Geography Division of the School of
Life and Environmental Sciences
University of Natal- Durban

January, 2002

PREFACE

The research work described in this thesis was carried out in the School of Life and Environmental Sciences, University of Natal-Durban, from February to July 2001 under the supervision of Ms. Cathy Oelofse and from August 2001 to January 2002 under the supervision of Dr. Helen Watson.

The study represents original work by the author and has not been submitted in any other form to other Universities. Where use has been made of the work of others, it has been duly acknowledged in the text.

A handwritten signature in black ink, appearing to read 'K Molapo', written over a horizontal dashed line.

Keneiloe Molapo.

ACKNOWLEDGEMENTS

I am grateful to all those who gave their support in assisting me to finish this study, all of which was made possible by the Power above.

My sincere gratitude goes to my Supervisor, Dr Helen Watson, for all the support, sacrifice and attention and most of all for the patience. “I probably wasn’t the easiest kid to work with, nonetheless, your criticism made me a better thinker, and thank you! though I know it is not good enough”.

Special thanks to Cathy Oelofse, for suggesting this topic and helping me get started, “you have been more than just a lecturer to me, your belief in me became my strength”.

Sincere and special thanks to Dr.Ardington for entrusting Teboho and me to work on these projects with and for Michaelhouse.

I wish to pass my heartfelt thanks to all Michaelhouse Environmental Committee members and the whole Michaelhouse community, for their cooperation and assistance, especially Paul Fleischack, Dave Pickstone, John Rockcliffe, Raymond Duma, Bridget Ussher-Stanley, Pushpa, Joanne and Alice.

Most of all, I would like to thank my colleagues and friends who walked this journey with me, for their support was accepted and appreciated wholeheartedly.

Enduring gratitude to my family for the unconditional support, emotionally and financially, throughout my studies for the past 20 years of my life.

I am indebted to all of you!

ABSTRACT

Educational institutions are obliged in terms of the Constitution as well as a number of National Policies to manage their environment in a sustainable manner and to provide a healthy environment for the employees and learners. Michaelhouse is also obliged by the Constitution and National Policies to manage its environment in a holistic manner. Michaelhouse is a private boy's school situated in the Balgowan valley in the Midlands of KwaZulu-Natal. For this reason and for the school's own individual gain, the school's management wishes to fulfill two objectives. First, to produce environmentally sensitive citizens. Second, to acquire the expertise to administer the school in an environmentally sensitive and holistic manner.

Although Michaelhouse has had an environmental discussion group since 1996, issues were discussed on an ad hoc basis. Likewise, there have been a number of environmental initiatives in the school, however these initiatives were fragmented. Due to the fragmented initiatives, the management realised the need for environmental management. The school approached the Department of Life and Environmental Sciences at the University of Natal, Durban for assistance in this regard. Two projects were formulated to meet the school's set goals. The first was an Environmental Education (EE) project to fulfil the first objective. The second project aimed to fulfil the second objective, that is, to acquire the expertise to administer the school in an environmentally sensitive manner is described in this thesis. An Environmental Management System (EMS) was identified as the best system to ensure sound environmental management performance. The baseline information provided in this thesis is expected to contribute towards the development of this EMS.

South African legislation at the national level with regard to environmental management was reviewed in order to ascertain how environmental problems are dealt with. In order to obtain the necessary information, the study involved three distinct tasks. The first was the pilot study to determine the way the questionnaire would be structured and the type of questions to be asked. The second was development of the school's environmental mission statement. The third, an environmental audit which had two components; administering of questionnaires to the residents and the inspection of the school's environment. The three main problems identified in the school were the management of water, waste and vegetation.

The supply of water was found adequate for the entire school and the water quality acceptable. The only problem found was excess use of water due to multiple uses in the school. It is proposed that a water policy be developed which will include the monitoring of water use. Two types of waste were identified, solid waste and low-medium hazardous waste. The former requires proper management which includes reintroducing recycling, but also other methods were recommended to be incorporated in the waste management process such as minimisation and re-use. Low-medium hazardous waste requires disposal in an appropriate manner and the use of a designated landfill was recommended. With regard to vegetation, the study dealt with the significance of exotic and indigenous trees in the school. The main problem found was that exotic tree stumps are undermining the sewage pipes. The researcher was not able to deal with this issue due to lack of expertise in this field, but it was recommended that the assistance of experts be requested to trace the location of these pipes.

In order to have control over the environmental concerns and the environment at large, the development of an environmental policy for Michaelhouse School was found necessary. It was considered essential because it is a building block for an EMS. The policy was developed in collaboration with the School's Environmental Committee. This baseline information contained in this thesis will provide a means of assessing the performance of an EMS once it is put in place. It is therefore concluded, that for the EMS to be effective, it should include all sectors of the entire school property and it was recommended that a full audit be conducted of other sectors of the school.

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CHAPTER ONE: INTRODUCTION

1.1 Motivation for Study

Michaelhouse, a boarding school for boys, is located in the Balgowan valley in the Midlands of KwaZulu-Natal. The school is situated on approximately 1000 hectares of land. The built environment covers 60 % of the area while the remainder is undeveloped. The school's Rector is working towards steering the school towards optimal performance and excellence in all disciplines, including environmental management and education. The school's mission statement, which also motivated the need for environmental management and education in the school, is provided in Appendix A. Although Michaelhouse has had environmental discussion groups since 1996, issues were discussed on an ad hoc basis. Likewise although there have been a number of environmental initiatives in the school such as the establishment of the Midlands Oribi Reserve, the Bog Stream rehabilitation project and waste recycling (all of which are described in more detail in chapter two), these initiatives were fragmented.

Educational institutions are obliged in terms of the Constitution as well as a number of National Policies elaborated on in chapter three, to manage their environment in a sustainable manner and to provide a healthy environment for the workers and the learners. In 2001 an environmental committee was established at Michaelhouse to assume responsibility for addressing the school's environmental issues (The composition of this committee is provided in Appendix B). It was at this juncture that the need for environmental management was recognised. The school's management wishes to fulfil two objectives. Firstly, to produce environmentally active citizens, and secondly, to acquire the expertise to administer the school in an environmentally holistic manner.

The school approached the Department of Life and Environmental Sciences at the University of Natal, Durban for assistance in achieving these two goals. Ms Cathy Oelofse, who holds the SAPPI lectureship in sustainable development recognised the symbiotic opportunity for postgraduate student research projects to be carried out

while at the same time assisting the school in fulfilling these objectives. Environmental educators suggest that if learners are taught about something, their behaviour is automatically modified. In trying to produce environmentally aware citizens, it was necessary that the learners be taught about environmental education practices, so they become actively involved and take responsibility for their actions. Lethoba (2001) carried out an Environmental Education (EE) project which aimed to fulfil this first objective. The project focused on determining the extent to which EE was incorporated into the school's curriculum. The use of the school's environment as a framework for EE programmes and the factors which may limit the development of EE programmes. She conducted interviews with teachers and taught pupils in grades 8 and 9. Finally, she made recommendations for the nature of participatory EE programme at Michealhouse (Lethoba, 2001).

Ms Oelofse identified an Environmental Management System (EMS) as the best way to achieve the second objective. An EMS is defined as a framework for guiding organisations that need to address environmental problems to sustain good performance with established goals and in response to changing competitive environmental pressures (Brierley, Little and Pearson, 1992). The project described in this thesis was formulated to provide the foundation for the development of an EMS for Michaelhouse.

The staff and learners live on the property, which has a clear geographic boundary. The scholastic and residential activities of the school use a large number of resources and impact on the environment in a number of different ways. Past experiences have shown a number of environmental problems as a result of resource use. These resources require management so that they can be sustained. The management of the school found the involvement of students from University of Natal essential because it was expected that the outcome of work conducted would result in effective environmental education, such that the management team of the school, the staff and the learners would shift their way of thinking with regard to environmental issues on the property.

This project aimed to provide baseline information, contributing towards the development of this EMS. Environmental problems were identified through

conversations with key informants and through examining the minutes of previous school environmental discussion group's meetings held to address problems in the school. Among these problems three were identified as most dominant and affecting each other in one way or the other namely water, waste and vegetation. These problems were assessed by conducting a targeted environmental audit to explore measures that can be taken to minimise the negative effects they have on the environment. The literature used in this research reviewed South African legislation at national level with regard to environmental issues, then focused on the local level, the study area. The information collected for this research consisted of three distinct tasks. The first involved the pilot study. The second involved the development of the school's environmental policy. The third was an environmental audit which had two components; carrying out a questionnaire survey of the residents to find out their attitudes and perceptions towards the need for environmental management at the school and carrying out field observations and collecting all information pertaining to all activities related to water, waste and vegetation in order to ascertain just how much of an environmental problem they actually were and what particular aspects of their regulation posed problems.

Information on these problems was needed if the implementation of an EMS at the school was to be successful. This baseline information provides a means of assessing the EMS's performance in assisting the school's environment to be managed in a more sensitive and holistic manner. Once the EMS is in place a repeat audit of these problems will indicate whether there has been any improvement in them as well as highlight aspects of those that still need attention. As it is crucial to repeat the audit on a regular basis, simple questionnaires and observation checklists were devised.

It must be acknowledged that the researcher could not develop the entire system alone for two reasons; firstly, the system is huge and requires the inclusion of all sectors of the school; secondly, the inhabitants have to be involved in developing the system. This research is a guide to developing the system. The research is a contribution to basic knowledge, which could be challenged, corrected if necessary or used as bases for follow up to continue improving environmental performance. This is the first time this kind of study has been conducted at Michaelhouse. It is anticipated that similar studies will be necessary in future and that a similar approach

will be adopted. By providing a solution to a real-world problem, this study has applied significance.

1.2 Aim:

To provide baseline information on the most significant environmental problems identified at Michaelhouse, as a contribution towards the development of an Environmental Management System for the school.

1.3 Objectives:

1. To establish whether national policies relating to environmental management can be used as a framework for establishing an environmental policy for Michaelhouse School.
2. To identify environmental problems at Michaelhouse and their impacts on the environment (water, waste and vegetation).
3. To develop and administer a questionnaire based on the problems identified in objective two.
4. To develop and test an environmental audit checklist that is simple and can be used to assist the management of the school for improved environmental performance and in addition determine how this can be used to change or enhance the environment.

1.4 Structure of the Thesis

Chapter two provides a description of the study area. In addition to giving the location, major bio-physiographic characteristics and the historical background of the school, this chapter describes the environmental problems recognised and the environmental initiatives implemented to date. The background information provided by this chapter motivates the need to implement an Environmental Management System in the school.

Literature reviewed in chapter three provides the conceptual framework for the study, which is derived from a broader framework of sustainable development, showing the

importance and necessity to manage the environment in an holistic manner. This chapter presents an international perspective of environmental concerns prior to the 1992 Rio Summit on sustainable development. The chapter commences with the definition of sustainable development as provided by the 1987 Brundtland report. Furthermore a number of definitions of sustainable development are also given as perceived by different authors; the highlight being a definition which states that ‘the strength of sustainable development is said to lie within the fact that it can accommodate different and sometimes opposing themes but nevertheless still show the value of its goals and objectives towards positive development’ (Blowers, 1997). Agenda 21, whose aim is to achieve sustainable development, is discussed in this chapter, together with the principles of sustainable development. It was considered necessary to include in the discussion the issues of globalisation, as it was a result of the new developmental dimensions that were being introduced worldwide. To narrow down the focus, the history of similar environmental problems were identified and the evolution of South African environmental management is also discussed from its inception and how it has affected the environment as it changed over time. The Constitution’s requirement is used as a start, as it is the umbrella of leadership in South Africa, followed by the National Environmental Management Act and other Environmental Acts contributing towards the achievement of sound environmental management. These policies and legislations are further discussed at the local level and emphasis is placed on how they relate to different institutions, businesses, industries and educational institutions. Lastly the local perspective provides further details about authorities working towards the implementation of Local Agenda (LA) 21 programmes for cities, towns and local communities. This conceptual framework is later linked to the empirical data in chapter five.

The choice of methodology used to conduct research is important because it significantly determines the research outcome. Chapter four describes the methods used to collect the data needed for this research. Both primary and secondary data sources were used to provide background information. Huge emphasis was placed on the minutes of the meetings of the school’s environmental discussion group and the environmental committee to identify the main environmental problems. Given the fact that individuals initiated the environmental projects taking place in the school, it was essential to build on the existing effort by encouraging the whole Michaelhouse

community to get involved. To achieve this, a questionnaire was designed for each of the schools' population subgroups, namely the administration, teachers, students and workers. The questionnaire was designed to ascertain their attitudes and perceptions of, and contribution to, these identified environmental problems. Data obtained from these questionnaires was processed using Microsoft Excel and Microsoft Access computer packages, then the results compared to those gathered through carrying out a targeted environmental audit in order to draw conclusions and make recommendations regarding the development of an EMS in the school.

Chapter five presents and discusses the findings of this research. The perceptions of the residents regarding environmental problems relating to the management of water, waste and vegetation as assessed from the questionnaire survey are compared and contrasted with the assessment of them from the field observations carried out by the researcher. It was found that the respondents assumed a possible shortage of water in the long term, when taking in to consideration water wastage in the school. This assumption was confirmed through the audit that there is water wastage. However, this was not perceived as a difficult problem to address because the respondents realised the need to conserve water for their benefit. It was further acknowledged that education would be an appropriate tool to help manage water. Furthermore, the respondents regarded waste as a major problem for the school. However measures are being taken by the school to address this problem, and options are being weighed but the school wishes to adopt the most cost effective method for waste management. Lastly, regarding vegetation, the respondents did not comment much on the vegetation aspect except for great emphasis to clear alien vegetation, which was perceived as the main problem. The school has a history of dominant exotic trees and it has further emphasised the importance of shifting from the foreign culture to a local culture of planting indigenous trees, in anticipation of benefiting the residents for educational purposes and to have a sense of belonging.

The development of the school's environmental policy is also described in this chapter. In order to have control over the resource uses and environmental concerns in the school, the development of an environmental policy was suggested by the researcher and was accepted by the school environmental committee. The development of the policy was also facilitated by the perceptions of the school's four

groups of residents regarding the need for such a policy and environmental management. It is clear from the survey that the residents will be very co-operative in the implementation of EMS. The environmental policy was successfully developed but is still awaiting the approval of the school management before it can be implemented.

Chapter six provides the conclusions reached from the discussion of the findings in chapter five. It also provides a synthesis of recommendations made in chapter five. It was established from the findings that environmental awareness is essential for Michaelhouse residents. Eventually, the practicability of environmental awareness lies heavily with a question of ethical concern from the people involved. The point being, the fact that it is up to the people involved to change their way of thinking and embrace the new forms of developments which environmental awareness is part of, in order to attain sound environmental performance. There was apathy detected from the respondents, it was therefore concluded that the residents have to change their attitudes and perceptions towards the environment and improve their understanding of environmental issues. This is an essential step towards facilitating the implementation of the Environmental Management System (EMS). There is no supporting structure to manage environmental initiatives in the school; therefore an environmental policy was established as a stepping-stone towards the implementation of an EMS.

It is recommended that taking an holistic approach when dealing with environmental initiatives will help improve the existing conditions and shed light on how new initiatives can be managed. Therefore it is recommended that a complete environmental audit be conducted by considering other parts of the school that were not assessed by the researcher as this research was baseline information to help kick-start the environmental management programmes in the school. The school is already involved with the neighbouring community outreach programmes; it is recommended that with regard to some of the environmental practices proposed, learners and teachers should consider working with the community to establish environmental projects, both for their benefit and upliftment of the local community.

CHAPTER TWO: DESCRIPTION OF THE STUDY AREA

2.1 Introduction

Chapter two provides a description of the study area. In addition to giving the location, major bio-physiographic characteristics and the historical background of the school, this chapter describes the environmental problems recognised and the environmental initiatives implemented to date. This is done by narrating circumstances that led to these problems, as pointed out from extracts of past environmental discussion group meetings notes held at Michaelhouse. The background information provided by this chapter motivates the need to implement an Environmental Management System in the school.

2.2 Location

Michaelhouse is approximately located at 29^o 24' 0" S latitude and 30^o 03' 0" E longitude. The school is an approximately 1000 hectare estate situated at 1300 meters above sea level in the Balgowan valley in the Midlands of KwaZulu-Natal. The region is described, as a rolling upland, with undulating plains and rivers, which do not have broad flood plains, but rise in a series of structural steps. The school is located within the Lions River Municipality in KwaZulu-Natal Province. Figure 2.1 shows Michaelhouse and other settlements closest to the school within the Lions River Municipality. These settlements are Fort Nottingham, Lions River, Balgowan and Howick. Two major rivers, Tugela and Umkomaas, bestride the Lions River Municipality.

Michaelhouse is widely recognised as a highly prestigious school and learners at this school come from different regions in South Africa, other neighbouring African countries and also from overseas countries. Figure 2.2 shows the location of Michaelhouse relative to surrounding major roads, rivers and towns/cities. The school is approximately 431 Kilometers (km) from Johannesburg City and can be reached comfortably in less than four hours by car. It is approximately 120 km from the Durban Unicity, with one and half hour drive by car. The nearest city,

Pietermaritzburg is approximately 45 km and about 30min. drive by car. The school can be accessed from Durban Unicity by the N3 to Johannesburg which passes by Pietermaritzburg, then a left turn off on to R103 (also shown on Figure 2.3) at Howick North, proceeding to Mooi River leading to Michaelhouse which is situated by the roadside, right and proper to its unique features; the school cannot be missed. The landmarks provided above are clearly shown on Figure 2.2.

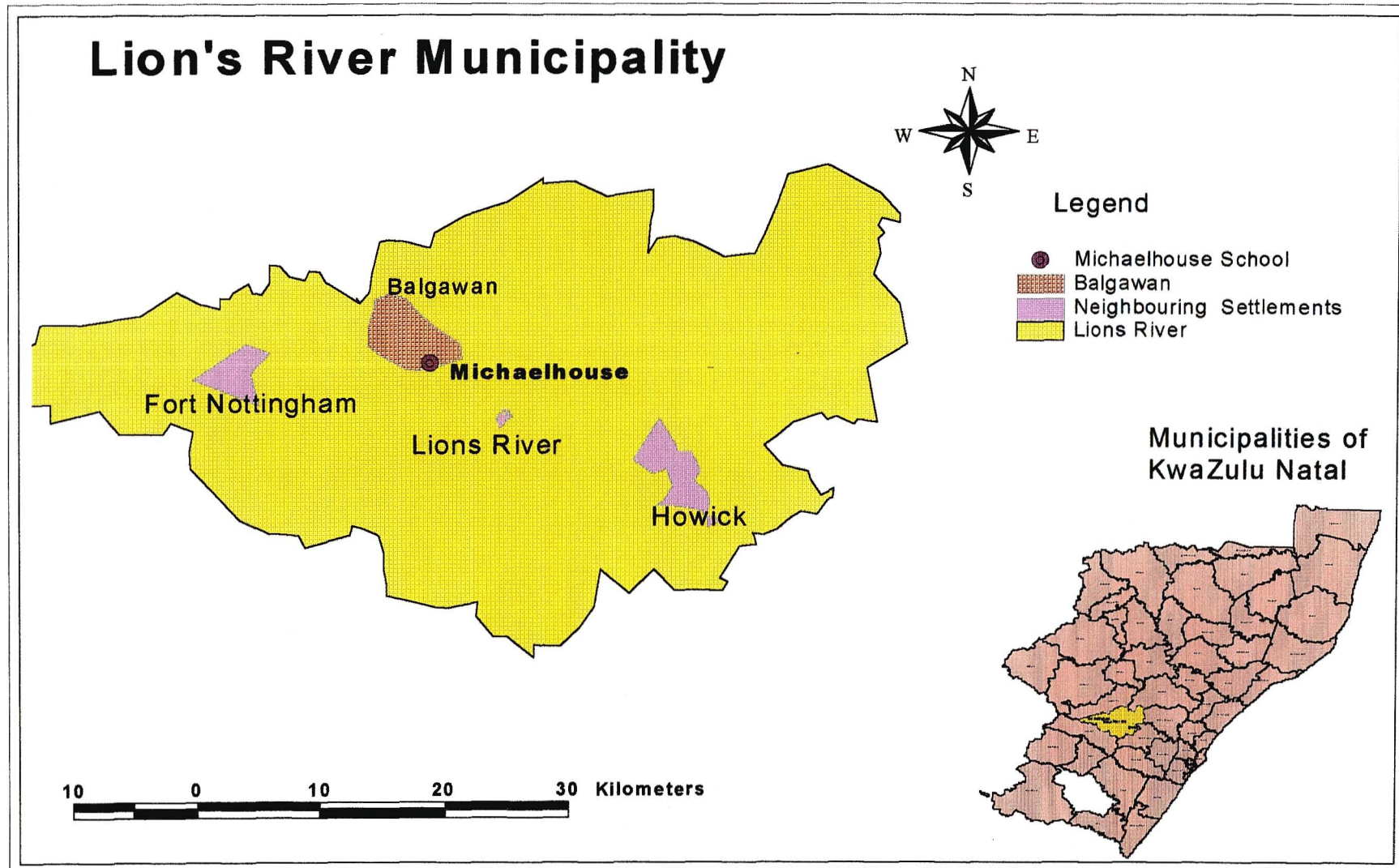


Figure: 2.1: Location of Michaelhouse within the Lion's River Municipality of KwaZulu-Natal



Figure 2.1: Location of Michaelhouse in Relation to Surrounding Towns/Cities, Roads and Rivers.

2.3 Biophysiological Characteristics

2.3.1 Topography

Four distinct terrain types are present in the school's property. About a third of the northern portion of the property is a relatively flat plain or pediment surface on which most of the school buildings are located. The main entrance to the school is situated on the northeast corner of the property at an altitude of 1275 meters above mean sea level. The road serving the school runs parallel to the northern boundary of the property. It crosses a small stream then follows a gentle uphill course to the campus infrastructure where the altitude is 1295 meters above mean sea level. Southwest of the campus is a distinct hill known as St. Michael's Mount, the crest of which is 1340 meters above mean sea level. Situated on this hill are the reservoirs and a garden refuse dumpsite. A valley occupies the central portion of the property and traverses southwest to northeast from an altitude of 1305 to 1275 meters above mean sea level. The dam, willows, vlei, meadows are located in this valley and the dam feeds the small stream noted above. The southeast portion of the property is a long slope that inclines down to the valley from 1385 meters above mean sea level; this is where the school's sewage oxidation ponds are situated.

2.3.2 Geology and Soils

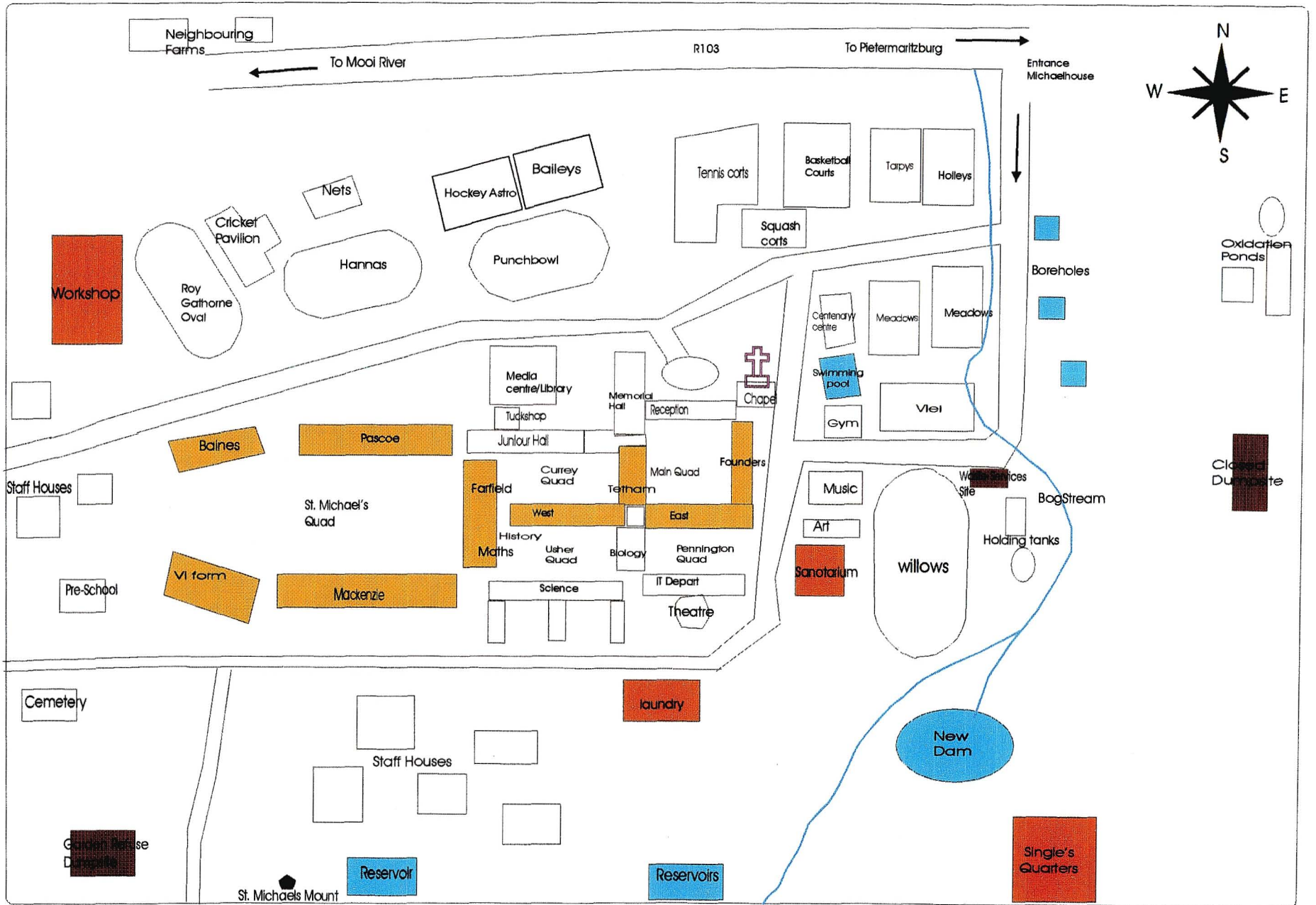
Michaelhouse is underlain by Vryheid formation shale and sandstone of Ecca subgroup of the Karoo sequence. These rocks are generally covered by up to a meter of Farningham soil. The A horizon of this soil form is a dark reddish-brown, loamy sand to clay, seldom deeper than 200 meters. The B horizon is a reddish-brown, loamy sand to porous non-block clay (SASAES, 1999). These soils have a very high agricultural potential (Schulze, 1982). Their soil water holding capacity is medium to good and they are not erodible. While slightly acid with a possibility of a toxic concentration of aluminium, they are rich in organic matter and have most macronutrients and micronutrients needed for plant growth.

2.3.3 Climate

According to Schulze (1982) the region receives precipitation ranging from 650mm to 900 mm per annum and a mean annual precipitation of 700mm, mostly falling in summer. Michaelhouse falls within rainfall region 14 of the KwaZulu-Natal Province. This region receives between 20.1 to 25.0 % of the annual rainfall during the winter months from mid May to the end of August. The mean annual, January and July temperatures are 19.5 °C and 10 °C respectively. The January temperature ranges from 13.5 to 26.5 °C while the July temperature ranges from 1.0 to 17.5 °C.

2.3.4 Vegetation

Michaelhouse is found in the Acocks 's (1988) veld type Southern Tall Grassveld number 65. This veld type is potentially dominated by the following grass species *Themeda* and *Hyparrhenia spp.* in exposed areas. In protected areas such as the School's valley, tree species, which could potentially be found, are listed in Appendix F (list derived from Acocks 1988). Vegetation at Michaelhouse and the immediate surroundings comprises predominantly grasslands but there are also trees and shrubs. The hill is covered with grass as well as the hill slope as it is exposed to the wind. The low-lying areas of the school are also covered with grass although constant mowing within the school buildings modifies the grass. There are certain plants which are suitable for this veld type and those that are not; Appendix F lists the planted exotics and indigenous trees at Michaelhouse.



Legend

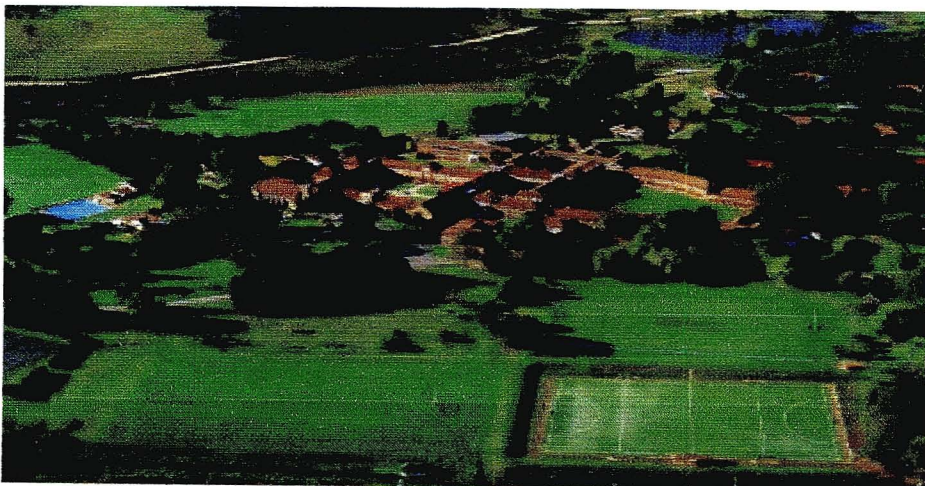
Areas of Concern

Water Access

2.4 Historical Background

Figure 2.3 shows the layout of the school's buildings. The school buildings are mostly redbrick, double-storied and tile-roofed with white window frames. The buildings are planned around beautiful quadrangles, decorated with fountains and statues. Archways and corridors replicate the British structural design. Downstairs there are wood-panelled dining rooms and classrooms and dayrooms, which face the quadrangles. Directly above these are study rooms for boys and dormitories. The chapel is situated at the heart of the school. Other facilities include the Media Centre/Library, which is fully equipped with computer rooms; video stations and its own Multi-Media Lecture Theatre; Science Department; Academic Departmental Centres and Counselling Complex and Outdoor Theatres. Further up, near staff houses, is the school's Laundry. The school also has a Sanatorium which is fully equipped to house 28 boys. Situated on the edge of the playing fields, is a fully equipped Gymnasium, and 25-meter Swimming Pool. The sports fields consist of an Astro-turf Hockey Pitch, six Rugby Fields, seven Turf-pitched Cricket Fields, three of which are used for Hockey, an Athletics Track, two all-weather Basketball Courts, seven Tennis Courts, and six Squash Courts, three of which are glass-backed and a number of Pavilions. The boys get involved in canoeing, fishery, cross-country running and cycling among other sports. The learners also become involved in regular outdoor activities where they demonstrate their leadership skills. A unique appearance of the built environment and the natural environment of the school is shown on Plate 2.1.

Plate 2.1: Michaelhouse Built and Natural Environments



The Anglican Church founded the school in Pietermaritzburg in 1896 as a private venture. It had two buildings and 15 boys. In 1901 the school was relocated to the Balgowan valley with 77 resident boys. A hundred years later, the school's intake is 533 boys and its infrastructure includes various buildings and facilities described in the preceding paragraph. The resident Chaplain together with the Rector assume responsibility for the welfare of the boys. There are no day scholars; all the boys live in the school's boarding houses, East, West, Founders, Tatham, Farfield, Pascoe, Baines, Mackenzie and VI form (refer to Figure 2.3). The school provides secondary education for boys from Grade 8 to Grade 12. It also offers a post-matric programme which provides a unique opportunity for learners to grow and mature while making progress academically as well as in the development of their chosen future careers. The population at Michaelhouse consists of four different categories, namely the Learners, Teachers, Administration and Blue-collar workers (gardeners, cleaners, cooks, mechanics, clerks). There are 45 permanent teachers and 14 temporary teachers and they reside on the property. There are 32 administration staff some of whom live at Michaelhouse. While some of the blue-collar workers live at the school, others travel in from surrounding villages and farms, some on the school owned property known as Zenzane village.

Michaelhouse owns two properties. The main one houses the school buildings; the other is Zenzane village and houses a primary school and some workers. Currently the school provides services such as water, waste collection, electricity and other basic services that may be required for this property. The school management wishes Zenzane to be an independent village that will be able to operate on its own in future, while the school acts as the administrator. The village is expected to expand and there are plans in the pipeline to provide more houses, approximately 70 more in addition to the existing 40 houses on this property. The additional houses will be sold to the public with first preference given to the Michaelhouse staff. The plan is expected to be set in motion in 2002 (Bates, pers.comm.,2001).

2.5 Environmental Problems and Response

An awareness of environmental problems in the school has existed for a number of years and because of these problems an Environmental Discussion Group (EDG) was established in 1996. This group dealt with environmental issues until early 2001 when an Environmental Committee (EC) was formed. As noted in chapter 1 that the school approached the University for assistance, it was necessary to inform the residents of the plan of action. The Director of Academics at Michaelhouse organised a workshop which was attended by all Michaelhouse teachers. It was at this workshop that the two projects, which were to deal with the two main objectives noted in chapter.1, were presented. During the presentations, a teacher asked the following question, “What is it that we are doing wrong in the environment?” (Molapo, pers.comm.,2001). The researcher interpreted it to mean that while there was awareness of environmental issues, an understanding of how to manage the environment was lacking. Furthermore, the question indicated willingness to have a better understanding of how to manage the environment.

2.5.1 Water Management

Domestic water at Michaelhouse is a free resource because users do not pay for it. The school originally had one reservoir located at St Michaels Mount seen on Figure 2.3, in addition to the existing three boreholes which are the main source of domestic water supply for the entire school; the location of boreholes is also shown on Figure 2.3. Two more reservoirs were installed in the 1990’s to improve the supply of water in the school. For water consumption purposes, the school’s water is regarded to be adequate because the school has not had major problems with the supply of water (EDG, 1996). In terms of boreholes efficiency, there has not been any concern with regard to boreholes drying out until 1999 when the water table was reported to have dropped considerably from a static water level of nine meters to 22 meters (EDG, 1999b). These boreholes are used for all the residents’ needs that require water-use including gardening, daily domestic activities and watering sports fields. As a result of multiple uses of water and total reliance on boreholes, the concern is that there might be problems in future as a result of over-consumption since the boreholes are put under pressure to supply sufficient water for the entire school. A new dam was

built (refer to Plate 2.1 and Figure 2.3), although the motivation behind building a dam was to have stand-by water for emergencies such as fire, EDG decided that the dam water may as well be used for watering of sports fields and gardening to ease regular boreholes use (EDG, 1999c). This would also help save power as the boreholes uses generators to pump water. The generators are set on timers to go on/off at 3 hour intervals to allow other boreholes to pump water as they are set on timers to go on/off at different times.

Water use is measured on daily basis except on Sundays. This is done at standard time (0730hours) to ensure precise measurements. The school uses a maximum of approximately 3 060 000 litres per day and a minimum of 629 00 litres per day from these three boreholes. Rockcliffe (pers.comm., 2001) stated that the demand is consistent throughout the year except during vacations, when learners and staff are absent, during which period water consumption drops to as low as 700 litres per day. It was also pointed out that the use of water also drops during rainy season when it is unnecessary to water gardens and sports fields, which have proved to be a major water consumer in the school. Further discussion of water use continues in chapter five.

In 1996 in the EDG meeting, as noted in section 2.5.3, there was concern that the leaking sewage pipes might affect domestic water. It was felt necessary to conduct water quality tests in order to be familiar with water quality status in the school. Mgeni Water Services was requested to conduct water tests on a regular basis for the school to check for the absence or presence of coliform bacteria in the water. These water samples were taken from three boreholes and the stream. Coliform bacteria were found in the stream and none in the boreholes. The polluted water is being treated. The Environmental Committee has assigned a member to establish a map which will indicate the water flow in the entire school and map out areas where water quality tests have been done. It is anticipated that with such information gathered, it will be easier to draw up a water management plan for the school.

2.5.2 Solid Waste Management

Prior to 1996, solid waste generated by the school was simply dumped at the site on

the school property (refer to Figure 2.3). At a meeting of the EDG, it was decided that the dumpsite had negative impacts because it was an eyesore, possible health hazard to the residents, source of possible water contaminant and its location was inappropriate. A decision was therefore made to close the dumpsite and upgrade the management of waste so that it would meet the requirements of the national legislation (EDG, 1996b). This upgrade involved the implementation of a number of initiatives. The most notable, was the attempt to recycle paper and plastic. This initiative was implemented by a science teacher and lasted for eighteen months. Paper was collected and taken to a paper recycling company in Pietermaritzburg where it was sold. This operation apparently stopped because the project supervisor became discouraged due to lack of support from the school management and secondly, when the supervising teacher left. Meanwhile the problem of increasing volumes of waste persisted.

In 1997, during an EDG meeting, a member proposed that an incinerator be purchased due to the increasing volume of waste but this was not feasible due to financial constraints. Other options were considered. The EDG considered getting the school engaged in a recycling process. It was anticipated that recycling would benefit the school in a number of ways such as keeping the school clean and also generate an income for the school, which would be used to purchase waste equipment needed for the school. The school management accepted the idea and the Rector authorised another attempt to recycle waste as an educational activity to encourage participation of learners in waste management. The attempt was unsuccessful due to lack of participation and lack of policy to enforce the process.

When solutions could not be reached regarding waste management, hiring an independent waste disposal consultant was an option. It was concluded that whatever system was adopted it should be flexible and cost-effective. In 1998 it was suggested that Waste-Services be contracted to provide a service for the school (EDG, 1998). Waste-Services was employed in 1999 and is still employed to date. Waste Services provided the following equipment, wheeli-bins, compactor and large containers. Plate 2.2 shows some of the equipment provided by Waste Services; their location is also shown on Figure 2.3. The compactor is used to compress all other solid waste generated in the school except bottles of which two containers are provided, one for

clear bottles and the other for brown/green bottles. The Wheeli-bins are placed on certain areas around the school, whereby labourers on a regular basis empty them. It must be noted that waste is not separated before it goes into the waste stream.

Plate 2.2 Waste Service Compactor and Containers



In 2001, the estate manager conducted investigations to determine the possible cost implications of supplying 45 staff houses, nine dormitories and some school facilities with 4 refuse bins to enable separation of waste before it enters the waste stream / at source. The costs were found to be too high, estimated at approximately R43, 590.00 including four bins per unit; concrete stands for bins, composting units, transportation costs and full-time labour responsible for the process. The cost implications were considered too high therefore the possibility was abandoned (EC, 2001a). Towards the end of 2001, Enviro-Serv (a waste company) approached the school with a proposal to establish an on-site waste management system at Michaelhouse. The proposed waste management system entailed management of dry general waste and management of hazardous waste. The cost implications for the following services from Enviro-Serv were approximately R11, 400.00. These costs will fluctuate depending on whether the school purchases bins or hires them. The proposal was reviewed, discussed by EC and found feasible. It was handed over to the school management to decide whether it was viability. The decision is still pending (EC, 2001b).

The disposal of garden refuse is also another major problem because this type of waste is being produced in high volumes as the grounds require to be modified regularly and also the clearing of alien plants. The garden refuse is collected by the workers and dumped on the garden refuse dumpsite located at St. Michaels Mount, the refuse dumpsite is shown on Figure 2.3. The EC suggested that the school should compost this valuable resource, and re-use it whenever necessary. The members discussed the possibility of employing a waste contractor, who would be responsible to dig up the compost and turning it every three to four months in order to produce good compost, At the moment the dumpsite is filling up fast and to slow it down it was suggested that timber could be sorted out and used for firewood purposes. The idea for composting was accepted by the EC and at the moment an experiment is being conducted in one of the staff houses with a vemi-compost (an equipment which uses worms to compost) to determine the viability of the equipment working properly in the school. If it works properly, it will be used to compost waste from the kitchen, staff houses and other school facilities producing waste suitable for composting and refuse from school grounds (EC, 2001b).

2.5.3 Sewage and Wastewater

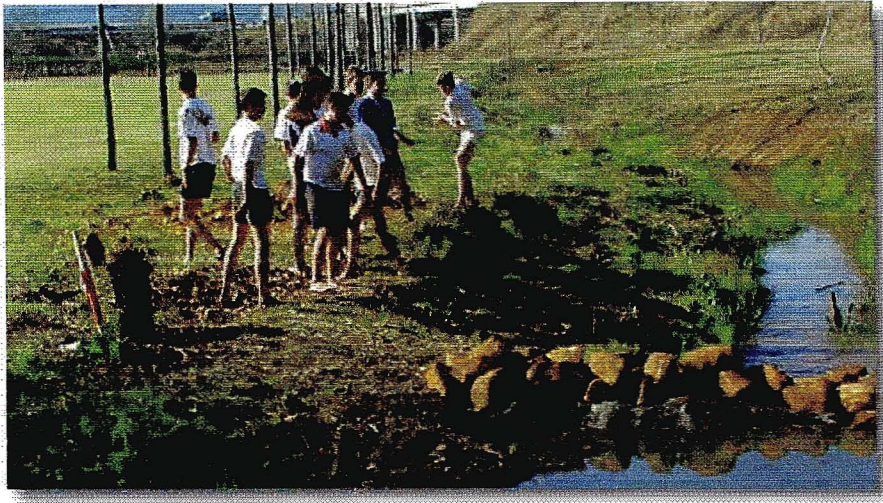
According to Pickstone (pers.comm., 2001) there was a stream flowing close to the school which was re-channelled through the school grounds and used as the main sewage outlet soon after the relocation of the school to the Balgowan valley. The stream also known as the Bog Stream (also shown on Figure 2.3.), was used for this purpose over the years but its use ceased when new technology was introduced to the school, that is the implementation of oxidation ponds to manage the school's sewage. However, some of the pipe outlets to the stream were not blocked entirely. It was at this point that major problems were experienced with regard to the contamination of the Bog Stream. The EDG discussed these and concluded that the school's sewage system, like the solid waste disposal system, needed upgrading and a long-term plan in place in order to function properly and be maintained for future use (EDG, 1997). In 1998, the EDG decided that a sewage system specialist be brought in to investigate the long-term solutions. The specialist was brought in the following year and his investigations revealed that a sewage outlet leading to the Bog Stream needed to be blocked properly. The investigations also uncovered an unrecorded drain north of the

Junior Hall (EDG, 1998) its location is shown on Figure.2.3. The location of this drain was noted and recorded.

The sewage systems at Michaelhouse have changed remarkably over time, as mentioned earlier. At first the Bog Stream was used as an outlet, then with technology, the oxidation pond system was adopted; the sewage is now pumped into the oxidation ponds where it is treated. Despite this effort made to implement improved technology, there were some problems associated with the oxidation ponds. There was concern that the oxidation ponds might not be able to serve the growing population at Michaelhouse in future. At this point an engineer consultant was appointed to evaluate the long-term plan for the oxidation sewage system. His findings indicated that because of the geology of the area, the location of the oxidation ponds on the hill was not appropriate and the ponds would always be a potential source of pollution. The consultant suggested that while it would be possible to keep the oxidation ponds for short-term solutions, implementation of a new sewage system must be considered (EDG, 1999a). In 2000 septic tanks were considered as an alternative and were installed in some of the houses, but it was also discovered that it might not be feasible to install septic tanks for all houses and facilities due to the topography of the school and also the inability to identify the exact location of certain pipes. It is important that sewage systems are properly managed because if not, they can pollute drinking and/or surface water or cause detrimental health consequences.

In 1999, a decision was made by the EDG to rehabilitate the stream and a wetland/Vlei that had become stagnant. The rehabilitation process entailed recreation of the stream to its natural form by re-introducing species that were found along the original stream, as well as species that could stabilise the stream's natural system. Plate 2.3 shows a section of the Bog Stream rehabilitation project at Michaelhouse.

Plate 2.3 Bog-Stream Rehabilitation Project



A KwaZulu-Natal Parks Board Area Manager conducted the Bog Stream Environmental Impact Assessment (EIA) to determine whether the school should embark on the rehabilitation process. The plan was accepted and recommendations regarding the Bog Stream were forwarded to the Department of Forestry and Land Affairs in Pietermaritzburg. The rehabilitation project commenced in 2000 and it is expected to run indefinitely as it is expected to bring in new initiatives and improvements as it progresses (Pickstone, pers.comm., 2001). Plate 2.3 shows the learners working on the Bog Stream during their free period. The boys are sloping the edge of the stream. The rehabilitation started down stream to the northeast corner of the property, close to the school main entrance and the work progress up stream towards the new dam.

In 1997 there was a complaint from the Environmental Justice Network Forum, a local organisation dealing with legal concerns in the District. There was effluent from Michaelhouse polluting the neighbouring farm as the same stream runs through to a neighbouring farm. The problem was looked into and the estate manager worked with the Mgeni Water Services to conduct tests in the Bog Stream. High counts of e-coli were present and the EDG suggested that investigations be carried out to check whether there were any leaking pipes overlooked that might be causing the pollution in the stream. The pollution in the Bog Stream persisted and in 2000 the previously

mentioned problem was raised again to in an attempt to solve it. Traces of coliform bacteria were found in the stream and the water was found unsuitable for human consumption. Having blocked the suspected outlet, the source of this contamination was not conclusive but there was speculation that the source might be treated wastewater from the holding tanks or waste from the kitchen drains or leakage from oxidation ponds or pollution from outside the school premises because some water flowing into the stream comes from outside. The EDG assigned a member to investigate this problem further and seek advice on the approach to be taken to address this kind of problem (EDG, 2000).

In 1999, EDG suggested that wastewater from the laundry be treated separately and re-used for other purposes such as irrigation or returned to the laundry for re-use. This was accomplished in 2000 whereby wastewater was diverted from the laundry into holding tanks where it is chemically treated; the location of holding tanks is shown on Figure 2.3. Despite the excellent decision made for re-use of water there were concerns raised that the precipitated chemicals might affect the wetland nearby and also as a result of the chemicals, an obnoxious odour was reported and it was also reported that during power cuts the two holding tanks fill-up. Furthermore, during heavy rainfall effluent in these tanks is washed away in to the stream and this could be the reason why the stream may be the source of pollution reported to the Environmental Justice Network Forum. The EDG proposed to address the odour problem by adding chemicals into the holding tanks to eliminate the smell (EDG, 2000) and have a stand-by generator should there be power failure. Leakages and bust pipes continue to be a problem at Michaelhouse.

2.5.4 Vegetation Management

As noted in section 2.1.4 Michaelhouse vegetation is predominantly grassland. There are trees in the school but they are largely exotics, these trees were planted to commemorate Michaelhouse boys who died in World War. One. These trees were imported a number of decades ago and have persevered because being new to the region, exotics grow quicker and easier than indigenous trees as they are not exposed to insects, fungi, bacteria and animals which might destroy them. The school is in the process of introducing indigenous trees. The school made a request to the Department

of Water Affairs and Forestry to introduce indigenous trees in the school and the request was accepted. The school is now planting indigenous trees along the Bog Stream and close to the school's main entrance. It is anticipated that in the long run the indigenous plants will be more dominant in the school and will benefit the school in terms of educational purposes by acquainting boys with the local heritage.

Another area of interest regarding the plantation of indigenous trees is St. Michaels Mount (refer to Figure 2.3) for its location. St. Michaels Mount is one of the areas defining the environmental beauty of Michaelhouse. Pickstone (pers.comm., 2001) stated that the decision to plant indigenous trees at St. Michaels Mount was done mainly to hide the reservoirs from view. He also mentioned that in other parts of the school the indigenous trees were grown for the aesthetic purposes. Since the school has predominantly exotic trees. Introducing indigenous trees would be a way of changing the exotic culture and bring the school closer to an indigenous culture. He pointed out that there were factors which required attention to be able to succeed in growing indigenous trees. Firstly, to take into consideration the soil depth because the soil on St. Michaels Mount is very rocky and shallow therefore trees might not survive. Secondly, the area was previously covered in *Acacia dealbata* and Gum⁺ (alien invasive plants). These are difficult to remove, and the new plants have to be able to tolerate competition from reinvasion of these alien plants. The plants decided upon for St. Michaels Mount were *Buddleja* as it is a tough pioneer species that is likely to tolerate the rough conditions. Yellowwoods would be planted later to provide protection for the *Buddleja*. The reason for the Yellowwoods is that they will provide height without being invasive. Exotics are also known to consume a lot of water and in order to conserve water all the exotic trees on St. Michaels Mount have been felled. The southern slope will be returned to natural grassland and the northern slope will be planted with specific indigenous trees.

In general the school has a huge problem of invasive alien plants specifically *Acacia dealbata*, Gum⁺ and *Pinus spp.* Cutting down the re-growth and burning it are some of the methods used to deal with invasive plants. Other ways include poisoning the tree stumps and pulling out the roots whenever possible; the treatments for these invasive plants are further detailed in chapter five. Whilst the trees are expected to benefit the school, there are also problems associated with the activity of planting

indigenous tree in the school.

Some of the problems faced as a result of the vegetation are connected with water management. It was reported that some tree roots from these exotics have cracked one of the main water pipes resulting in excessive water loss. The plan was to remove the trees on the watercourses and de-stump them to be able to upgrade the pipes. However this is difficult to implement as the map which will indicate the location of water pipes/ watercourse is still being done. The recent proposed development regarding vegetation management in the school is to have a holistic and constructive management plan for the trees. At present an EC member is investigating this issue but the choices are either to have learners at Michaelhouse engage in a project to identify all the trees in the school or to have an independent project to map out all trees in the entire school on Geographic Information System (GIS).

2.6 Other Environmental Initiatives

As noted in chapter one that the school has committed itself to achieving two main objectives with regard to environmental management, one of which is to produce environmentally active citizens. In order to achieve this objective, an Environmental Education (EE) project was carried out at Michaelhouse. The initiative was strongly supported by the school as the following quotation suggest, *“We believe that those who acquire a love for learning early in life will develop the inner resources necessary to meet, successfully, the challenges of their future”* www.michaelhouse.org/. This indicates the importance of learning in general terms and it is anticipated that since the environment has become as important to the world at large, learning about it at an early stage will help prepare learners to face future challenges in this perspective; *“We believe that boys should be educated in ways that will ensure long term conservation of our natural resources and through this understanding be able to provide leadership in creating a sustainable environment in the future”* www.michaelhouse.org/.

The school management wishes to integrate environmental education in all aspects and levels of the school and in order to achieve this; Lethoba (2001) investigated ways in which EE can be implemented in the school. Lethoba (2001) took EE classes

with grade 8 and grade 9 learners to explore the extent to which EE will be received by learners. She and the learners explored the use of the local school environment as a framework for EE programmes. The findings indicated that there was awareness among learners and teachers about environmental matters. What lacked was more exposure to hands-on activities. Environmental Education encourages development of skills rather than just passing of knowledge from a teacher to a learner. It was therefore suggested that more time should be dedicated to EE to make it a success. This would be possible with the help of the school management and administration, to accommodate EE programmes from the on-set when structuring the school's curriculum. Once the programme is in place, all teachers should be given training on how to integrate EE into the formal curriculum, thus learners would be able to develop the necessary skills and attitude about the environment. Lethoba (2001) asserts that the success of implementing EE will lay a good foundation towards having an environmentally sensitive and literate future generation.

Also related to education, the school owns land which was originally leased out as grazing land. It was later proposed that the land be developed as a mini game reserve called Midlands Oribi Reserve. In conjunction with the KwaZulu Natal Wildlife Services and Michaelhouse School, a private Midlands Oribi Reserve was established (refer to Appendix G, Figure 7.2). The property has been restored to its original condition through the eradication of timber plantations, wattle and other invader species. Indigenous game have been reintroduced and trout dams will be established in the near future. The property has breeding pairs of Reedbuck and Oribi. Species reintroduced include, Blesbuck, Hartebees, Wildebeest and Zebra. It is anticipated that the project will be beneficial to Michaelhouse both financially and educationally. The reserve will be available to the staff and learners on a controlled basis for learning and recreational purposes and will also be available to the public for leisure. The reserve was officially declared opened in 2001.

The initiatives and problems mentioned in this chapter strongly demonstrate that there is need for a framework in place that will regulate environmental practices in the school. The framework will provide the school with a formal set-up that can be referred to as a form of guidance whenever important initiatives are to be embarked on in the future. As noted in chapter one, this project provides baseline information, it

is a progress towards achieving the second objective also noted in chapter one. To recapitulate, it is 'to acquire the expertise to administer the school in an environmentally holistic manner' to ensure sustainability.

CHAPTER THREE: CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter provides the conceptual framework used for this study and way of thinking used by the researcher within which the research problem is situated. The challenge was to try to attend to the research problem in the best possible manner. To accomplish the aim of the study, as an opening to the discussion, issues researched in the literature were presented in a form of questions, such as: to what extent is the environment protected by the legislation? To what extent can tools of environmental management be used to ascertain sound environmental performance in South Africa? And how can an environmental management system as a tool for environmental management be used to manage the environment at Michaelhouse private school?

In order to answer these questions, the literature is drawn from a broader framework of sustainable development. Sustainable development becomes important because it has been fully embraced worldwide. To kick-start the discussion, the international perspective of environmental concerns prior the 1992 Rio de Janeiro summit on sustainable development are discussed, in view of the definition of sustainable development as provided by the 1987 Brundtland report and other authors who have provided related definitions of sustainable development. Furthermore, Agenda 21 whose aim is to achieve sustainable development is discussed in this chapter intertwined with the principles of sustainable development. It was considered necessary to include in the discussion, globalisation as it was a result of the new developmental dimensions that were being initiated worldwide. The concept of globalisation is linked to sustainable development framework because, as a result of these developments, it was realised that there is a need to have sustainable development. The literature on the history of environmental management in South Africa was reviewed in order to ascertain how environmental problems at Michaelhouse are dealt with at national level and whether there are guidelines or legislation, which addresses waste, water and vegetation management at national level.

3.2 Sustainable Development

The inspiration to establish sound environmental performance comes from the need to have sustainable environmental management. The strength of sustainable development is said to lie within the fact that it can accommodate different and sometimes opposing fields but nevertheless still show the value of its goals and objectives towards positive development. It shows the importance and necessity to manage the environment in a holistic manner to maintain the well being of present and future generations (Brundtland report, 1987 cited in Reid, 1995). The term 'environment' is discussed below to highlight the path towards the need for sustainable development.

A definition of 'Environment' in general terms embraces the conditions and /or influences under which any individual or thing exists; lives and developments; this includes land, water, atmosphere and places of special importance, plants, animals and human beings. This environment has to be kept clean and healthy in order to maintain the living things in it (Barrow, 1995). International countries have mostly practiced the above mentioned concept and there are examples of well-established environmental management in the developed countries, which have been possible through improved information and technology. International environmentally aware organisations, have dealt with the term environment through encouraging and putting pressure on their respective local organisations to manage the environment in a way that will lead to sustainable development (Blowers, 1997).

The last author noted above asserts that the concern apparent in modern society, towards achieving sustainable development has emerged against the background of geopolitical change worldwide. Against this background is the problem of environmental instabilities and insecurities. It is the nature and the scale of these environmental concerns and their political importance that has grown and changed considerably over the past two decades. There has been a perceptible shift in these environmental concerns both in scale and nature, especially at global level. It is conceivable that the challenge posed by these concerns of global environmental changes heralds a defining moment of social change worldwide; globalisation is discussed later in the text. As much as it is important to focus at the national and the local levels when addressing these environmental problems, the global level should

not be neglected because in one way or another the global level will be affected by what happens at the national and local levels.

In 1987, the Brundtland Commission was the first institution to openly propose a conference on the combination of environment and development. The Brundtland report defined sustainable development as a concept that “*meets the needs of the present without compromising the ability of future generations to meet their own needs*”(Brundtland report, 1987 cited in Reid, 1995:16). Whereas United Kingdom’s White Paper drawing from the Brundtland report though it modified the concept and defined it as “*living on the earth’s income rather than eroding its capital. It means keeping the consumption of renewable natural resources within the limits of their replenishment. It means handing down to successive generations not only man-made wealth, but also natural wealth, such as clean and adequate water supplies, good arable land, a wealth of wildlife and ample forests*” (DoE, 1996:1). The latter definition is an extension of the former and simply puts emphasis on the fact that the resources should be used but within reasonable quantities with the key word as ‘conservation’. Both definitions place emphasis on the wise use of resources for present and future generations. However the latter acknowledges the fact that, as much as resources should be used considerable they are limited therefore should be conserved depending potential replenishment.

The wide ranges of interpretations and definitions given to this concept have shown that there is no single accepted definition and no single clear path, or model for achieving sustainable development. Environmental pressure groups present the concept of sustainable development as an important new contribution to the environmental debate (Beckerman, 1994). Arguing that the relationship between the environment and the society poses a challenge both at the level of thought and of action. Even more of a challenge is what kind of action that can be taken to deal with problems associated with the physical environment versus the social environment.

The combination of the physical and social environments represent an enduring debate in social scientific discourse between a liberal, pluralist and reformist explanation of social change as opposed to radical perspective which stresses conflict, inequality of power and revolutionary change (Blowers, 1997). The debate holds an

ideology known as environmentalism, basically recognising environmental constraints on development. These perspectives also hold the theoretical discourse about the nature of modern society and the sources of these changes. Environmental problems do not occur by themselves but are the products of the society's actions. Almost all of the environmental problems are interference and imposition of human activities. These actions take place as the society is changing to better its living environment. Some problems will demand attention and immediate action while others will be neglected as they may be considered as less harmful. This is a problem because some of these neglected problems may show little impact at that present time but in the long-term prove to be detrimental. It also becomes difficult to address some of these problems as some are physical in nature while others are socially related.

03
The core objective of sustainable development is optimising human welfare. Sustainable development ensures that the local and global environmental resources that communities depend on are maintained and enhanced. 'The key word in sustainable development is to try to ensure 'intergenerational equity' (Barton, 1995; Furuseth and Cocklin, 1995). Furthermore to achieve sustainable development, conservation of resources must be practiced. It is argued that pressure on resources increases when people do not have choices. One way to overcome this pressure is through developmental policies providing a space for alternatives to widen people's choices. An example as noted by Nath, Hens and Devuyt (1993) is that areas where resources like fisheries or forestry have been over exploited; agriculture can be introduced as an optional resource for living. It is important to emphasise the fact that living sustainably depends on commitment of individuals, who in turn will make a community which believes in sustainable practices. This is essential because communities are ideal places where changes initiated by members are bound to show valuable significance and in the long run attain sustainability.

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Furthermore, sustainable development is primarily about the management of natural and physical resources- land, air, coast, the urban infrastructure and so on. Fuggle and Rabie (1992) assert that although the supply of certain resources may be in abundance, supply of some important resources is very limited. Therefore, Furuseth and Cocklin (1995) argue that these resources may be used and developed but within a framework of sound ecological practices. Many authors are of the opinion that

sustainable management requires sustainable resource use, sustaining ecological systems and sustaining environmental costs in decision-making and environmental quality. With this regard, sustainable management becomes a vision of the promotion of sustainable development in a long term because it is anticipated that sustainable management would make provision for the needs of future generations and ensure that fundamental resources are safeguarded. This is done in such a way that people are allowed to be the managers of their own resources. Furuseth and Cocklin (1995) assert that whatever is in the best interests of the environment as a whole should be a guideline when addressing environmental issues.

Among other authors, Blowers (1997) addressed sustainable development by indicating that sustainable development has emerged as an all-encompassing idea suggesting a process of social transformation (development) brought about by irresistible physical constraints (sustainability). *“It is at once a scientific principle, a political goal, a social practice and a moral guideline (Blowers, 1997:846)”*. The authors’ addition to the Brundtland and DoE’s definitions is to bring to the attention of the reader the need to acknowledge the fact that conservation of resources may not be as straight forward as it might be perceived, taking in to consideration the previous definitions but that a comprehensive approach towards attaining sustainable development should embrace other external elements such as politics, social needs and moral issues. This indeed is supported by the South Africa’s National Environmental Management Act (NEMA) 107 of 1998, which defines sustainable development as the integration of social, economic and environmental factors into planning. However the definition provided by Brundtland report of 1987 remained the most dominant and most used definition over the years and to date.

Sustainable development can be traced from the early 1960s to 1970s. However, the definition as given by the Brundtland commission on sustainable development was legitimised and elaborated on by the United Nation’s Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 on sustainable development. The dimension taken from this conference was to give the natural environment equal weight to the social environment by considering the natural and the social aspects at the same level (Barrett and van der Merwe, 1992). In essence the message from this conference was to emphasise urgency in putting the human beings at the center of the

environmental concerns. The Brundtland report had proposed specific measures for implementation inter alia: 'to prepare under United Nations (UN) auspices a universal declaration on environmental protection and sustainable development and a subsequent convention', 'to transform this report into a UN programme on sustainable development' and 'an international conference could be convened to review progress made...' (Grubb *et al*, 1993:7). The Rio de Janeiro conference was thereof a direct response to the proposal put forward by the Brundtland commission report, as a follow up conference convened to review progress made on the global environmental concerns.

Furthermore, the 1992 Rio conference also tabled Agenda 21, which is an action plan and blueprint for sustainable development adopted at this same conference. Other documents adopted were; the Rio Declaration on Environment and Development and its 27 principles that guide nations as they pursue human development and well-being; A statement of principles to guide the management, conservation and sustainable development of all types of forests; The United Nations' Framework Convention on Climate Change and The Convention on Biological Diversity (Grubb *et al*, 1993). Five years later in 1997 there was a follow up summit known as the 'Rio+5' Earth Summit held in New York by the United Nations General Assembly to review and evaluate progress since the Rio Earth Summit.

Rio+5 attempted to raise the profile of issues that had come to the forefront subsequent to United Nation programme and define priorities for the after Rio+5. However, according to most observers, Rio+5 was viewed as a major disappointment, lacking particularly clear and concrete targets and timeframes, as well as strong commitments. Developed countries and their specific agendas were seen as dominating the debate and setting priorities while little attention was given to the development concerns of developing countries. It was due to this factor that a decision was made to organise another Earth Summit. The subsequent Earth Summit is to be held in South Africa-Johannesburg in 2002. Since the Earth Summit will be held in Africa, the poorest continent on the planet, it is anticipated that the summit will address important issues of equity, poverty alleviation and sustainable socio-economic development, as they are the major problems facing Africa. Countries, which signed agreements for international treaties, are required to send annual reports

to the United Nations Commission for Sustainable Development (UNCSD) for the progress on sustainable development for each respective country. The Department of Environmental Affairs and Tourism (DEAT) as the lead agent for the environment in South Africa is responsible for providing the UNCSD with annual reports on progress on sustainable development.

3.2.1 Agenda 21

South Africa, having been inspired by these international summits to take action on environmental matters, and as part and parcel of the international treaties, took responsibility to get involved with institutions that will bring in change to South Africa through passing of national laws and development of national policies, implementation of management strategies to accommodate environmental change. South Africa adopted Agenda 21 as part of the management strategies and this was reaffirmed at Rio+5 Earth Summit. Agenda 21 (the Global Environment and Development Agenda for the twenty-first century) was originally adopted at the Earth Summit in Rio de Janeiro in 1992 by a multitude of countries.

Agenda 21 is a dynamic programme carried out by the various numbers of countries according to their different situations, capacities and priorities of countries' needs. When the concept was adopted, it was expected that it could evolve over time in the light of changing needs and circumstances for different countries. Irrespective of the changes, adoption of Agenda 21 marked the beginning of a new global partnership for sustainable development. It provides internationally endorsed guidelines for the preparation of national policy frameworks to promote sustainable development and the integration of environmental considerations with development. Agenda 21 aims at addressing the unfavourable problems of today. Furthermore, it aims to prepare for the challenges the world has to face for the next generations. It reflects a global common agreement at the highest level of development and environment. The implementation of Agenda 21 is the responsibility of governments globally towards achieving sustainable development. Some of the principles as laid out by the Rio Declaration on Environment and Development were found relevant to this study, the relevant principles proclaims that,

Principles of Agenda 21

- Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony of nature (principle.1).
- The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations (3).
- In order to attain sustainable development, environmental protection shall constitute an integral part of the development process (4).
- To achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies (8).
- Environmental issues are best handled with the participation of all concerned citizens, at all relevant levels. At the national level, each individual shall have appropriate access to information concerning the environment... and the opportunity to participate in decision-making process. States shall facilitates and encourage public awareness and participation by making information widely available (10).
- States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply (11).
- ...the precautionary approach shall duly be used.... Where there are environmental threats, cost effective measures shall be used to prevent environmental damage (15).
- States and all people shall cooperate in good faith and in the spirit of partnership in the fulfillment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development (27). (Grubb *et al*, 1993:87-89).

The above principles correspond with the key principles of sustainable development as detailed by Atkinson and Urquhart (2000) when discussing sustainable development and local government. These principles place emphasis on the relationship between the environment and people, these principles further encourages sustainable development and any intentions pertaining to new developments. It is argued that sustainable development is possible when there is effective dissemination of information among all people concerned. In addition to this, enactment of environmental legislation, which shall be abided by, and guide all forms of development is essential. The use and application of such laws can be seen in a case whereby environmental damages occurred but the sources of damage could not exactly be traced, and as a result to this, precautionary principle was considered necessary and the circumstances were internalised by adding the polluter-pays principles which actually lay responsibility to whoever is accountable for the environmental damage.

3.2.2 A Critical Review of Sustainable Development

As a result of confusion and inability to understand the consequences of development incidences worldwide, authors determined to find solutions to the problems, started viewing effects from a different angle by critically evaluating the effects resulting from developments. Sustainable development is critically reviewed in the light of a cause or contribution towards poor developments noted above. The argument is that the concept is inconsistent because of its numerous definitions therefore makes it hard to rely on. Sharachcharandra (1991) identifies a number of issues within the framework of sustainable development and suggests that for the concept to be acceptable such elements require attention. The author acknowledges that sustainable development as a concept has been under scrutiny for the last two or three decades. The author further acknowledges that there has been transformation in the environment and development relationship. In the past, the question that was frequently asked was ‘do development and environment contradict each other?’ but recently the common question asked is ‘having combined development and environment, how can sustainable development be achieved?’ This is now the question because a consensus was reached that the two concepts can actually be related and this shows progress in terms of continuance in understanding the global

effects.

Sustainable development gained popularity among developers all over the world. Most appraisals were of how the concept would lead the world into a better future. There has not been complete support though; instead there have been murmurs of disapproval and doubts have been voiced regarding the concept providing a bright future for all. The doubts were raised because of lack of consistency when defining the term as mentioned in the preceding paragraph. Through these disapprovals, some authors still maintain that sustainable development is worthy, Buttel and Gillespie (1988) cited in Sharachchandra (1991) asserts that the value of the phrase lies in its vagueness and ambiguity, thus allowing people to search for common ground without appearing to compromise their positions. As discussed in Sharachchandra (1991) the vagueness of the term has led to misinterpretation of the concept by different institutions when trying to define it. Thus the best approach forward would be to identify the common ground, that is important elements that constitute the term then capitalise on these aspects without necessarily redefining the term.

In contrast, as discussed by Mkhulisi (2000), the vagueness of the term opens it to political manipulations. Defining the term is a crucial stage if the term is to be used as a new pattern of development, therefore an exact definition must be attained. Others argue that despite its vagueness perhaps because of the vagueness, the phrase becomes an important statement. A Dutch scientist pointed out that the phrase has more character of a moral principle than a lot of precise definitions. He says, 'sustainability is not something to be defined but to be declared, it is an ethical guiding principle' (Reid, 1995). The phrase is about people being in favor of it while retaining their individual definitions of what it actually means. The vagueness and ambiguity stems from the Brundtland report's definition of sustainable development. The famous "...meets the needs of the present without compromising the ability of future generations to meet their own needs" is said to have a gratifying simplicity. Offering no hint of what sustainable development involves in practice, what commitments it requires and at what costs, one can just about deduce that it is an ambitious statement. In addition, the definition has a rhetorical quality when saying without compromising the future generations. It is totally avoiding acknowledging that there are negative implications that can occur. It also refuses to admit openly that

it is possible that the world is fast approaching limits to growth and that the limit can actually be reached.

When assessing the same definition as provided by Brundtland commission, ironically, the strength of the concept is in "...meets the needs of the present without compromising the ability of future generations to meet their own needs". While the weakness is that it does not acknowledge negative implications of developments, it encourages conservation and conservation ensures opportunities for future generations. The ambiguity of sustainable developments' definitions raises more questions of what sustainable development really is. However one can conclude that explaining the term sustainable development is an on-going process, which seems to require full cooperation of developers and environmental activists to work together to reach a consensus. The concept should work even if it has not reached certainty of how it should work so long as it gives out half or satisfactory results because that holds remarkable improvement considering the state of the environmental problems experienced worldwide.

The use of the term interchangeably with other related phrases has proved to be problematic as they give the term different interpretations. Phrases such as 'ecological sustainability' 'environmentally sound development' 'sustained growth' 'successful development' and so on. However one could refine this contradiction by conceptualising the terms 'sustainable' and 'development' separately first to have a clear meaning of each, then merge them. For example defining development as a process of change then define sustainable as a process of change and give reasons why the process of change is necessary. It is essential to understand what constitute development to determine the extent to which the process of change can be stretched. In this way the two terms can be easily associated with each other in a meaningful manner.

Furthermore, it is important to acknowledge the fact that even before sustainable development was introduced, environmental problems were still within the capabilities of the humans to solve. The most probable aspect missing was the ability to act on those capabilities. This aspect was realised, hence the decision to put together World Summits that subsequently introduced sustainable development. The

central point to sustainable development is to focus on its context, which is to look at environmental problems not in isolation rather look at them in relation to each other.

3.3 International Perspective

Historically, the debates about environmental concerns were directed at the local level and occasionally regional level and none appeared to be noticed at global level. Over time it became apparent that environmental problems, although visible at the lower levels, were indeed affecting the national level and ultimately the global level (Grubb, Koch, Munson, Sullivan and Thomson, 1993; Reid, 1995). After that realisation, environmental concerns at the global level were taken more seriously as they became an eyesore to many countries and a center of concern. Impacts of human activities on the environment became increasingly clear and a link was recognised between broader aspects of social and economic developments and the environmental concerns. Most of these environmental concerns are related to each other although their relationship may not always be obvious or easy to identify. Due to the persistent deterioration of the environment and the need to preserve it for present and future generations, the environment became an essential component of international treaties working towards solving global environmental concerns.

For example, in Europe, the driving force to address environmental issues came from two events, first from the Stockholm Conference in 1971 and the second through adoption of a formal Environmental Policy in 1972 by the European Community. Each event stressed the need for concerted action to tackle the growing environmental problems at an international level. Both developments emphasised the need for preventative action, which as far as possible avoided environmental damage, rather than simply trying to control or ameliorate damage after its occurrence (Nath, Hens and Devuyt, 1993). The two developments realised the importance of information dissemination in directing and underpinning policy action and informing the public about plans of action in addressing environmental issues. This European example highlights two things, firstly, the importance of taking measures before damage occurs and secondly, the importance of participation by the public in dealing with environmental issues as people are affected and are responsible either directly or indirectly.

3.3.1 Globalisation

Bromley (1996) argues that the central message for globalisation becomes difficult to capture because there are many discourses which characterise the concept, nevertheless there are common themes that may be used to identify the concept. Globalisation is identified as *“the process whereby the economic, political, social and cultural links between different countries, industries, companies and organizations and individuals of the world are increasing”*(Isaacs, Shafika and Turp, 1997:11). While Atkinson and Urquhart (2000:11) define it as *“the increasing integration of the world in a variety of economic and non-economic ways, as the flow of goods, services, people and money across national borders increases”*. Both definitions emphasises the involvement of countries at the international level in terms of resources’ supply and flows among countries. Globalisation has been occurring gradually for a long time but rose rapidly in the 1970’s just as well as sustainable development, due to the economic crisis experienced globally during this period. This period coincides with the research conducted with regard to environmental concerns that led to the need to organise an Earth Summit that would address environmental concerns. As mentioned earlier that globalisation integrates a number of issues such as political, social and economic effects, whilst there has been progress in the integration process in terms of technological advance, it is important to point out that the same effects have impacted negatively on the poor people internationally. One can draw a conclusion in this regard that globalisation has made rich people richer and has made the poor poorer. It is anticipated that uniting as a global world, some of the crucial issues such as poverty alleviation, over-exploitation of resources and perhaps quality of life for all people may be addressed comprehensively through World Summits.

3.3.2 Global Environmental Concerns

Barrow (1995) argues that attitudes towards the environment and human kind’s ability or willingness to modify it, are not fixed. Different groups at any point in time may vary their outlook on the environment and development. This shows that people’s opinions and views vary despite the environment they are in or any given time frame. What is essential is to work on changing those varying attitudes and

perceptions, perhaps channel them in one direction while accommodating the also changing environment and how people relate to the environment. Blowers (1997) suggest that global environmental change occurs in a number of dimensions. These dimensions are listed in nine steps and discussed therein. The main intention is that these dimensions attempt to explain the contemporary environmental problems from a global point of view.

The first dimension emphasises the fact that environmental problems are not anything new as they were realised long before the period leading to the Rio de Janeiro Summit in 1992. The 1970s was a period when the importance of environmental issues were realised most and action was taken towards addressing them. The second dimension is that contemporary environmental changes result from the imposition of human activities on the natural environment that result in the depletion of resources. Nonetheless, humans are entitled to a healthy environment in harmony with nature as recognized by principle one of the Rio Declaration on Environment and Development noted in section 3.2.1. It must be acknowledged that environmental problems are not entirely a result of human activities but may also result from natural disasters. However, more often than not, these natural disasters are associated with human activities that may have taken place over a long period of time, the argument here remains open to possibilities whether people are entirely responsible or not. An example of a situation whereby the damage was a result of human activities, though they occurred over a period of time, is the development of gullies from severe soil erosion as a consequence of forest clearance.

The third dimension supports the second, by suggesting that the environmental problems are socially constructed. The example given above is a clear link between the physical and the social aspects. This fact was clearly noted and taken into consideration when the need to incorporate environment and development was realised. This came from the realisation that environmental problems do not materialise by themselves but are a cause and effect of human beings either by an individual or by organisations (Blowers, 1997). The difference is the fact that there are problems, which require attention more than others, pushing for concern from the human race. The involvement of humans addresses the fourth dimension. The dimension highlights the environmental conflicts, which arise as a result of decisions

that need to be made about who is afforded the opportunity to live in a healthy environment. Those with power, usually the elite, would have first preference compared to the poor. The fifth dimension discusses the global focus whereby problems are seen at a global level because this is where problems occur at one end of the world but are experienced by those of the other end of the world. For example, industrial pollution requires to be addressed at the international level because the effects of pollution are experienced by more than one nation. This is usually very difficult to address because such environmental problems will not occur at the same scale at different places. As Blowers (1997) asserts, place A may experience 60 % of pollution effects from an industry while place B may experience 40 % of pollution from the same industry therefore the reaction to this problem may be different for each area. Such problems require effective use of precautionary and polluter pays principles to determine the source of pollution and force the source to take responsibility for their actions.

The sixth dimension discusses uneven distribution of resources. The concern is whether the resources satisfying the present generations will be in a state capable of satisfying future generations. There is also uneven spatial distribution, which is the seventh environmental concern. This pattern of uneven spatial distribution is both created and reinforced by conflicting interests usually raised by the powerful against the weak. This raises debate between and among different groups, those who can enforce power and make decisions regarding environmental agendas. The most powerful use their resources to acquire experts and expert systems in identifying problems and providing solutions to environmental problems.

The eighth dimension elaborates more on the previous dimension about the value of science and technology when dealing with environmental issues. The ninth and final dimension covers people's values, which shape their attitudes and ultimately their behaviour. It considers the value of the environment and policies to deal with environmental problems; the rights of individuals and future generations; the nature of participation in decision-making; the value of costs of environmental assets and the problems of social inequality. All of these dimensions are very real and require to be addressed if environmental problems are to be dealt with appropriately. These dimensions may form an ideal way of how environmental problems can be

confronted and managed to achieve sustainable development. Some of these dimensions may be more theoretical than practical. Nonetheless these arguments are ideal viewpoints put forward by different authors but very possible.

3.4 National Perspective: Policy and Legislation

As discussed by Fuggle and Rabie (1992) environmental concerns became evident throughout the world in the 1970s, and South Africa was no exception. Action in this regard became evident in 1995 when the White Paper on National Environmental Policy was published. This was soon after the democratic elections, which took place in 1994, which in turn gave way for South Africa to be a signatory member in the international treaties with other countries, which were also addressing environmental concerns. Contemporary South Africa has three major environmental issues to consider, first, its degraded environment. Second, inadequate policy for environmental protection. Environmental controls are still fragmented and under researched. Third, there is no mass-based environmental movement (Ngobese, 1995). Ngobese (1995) and Fitzgerald, McLennan and Munslow (1995) assert that a new form of environmentalism must emerge in order for South Africa to move forward in the quest for sustainable development. South Africa has developed its National Environmental Policy through a comprehensive participatory process known as the Consultative National Environmental Policy Process (CONNEPP). The Consultative National Environmental Policy Programme's purpose was to give all stakeholders in South Africa the chance to contribute to developing the new environmental guiding principle done in 1996 as a review of the White Paper on National Environmental Policy published in 1995.

Prior to 1994 elections, South Africa was controlled and ruled under the apartheid system. For centuries the colonial rule shaped the cities of South Africa and the country as a whole, including the rural areas. The interaction between people and the environment in the struggle to overcome social and economic problems that were imposed by the apartheid cities and governed by racial regulation of urban space influenced South Africa's environmental deterioration. The Group Areas Act empowered administrators to slice the cities into different racial segments and each segment was separately governed. This viewpoint is further detailed in Ramphela

(1991). The post-apartheid era in South Africa came about with opportunities for change and new ways of doing things at all levels of the society. This made an impact in the cities and rural areas as this period was characterised by massive movements of people from rural areas into cities in search of new and better opportunities.

In the new found South Africa, the government reviewed previously implemented policies to make them compatible with sustainable development. Most of these reviewed policies and the new policies are now in place. These changes in legislation represent a move from a representative democracy to a participatory democracy whereby people are given opportunities to participate in the formulation and decision making of policies through what is now known as public participation. The role of public participation in environmental decision making is detailed further by Scott and Oelofse (1998). This shift has also undermined the traditional way of decision making which followed a top-down approach. The government system is incorporating a bottom-up approach whereby people at grassroots levels get the opportunity to contribute in decision making.

Environmental issues were highly politicised during the transition period of the apartheid to post apartheid eras in this country whereby the dominant approach used in the formulation of policies was usually top-down approach as noted above. With the proposed changes to incorporate the bottom-up approach, it was also added that another valuable strategy put forward towards achieving sustainable development would be to perceive environmental issues from an economic point of view. As discussed by Blowers (1997) it is anticipated that this may actually ensure a faster and more effective response, than previously when these issues were treated as political issues. This has been suggested after observing the culture of wasting resources. Due to this, it was decided to include the natural resources in the national accounting system whereby users will bare the consequences of resource wastage and pay for the damage incurred on the natural environment. This is essential because in the past resources were cheap, there was no encouragement to use them wisely and considerable wastage occurred. It is anticipated that paying for them would encourage proper use of resources because this not only forces recognition of their value but also forces the realisation that they are being used at unsustainable rates. There is

legislation which is in favour of wise use of resources, such as NEMA 107 of 1998.

There are environmental standards, which deal with environmental problems at the national level. Environmental standards refer to documents setting rules, guidelines and numeric values defined by the involved parties and regulating activities, which have or are likely to have an impact on the environment. DEAT and DWAF (1998) discuss the environmental quality standards and criteria in South Africa. These standards are reflected in regulations published in terms of environmental legislation. However these environmental standards are uncommon in South Africa, apart from water quality standards. An example is given of the Department of Minerals and Energy (DME), which recognises and applies standards that are not legally binding but are generally accepted. These include water quality standards, effluent discharge standards, air emission standards, noise emissions, and waste disposal, especially material disposed off at landfill sites and human exposure to hazardous materials. In terms of groundwater, general authorisations and licenses are determined under the National Water Act (1998) whereas for vegetation, the protection of flora and regulations on weeds and invader species are promulgated in terms of Environment Conservation Act 73 of 1989 now Environment Conservation Amended Act (1994) and for waste management is detailed in the Waste Management Series: minimum requirements of 1998. There are no written guidelines on the management of hazardous chemicals in South Africa but there are institutions, which are using United States of America or Canada's guidelines in identifying and managing hazardous chemicals. This guidelines are termed Material Safety Data Sheet (MSDS), which lists all the chemicals, their content, how they can be handled and disposal methods.

3.4.1 National Environmental Management Act (NEMA)

The National Environmental Management Act (NEMA) 107 of 1998 is a special environmental legislation for South Africa, which embraces the protection of the environment. The National Environmental Management Act was promulgated within the framework of the Constitution, which guarantees basic human rights and provides guiding principles for the society. The rights and obligations in the South African Constitution belong to each person and communities in South Africa and the Constitution recognises 'that a healthy environment is a basic human right'.

Therefore NEMA reinforces the Constitutional requirements for a clean environment and the basis for co-operative governance in the field of environmental management (NEMA section 28). The requirements of NEMA proclaims that,

- We all have a right to sustainable development; therefore all-important environmental factors must be considered before development decisions are taken (section 2).
- Everyone has the right to demand that the environment be taken care of (section 28).
- Everyone has the right to legal standing to enforce environmental laws (section 33) (Andrews, undated.)

The National Environmental Management Act outlines the principles that show the government how to act in order to protect the environment and the above listed sections of NEMA were considered relevant to this study. The principles also provide a framework for environmental management in South Africa. Provision is made for the integration and co-ordination in the implementation of all government environmental related policies, meaning the public also becomes actively involved in decisions regarding the environment. The National Environmental Management Act provides procedures for co-operative governance, co-ordination and alignment of environmental plans and programmes and the exercising of powers relating to the environment. The act also provides for different governmental departments involved in the environment to conduct an assessment system in their areas of responsibility to empower themselves towards achieving sound environmental performance (NEMA section 2). Andrews (undated) provides a detailed guide on how people can use NEMA to their advantage to protect their environment. Sections 33 of NEMA provide assistance to whoever wishes to lodge a complaint in relation to any environmental concern.

Apart from the Constitution and NEMA, there are many other laws that protect the environment. Others laws include Environmental Conservation Amended Act of 1994, Water Act 36 of 1998, Dumping at Sea Control Act 73 of 1980 and Atmospheric Pollution Prevention Act 45 of 1965 and many more, which protect and conserve the environment. There is also a document compiled by the DWAF (1998) noted above, a waste management series for minimum requirements for handling, classification and

disposal of hazardous waste. These laws naturally empower individuals and communities to protect themselves against pollution and waste. Other ways people can be protected against pollution is through the government enforcing laws on taxation of pollution, use of pollution permits and subsidisation of cleaner technologies, recycling and other waste minimisation strategies. An example of the recent effort on waste management is the Summit held in Western Cape in 2001 on Integrated Pollution and Waste Management for South Africa. Last but not least the government of South Africa recognises the need to empower and uplift the people through education. Education has received the largest share of government spending in the last two years, and curriculum 2005 is expected to reform the old education system and include environmental education as an integral component of every subject in schools. This is further discussed in section 3.4.2.2.

3.4.2 Environmental Resources and Concerns

There are a number of environmental resources and concerns at national level. However, the researcher found it essential to focus on water, waste and vegetation to demonstrate the status of these aspects, how they are addressed at the national level and also highlight the need for proper management. Each aspect is discussed separately on the following text.

3.4.2.1 Water Management

As a resource, water has a number of characteristics; the most common is its flexibility of use. The reality is that water has been so basic to the historical development of man that its availability has determined the pattern of human activities attempted in any given location. The demand for water use was originally so small that water was regarded as a free resource. However with the recent growing population rate in the world, water problems have been directly related to its demand. However, Fernie and Pitkethly (1985) assert that water is a valuable resource and requires management if it is to sustain the present and future generations

In many parts of South Africa, water shortage is directly related to poverty and hunger and this makes the situation a crisis facing this country. As far as water

availability is concerned South Africa has a doubtful future (van der Watt, 2000). The author also comments that people tend to seldom get involved in any activities that may help conserve water. It is estimated that if water is not managed properly and people do not change their attitudes towards water and water usage, by 2020 South Africa will need more water than is available. South Africa is still in the midst of trying to manage this resource efficiently. One of the important ways of managing this resource is through raising awareness for the need to save water.

Attempts have been made to try and put systems in place that will ensure sustainable use of water in South Africa such as Water Act 36 of 1998 as a guiding legislation. The Water Act specifies that the government, as the public trustee of the nation's water resource, has to act in such a way that it can earn the public's trust. The government has to make sure that water is protected, used, developed, managed and controlled in a sustainable and equitable way so that all persons can benefit. The Water Act recognises that all people have basic needs for water for drinking and hygiene and that these needs must be satisfied at all times. van der Watt (2000) asserts that the ultimate aim of water management in South Africa is to have sustainable use, which meets the social, economic and ecological integrity of the country.

South Africa's Water law should reflect the principles of the Constitutions, as do other laws in the country. It is important that the legal framework governing access to water supports the developments of the nation and the quality of life for the citizens of South Africa, and in order to attain these objectives, water law principles were formulated. Some of the principles relevant to this study are

- The legal aspects of water states that the water law shall be subject to and consistent with the Constitution in all matters including the determination of the public interest and the rights and obligations of the public of all with regard to water; all water, despite where it occurs in the water cycle is a resource for all, the use of which shall be subject to national control.
- With regard to water resource management priorities, all people shall have access and sufficient water; the quality, quantity and reliability of water required to maintain the ecological functions on which humans depend shall

be reserved so that the human use of water does not individually or cumulatively compromise the long term sustainability of aquatic and associated ecosystem.

- In terms of water resource management approach, water resources shall be developed, apportioned and managed in such a manner as to enable all users to gain equitable access to the desired quantity, quality and reliability of water. Conservation and other measures to manage water demand shall be actively promoted as a preferred option; water quality and quantity are interdependent and shall be managed in an integrated manner consistent with environmental management approaches (Andrews, unknown)

With these guiding principles in mind, there are a number of ways which water can be conserved. All water users should find ways to use water wisely; this is possible through cooperation from all people. This is important because as it is, South Africa is losing a lot of water from dams as a result of the hot and dry weather. Government and private schemes such as ‘The Working for Water’ programme are tackling threats to water and biodiversity threats caused by alien invasive organisms, which are number one enemy to water loss in most regions in South Africa (Versveld, Le Maitre, and Chapman, 1998). This programme has been quite successful in controlling the spread of alien vegetation. However, more resources are still needed for such programmes to be successful. Investigations are under way to secure additional water supply from the neighbouring countries. However these measures are still being looked into. There is a possibility that these measures may not be economically viable for the country and that dependence on water supply from other countries may give rise to a politically unstable situation. The most reliable manner to water management is still through water conservation, education and awareness programmes.

Drinking water standards are established for protection of public health. Drinking water must be free of all pathogenic micro organisms; however conducting pathogen is not feasible because of the difficulty in performing laboratory analyses and their poor quantitative reproducibility. Therefore the microbial quality of drinking water is controlled by specified treatment techniques and monitoring for the presence of

coliform bacteria which a nonpathogenic indicator organism (Hammer and Hammer (Jr), 1996). These tests mentioned above are also essential for testing groundwater. Ground water contamination commonly results from human activities, where pollutants susceptible to filtration are stored and spread on or beneath the land surface. It must be acknowledged that almost all the ground water contamination problems have been realised only after the drinking water has been affected. Hammer and Hammer (Jr) (1996) asserts that common pollutants include wastewater, overflowing household septic tanks, wastewater disposal tanks and different sorts of chemicals.

3.4.2.2 Waste Management

The political, social, economic environment and technical situation in South Africa create a unique and dynamic background for waste management systems. New approaches are required to handle the fast growing nation. The socio economic level of its people, the potential for industrial growth, the vulnerability of the environment and the quantity and type of waste generated is increasing the complexity of the problem. The greatest challenge is to be able to manage waste in such a way that the environment is not compromised or threatened unnecessarily (de Plooy, 1997). Recently, the Department of Environmental Affairs and Tourism (DEAT) co-ordinated a waste Summit on national waste management strategy for Sustainable Development in terms of the White Paper Policy on Integrated Pollution and Waste Management for South Africa. The summit was held in September 2001 and it was anticipated that afterwards a unison agreement would be made of a coordinated structure that will define waste management in South Africa (Staatskoerant, 2001). Some of the issues discussed included landfilling, composting and incineration, recycling and others.

Approximately 95 % of all urban waste is disposed of on land, either in open trenches or sanitary landfills. There are approximately 1200 landfill sites in South Africa, mostly run by local authorities (de Plooy, 1997). The author noted further that some of these landfill operations are not permitted to function as landfills whereas others are. Of the 1200 sites, 18 % are legally recognised which became a

requirement from 1995. It is important for organisations that use landfills to have information about the status of the landfill they use to dispose their waste to ensure legal standard. This is essential because organisations incur costs for waste disposal. However it is specified in the waste management minimum requirements that organisations are responsible for their waste when it enters the waste stream throughout the whole process. This is important to take into consideration, in the event that something goes wrong. The organisation's stand is safeguarded instead the company providing the waste removal services can be held reliable.

Pellaumail (2001) discusses a number of waste management methods; these methods are also discussed in the White Paper Policy on Integrated Pollution and Waste Management for South Africa. Composting is one of those methods and is considered a viable method of waste disposal. There is no existing legislation addressing composting. Incineration is also a waste management method commonly used to dispose off hospital wastes. The method is addressed under the Atmospheric Pollution Prevention Act 45 of 1965 which addresses air emissions of incinerators. The Division: Air Pollution Control of DEAT compiled guidelines for design, installation and operation of incinerators. The aim of the guidelines is to provide measures and procedures to prevent or at least to minimise the effects on the environment, in particular the pollution of air, soil surface and ground water and the resulting risks to human health.

The extracting of materials from the waste stream and its utilisation in various ways is commonly termed "recycling". As noted by de Plooy (1997) recycling is practised for many reasons including financial gain, energy conservation, litter abatement, reduction of the waste stream itself and its potential to pollute and the conservation of raw materials. An effective recycling programme, that is economically viable, can reduce the amount of waste that enters landfill sites and simultaneously save scarce raw materials. Industries which recycle their productions are able to minimise waste and improve the utilisation of resources. This is because it costs money to buy raw materials and it is also expensive to dispose of waste in an environmentally acceptable manner. The recycling industry in South Africa has originated spontaneously and developed through the years without the intervention of any legislation. Even so, the recycling initiative in this country is reasonably successful

as there was considerable increase in the recycling percentages during the last ten to fifteen years (Jenkin, Murray and Roberts, 1997). Recycling is done for the following main reasons, to conserve landfill space, conserve energy and reduces the effects of global warming, conserve natural resources, generate income, reduces pollution, demonstrate community commitment to environmental preservation and energy conservation.

Collection of recyclable materials occurs mainly through private entrepreneurs and agents for the different recycling companies. The public, schools and other organisations collect the different materials and supply the waste collector agents in metropolitan areas. Informal recycling takes place on many of the municipal dumping sites through scavenging. Though the activity may be considered reasonably successful, the market for it in South Africa tends to be poor. This is assumed to be the case because, through research, it has been established that poor people rely on recycling for income generation, therefore it is difficult to meet the market that will satisfy this need. The recycling industry remains vulnerable and heavily dependent on the availability of markets for the recycled products. A number of recycling ventures failed as a result of lack of the market. Therefore, it was concluded that recycling could only be done if it is economically viable for both the recycler and the buyer. (Pearce, 1993; Jenkin *et al*, 1997).

It is indicated from the literature that it is fashionable to turn to recycling as the answer to solving the growing litter and waste problem in South Africa. Recycling has been considered as a critical component of a responsible waste management system, but it alone cannot solve the identified waste problem. For various reasons, some products are more conducive to recycling than others. Pearce (1993) suggests that effective waste management can be accomplished from a system known as integrated waste management. A system of integrated waste management offers alternatives, such as landfills, for those products that are not recyclable. It is cost effective and offers efficiency and environmental safety for other alternatives such as recycling, incineration and composting, etc.). Selecting any of these methods that would be environmentally sound, economically feasible and acceptable to society would be the best approach towards achieving integrated waste management.

3.4.2.3 Vegetation Management

Many companies are implementing environmental management plans, which set guidelines for wise resource use, minimisation of impacts and rehabilitation of degraded and damaged habitats. The Green Paper on Conservation and Sustainable Use of South African's Resources (1996) aims to promote sustainable use and sharing of benefits by local communities, promoting ownership rather than alienation of natural resources. The establishment of policy for biodiversity in South Africa was set in motion by the United Nation's Convention on Biological Diversity opened for signature at the UNCED held in 1992, prior this period biological diversity issues were constituted under Environment Conservation Amended Act of 1994. South Africa's biodiversity holds value and significance at the international, national and local levels (DEAT, 1996). The implementation of biodiversity laws were necessary because the country's biodiversity needed protection from human activities which have changed South Africa's ecosystems over the years. These human activities damaged and degraded the natural habitats, the damage and degraded habitats are a result of overexploitation of resources. Moreover, introductions of exotic species and pollution have added to the list of causes for environmental damage and degradation. Overexploitation of resources is dealt with by encouraging sustainable development whereas pollution is also dealt with, within the global environmental concerns.

Exotic/alien invader plants are species deliberately or accidentally introduced into the country, which are capable of invading even stable natural vegetation. They are on the increase in South Africa and have already caused dramatic and probably irreversible changes to the plant cover of the country. Alien plants have invaded more than 10 million hectares of South Africa's intact environments. It is estimated that putting together the infested regions all over South Africa, the infested area would be the size of KwaZulu-Natal province (Versveld *et al*, 1998). The main notorious culprits are pines, gums and wattle. This invasion is expanding at a rate of five percent per year, it is expected to double in the next 15 years (Versveld *et al*, 1998).

As mentioned earlier when discussing water problems, Versveld *et al* (1998) assert that these alien species are a threat to the surface and ground water supply and natural

flow of rivers. Affected areas can lose up to 74 % surface water. There are also detrimental impacts on the indigenous vegetation on potential production and to conservation areas and private land-uses as a result of these alien invasive plants. These plants are said to reduce crop and animal yields not only by releasing chemicals into the soil but also by competing with crops for soil nutrients and water, carbon dioxide and light. Livestock yields are said to be reduced through less pasture forage, or by poisonous or toxic plants, which cause slower animal growth or death. The land previously infested becomes less efficient in terms of plantation; basically all types of crop products may be reduced in quality. This problem has caught the attention of national role players and efforts are made to deal with it through programmes which deal with 'impacts of alien plants on water resource of South Africa'. This issue is also addressed by 'Working for Water programme' launched in 1995 in an effort to tackle the problem of invading alien plants. The programmes are a multi-departmental initiatives led by the DWAF, DEAT and the Department of Agriculture (DoA) and other organisations such as Council for Scientific and Industrial Research (CSIR).

3.5 Local Perspective

3.5.1 Local Agenda 21

Environmental problems at local level are not so different from the problems at the national or international level except in scale at which these problems occur and most importantly the way they are perceived and dealt with. At these level authorities are working towards the implementation of Local Agenda (LA) 21 programmes, which consists of action programmes for sustainability through the involvement of cities, towns and local communities. As noted by Atkinson and Urquhart (2000) LA21 is a process aimed at achieving sustainable development at the local level. The process is anticipated to be an integral part of development planning and management requirements. Local Agenda 21 perceives sustainable development as a way to reverse poverty and environmental degradation by providing people with resources that are needed to live sustainably especially getting people involved in making decisions concerning resources. The programme calls upon governments working in partnership with all sorts of organisations, such as international organisations, local

businesses and Non-Governmental Organisations (NGO's) to develop strategies for sustainable development as an on-going process. Local Agenda 21 consists of forty chapters of which four sections overlap and interrelate with regard to issues pertaining to sustainable development. (Atkinson and Urquhart, 2000). An Overview of a sections considered relevant to the study are provided below.

The way decisions are made with regard to sustainable development, economic, social and environmental factors, should not be addressed separately instead should be addressed in a holistic manner. It is necessary to understand the links between the environment and development in order to make development choices that will be economically efficient, socially equitable and environmentally sound. Many of the problems identified by LA 21 have their roots in local activities, so it is important that the local authorities play a role in addressing such problems and ensure involvement of their respective communities. It is likely that if authorities communicate with the locals, there would be a better chance that people would listen and respond, by so doing increase their awareness towards sustainable development. It is further discussed in the LA21 document that education, training and public awareness are important characteristics to make LA21 successful. Atkinson and Urquhart (2000) argue that there is a need to increase people's sensitivity in finding solutions to environmental problems and education gives people environmental ethical awareness, values and attitudes, skills and behaviour needed to be more sensitive towards the environment.

South Africa is committed to the goal of sustainable development. The government has formally adopted LA21 and has stated that the country will have a national strategy for sustainable development by the year 2002 (DEAT, 1998). The Department of Environmental Affairs and Tourism is responsible for coordination of the implementation of LA21 in South Africa. The response to LA21 was found greatest in areas where local governments have been involved in managing national and regional campaigns. Formal LA21 are taking place in cities of Durban, Cape Town, Johannesburg, Pretoria, Kimberly, Port Elizabeth and East London. As noted by Atkinson and Urquhart (2000) the key character of LA21 is that it sets partnerships between the state and local communities.

3.5.2 Institutions

3.5.2.1 Environmental Policy in Businesses and Industries

A number of organisations are now dependent on policies to manage their day-to-day activities in their respective working environment. Either they devise a policy suitable for their organisation, which they will act in accordance with, or they use the existing national policies as guiding principles to comply with. The objective is to commit the local authority, local businesses and organisations to evaluate and improve their environmental performance and to provide relevant information to the public of their environmental position. Among other policies, an environmental policy becomes important because it sets the foundation for an environmental management system in any organisation (Ryle, 1995). The author argues that an effective environmental policy must be able to cover a range of issues about the environment. Any type of policy may be characterised by a three level structure, mission statement, a series of specific policies or commitments and a series of procedure manuals. This however is not a compulsory set up; one setting may differ from another depending on the objectives of the policy and the type of organisation. An attempt was made by a number of authors to define an Environmental Policy and a consensus was reached that Environmental Policy proposes a framework of principles, structures, processes and mechanisms to integrate environmental governance to address specific problems (DMA-EP, 1998; DEAT, 1998; Ryle, 1995). The country's National Environmental Policy affects all South Africans towards developing a sustainable environmental management. Small organisations, which are aware of environmental problems, have developed their own environmental policies to help guide them to manage their environment in an effective manner. Recently schools have embarked on the same processes of developing environmental policies termed 'Schools Environmental Policy' to manage their environment and introduce environmental education to the school community.

3.5.2.2 Environmental Policy and Educational Institution

Educational institutions are obliged in terms of the Constitution as well as a number of National Policies to manage their environment in a sustainable manner and to provide a healthy environment for the workers and the learners. An example of such

policies is the White Paper on Education and Training (1995, chapt.4 principle 20), which states that ‘Environmental Education (EE) must involve an interdisciplinary, integrated and active approach to learning in such a way that all levels and programmes of the education and training system should create environmentally literate and active citizens and to ensure that all South African citizens, present and future, enjoy a decent quality of life through the sustainable use of resources’. The White Paper on Environmental Management Policy (1997) states that ‘Environmental Education (EE) promotes the education and empowerment of people of South Africa and also increases their awareness of, and concern for environmental issues, and also assist in developing the knowledge, skills, values and commitment necessary to achieve sustainable development’.

A School’s Environmental Policy is a statement of intentions and principles for improving a school's environmental performance. It contributes to an enriching, happy, healthy and sustainable environment. The Policy must be a product of the school community. The introduction of a School’s Environmental Policy must be supported by the principles of sustainable development in order to achieve an efficient management. This includes raising awareness on environmental issues, creating sensitivity towards the environment, providing skills to respond to environmental crisis, adopt a participatory approach and introduce the concept of sustainable resource management in the school community (Share-Net, 2001). There are different types of resource uses in the school. These resources need careful management to reduce wastage and expenditure. Schools are sometimes the center of litter production and need careful planning and consistent effort to get rid of waste produced on a daily basis. All of these require carefully constructed action plans, which can be outlined in a school’s environmental policy. In this regard environmental management and sustainable development can best be achieved.

3.5.2.3 Environmental Management System

This realisation of environmental unsustainability led to the development of a wide range of environmental management techniques aimed at controlling the impacts of human activities on the environment. The environmental managers of South Africa are aware of the need for proper management of the environment and are exploring

different tools to attain their goals (Mohr and Soutter, 1993). There are a number of environmental management tools essential for environmental management of which EMS is one of them.

Many of the serious environmental impact assessments have resulted from developments that were badly designed, and sometimes these effects are only noticed a year later or ten years later. *“Environmental management’s basic need is to understand the exceptions or problems noted during the audit and specific deficiencies or discrepancies on which they are based, so that they can be corrected and not just the symptom”* (Greeno, Hedstrom and Diberto, 1987:56). There are benefits to be gained in enabling a good environmental performance in any organisation that have environmental management programmes in place. The concept of an EMS was developed in response to this recognition that environmental pressures and issues have to be addressed in a holistic manner. Kirkland (1997) defines EMS as a system that enables an organisation to manage environmental issues in a consistent and considerable manner. Environmental Management Systems are increasingly suggested as effective means of improving environmental performances but information of how they can be implemented has not been well documented. However, work still continues to provide a meaningful document which will include implementation procedures.

Meanwhile this study adopts a definition given by Paramanathan (2001) whereby EMS is defined as ‘the framework for or method of guiding the organisation to achieve and sustain performance in accordance with established goals and in response to constantly changing regulations, social, financial, economic and competitive pressures and environmental risks’. It can be implemented by undertaking the following four factors into consideration, which form a basis of a most effective EMS.

- An environmental review to establish an organisation’s current position,
- The formulation, communication and periodic review of an environmental policy, such a policy should outline the future environmental aims and ambitions of the organisation;
- An action program with appropriate targets and a defined methodology,
- A system of controls and measurements (Paramanathan, 2001).

The importance of putting an EMS in place is that the system does not necessarily have to be a rigid product but be flexible enough to be enhanced when the need arises. Enhancing the system that is already in place would require following similar steps of those of implementation but with caution. Implementation of any system requires training of the personnel and staff members to improve the desired outcome that the system is expected to achieve, hence participation of the personnel and staff is essential. An EMS would enable the organisation to control environmental impacts, achieve and demonstrate ongoing compliance with laws and regulations. An EMS has proved to be very important, with companies, which have implemented it regardless of their size or area of business (Hunt and Johnson, 1995). There are a number of specific international standards for EMS. In South Africa the most commonly used international standards for EMS is the International Organisational Standards (ISO) 14001, which is one of the many series for environmental management guidelines (Atkinson and Urquhart, 2000).

The implementation of EMS and the commitment towards achieving the set goals has to start internally within an establishment. The critical success of EMS requires total acceptance of the concept by top management and also to achieve the objectives set for an effective EMS. The objectives entail,

- To enhance the efficiency of an establishment.
- To strengthen the company's credibility with customers, governments and communities.
- To establish a green economy.
- To manage those activities that may affect the environment negatively, while adhering to the requirements of the legislation.
- To establish a disciplined system, achieve performance according to a company's policies and procedures, and through audit, ensure full conformance and continual improvement. (van den Berg, 2000).

The process for establishing an EMS starts with the development of an environmental policy. Once the policy is in place plans can be made that is, all aspects that are to be included in the management system be explored. These plans are made possible through the approval and support of the school management.

These are followed by implementation of the plans to ascertain how their operation may improve the environmental performance. This process is continuous; it requires frequent monitoring and corrections to enable effective performance. Sometimes the results may not be satisfactory and that implies re-doing the process over again and sometimes the process may be satisfactory, with minor adjustments to complete the system.

In this study, as mentioned in chapter one, an EMS was suggested as the best environmental system for the school and the fact that the system has to be developed by the residents and management of the school, in order to get started in the process it was necessary to evaluate the current situation in the school, which is one of the necessary steps considered relevant to form basis for an effective EMS. The school has environmental initiatives in place although on an ad hoc basis. One of the outcomes for establishing an EMS is to be able to integrate these existing initiatives and this will be achieved through establishing controls and procedures to guide these initiatives. It is further pointed out that the formulation of policies is a necessary step. Formulation of an environmental policy was accomplished in this study, and the procedure used is detailed in the subsequent chapter. The above paragraph points out that the process may not always be satisfactory as most processes are not full proof from developmental constraints. The following chapter provides detailed methodologies so that if this may be the case, other methodologies may be applied to correct problems that may be encountered.

CHAPTER FOUR: METHODOLOGY

4.1 Introduction

The choice of methodology used to conduct research is important because it significantly determines the research outcome. This chapter provides a description of available and related theory of research methodology, which has guided the choices made in carrying out this research. Both primary and secondary data sources were used. The latter included books, academic articles, websites, newspapers and minutes of the meetings of the Environmental Discussion Group (EDG) and Environmental Committee (EC) to provide background information. The former included a pilot study, a questionnaire survey and field observation. Baseline information collected and the research approach tested in this study was used to develop an environmental policy and an environmental audit procedure, which will enable the Michaelhouse community to develop an Environmental Management System (EMS) for the school and monitor its progress in achieving a sustainable environment. The methods of data analysis are also discussed in this chapter. Finally, limitations in the methodology encountered during fieldwork are discussed.

An EMS as noted in section 3.4.2.4 of the conceptual framework requires a number of processes to be developed. As noted in section 1.1 that this project provides baseline information, different procedures were used to ascertain which would be most applicable for future use. The methodology was basically an environmental assessment but different procedures such as questionnaire survey and environmental checklist were used. To make this choice, it was particularly challenging because this is the first time this type of study has been carried out and also because of limited financial resources and time in which to do the study.

It is important to note that research methodologies may not always provide a full prove surety of the results obtained in the field. There is likely to be external or internal factors in any methodology that may influence data collection. The success of any methodology used in any research is dependent on the ability of the researcher to strategically present data and also the willingness of the respondents to be studied. Anyone of these factors may introduce an error in the data collection. It must be

acknowledged that there is error that can be tolerated in these techniques and that which can ruin the survey. Criticisms of methods used in the research are discussed at the end of each section.

4.2 Research Approach

In order to obtain the necessary information, the study involved three distinct tasks. The first was the pilot study which entailed; visit to study area, getting acquainted with key informants, a group meeting with the teachers to inform them about the project, assessment of the minutes of meetings held by EDG and EC to identify problem areas. Then snowballing to find out from the respondents whether the types of questions to be asked were appropriate in order to design the questionnaire. Secondly the development of the school's environmental policy which involved reviewing national policies and attending the school's environmental meetings. This approach can be referred to as a participatory action research. The third was the environmental audit which had two components; administering a questionnaire to the four population residents at the school to assess their perception of these problems and willingness to get involved in ameliorating them, and the inspection of the school grounds that is, observation using checklist of questions and soliciting factual information from key informants.

The first and third tasks involved the collection of both quantitative and qualitative information. The second was essentially a qualitative exercise. Before proceeding to explain what each of these three tasks involved in detail, it is pertinent to explain the following; differences in the manner in which quantitative and qualitative information is obtained and how it can be used. Differences in the manner in which information is obtained and the nature of the information obtained using different interviewing techniques and last, the type of information gathered and the role of participatory action research, key informants and observations.

4.3 Qualitative and Quantitative Methodologies

There are two different types of methodologies that can be used when collecting data. The quantitative method collects numerical data while the qualitative method collects

information which is more descriptive or illustrative. Qualitative data can be manipulated into quantifiable data to provide standardised information. Quantitative study tends to involve few variables which makes it more specific than a qualitative one which has many variables and may take a more general approach. Historically, the quantitative approach was considered a narrow method of enquiry leading to the qualitative approach being employed to complement it. Given the degree of interrelationship between the three aspects examined in this study and the need to incorporate it in an holistic EMS framework, and the nature of the research questions asked (refer to Appendix D), both quantitative and qualitative methods were chosen for use.

4.3.1 Quantitative Method

Quantitative research generally deals with numbers and calculations which make it easy to analyse and manipulate data (Creswell, 1994). The method consists of graphical and numerical techniques for summarising data. This method is easy to use when interpreting data, once data has been collected, however it may also be difficult to use this method to determine social aspects of the population under study. To address this aspect, it is most suitable to use this method in collaboration with qualitative method. The method became useful when gathering information on water usage and water disposed from facilities such as the laundry as this was measured in litres. It was also efficient when gathering information on the quantities of chemicals used and disposed off in science laboratories. It was also necessary to use a quantitative method when rating or scoring the intensity of the respondent's attitudes and perceptions towards different issues. Through this method the researcher was able to get an overall assessment of these attitudes and perceptions relating to particular issues as well as a comparative assessment of the issues.

4.3.2 Qualitative Method

Qualitative research has formed a central part of geographical investigations and is considered more in tune with reality than quantitative research. Dey (1993) elaborates more on this subject for the benefit of social scientists who uses qualitative method for data collection and analysis. This type of research entails a situation whereby the

researcher is the instrument of data collection by gathering words or pictures and analyses them in the most natural order as perceived by respondents. Eyles and Smith (1988) and Robinson (1998) argue that the qualitative technique is essentially a description of people's representations of what is occurring in their world. The main weapon being to focus on the meaning provided by the respondents, describing a process that has been put in an expressive and persuasive way though relying on words/ language used. This qualitative research method can be described as a multi method in that it involves an interpretative, naturalistic approach to the respondents. As noted by Creswell (1998) the qualitative method is suited to studies that encompass personal experiences, life stories, observations, history, interactions and visual and was therefore additionally used in this study. Qualitative method enables the study of individuals on the natural setting, which in turn enables a detailed view of the situation (Creswell, 1998). This method is essential to understand the behaviour and perceptions of people, however it may be difficult to rely on as sometimes judgement made by the researcher may be clouded by circumstances surrounding the study area and population under study. For instance the attitudes presented by people being studied, may affect the way the researcher will draw certain conclusions with regard to information being collected. The type of qualitative technique applied may address this aspect. For example use of self-administered questionnaires will help minimise such error, as the researcher will have minimal contact with the respondents. Moreover, the interaction between the researcher and the respondents on their own environment may help minimise potential animosity that may exist as the respondents feel comfortable to express themselves in familiar environment.

This method was chosen to compliment quantitative research method. For this study, qualitative research method was used to find out the behavior and attitudes of people about the environmental aspects at Michealhouse. This was done by frequent communication with the respondents both in a formal and informal setting. Some of the techniques used are described on the following text.

4.4 Techniques Used in the Research

4.4.1 Use of Documentary Sources

Use of documentary sources was essential to familiarise the researcher with both the study topic and the study area. Therefore documented information with regard to background of the study area (Michaelhouse) and documented information to address the conceptual framework for the study was collected. For this technique both primary and secondary data sources were used. Primary data referring to uninterpreted information such as maps, aerial photographs, census information and archival records. Secondary data referring to data that has already been interpreted to a certain extent, such as minutes from previous school committee meetings held to address problems in the school, other sources included academic articles, policy documents and books of a similar nature.

4.4.2 Interviews

“Interaction with and talking to people who are objects of study can take many forms” (Robinson, 1998:377). The author just noted considers interviewing as one of the techniques used to interact with people who are objects of study. This is a tool common in collecting qualitative information. This is important as it entails a human to human interaction. This method was employed by the pioneers of qualitative methods in an attempt to resolve the problem encountered of false claims from respondents when answering questionnaire surveys. Therefore this technique was developed and used as an indirect way of probing for the ‘truth’ from the respondents. Interviews may be further categorised into sub groups, such as structured, semi structured and unstructured interviews.

Structured interview is defined as a fixed set of pre-established questions asked in the same order and the manner for all the respondents. These questions usually have limited number of responses given especially when it is in a form of a self-administered questionnaire. This type of technique is used to address a defined topic and is also used on a large group of people who have to be interviewed over a short period of time. This method was used extensively in this particular research.

Semi-structured interviewing method is not as fixed as a structured interview. This method is necessary when a specific area of interest is to be addressed. The method can be considered as a form of guiding questions that the researcher uses to steer the direction in which the interviewee should take. This type of technique was used in this study particularly with the key informants and specific targeted people who were likely to provide specific information required. For example, kitchen management, laboratory assistant, laundry manager, estate manager and some workers.

Unstructured interviewing method, also known as informal conversation, was conducted for the study. This was conducted mostly with the key informants whenever the need arose. This method implies probing in to the way the interviewee is thinking about the topic of study. Types of unstructured interviews include in-depth interviews, participation observation, oral histories and conversations (Rothwell, 1999). Such methods are used to establish human to human relations, to have an understanding of each other rather than an explanation of issues.

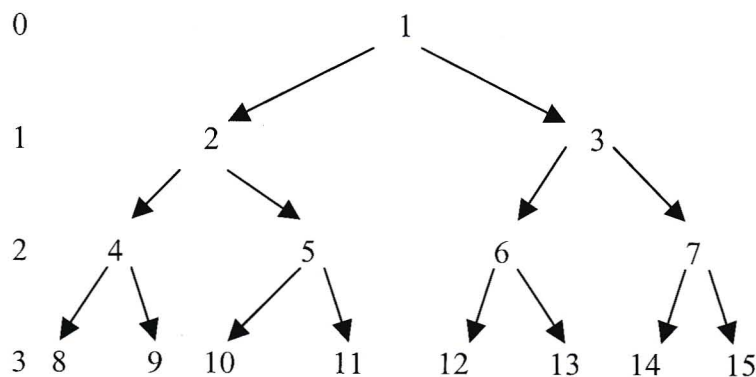
A group interview is also another method that can be used to collect qualitative information. As discussed in Rothwell (1999) this method is defined as the systematic questioning of several individuals at the same time in an informal or formal setting. Group interviews are a valuable source of information used for generating general information or testing ideas before entering the field. This method was used in this study whereby a workshop with the teachers was conducted and the researcher introduced the topic of study and opened it for discussion.

Difficulties with group interviews as a method used for collecting data are that there could be domination of one party, either the researcher or respondents. On the other hand non-participation by a person or persons in the audience can also occur. The latter seemed to occur in this study. However this was later rectified by follow-up questionnaire administered to the respondents individually which enabled them to express their opinions freely and openly.

4.4.3 Pilot Study

As part of the pilot study, minutes from previous meetings were studied to be able to identify environmental problems at Michaelhouse. Having identified environmental problems, the most severe problems were selected and researched in-depth. In order to develop an appropriate questionnaire it was necessary to establish the kind of questions to ask and in what form they should be addressed and how to ask them based on the responses of some of the Michaelhouse staff to some basic probing. A snowballing technique was used to identify interviewees, who had interest or knew about problem areas identified and an informal visit to the school merely for observation of the environment. Figure 4.1 shows the characteristics of the snowballing method used in this study. The first person spoken to, suggest two other people to contact, they then suggest four other people who also suggest more people, in this way, contact with one person eventually leads to contact with 15 other people. The advantage of this method is that it enables easy search for the reliable key informants to contact.

Stages



Source: Hall and Hall (1996)

Figure 4.1 Snowballing

4.4.3.1 Key Informants

This phase of the research methodology relates to developing a list of people who provide key background information and assist in the structuring of the project. Informants were selected on the basis of people who were thought to be interested in

the topic of study and in this regard, the environmental committee members were selected as the main key informants. A list of these key informants is provided in Appendix B. The information provided by these informants was used as part of the data collected and not necessarily the most important compared to the other data collected from the questionnaire survey.

4.4.4 Targeted Environmental Audit

Many authors suggest that an Environmental Audit (EA) of a school can make a difference by helping educators to engage learners, parents and the surrounding communities in environmental education. Usually, an EA is considered as a complex process as it has been frequently conducted for large industries and large companies, but there is current view that it is also a necessity to conduct this process within schools. An EA is about asking as many questions as possible without necessarily trying to get answers or solutions to the questions asked. The idea behind it is to bring awareness to the researchers and the impediments that require attention. An EA contributes towards identifying areas of concern and proposes measures that can be taken to minimise the negative impacts on the environment and perhaps enhance the positive impacts in a way that may be beneficial. Environmental Audit process necessitates 'turning over stones that needs to be turned' (Share-net, 2001) in order to address environmental issues.

The audit procedure in this particular case has taken a similar approach of trying to raise as many questions as possible and answer them in the best possible way, where not possible to carry out more research that will eventually enable the researcher to provide answers to the questions asked with regard to environmental problems. This is a way of showing the public and any concerned party that the organisation in question is doing all that they can do to minimise the environmental impacts. The researcher made a decision to choose the specified resources depending on the severity of the problems and made an in-depth research on them. Focus was placed on the long-term three problems that were affecting the environment in the school. Identified problems were waste, water and vegetation. Thus a targeted EA was used which entailed in-depth research of the three selected problem areas. These problems were selected on the basis of past work carried out as part of the management of the

school. The plan was to assess the problems and their impacts on the environment. A list of questions was formulated for a targeted EA which was to be carried out by the researcher. The questions asked for the targeted EA are provided in Appendix E. To complete the independent audit, the researcher made a reasonable judgement through observation and interviews with the key informants.

4.4.4.1 Observation

There are several forms of techniques that can be used in research. Observation as a technique can be used as an alternative for in-depth interviewing. The technique includes looking, listening, experiencing and recording an observer's observations of daily occurrences. Total-participant is also another research technique. It involves a situation whereby the observer's role is concealed; researcher-participant whereby the researcher is both in and outside the group being studied; and total-researcher whereby participation by the researcher is limited. For this study, a researcher-participant form of observation was used. Regular field visits were necessary to be able to carry out observations. The observation phase was most relevant during the auditing stage. It was essential to observe how resources in the entire school were managed, particularly water, vegetation and waste. Notes were taken whenever appropriate.

Observations were made in the nine boy's houses to determine the use of water. Information about the number of showers, washing basins, toilets, urinals, baths was obtained to find out whether their functioning was acceptable. This was done to assess whether the problems identified may be associated with the management by the residents or the administration. The researcher assessed the facilities mentioned above by moving from one house to the other and check for dripping taps, sinks, hand basin, toilets, urinals and showers, those that were dripping were closed properly and recorded as negligence from users and those that did not close were recorded as faulty. Similar procedure was applied at the single's quarters and the Sanatorium (shown on Figure 2.3), the Sanatorium, Single's quarters and the boarding houses because the residents regularly use these facilities. General observations were also made to determine the movement of water in the school's facilities such as the kitchen,

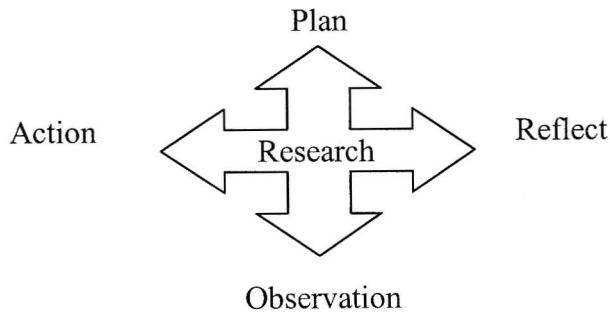
laundry and also in the maintenance of the grounds. As previously noted, water quality samples were also carried out.

In terms of waste management, an observation was made around the school of the number of waste bins provided around the schoolyard, in classrooms, in the kitchen and the sanatorium and around the single's quarters. The contents of the bins were also inspected to identify the categories of waste that goes into the bins. The concern here was not what is produced but what is recyclable. In terms of vegetation, the overall cover efficiency was investigated to determine the value of trees in the school. This was done to find out whether trees were detrimentally shading the buildings and to observe areas where trees were adversely affecting the water and sewerage pipes.

4.4.5 Participatory Action Research

Some researchers around the world have been identifying what they do using terms like 'action research', or 'participatory research', or a combination of these. Some have stressed the action component while others have focused more on the participatory process. It is important to apply both action and participation together as a means of inquiry when conducting research. Participatory action research is a description of social research which is more conscious of its underlying assumptions, and collectivist nature, its action consequences and its driving values. This type of research faces numerous barriers to its practice because it is difficult to differentiate between action and theory. Some authors have concluded that pretty much all of the research work conducted is more or less an approximation in the direction of participatory action research. The difference will lie with depth or the type of study being conducted.

There are three elements, which make up an action research; these elements are research, action and participation. Participatory action research aims to improve social situations through planning, researching, taking action, observation and reflection. It is a combination of activities that needs to function together; the process is illustrated below on Figure 4.2.



Source: adapted from Cohen, Manion and Morrison, (2000)

Figure 4.2 Attributes Involved in Action Research

Participatory action research involves the following,

- Identification of a situation that needs to be improved
- Listing of factors that one hopes to modify in order to improve the situation.
- Identification of key sources of information
- Implementing the first action step
- Description of the facts and explaining the reasons and critically analysing them
- Monitoring and evaluating the action steps

The above mentioned basics were used in this study. Participation involves placing a strong value on democracy and control over one's own life situations (Greenwood and Levin, 1998). This means that the inclusion of people in matters that involve them can help them determine their own destiny. Therefore, the team involved in solving problems should include members of the community as well as the professional researcher. This involvement is referred to as a participatory approach. A participatory approach is particularly useful because of the need to provide local interpretations of situations in the study area and incorporate it with the external interpretation (Najda, 1994). This type of research has been described as a research which effectively aims to bring about change. The participants identify the problem, collect knowledge about the problem and evaluate the results based on what they know and take action in accordance with the problem. Through this method a relationship is created between the researcher and the community.

This type of method is a way of practising social sciences by transforming the world with those who wish to build their own history (Wallerstein and Heller, 1998). This is done through using action and research as powerful tools for change and improvement (Cohen *et al*, 2000). Action research is also a bond of knowledge between people born at opposite ends or with different beliefs to work together towards common goals. This method has been given great value and support by researchers who attempted to define the concept worldwide. For example, Hopkins (1985) and Ebbutt (1985) quoted by Cohen, *et al* (2000) suggests that the combination of action and research renders a disciplined study, in which a personal attempt is made to understand, improve and reform practice. The authors noted above define the concept as a small-scale intervention in the functioning of the real world and a close examination of the effects of such intervention.

Participatory action research is also known as applied research with the involvement of the subjects of study (William, 1991). This applied research can have far greater impacts than the conventional professional expert role of the researcher. This means that the research may not be based on the views of the researcher only but may have a combination of the researcher's views and the respondent's views as well. It is important to note that the participatory action research can be used together with various qualitative techniques for a better outcome of the research.

This was the case in this particular research whereby the researcher collected information on the areas of concern and together with the residents of Michaelhouse and came to an understanding of how to deal with the identified problems. The interaction between the researcher and the residents of Michaelhouse took different forms although all aiming at one goal. As a first step a workshop was conducted with the teachers as noted in section 4.4.2 whereby the researcher presented the proposed idea of how to go about managing the environment. At this point a discussion was encouraged to brainstorm the issues of concern and important facts were noted down to help the research. To follow through, the researcher and the school's environmental committee to discuss environmental problems in the school held regular meetings, and the researcher was a full time participant in all these round table discussions.

The researcher proposed that an environmental policy for the school be developed and this was agreed to. To include the residents' views in the development of the policy, a survey was carried out as noted in the subsequent section. The questions asked enquired about the possible implications that can be anticipated from the community towards implementing the environmental policy. Furthermore, when the policy was developed, the committee, together with the researcher, discussed the contents of the policy sentence by sentence until all the participating parties were satisfied.

4.4.6 Questionnaire Survey

The use of questionnaires has both advantages and disadvantages and one of the major disadvantages is that, *"A questionnaire will always be an intrusion into the life of the respondent, be it in terms of time taken to complete the questionnaire, the level of threat or sensitivity of questions or possible invasion of privacy"* (Cohen, et al, 2000:245). It is however a necessary tool when conducting research that requires information from unknown populations or populations which researchers need to derive specific information. Labovitz and Hagerdorn (1971) define a questionnaire as an instrument comprised of a series of questions filled in by the respondent. Flowerdew and Martin (1997) define it as a principal tool for collecting behavioural information from individuals and Hall and Hall (1996) share the same views of the above noted authors about the definition of a questionnaire.

In this research, it was essential to use questionnaires because they are valuable tools used in doing environmental audits and they can also be effective in a participatory approach. The delivery and collection technique was used. This technique can be used on individuals who are literate. Information derived from this technique is quantifiable. Four sets of self-completed questionnaires were developed using dichotomous questions, multiple choice questions, rating scale questions and both open-ended and closed-ended questions. The latter being most dominant as answering the questions should not be taxing to the respondents. These types of questions helped to ascertain different kinds of evidence as perceived by respondents. The following questions were used as a broader framework, which several questions were drawn from to compile a questionnaire.

- What is the vision of the school with regard to environmental management and education in the school?
- Which are the environmental problems in the school?
- What are the prospects of developing an environmental policy for the school that will control or monitor the environment?
- What can be done to motivate environmental management and education in the school?

As noted in section 4.4.2, in administering questionnaires both open-ended and closed-ended questions were used. The open-ended questions asked by the researcher were constructed in such a way that the respondents would feel free to state their personal views by providing a space for every question. For closed-ended questions the respondent had to choose one or more answers of the pre-selected answers. These questions ranged from yes/no answers to five point rating scale to choose from.

An error to result from self-administered questionnaires was the inability of the researcher to probe for more information from the respondents and the inability to do anything about the questions that were not answered. It was difficult to figure out why these questions were not answered. With this regard, the researcher made an assumption that unanswered questions signified unknown. Furthermore, there was also an issue of erroneousness of some answers from the respondents. The researcher felt that some questions were answered just for the sake of answering and not necessarily what the respondents knew thus weakening the information, this kind of problem is actually noted by Robinson (1998) that usually respondents can falsify information when answering self-administered questions, the researcher is not present to question the responses.

While having conversations with some of the respondents, it was revealed by them that the questionnaire was too long. This however may be justified by the fact that the study was more focused therefore required an in-depth approach to get information. It was also necessary to rephrase certain questions in order to confirm responses given by respondents for example, a question on recycling, people did not know what waste

management entailed, but they knew that to deal with waste, recycling had to be done or they did not know recycling methods but had ideas of how recycling could be improved upon.

4.4.7 Sampling

In order to ascertain a sample size, the population of the study area has to be categorised in terms of units: elements or time period (Robinson, 1998). The overall population size at Michaelhouse is approximately 800 and was defined in terms of units, the administration, teachers, learners and the workers. Labovitz and Hagedorn (1971) assert that sampling is necessary when a total population cannot be observed due to certain limitations. For instance time and costs limitations which were the case in this study. Sampling is necessary and assists to determine representativeness of the sample to the degree that it can reflect the true characteristics of the entire population. It must be emphasised that achieving the true characters of the entire population based on a sample can be difficult because usually a sample is taken of the unknown characteristics of a large population. However in this case the population size is known but cannot be observed entirely. The technique used for the research permits contacting between 200-300 respondents, which must be considered carefully with regard to the timeframe of the study, to allow enough time for analysis. In this research, a sample of 165 respondents was chosen; the reasons are given in the subsequent text. Methods in which units were sampled was purposive and biased techniques.

4.4.7.1 Purposive and Biased Sampling

Two types of sampling methods were considered to be most resourceful for the study; purposive and biased samplings were used to select respondents who will represent the characteristics and certain features required by the researcher. These characteristics and features will be reflected in the questions answered by the respondents, which may introduce bias to a certain extent. It is anticipated that with the information provided by the respondents these will reflect the true characteristics of the total population (Fowels, 1988 cited in Creswell, 1994). The other method,

which was predominantly used in the audit procedure, was purposive sampling by choosing the specified key informants who will provide necessary information.

Sampling size for the residents followed a disproportionate stratified sampling frame. The inhabitants of Michaelhouse were categorised into four classes, noted in the subsequent section. The method was chosen because the proportions of chosen classifications of the residents were not balanced. After the number of sample size was decided upon, the sampling fraction for each group was determined then a quasi-random or systematic sampling was done on each stratum. The first number was chosen at random then the next number at an interval of the sampling fraction.

The problem with sampling is, using the technique purposive sampling when selecting key informants. This method is likely to introduce error as a result of the deliberate choices made. However this can be justified by the fact that the chosen sample of key informants had far better knowledge of the information that was required by the researcher as compared to the respondents who were not selected. It is presumed that these possible errors will not affect the data analysis and that the required information was obtained as the techniques were enhanced with the length of time in the field.

Furthermore, the sample sizes taken from the units of study for the self-administered questionnaires are non-representative with regard to the total populations, except for the teachers' category, whose sample was at 100 %. It is anticipated that in the light to which the results were going to be used, which was under general conditions to provide guidance towards achieving the aim of the study. It should be clearly stated that the sample size of other categories, Learners, Administration and Workers might not be taken to represent the whole population. However this should not have posed a big problem especially if a 100 % response rate was received from the respondents. The researcher was expecting at least an over 50 % of response rate as the sample population is immobile and there may be a possible way to retrieve some questionnaires from respondents. Apparently this became the case with questionnaires from the Learners. The response rate was 64 % which is an acceptable percentage to make a fair judgement to generalise the outcomes of the study. When analysing the categories individually, Teachers' returns were 64 %,

Administration was 20 %, Workers was 80 % and Learners was 66 %.

4.4.7.2 Population Size

The common question, which is usually asked, is how big should the sample be? To answer this question, Hall and Hall (1996) suggest that it must be clear what the purpose of the study is. In this particular case the aim is to generalise the results to the total population. The population at Michaelhouse is approximately eight hundred. The questionnaire distribution within four selected categories is as follows.

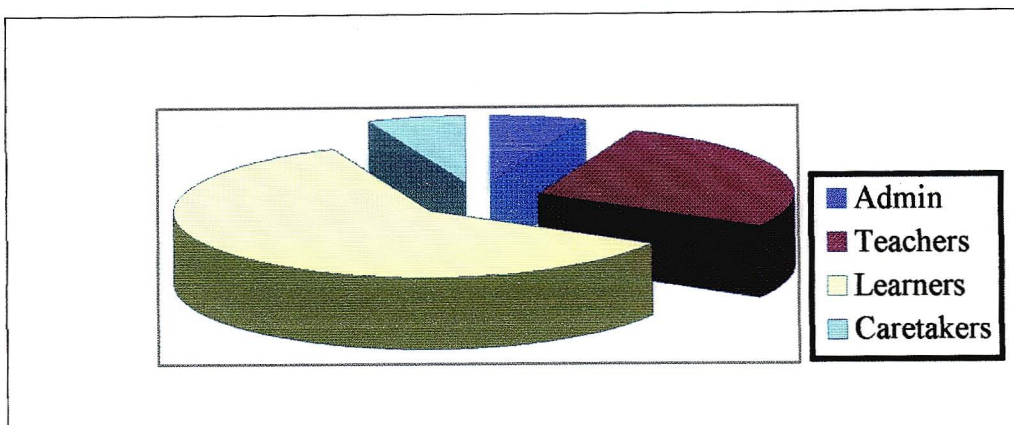


Figure 4.3 Distributions of Questionnaires among School Populations

Figure 4.3 shows the proportions of four categories of population at Michaelhouse and number of people who were given questionnaires to fill in: 100 learners, 45 teachers, 10 administration staff and 10 caretakers all adding up to 165 people. These proportions were selected because of different reasons. Hundred learners because their population was the largest and more learners had to be interviewed so as to have a representative sample of the results. It must be noted that the questionnaires among learners were distributed evenly among different grades. Forty-five teachers were selected because teachers were the most important category, which will enforce and assist in the introduction of the environmental concept in the school. The administration was also considered important, as they are responsible for the management of the school at a high level. However, for the workers a small percentage was taken to determine their status as far as environmental issues are concerned.

Table.4.1 Sample Size of Respondents at Michaelhouse.

Categories	No# of People	Sample #	Percentage %
Administration	32	10	30
Teachers	45	45	100
Learners	533	100	20
Workers	120	20	8

de Vaus (1986) presents tables of calculations showing that for a sample of 400 people, the sample value is likely to be within plus or minus five percent of the true population value with at least 95 % response rate. It must be noted though that with the delivery and collect technique the expected response rate is moderately high. Table.1 shows the sample size taken out of the total population for each group. This was done at the researcher's discretion to acquire specific valuable information from the respondents at the same time to keep the sample size within reasonable limits and as close as possible to representativeness of the true population. Cochran (1977) adds to this by saying "*consequently, the specification of the degree of precision wanted in the results is an important step. This step is the responsibility of the person who is going to use the data*" (Cochran, 1977:340). The decision cannot always be satisfactory, there is never enough information to prove that the choice made of the sample is the best choice.

4.4.8 Data Analysis

The purpose of analysing data is to find meaning in the data. And this is done by arranging and presenting the information in a systematical manner. It has to be organized so that comparisons, contrasts and insights can be made and demonstrated. Data usually has meaning only in terms interpreted by the researcher (Labovitz and Hagerdorn, 1971). It is essential that a completed questionnaire be edited in the hope of amending recorded errors or erroneousess. However these errors must be recorded and mentioned in the problem areas experienced in the research. During data collection, codes and categories were developed to make a provision to quantify data when the need

arises. Coding refers to a process of transforming worded data into numerical data while categorisation refers to giving data classes so that the best answer may be selected. This step is essential when constructing a questionnaire, if properly done it simplifies data analysis. The purpose of codes and categories is to try and reduce data so it can be manageable and meaningful. Coding assists in organisation, quantification and analysis of data.

In any research, it is essential that a lot of data be collected to leave no room for incomplete data. (Creswell, 1998). In this case however, learners were advised to state 'I don't know' on those questions they felt they were unable to answer but were encouraged to answer questions to the best of their ability. Analysing qualitative data requires careful 'reading' to avoid misinterpretations. There are three ways in which the 'reading' of data can be done namely literal reading for example, the literal dialogue including its form and sequence, interpretive reading for example the researcher constructing a version of what the respondents think they mean and reflective reading whereby the researcher explores the respondents' roles to provide meaning of what they said. Robinson (1998) found the best method is to employ the three mentioned methods; therefore these three methods are used in the analysis of the questions. The analysis is done on each category, question by question to be able to establish patterns or trends similar or otherwise from the respondents.

Another way of data analysis involved showing relationships between different variables. In order to carry out the analysis two computer packages were used to interpret data, the Microsoft Access and Microsoft Excel. Microsoft Access was used to conduct coding of the qualitative data while Microsoft Excel was used to interpret data using graphical techniques and calculations of summary statistics to determine frequencies. Microsoft Excel is also useful in analysing quantitative data. Tables were also used to present and analyse information in an attempt to estimate particular characteristics of the sampled population. These tables and graphs are presented in chapter five.

CHAPTER FIVE: RESULTS AND DISCUSSION

5.1 Introduction

Based on the aim and objectives of the study, this chapter provides the findings of the research. As noted in section 4.2 the first task was the pilot study, which guided the structure this study entails. The development of an environmental policy for the school played a large and important role in this study as it was considered an essential building block towards the development of an Environmental Management System (EMS). Therefore, it is discussed at the beginning and constantly referred to whenever necessary throughout the discussion. A survey in a form of questionnaire distribution among the residents was carried out at Michaelhouse and a targeted audit was conducted through field observations. The questionnaire and the field observations were compared and contrasted to determine the extent of the environmental problems identified at Michaelhouse. Data collected is presented in this chapter in a form of a discussion. The chapter draws from the literature review to enhance the discussion and it also draws from the methodology chapter, in terms of the way the results have been quantified.

5.2 Environmental Policy

One of the objectives was to find out whether existing policies, regulations and/or standards were in place and to evaluate the degree of adherence to environmental management at Michaelhouse. Environmental management is about protecting the resources on which our quality of life depends. In order to achieve this a policy is required to identify goals that need to be achieved (DMA-EP, 1998). It was established that there was no environmental policy in place whatsoever. However, this did not mean that no environmental activities were taking place. Environmental awareness did exist within the Michaelhouse community and there was proof of environmentally friendly activities taking place, although at a very low scale. While most of Michaelhouse's residents were very enthusiastic about environmental issues, a small percentage of them were found to be apathic. Also worth noting, is the fact that few individuals have initiated the few environmental activities that have taken place.

In most cases where an EMS has been developed, the first building block was formulating an environmental policy (DMA-EP, 1998). The researcher and with the assistance of Michaelhouse environmental committee (refer to Appendix B) therefore decided that the first step to achieving effective environmental management in the school was to develop an environmental policy. The policy was developed based on information collected, observations made, and impressions gained from regular meetings and interviews with staff members. Environmental policies from various organisations and the National Environmental Management Act (NEMA) 107 of 1998 was also used to guide the development of the school's environmental policy (refer to Appendix C).

An environmental policy¹ is the driver for implementing and improving an organisation's EMS so that it can maintain and potentially improve its environmental performance (DMA-EP, 1998). Other organisations which have an environmental policy in place are committed to ensuring that their organisations abide by the guiding principles of the environmental policy (DMA-EP, 1998). Adopting an environmental policy shows commitment from top management to comply with applicable laws and continually improve. Such commitment is critical as it has a trickle down effect of commitment at lower levels within an organisation. With the existence of the policy an organisation is able to form the basis upon which it sets objectives and targets to guide it towards better environmental performance. The policy should be amended whenever necessary hence it was decided that the committee would meet quarterly to review progress with the implementation of the targets set.

5.2.1 Respondent's Attitudes on Environmental Policy

A section of the questionnaire used for each category of the school's residents (refer to Appendix E) dealt specifically with policy assessment. The aim was to evaluate the potential degree of cooperation from the residents to the implementation of an environmental policy in the school. The respondents were asked whether they knew

¹ A **policy** is understood as a purposive course of action based on current societal values, to influence the human behaviour- as defined in the DMA- EP, 1998-draft document.

that the school's environmental committee and environmental policy existed. Their general feelings towards the policy were also assessed. Forty-nine percent of all the respondents did not know of the existence of the school's environmental committee while 29 % did not know that the school had recently developed an environmental policy. However, 63 % supported the development and implementation of the school's environmental policy. It was also important to establish the awareness of issues around the school in general and the respondents were asked whether they knew of any other policies in the school. The response was that 56 % did not know about other school policies while 44 % knew that the school had policies other than the environmental policy.

The questionnaire survey elicited no further suggestions from the respondents on how the environmental policy should be implemented in the school. While the majority support the policy, the survey indicates that its implementation is unlikely to be problematic. Transparency of information and publicity are essential because most respondents did not know the policy's obligations. Transparency and publicity are again essential because there were teachers and learners who did not know about other school policies regarding the overall performance of the school. With regard to the implementation of the EMS the respondents were asked to mention factors which may inhibit the implementation of EMS. The common reason raised was 'apathy'. Other reasons worth noting included lack of guidance, illiteracy, lack of money and lack of time and overloaded staff. Furthermore, it was mentioned from the survey that there is need to change the set European cultural paradigm adopted when the school was originally designed and perhaps incorporate local culture. The introduction of the indigenous foliage will be a step towards achieving this pre-determined change. It is important to note that the change anticipated requires more time because environmental management does not focus only on new activities but can also refer to activities which are already being practised and are a part of daily routine.

5.3 Social Profile of Respondents

Table 5.1: Response Rate to Questionnaire Survey

Categories	Total Pop (#)	Distribution (#)	Returns (#)	Returns (%)
Administration	32	10	2	20
Teachers	45	45	29	64
Caretakers	120	10	8	80
Learners	533	100	66	66
Total	730	165	105	64

Table 5.1 shows the total number of people in each of the school’s four population categories as well as the number in each of those categories who received a questionnaire. The table also shows the respective proportions of the questionnaires that were completed and returned. Overall, 64% of the questionnaires were returned which is sufficient to be fairly confident in the outcome of the study. However, it should be noted that the poorest response came from the administration staff (refer to Table 5.1). Such low response is considered poor and thus not really representative.

The two respondents from the administration were both females of the 31-40 years age group. While they held different positions both were involved in management and/or training. Of the eight workers who responded, four were female and four male. Seven were between ages 20-30 years and one between 51-60 years. The level of education of the workers was either they did not finish school or were high school graduates. The respondents were workers who had not been employed prior to working at Michaelhouse. All the permanent teachers in the school were asked to fill in the questionnaire. Out of the returned questionnaires, six were female and 23 male. Fourteen percent were between the ages of 20-30, 17 % were between 31-40, 41 % were between 41-50 and 24 % were 51-60 years. Fifty-nine percent of the teachers had post-graduate qualifications, 34 % had university degree qualification and seven percent had college qualification. None of the teachers were only high school graduates. The majority (62%) of the teachers held the Housemaster or the Head of Department responsibility whereas 38 % held teaching positions only. Sixty-six percent of the teachers were in the teaching profession before they were

employed at Michaelhouse, however 21 % were new teachers and 14 % were in other professions other than teaching before they became teachers. Michaelhouse strive for excellence and therefore employs highly qualified teachers. Fifty-five percent of the teachers taught physical science subjects including biology, science, geography, maths and technology. Thirty-eight percent taught general subjects including arts, life skills, linguistics, music, religion, and history. The remaining seven percent taught accounts.

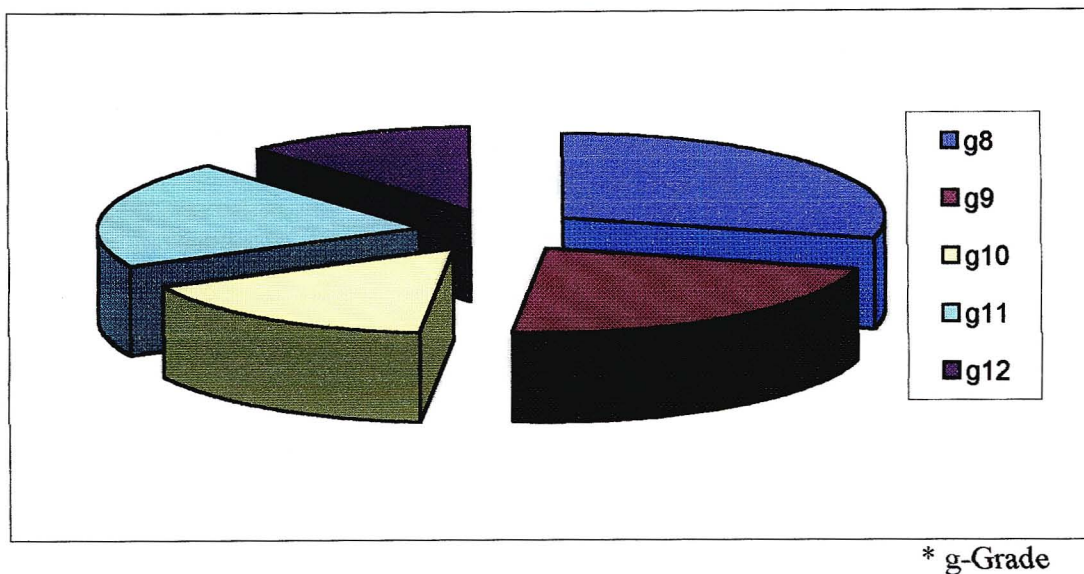


Figure 5.1 Proportions of Learners who Responded in Various Grades

Figure 5.1 shows the relative proportions of learners who responded. The largest response came from grade 8 learners. The second best response came from grade 9 learners. This can be perceived as a good representation because pupils of both grades are likely to follow through the implementation of the system in the school in the subsequent grades. Fifty-six percent of the pupils undertook physical sciences, general subjects and accounts at any point between grade 8 and grade 12 whereas 39 % undertook physical sciences and general subjects only also between the grade 8 and grade 12. The majority of the learners also rated physical sciences and general subjects as preferred subjects.

5.3.1 Need for an EMS by Respondents

Different viewpoints were apparent from the respondents some were extremely critical while others were in favour of environmental management and education in the school as well as environmental policy as noted in section 5.2. It must also be noted that the non-supporters were of the minority compared to the supporters. Sixty percent of the respondents claimed they knew what an EMS is whereas 40% did not know. Eighty-one percent thought it was necessary for the school to have the system in place. The question was open ended and the respondents gave various answers which were categorised into five themes. The most similar and /or related themes are as follows,

- A relationship between the humans and the environment
- A holistic process towards achieving set environmental goals
- Environmental management
- Resource management
- A system allowing institutions to manage the state of their environment.

As noted in section 3.4.2.4, the actual definition of the concept is ‘a framework for guiding organisations that need to address environmental problems to sustain good performance with established goals and in response to changing competitive environmental pressures’. Comparing the definitions given by the respondents and the actual one, it is perceptible that the implementation of EMS is feasible and that the residents can identify with the expectations of environmental management programmes in the school.

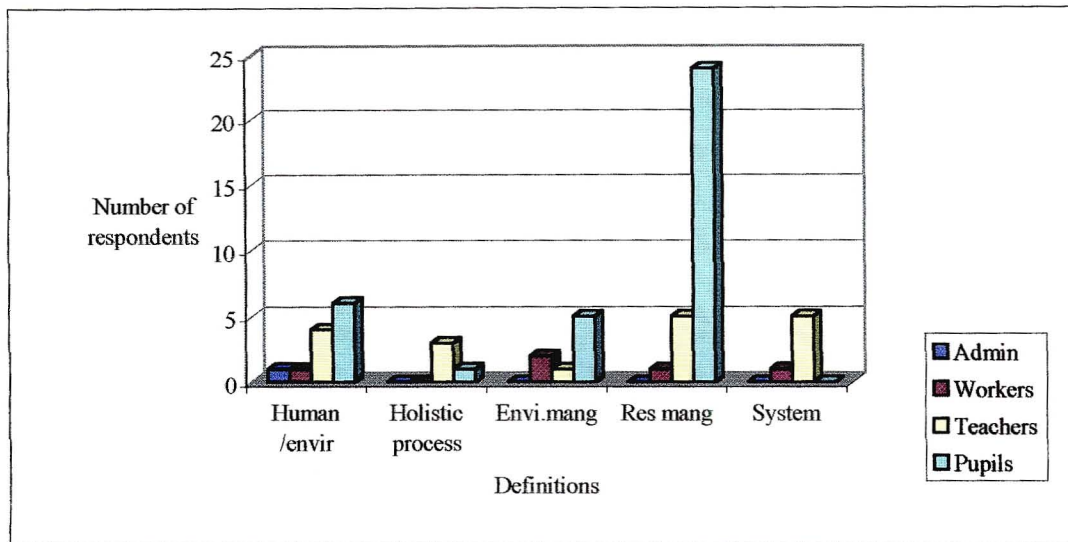


Figure 5.2 Definitions of EMS by Respondents

Figure 5.2 shows the responses as given by different respondents' categories when answering a question in relation to providing an EMS definition (refer to Appendix D, questions B1 and 1a). Both administration responses defined it as the relationship between the humans and the environment. The workers defined it as resource management, environmental management and a relationship between the humans and environment. None of them defined it as a holistic process towards achieving set environmental goals. The teachers included all the five themes. The learners' most popular definitions were resource management and a relationship between the humans and the environment. The most popular definition among the four categories in the school was the relationship between the humans and the environment. This suggests that respondents had knowledge or a creditable guess of what an EMS entails, most importantly the awareness that there is a relationship between the human beings and their surroundings. Therefore the implementation of an EMS again is likely to be welcomed.

The response to the question "does the school need an EMS?" (refer to Appendix D, question B2) supports this suggestion. The different respondents' categories gave different batches of answers to this question. One of the administration respondent noted that the EMS would encourage recycling asserting that practising recycling was essential for the school. Two workers thought the EMS necessary to conserve the existing resources. The remaining three were of the opinion that it would bring in

environmental awareness to all the residents. Teachers had a similar perception to that of the workers with 27 % commenting that it would create environmental awareness, ten percent and three percent said an EMS was necessary to solve environmental problems and conserve resources, respectively. Twenty-four percent of the pupils said an EMS was necessary to create environmental awareness, whereas 15 % said to conserve resources, 14 % said to solve environmental problems and another 14 percent said to keep the environment beautiful. As noted in section 3.2, awareness of environmental problems is a key towards finding solutions to those problems. From this information it is gathered that the respondents are also under the impression that an EMS will improve their awareness regarding the environment thus help tackle environmental problems. The researcher also shares the same sentiments in this regard.

It is discussed in section 3.4.2.4 that an EMS must be connected to other existing systems before or when implementing it. Therefore it was considered necessary to work around the existing systems in the school in order to introduce an EMS. Several options were given to the respondents to determine the extent to which the environmental component could be incorporated in the school. The options included the following,

- Incorporate environmental issues into environmental holidays
- Public holidays
- As extra-curricular activities
- Incorporate into the curriculum
- Stand alone as an environmental education module.

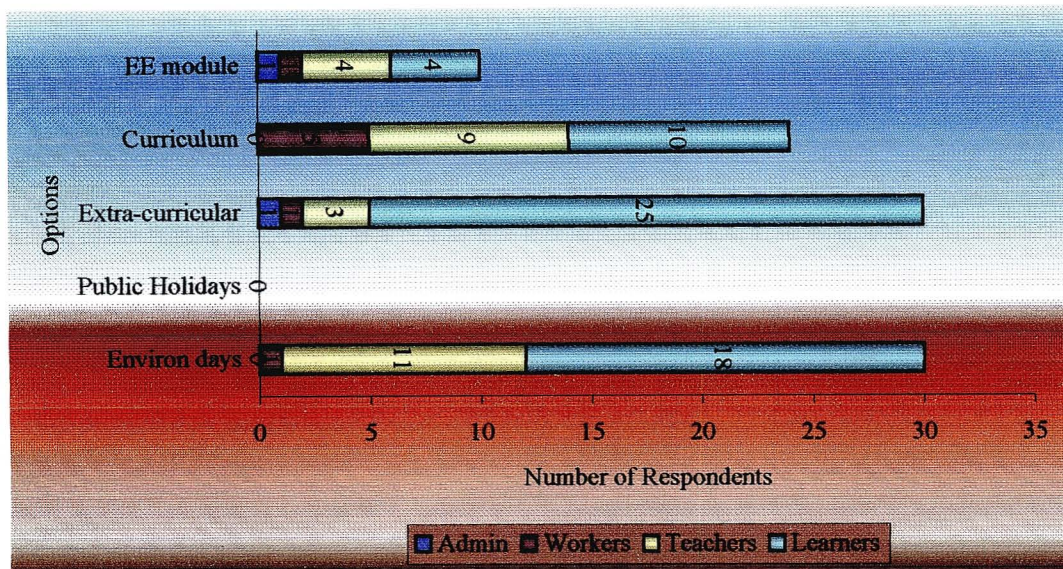


Figure 5.3 Incorporation of Environmental Component in the School

Figure 5.3 shows the responses to these options by different school population categories interviewed. The administration respondents favoured the extra-curricular and environmental education module options, respectively. Most learners preferred to have environmental issues offered as part of extra-curricular activities. The second most preferred option was to incorporate them during days of environmental significance; learners were also open to the options of incorporating into the curriculum and as an environmental education module, respectively. In common with the administration respondents and learners, none of the teachers or workers favoured using public holidays for the purpose. Both teachers and workers were open to all the other options but teachers favoured using days of environmental significance and incorporating environmental issues into the curriculum. The latter was the most favoured option by the workers.

It was important to find out how new the concept of an environmental programme was to the respondents. This was achieved by asking them if they had seen examples of such programmes in other schools or organisations involved in environmental programmes (refer to Appendix D, question B4). Sixty-six percent of all the respondents had not while 19 % claimed they had. The latter were required to provide examples. Three learners said the workers in their school were an example of such exercise. Three learners, two workers and a teacher mentioned the rehabilitation of the

Bog Stream and the planting of indigenous trees as examples of the exercises they are aware of, that involve environmental management. When asked to rate the significance of their personal contribution to the environment, 62 % of the teachers felt they contributed occasionally teaching in class, 14 % contributed through waste separation at home while 21 % admitted not to contributing at all. Seventy-nine percent of the learners claimed to contribute sometimes principally in ensuring that they do not litter and in working in the Bog Stream project. Eleven percent claimed to contribute all the time in ensuring an absence of litter in the school while only six percent admitted not contributing at all. One administration respondent contributed by recycling while the other made no environmental contribution at all. All the workers believed they contributed by cleaning up waste. Two of the eight claimed to do this all the time. The remainder made the contribution sometimes.

As indicated in Appendix D, question B4a, the respondents were asked to rate on a scale of very low to very high, the degree of environmental awareness in the school. Eighty-six percent of the respondents acknowledged the existence of environmental awareness in the school while ten percent claimed lack of awareness. The results are shown on Figure 5.4 below.

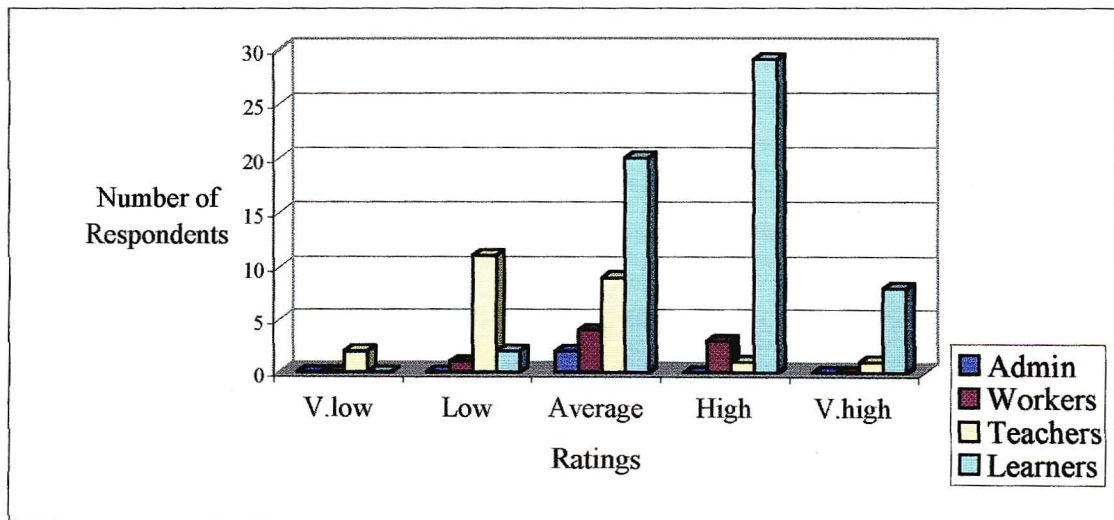


Figure 5.4 Level of Environmental Awareness by Respondents

According to the majority of respondents and across the four groups interviewed, the response reflected an average view on environmental awareness. Teachers perceived

the level of awareness as low and at most an average which was also identified by the administration respondents. Very few teachers regarded the level of awareness as high, like the majority of learners, while workers were of the impression that environmental awareness is average to high. This information reflects uncertainty among the respondents of the environmental status in the school. It has been noted earlier in the discussion that initiatives are not well known to the entire population in the school due to the fact that few individuals conduct these initiatives. This point becomes evident from the vagueness in the responses given when defining what EMS entails.

5.3.2 Environmental Concerns and Responses

Michaelhouse is a workplace, a home and has diverse natural surroundings making it susceptible to environmental problems. To determine the kind of environmental problems in the school, the residents were asked to list environmental problems known to them (refer to Appendix D, question 6). This was an open-ended question thus the respondents were free to list any problems and as many as they could. The information obtained from the respondents was used in collaboration with the observations made by the researcher, which was done as described in section 4.4.3 in identifying environmental problems. This decision to select the three identified problems was verified by asking the respondents to prioritise environmental problems in the school.

The problems identified were solid waste, sewage, wastage of electricity, air-pollution, vegetation, fire hazard, wastage of water and erosion in no particular order. The most identified environmental problem was waste, followed by vegetation and air pollution, then sewage and water, a minority mentioned fire hazard and soil erosion. The respondents mentioned more than one problem and in most cases it was either waste and air-pollution or waste and vegetation and on rare occasions it would be waste and any other listed problems above. To probe the respondents' views and perception of the environment further questions were asked regarding use of certain assets and environmental problems associated with their uses. From the above given environmental problems, five aspects namely, water, electricity, vegetation, waste and maintenance of school facilities were identified as major issues of concern and

respondents were asked to prioritise by ranking these five from the worst case scenario to the least in terms of their need for the attention of the management.

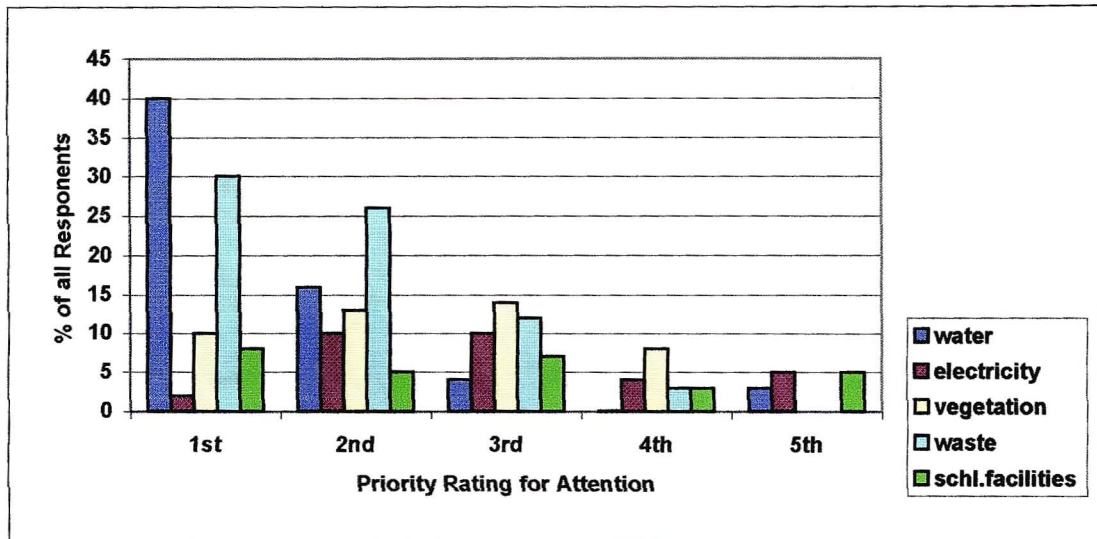


Figure 5.5 Resources Requiring Management’s Attention as Perceived by all Respondents

Figure 5.5 presents the respondents’ priority rating of environmental problems. Forty percent rated water as the aspect which needed the most attention. The reason given was that as water is a free commodity, there is danger that if it is misused continuously there will be a problem of water shortage in future. Thirty percent of all the respondents mentioned that solid waste needed attention. The reason given was that litter was an eyesore to the environment and unsightly particularly on the school grounds. The second largest group of all the respondents as shown on Figure 5.5 mentioned that solid waste management needs to be the first priority then followed by water. The third and fourth categories, indicated vegetation as the major concern and waste. Analysing the responses by the four different population groups, the administration rated waste as the first priority and 24 % of the teachers shared their view. Fifty-nine percent of teachers viewed water as a greater priority. Thirty-two percent and 30 % of the learners rated water and waste as the first priority, respectively. Three workers considered vegetation to be a resource that should get most attention, two considered water and two considered waste management.

The reason given by the respondents to justify the choices they made were to have proper management of the school in order to avoid circumstances that may pose a health threat to the residents. The information gathered here indicates concern on water, waste and vegetation which also are the main aspects identified by the researcher. However it is worth noting, as the bar graph also indicates, that electricity is of great concern, considering the ratings provided by the respondents. Therefore, it should be among the issues to which the management attends. The school facilities came in last in almost all of the categories provided in terms of priority rating for attention; nonetheless the category was recognised therefore it should not be disregarded. It is important, as noted in section 4.4.4, that to obtain an effective system, environmental audits conducted must ensure that all potential and possible concerns are investigated.

Another factor, which was of importance to determine, was the perception of the respondents towards environmental problems being a health risk factor. Human beings are at risk most of the time and worst of all to circumstances which may not be noticeable immediately. Twenty percent of all the respondents claimed there was a health risk factor possible whereas 63 % stated that there was no health risk known. Those holding the former view comprised five workers, one administration respondent, three learners and 12 teachers. Their concerns were that poor management of resources poses a health risk such as potential fire hazard because of the grassveld, pollution from the smoke emissions from the laundry, leaking sewage pipes that might affect ground water which serves as main source of drinking water for the entire community. The suggested possible measures were to have proper management of the school jointly with the help of experts to address the identified problems. The field observations and communication with the key informants indicated a great deal of reliance on the outside expertise to attend problems in the school. This is not an inappropriate idea provided the solutions cannot be devised internally then experts can be consulted as the last resort.

As part of a pilot survey, it was learned from Fleischack (pers.comm., 2001) that there are many activities taking place in the school but these are not directly environmental in nature but can affect the environment in one way or the other. One example is sports. When the above-mentioned informant was asked the status of the

resource use in the school, he expressed that as far as the boys and the staff are concerned there is excess use of resources. However, looking at the school as a whole, resource consumption, if measured, would be approximately on average consumption. He was of the impression that the implementation of an environmental policy is a good opportunity to guide environmental matters comprehensively and can be an advantage for the school in the long run.

The only real basis for sustainable living is to achieve equity, efficiency and sustainability in the supply and use of resources. Michaelhouse, among other reasons due to its location, is in a state whereby it relies on use of natural resources to meet the residents' daily needs. It therefore requires proper management techniques to ensure the long-term supply of these natural resources. According to the respondents, resource consumption in the school is fairly stable; learners did not perceive resources as being wasted; the majority of teachers, workers and administration also perceived a stable use of resources. Figure 5.6 shows the perceptions of the respondents with regard to resource consumption. However, there was a perception of resource over-consumption, 20 respondents pointed out that people tend to abuse resources especially water and electricity, water because it is a free commodity and electricity because of negligence from the users' point of view. None of the respondents thought there was under-consumption of resources. These perceptions will either be confirmed or rejected as the discussion continues.

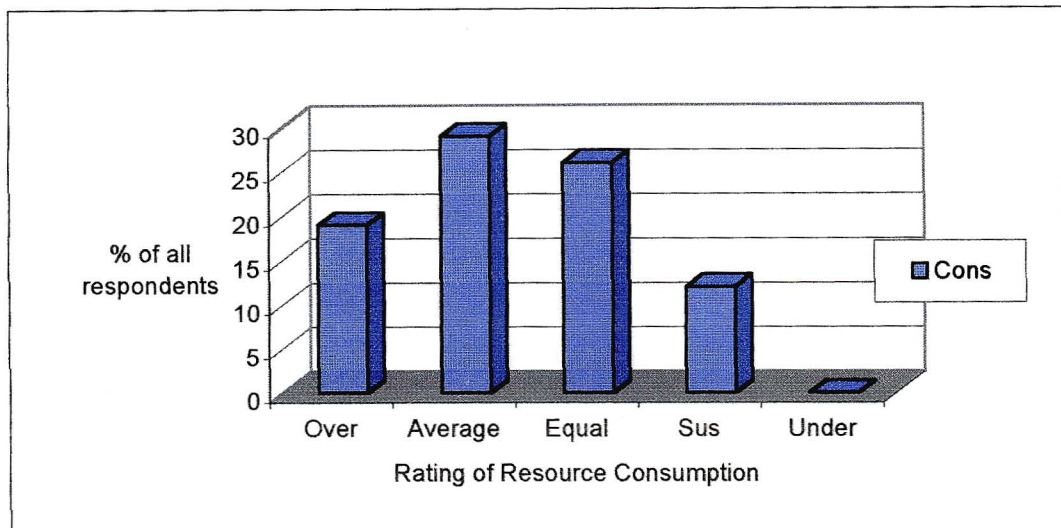


Figure 5.6 Resource Utilisation in the School Perceived by all Respondents

There are a great many lessons to be learned from this research and perhaps other follow up research before and during the implementation of a proper EMS. It is with this perspective that the following discussion of the selected resources water, waste and vegetation are done intensively. The first discussion is of water management, as it seems to be an important part of the school and perhaps the most vulnerable resource, which may be subjected to over-consumption. This may not be applicable to all circumstances, but over consumption is usually associated with affluent people, as wastage does not affect them as greatly as it does underprivileged people. It is anticipated that the discussion that follows will help bring about tangible changes of behaviour in the use of resources and hence promote sustainable lifestyles for all the residents of Michaelhouse.

5.4 Water Management

It is argued that ground water represents the most promising supply of water and if managed well can sustain large populations (Preston, Roux and van der Linde, 1997). As detailed in section 2.5.1, Michaelhouse uses this type of water supply for the provision of domestic water. There is also a stand-by dam for cases of emergency; this dam water is rendered unsuitable for human consumption; therefore it is used for irrigation purposes. It was important to address the management of water in the school, one of the reasons being the perception that water is wasted and this may be a major problem for the supply of water in the long run. In order to address this issue, it was

first important to determine the level of awareness of the source of water supply from the respondents, with the view that their awareness may encourage more informed methods towards proper water management. Of all the respondents, 15 % disclosed that their water supply came from taps whereas 75 % disclosed that their main source of water came from the boreholes, the latter of which 69 % were learners, 24 % teachers, four percent workers and three percent administration. This reflected that the majority of the residents were aware of their source of water supply therefore were aware that the school does not pay for water provision. It is important to establish awareness to the residents and mostly the learners, of the possible implication of lack of water or shortage of water in future, as a consequence of water wastage. A valuable suggestion put forward by one of the teachers, in an attempt to respond to the above mentioned implication, was that this can be achieved through implementing a multi-faceted approach using academic programmes to re-enforce this kind of venture.

To explore such a venture, Lethoba's (2001) Environmental Education (EE) project also noted in section 1.1, focused on learners in grades 8 and 9. During her encounter with the learners an exercise was carried out to determine the learner's knowledge with regard to wise use of water. They were able to identify the following conditions which waste water: leaving the shower dripping and taking too long showering and leaving the tap running while washing faces or brushing teeth. The average time spent showering was found to be between ten and 15 minutes. An exercise was carried out whereby a learner brushed his teeth while the tap was running. Four hundred milliliters of water were found to be wasted. This exercise revealed that leaving the tap running when brushing teeth could potentially have a substantial impact on the school's water supply. If each of Michaelhouse's 800 residents wasted 400 ml water on average twice a day, the total monthly waste would be 19 200 litres. Given this scenario, one of the learners volunteered that a solution would be to inform people to use water wisely, then drew a very impressive poster demonstrating how this could not be achieved (refer to Appendix G, Figure 7.1).

From the above collected information, it was apparent that there was water wastage. It was therefore considered necessary to obtain information on the actual quantities of water used. Readings are taken daily at the boreholes and 22 % of the respondents were aware of this while 15 % thought it was measured on a monthly basis and the

remainder had no idea of when, how or who measured it. The researcher is of the opinion that the school's residents need to know these basics in order to be able to manage water efficiently. Knowing the volume of water used each day and the proportion wasted may make the residents more conscious of wasting water. Figures 5.7a and 5.7b show quantities of water used in the school during August and September 2001 (these months were chosen at random just as examples to show water use in the school). The highest water quantities recorded per day from the three boreholes (B/H) readings were 1 771 000 litres/day in August and 3 066 000 litres/day in September. The lowest quantities were 629 000 litres/day in August and 722 000 litres in September. The peaks indicate periods whereby water was used in large quantities. It was gathered from the Estate Manager that these periods correlates with the frequent irrigation and daily use of the laundry.

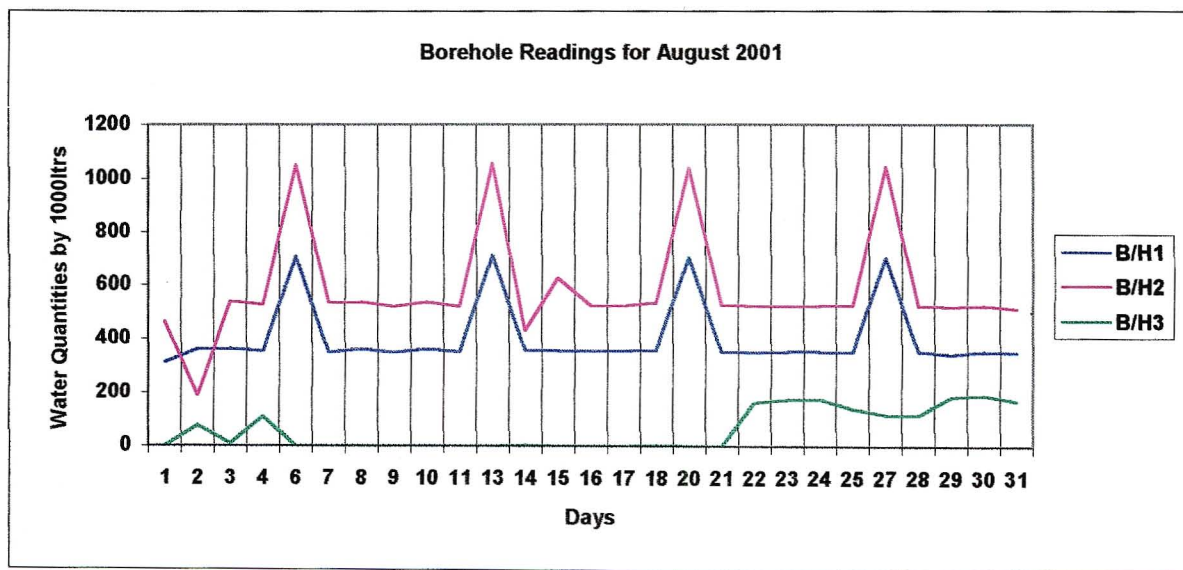


Figure 5.7a Boreholes Readings for August 2001

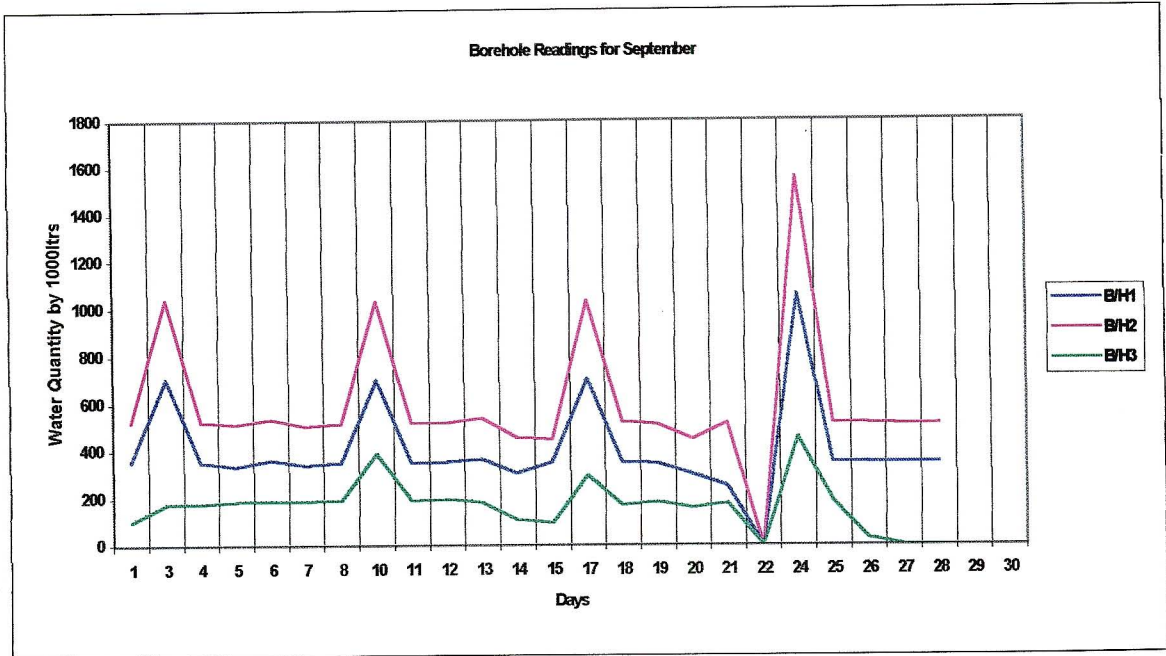


Figure 5.7b Boreholes Readings for September 2001

As noted in section 2.5.1 that the readings are taken on a daily basis at 0730 hours except on Sundays, these readings are taken per cubic meters for every 1000 litres. As seen in Figure 5.7a and 5.7b the most used Borehole is B/H2 followed by B/H1 then B/H3. The reason has to do with the location of these boreholes whereby B/H2 is situated further uphill than B/H 1 and 3. When B/H2 is running, it slows down the functioning of B/H1. However a timer on B/H2 switches on and off at 3 hour periods then giving a chance for the B/H1 the opportunity to pump water. Borehole 3 is also at a disadvantage because it is supplied by reservoirs that also serve B/H1 therefore reducing B/H3's activity.

The above Figures show considerable fluctuations in water use in the school. Given that the biggest water consumer in the school is the laundry using on average 46,000 litres of water per week (EDG, 1999) these fluctuations are most likely related to changing bed linen and the number of sporting events/ activities taking place which requires boys to use sports gears often. Month to month fluctuations are associated with the weather. During the winter dry season a lot of water is used to irrigate the sports fields increasing water consumption. During the school holidays, the absence of the boys and staff members results in the water readings declining to as low as 700 litres per day from three B/H (Rockcliffe, pers.comm., 2001).

It is clear that a significant amount of water is being unnecessarily wasted and that to address this, an intensive communication programme is required. Preston *et al* (1997) assert that communication is crucial for the success of water conservation projects as they require full support from all people. The researcher is of the opinion that the users should be shown their daily or monthly water consumption values for a period of a year and required to make comparisons. They should also be required to suggest reasons for above average consumption taking cognisance of rainy periods. With such careful monitoring it will become easier to identify problems such as leaking pipes e.t.c.

The other component of the study was to find out water use, from a third party's point of view (in this case the researcher). This was achieved by conducting a water audit in some of the Michaelhouse buildings. Water audits allow people to understand the way in which they are using water and help investigations of how to use water in a less detrimental way. The procedure used to conduct a water audit is described in section 4.4.4.2. The field audit of water use revealed negligence in use from the singles' quarters of the workers. There were eight showers, four of which were dripping even though still functioning properly. The dripping was not a result of poor maintenance but the taps had not been closed properly. The similar procedure was used to assess the hand basins, it was found that there were eight hand basins two of which were left dripping even though still functioning properly. This observation reflected careless behaviour and the need to educate residents in the singles' quarters' about the importance of using water wisely. It is suggested that this can be achieved through conducting workshops regularly for the workers, so that they can have a logical understanding of the repercussions involved when abusing or not caring for the facilities. As stated earlier that this can be an opportunity for learners to get involved in helping the workers by demonstrating drawings and visuals that are environmental in nature.

The same approach was used to observe water use in the sanatorium mainly because learners frequently use the sanatorium. The audit revealed proper functioning of facilities from the management point of view and no negligence was detected on the part of the users. However, these findings were considered inconclusive because the audit was conducted soon after a holiday and during summer. The researcher is of the

opinion that these conditions may have undermined the findings. Apparently the sanatorium is more fully occupied during winter when learners are more prone to suffer from cold related illnesses. This may be a better time to evaluate the use of water in this particular building.

The water audit conducted in nine boys' boarding houses as seen on Figure 2.3 adopted the same procedure as described for the singles' quarters and sanatorium. The total number of showers in all the houses was 105, with a number of showers in each house ranging between eight and 15. For each house two or three showers were found dripping even though still functioning properly. The same observation was made with the hand basins and toilets whereby very few were dripping. This reflected carelessness on the part of the boys though not too detrimental. A point made earlier on in this section whereby learners owned up to negligent behaviour sometimes, by leaving taps running, supports this.

Although further awareness may be required, it is suggested that other possible measures be considered, as awareness may not be the only answer (refer to Appendix G, Plate 7.1). It is anticipated that such facilities as shown in Appendix G, a toilet-lid sink, might be helpful as the user is able to wash their hands in the water that re-fills the cistern. This facility has been used successfully in other places². During the audit it was also observed that urinals were of the automatic flushing types; it is suggested that water could be saved more by installing low flush version urinals, which the user activates himself. It was also observed that the types of showerheads installed enabled rapid water flow; a lot of water could be saved through the installation of low water flow showerheads. For hand basins install taps with low water flow aerators with on/off switches which reduce casual water use especially for people when brushing their teeth. This would help minimise possible water wastage.

The kitchens and the laundry were also included in the water audit. Two kitchens in singles' quarters' kitchen and the main school kitchen were inspected. Observations were made to determine whether water was used efficiently by inspecting the use of sinks during food preparations and whether there was frequent movement of water

² The accommodation units in the Kruger National Park whereby a study of water and electricity conservation was conducted.

while working. For both kitchens, the findings revealed that sinks were blocked properly during food preparation therefore no water wastage was noted. In the laundry no water was carried around. All water was confined to machines and pipes, no spillage was noticed. However, as noted earlier in this section, the laundry is the biggest consumer of water in the school. As noted in section 2.5.1, the management is currently considering re-using wastewater from the laundry to try to reduce the overall water consumption.

The field audit also revealed that inefficient gardening practices are a significant cause of water wastage. Water is mostly used for irrigating the sports fields and the sprinklers are active in the morning through until about noon. According to Preston *et al* (1997) the proposed water management plan for the Hermanus programme³ stipulates that there should be a ban on watering between 10h00 and 15h00 because this is the time when 60 % or more water simply evaporates. The researcher is of the impression that the Michaelhouse environmental policy should include the regulation that watering should not be done between the hours 10h00 and 15h00.

5.4.1 Water Quality

To determine the water supply efficiency in the school, a rating scale was used whereby respondents were asked to select the most applicable answer (refer to Appendix D). The rating scale had five options from very poor, poor, okay, good to very good and the respondents were asked to select the most applicable rating in terms of how they perceive water supply efficiency. Seventy-nine percent of the respondents assert that water supply is fairly good, of which 16 % selected okay, 30 % good and 42 % very good. Twelve percent was not entirely happy with water supply efficiency, the reasons being that water is too chlorinated and fear of sewage leaks contaminating the water. The latter reason was challenged by the following question where respondents were asked to state their perceptions regarding water quality status and the responses ranged as follows; one percent stated that the water quality is bad, ten percent stated that water quality is not so good and 84 % stated that water quality is good.

³ The Greater Hermanus Water Conservation Programme, which is aiming at promoting reduction of water consumption in Hermanus region.

Having derived such confidence from the majority of the respondents about the good water quality, the researcher was inspired to verify this fact. The researcher found no need to conduct the tests personally as Mgeni Water Services was already contracted to carry out a monthly tests of water quality as noted in section 2.5.1. The water samples are taken on monthly basis, to test for coliform bacteria presence. A coliform bacteria count relate to a measure of faecal bacteria in water. Ideally if the number is zero, then it can be ruled out there is no danger of contaminated water. It must be noted that water in the environment is seldom totally free of faecal bacteria; there could be effects from birds and other animals that might introduce some. According to Hammer and Hammer (Jr) (1996) as noted in section 3.3.3.1 these tests are necessary for ground water, as contaminated ground water is usually realised only after the drinking water has been affected. They further assert that contamination commonly results from human activities and /or activities such as wastewater, flowing household septic tanks, wastewater disposal tanks and different sorts of chemicals put in water which in turn are disposed through sewage systems.

Tests were done in the three boreholes (B/H) and a stream. (It must be noted that records of other monthly tests are available but only records for three months were obtained and used as examples). According to the tests conducted on the 26th March 2001 the results and analyses indicated presence of coliforms in B/H2 and zero count in B/H1 and 3, therefore B/H2 was rendered unsuitable for human consumption until properly disinfected. Boreholes 1 and 3 were rendered satisfactory bacteriologically. Apparently B/H2 was treated accordingly because the subsequent tests conducted on the 21st August 2001 on all the watercourses mentioned above recorded zero count therefore rendered satisfactory bacteriologically. The latest tests carried out on the 2nd November 2001 read zero count in all of the three boreholes and were satisfactory bacteriologically. However, large amounts of coliform were detected in the stream. This indicated that there is a source of pollution, which needs to be identified in order to deal with it. The stream is not used for water consumption therefore it may not have a detrimental effect to humans directly; nevertheless, people responsible are advised to address this problem because as suggested by NEMA section 28 the environment must be taken care of. Furthermore, as noted in section 2.5.3, it is essential to keep the stream as healthy as possible as it is expected to maintain a healthy ecosystem for flora and fauna for an indefinite period.

5.5 Waste Management

Section 3.3.3.2 discusses different types of waste management procedures. The respondents were asked to provide a definition of waste management. Their definitions fell into three categories, firstly, 16 % stated that waste management implied collection of waste of which 58 % were learners, 29 % teachers and 11 % workers. Secondly, waste management entailed a process involving dispersion of anything unworthy. Ten percent all of whom were learners held this view while the remaining did not hold the same view in this regard. Ten percent of all the respondents considered recycling as a definition of waste management of which 80 % were teachers and 20 % workers, the administration staff and learners did not share this view. This reflects that the respondents were not totally clueless of what waste management entails. Generally, the majority of Michaelhouse's population supported waste management. These findings also reflect that there is potential for waste management initiatives to succeed, as the majority of residents support waste management and are likely to initiate waste management methods and try their best to make them successful.

It is noted in section 3.3.3.2 that it would be in the best interests of the school and to put in place the most effective waste management system. A key informant's opinion of a way to achieve this was for the school to have a waste management policy of zero tolerance of waste. The environmental committee however (EC, 2001) viewed this as too ambitious. The committee agreed to adopt the principle of integrated waste management which regulates dedicated commitment by all Michaelhouse residents and the management to reduce waste, re-use, separate at source, recycle and safe disposal of unavoidable waste (refer to Appendix C, principle.5). In addition, the researcher is of the opinion that to achieve an effective waste management system in the school, several options may be considered. Among other things, a form of participation towards initiating environmental management initiatives can be incorporated into the existing leadership courses offered for boys and outreach programmes boys participate in. The boys are awarded prizes for best performance in the leadership courses and for involvement in the outreach programmes. Encouraging boys to get involved through the above mentioned aspects would be a simpler way to gain their interest when they feel they are assisting the

communities while receiving prizes for their activities. Other options involve introducing various waste management projects, examples of such are shown in Appendix G, Figure 7.1 and Plate 7.2. Learners could produce useful drawings in their Art class and put them up in boys' bathrooms and workers' residences as a reminder to conserve water or paint different dustbins which will be used to separate waste at source as seen on Plate 7.2. Moreover, learners could practice composting and use kitchen waste as part of a science project and supply manure for school gardens or make a contribution for small gardens, to the local communities

Michaelhouse produces general/solid waste and hazardous waste; the latter was identified during a pilot study as low-medium hazardous waste. This hazardous waste mainly liquid, comes from the science laboratories where learners carry out scientific experiments. At present liquid waste is disposed of in the sewage system. However the laboratory workers disclosed that this liquid waste is neutralised to ensure that it is harmless before it is discharged down the drains. Liquid waste which was considered harmful is kept in five litre bottles in the laboratories and a decision has not been reached for the best method to adopt in its safe disposal. This was noted and investigated because, according to national policy and legislation detailed in section 3.3.1 and 3.3.2, caution is necessary in handling hazardous waste as almost any substance can be harmful to human beings if handled inappropriately.

Furthermore, some hazardous waste which may be considered safe can be lethal when produced in excess, when mixed with water or if kept over a long period of time. This hazardous waste from the laboratories was therefore considered a potential risk. This issue was not pursued in detail. However it is recommended that a proper assessment be made of the chemicals in the laboratories and use of the Material Safety Data Sheet (MSDS) which describes the ideal methods of chemical disposal. It is further suggested that liquid waste can be disposed directly into a low hazard waste landfill site (Shongweni or Bulbul drive hazardous landfill sites in KwaZulu- Natal). Upon deciding to take this latter route, it must be emphasised that it is important to obtain information about the status of the landfill they wish to use to dispose their waste. This is a necessary requirement as discussed in the document called Waste Management Series: minimum requirements of 1998 established by Department of Water Affairs and Forestry (DWAF) to ensure that the landfill

selected is within the legal system and has a permit to carry out such activity. It should be noted there are approximately 1200 landfills, some of which are not legally recognized by the law.

Section 3.3.3.2 discussed recycling and its value of promoting responsibility, forcing people to take charge of their own waste. Recycling has been largely embraced through out the world. Nonetheless it has been known to be common in most disadvantaged communities and more often than not become unsuccessful. Although Michaelhouse is not one of those disadvantaged communities, recycling initiatives have failed a number of times as noted in section 2.5. One of the reasons given was lack of support from the management and the other was poor participation from the respondents. The researcher explored this issue further by determining the opinions of the residents regarding the recycling process, perhaps to fill in the gaps that might encourage better participation and possible success of the initiative. This information was obtained through the questionnaire survey (refer to Appendix D).

As mentioned in section 2.5.2, that recycling was once put into practice by a science teacher. Fifty- seven percent of the respondents stated that they knew nothing of such practice with only 34 % were aware of the previous attempt of waste recycling practice. However, most respondents viewed recycling as worth trying again because it could benefit the school. Examples of these benefits include generation of cash or perhaps use of waste materials to make crafts such as furniture for local community schools. Learners and teachers stated that to promote recycling, learners could compete among themselves or inter house to separate waste and the best performing house be awarded a prize. The idea was further discussed by the environmental committee (EC, 2001) and further investigations are still being done with regard to organising such competitions.

Pearce (1993) states that the recycling industry remains vulnerable and heavily dependent on the availability of markets for the recycled products. Therefore it is important to note that recycling relies on the availability of material to recycle and willingness of people to do it. Leading from this argument the respondents were asked whether they would be willing to participate in recycling (refer to Appendix D, question.8). Eighty-seven percent respondents were willing to participate in

separating waste at source while five percent stated blatantly that they were not willing to participate in recycling. The reason given was that it would be a waste of time. Those who were willing to participate were required to indicate the most likely material to be recycled in the school. This was done by providing a list of recyclable materials and asked to indicate which would be most successful for recycling. Responses to this request are illustrated on the Table below.

Table 5.2 Recyclable Materials

Materials	Respondents (#)	Respondents (%)
Bottles	37	35
Paper	27	25
Glass	13	12
Plastic	8	8
Tin	7	7

Bottles scored the highest rating with respondents. However this may be due to the fact that it is the only material being collected at present thus respondents knew about it. As noted in section 2.5.2 that there are two Waste Services containers for collecting clear and coloured bottles, respectively. The waste audit conducted indicated that bottles are being successfully collected although the containers are taking long to fill-up. This may be because the use of bottles is not as high as it had been anticipated. It was further found that some coloured bottles were dropped in the clear bottle's container. This reflected negligence in the part of the workers, hence it is suggested that they be made aware of the importance to separating these bottles accordingly.

In as much as recycling has been considered as a critical component of a responsible waste management system, it must also be emphasised that recycling alone cannot solve the problem of waste in any given place. Therefore, other options need to be explored. It is suggested that a system of integrated waste management be embraced because it offers alternatives. Landfills are one such alternative for those products that are not recyclable. Other options are mentioned in section 2.5.2. An integrated

waste management system also offers efficiency, cost benefits and environmental safety of each alternative (i.e. recycling, landfill, incineration, composting, etc.). Therefore it is proposed that reducing waste should be a first priority when dealing with waste management 'the fewer resources used, the less would be the need to dispose of'. To test the awareness of the residents with regard to the type of waste production, respondents were asked to state the type of waste produced in some of the regularly used facilities; the kitchen, science laboratories, laundry and the clinic.

Table 5.3 Types of Waste Produced in Some Facilities by Respondents

Facilities	Respondents on %	
	Hazardous Waste	Non Hazardous Waste
Kitchen	8	74
Laundry	48	27
Clinic	49	30
Laboratories	66	10

Table 5.3 shows that most respondents did not consider kitchen waste potentially dangerous. Nearly half viewed waste from the laundry and clinic (sanatorium) as potentially dangerous (refer to Figure 2.3 for location of these facilities). While two thirds viewed the laboratory waste as dangerous. This reflects awareness from the respondents of possible dangers they are likely to incur with regard to waste production. Therefore, it can be concluded that given proper instruction on procedures to follow, the residents will have the ability to manage their waste accordingly. Furthermore, the school consists of a number of facilities other than those referred to above. It was important to determine other areas which may require the attention of the management with respect to waste management. The respondents identified the main areas that should be given attention as the workshop (refer to Figure 2.3), hillside and staff houses as well as dormitories. Field observation of these areas revealed that the workshop did require cleaning. The researcher was not able to investigate further about the workshop, however, it was noted during field observations that the workshop does a number of activities of which vehicle maintenance was one, on its own fleet of vehicles. The workshop staff also take

various responsibilities of maintaining the school facilities in general.

A proposal to provide waste management services for the whole school was made by Enviro-Serve to Michaelhouse through approaching the school's environmental committee. The proposal included all of the waste management steps necessary for a comprehensive and effective waste management system. The committee decided it would be too costly for the school to employ Enviro-Serv due to financial implications. However, the committee members discussed and came to an agreement that the decision should be based on the long term benefits for the school and if that is the case then the proposal should be reconsidered. The school's management is now reviewing it, and a decision is pending.

Regarding sewage disposal, there are also a number of options which Michaelhouse can embark on in order to have a long term proper functioning of the sewage system in the school. The first step is to decide whether it is feasible to have an entirely new sewage system or to continue upgrading what already is in place. In making the former decision, it is important to understand the disparity between using a system that will occupy a larger area using low energy and one that covers a small area but which uses a large amount of energy. On the condition that the latter is chosen, it is recommended that as part of upgrading process, options that can be looked into should include separation of grey water (wastewater from domestic facilities) and black water (wastewater from lavatories). It is presumed that such options will ease the overworked sewage system. The advantage again of separating grey water is that it can be chemically treated and re-used, while black water can be treated using a small packaged sewage treatment plant, probably at a lower cost, since it will require minimum use of energy. It is further recommended that sewage from the toilet and urinals can also be separated, as this will also render treatment of each less complicated.

5.6 Vegetation Management

The purpose of investigating the vegetation in the school was done for two main reasons. Firstly, because of the proposal of 'Africanisation of trees' which require a shift from predominantly exotic trees to indigenous trees. Secondly, it was pointed

out that the tree roots were affecting the sewage pipelines therefore it was considered necessary to look into the matter to assess the severity of the problem. While assessing the above mentioned two factors, other issues came out which are discussed in the subsequent text.

Currently, the types of trees dominant in the school are exotics. The school management has however realised the problems associated with some exotic trees, namely wattle, gum and pine trees, as they can become quite invasive. Versveld, Le Maitre and Chapman (1998) argued that alien trees act as pumps removing precious water from the soil. Other problems associated with them include soil erosion and potential causes of fire hazard and most of all a disruption to the biological diversity of any area. These alien plants are a threat to the school mostly because the school relies on ground water as their main source of water supply. It is further argued that clearing these plants increases the run-off of water and thus prevents decrease of water yields.

In order to achieve the objectives, respondents were asked a number of questions to assess their opinions regarding vegetation. Respondents were asked to select a category which best defines the type of trees in the school. The aim was to determine the respondents' awareness of the difference between exotic trees and indigenous trees. It was interesting to find out that the residents were not aware of the most dominant type of trees in the school as identified above because when asked to identify the most dominant trees, various strange answers were provided. The results are shown below on Figure 5.8.

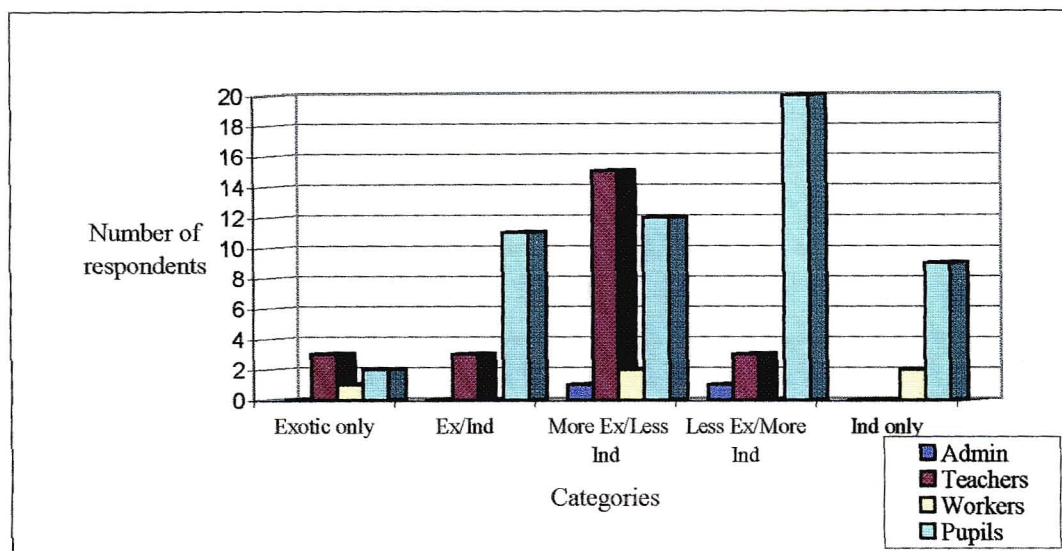


Figure `5.8 Type of Vegetation Dominant at Michaelhouse

The correct response that there are more exotics than indigenous came from the teachers and some learners although, the majority of learners stated that there were more indigenous and less exotics. Two workers were of the opinion that there were more exotics than indigenous and two stated that indigenous trees were most dominant while the remainder asserted that the dominant were exotics. Through probing during informal conversations with some respondents, it was gathered that some of the workers might have identified the most dominant trees as those trees, which were of significant value to them. For instance, one lady concluded that indigenous trees were dominant because she knew of the indigenous tree she used for medicinal purposes while one man knew of certain types of trees he used for firewood therefore concluded that they were most dominant. This reflects that identification and knowledge of trees was based on their value.

To confirm these perceptions, respondents were asked to rate the value of indigenous trees under three given categories, namely educational, leisure or aesthetic (refer to Appendix D). However 71 % emphasised the view that they perceive indigenous trees as valuable for aesthetics only while 26 % perceived them as valuable for educational purposes. A small percentage of four respondents stated the need for indigenous trees would be valuable for pure leisure, enhancing the school's appearance. Also the fact that the school is involved in sports the trees would be an advantage to provide enjoyable shade. Despite the reasons given regarding the

importance of having trees, the respondents saw no reason to have a special time to plant trees. The respondents thought it was acceptable to plant trees during environmental holidays such as Arbor Day or perhaps as a part of a school exercise.

The second objective was addressed with regard to vegetation status in the school to ascertain possible success of the 'Africanisation' of trees venture. This venture aims at introducing indigenous trees in the school as much as possible. The decision was reached upon due to the realisation that most of the trees at Michaelhouse are foreign species (refer to Appendix. F). This has been largely blamed on the climatic conditions of the area which are extremely cold and a lot of tree plant species can not survive extreme climatic conditions. Hence most of the trees were imported in the light that they are more tolerant of the climate of the study area (Pickstone, pers.comm., 2001). This however is not entirely the only reason exotics were planted in the school. It is also pointed out in section 2.5.4 the other significant reason was to commemorate the Michaelhouse boys who participated in World War One. The proposal is to move from predominantly exotic foliage to indigenous foliage as much as possible. To determine the support for this proposal from the respondents, they were asked to state the benefits they foresee with regard to this project. The majority of the respondents were in favour of the project meeting several needs such as educational, leisure and aesthetics purposes.

Although there is general support for planting indigenous trees in the school grounds, it is important to note that only seven of the species that have been planted to date (refer to Appendix F) are indigenous to this particular area. These are; *Celtis africana*, *Cussonia spicata*, *Dais cotinifolia*, *Euclea crispa*, *Halleria lucida*, *Maytenus heterophylla* and *Maytenus pedunculari*. While *Dombeya*, *Rhus*, *Buddleja* and *Canthium* are represented in this area, they are not specifically indigenous to Michaelhouse' veldtype. It is only trees indigenous to the specific veldtype of Michaelhouse that are likely to grow well. This are listed in Appendix F. The school's management is advised to rather acquire trees from this list for their Africanisation venture.

During the field observations, no evidence of the trees uprooting the sewage pipes was found. This is because there was no plan showing where the sewage pipes had

been laid, it was not possible in this study to predict where uprooting of pipes is likely to occur. According to environmental management tools discussed in section 3.4.2.4, it is important to have the ability to identify problems before they have a detrimental effect. For instance, sustainable development implies consideration of a long-term well being of the entire environmental system and to achieve this, problems have to be dealt with before hand.

According to Norman and Clive (2000) an EMS on the other hand suggests that many of the serious environmental impacts have resulted from developments that were badly designed, and sometimes these effects took long before they were noticed. An Environmental Management System ensures that such circumstances are avoided before hand. Environmental Management System procedures force developers to take precautionary measures to avoid negative impacts. It is apparent that Michaelhouses' original sewage pipelines were designed deficiently but the problems are only surfacing years later. It is considered necessary to correct the situation for the benefit of coming generations by ensuring that sewage system in the school is mapped, perhaps through the assistance of a specialist in the appropriate field.

The Bog Stream is again touched on because it also has valuable significance to the vegetation management in that. One of the goals regarding its rehabilitation is to re-introduce vegetation species which will sustain the ecological stability of the stream and the wetland. As mentioned in section 2.5.1 the project started approximately two years ago. It is likely to be a continuous project as it is anticipated that a step forward would successfully lead to another rewarding step. In the past, a wetland was drained to set up in its place some school facilities, specifically sports fields. At present, what is left of the wetland is stagnant water which is unpleasant to view. Part of the Bog Stream rehabilitation includes the recreation of the wetland and the stream and re-introduce flora and fauna that was originally present in the original stream. The learners have contributed very much to the recreation of this stream whereby they worked on it as part of their assigned duties to perform per house at different days of the week. Noticeable work has been done on the stream (refer to Plate 2.3) though not much has been done on the wetland. There is great enthusiasm from the environmental committee with regard to the revitalization of the wetland and duties

have been assigned to a number of committee members to investigate a way forward to achieve the targeted goal.

Respondents were asked to identify problems that may require attention regarding the trees. Seventy-four percent identified no problems whereas 13 % identified a number of problems. These included concern that alien plants are a threat to the biological diversity; use of excessive quantities of water which may affect the water supply and also spoil the pleasant appearance of the school. Wattle was particularly mentioned in this regard. Damage to the sewage pipes and shading were other problems identified. The audit revealed that shading was unlikely to be a problem because all trees were found to be a reasonable distance away from the buildings. Through an informal conversation with one of the key respondent, it was gathered that another problem, which had not been considered much and requires attention, is the fact that tall trees are a problem with regard to electricity wires. This could have disastrous effects. It is recommended that the issue be assessed to determine the probable degree of the problem and appropriate caution taken.

The other important factor was to determine the sentimental value or cultural significance attached to the trees by the respondents. Seventy percent maintained trees were of cultural significance and the remainder attached no such value to them. Forty-eight percent respondents stated that there were trees of cultural significance in the school and selected indigenous trees over exotics as their choice. This reflects the fact that respondents identify indigenous with culture. Exotics could also be trees of cultural significance depending on the reasons given. Infact 12 % of the respondents chose exotics as representing cultural significance. For instance one respondent pointed out that the exotics identify with the origins of the founders of the school. Eight percent stated that both types of trees have cultural significance value and they would like to see both types flourish and appreciated the same way.

The last section under this topic was to suggest a way forward to reach an optimal way of managing trees. This was considered necessary to allow respondents to make an input, as the environmental committee is in process of developing a plan for the management of this resource. So far, from the regular environmental committee meetings, it was discussed and a consensus decision was reached that it is feasible to

conduct a project whereby a Global Positioning System (GPS) will be used to identify the location of trees so that they can be labelled. Boys can take on this project as part of an academic exercise. It is further suggested that the information can also be entered in to a GIS database. It is anticipated that this will assist the future plans that may be done concerning vegetation management.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This last chapter provides the conclusions reached from the discussion of the findings in chapter five. It also provides a synthesis of recommendations made in chapter five. The conclusions drawn are based on the aim and objectives of the study as noted in section 1.3. Firstly the study sought to establish whether national level policies relating to environmental management could be used as a framework for establishing a policy for Michaelhouse. Secondly, it sought to identify environmental problems at Michaelhouse and their impacts on the environment. Thirdly, it sought to include the residents' input in the development of an Environmental Management System (EMS). Lastly, the study required the development and testing of an environmental audit checklist that is simple and can be used to assist the school's management to assess whether their environmental performance has improved. It is important to note that this thesis was to provide baseline information that formed the foundation for the development of an EMS for Michaelhouse.

6.2 Summary of Findings ^{N.B}

As noted in section 1.1, it was established that a number of environmental initiatives have failed in the past. The main reason for this was that they were usually started by individuals on an ad hoc basis and not adopted by management. Management has now realised the need for a framework for such initiatives. The school now has an environmental committee (Appendix B) which recognises the need to implement environmental education and an environmental management system. The implementation of both is likely to be successful because the school's management is now on board and the study also revealed that most of the residents want the school's environment to be better managed.

The study led to the development of an environmental policy (Appendix C) which was suggested by the researcher and in collaboration with the school's environmental committee. This was done in order to have control over the resource uses and to

manage them properly while addressing environmental challenges in the school. To develop the policy, an intensive literature search was conducted that traced the history of environmental problems globally and attempts made to address these problems. The literature used in this study was based on the broader framework of sustainable development discussed in section 3.2. Sustainable development has become widely recognised as a way for many countries to maintain the present acceptable 'quality of life' in a way that it would also be maintained for future generations. National legislation and policies regarding environmental management were reviewed and drawn from to develop the framework for Michaelhouse School. As noted in section 3.3.1 among others, the National Environmental Management Act 107 of 1989, the Water Act 36 of 1998, the Environment Conservation Amended Act of 1994, the White Paper on Education and Training (1995) were reviewed in this light. While the majority of the schools' residents support the implementation of the policy, it is recommended that transparency and publicity be guiding factors to improve the overall success of the establishment of the environment and education programmes.

The main environmental problems identified related to the management of water, waste and vegetation. These problems are discussed in detail in section 2.5. The residents' perceptions of these problems were evaluated by means of a questionnaire. All four groups of Michaelhouse's populations that is, administration staff, teachers, workers and learners participated (Table 4.1). The information derived from the survey was compared and contrasted with the evaluation from the field observations carried out by the researcher. The following are the main findings associated with the management of water, waste and vegetation.

The water supply was found to be sufficient and water quality acceptable. The only problem identified with water was the potential wastage revealed from multiple uses in the school, such as the laundry, irrigation and use of water by boys. The major concern is that there might be shortage of water in the future. The status of water in South Africa at large is detailed in section 3.3.3.1. It was found that irrigation mostly takes place in the late morning towards noon. As noted in Lethoba's (2001) project, boys evidently use an excess amount of water when cleaning themselves. For example, an average of 400ml of water was found to be wasted per person when they left the tap on while brushing their teeth. Regarding the laundry, the management is

aware of the excess use and is currently considering reusing the water for other purposes, as indicated in section 2.5.2. This plan to reuse the laundry water is highly recommended. It is further recommended that with regard to irrigation, it must be incorporated into the environmental policy not to irrigate between the hours 10h00 to 15h00 because these are the times when 60 % of water evaporates. With regard to water wastage from the boys and workers, it is recommended that environmental education and water monitoring programmes be introduced. Once the school has established a proper environmental framework then an independent water policy may be developed which will assist in regulating water use in the school. The researcher is of the opinion that intensive communication programmes with the residents should be implemented as this is one of the most crucial elements necessary to ensure water conservation.

The findings indicated that there are different types of waste produced in the school, namely solid waste and low-medium hazardous waste. In the past, focus was placed on recycling as the main method for dealing with waste. However, integrated waste management noted in section 3.3.3.2 consists of a series of steps of which recycling is just one. It is recommended that focus be placed on other steps of waste management such as reduce/minimise, re-use before recycling can be considered and then the final step can be considered which is disposal of unavoidable waste. Currently there are two containers provided by Waste Services for separation of bottles. However, the researcher found that separation was not being done properly. It is therefore recommended that workers need to be educated about the importance of waste separation and recycling process should continue.

In terms of hazardous waste, it is recommended that the chemicals should not be put down the drain. This is essential because the school is dependent on Borehole water supply for domestic purposes and the act poses a potential health risk to the residents. The chemicals should be disposed off appropriately at a designated landfill site. The environmental policy developed for the school, provided in Appendix C, requires that the residents are dedicated to integrated waste management, that is they should reduce the amount of waste generated, re-use, separate waste at source, recycle and dispose of unavoidable waste safely. Due to time constraints the researcher was not able to audit all the school's facilities. It is therefore recommended that the audit be extended

to the remainder of the facilities, in particular the workshop and sanatorium, which were found to be of concern to the residents.

The sewage system is one of the major concerns in the school. Over the years a number of different systems have been used, which have unfortunately led to more problems. Management has, however, attempted to correct these problems through upgrading the system. While it may be practical to upgrade the system, it must also be considered that it is possible to put in place a new system, which will be costly but will ensure the long term proper running of the sewage system for the school. This is important because the management is looking at the long term efficiency of the school.

It is apparent from the research that one of the major problems with regard to the sewage system is that a number of pipes have burst due to the exotic tree roots and the problem is still continuing. The management is unable to deal with this problem because the exact location of most sewage pipelines is not known. Their location only becomes evident when they are damaged. Although mapping the sewage system will be a complex process, it is of utmost importance that this task be undertaken. The researcher was not able to assess this aspect properly due to limited knowledge in this field but found out from informants in this field that the process is feasible and may take a while but will benefit the school in the long term. In order to do this, an expert/specialist should be consulted and requested to trace the original structure of the pipelines.

With regard to vegetation management, no problems were found regarding excess shading of the buildings. The study showed significant awareness by the residents of the type of vegetation present in the school. This was identified as more exotics than indigenous. The management has realised that the school has a problem of alien invasive plants as a result of exotics. Measures are being taken to address this problem. This is a problem currently being dealt with at national level and a number of consultants are available to provide assistance in this regard.

Furthermore, the management realised the need to introduce indigenous trees to bring the school closer to the local culture, hence came up with the concept of 'Africanisation of trees' which is expected to have a valuable significance to the

residents of Michaelhouse, especially in terms of educational purposes. The management has already embarked on planting indigenous trees in the school, however many indigenous trees planted are not indigenous to the veldtype identified at Michaelhouse therefore may not survive. It is recommended that trees which are certain to survive and are indigenous to the veldtype identified at Michaelhouse be planted. These suitable trees are listed in Appendix F as suggested by Acocks (65).

Michaelhouse is also involved in a number of environmental related projects, which have proved to be very successful. Firstly, the involvement of the school in conjunction with the KwaZulu Natal Wildlife for the establishment of Midlands Oribi Reserve was found commendable and greatly admired; this is discussed in section 2.6. Secondly, the rehabilitation of the Bog Stream project was also found commendable; the project is discussed in section 2.5.2 and the continuance of these projects is highly recommended.

Further conclusions drawn, came from the general questions asked to determine the residents' perceptions and during the study time frame given for this thesis. Apathy was recognised from a minority of the respondents while the larger population seemed concerned about the environmental issues. This was important because at the end of the day, the practicability of environmental awareness lies heavily with a question of ethical concern from the people involved. People need to change their attitudes and perceptions towards the environment and can only achieve this through their consent and willingness. Peoples' consent and willingness are important because they will help facilitate the implementation of a successful Environmental Management System.

To address the last objective of the study, it was decided that the framework being developed for the school, needs to be as simple as possible. The framework should include a simple procedure which the school will be able to use without the help of a professional if they so wish. In this regard, it is suggested that the checklist provided in Appendix E be used for further audit in other areas of concern. The list may be adjusted, depending on the issue been addressed. It is also recommended that the same procedure followed for this study as discussed in chapter four be followed to provide an opportunity to make comparisons of findings. In this way the tool will be

effective, as the shortcomings encountered in the previous study will be corrected.

Further recommendations include, harnessing programmes the school already has to improve the environmental performance, for example the outreach programme. The outreach facilitates the involvement of boys with neighbouring communities. This programme can be used as an output for waste management projects. For instance, local communities especially in the Zenzane village who wish to begin mini projects may use sorted waste from the school. They can initiate a local nursery for local children, which will take up cans and bottles to built playing facilities for the children. Or the school can open a craft-shop as a form of community development for local people and provide opportunities for them to get involved in the production of various arts and crafts from various waste materials such as plastic bags, plastic bottles, glass bottles, paper, cardboard and tin. The production of arts and crafts can contribute substantially to the economy of rural/local communities. A project of this nature should be able to succeed, as Michaelhouse is located on a tourist route and in one of the most famous tourist destinations of KwaZulu-Natal, the 'Natal Midlands Meander' in Balgowan. Secondly, occasional leadership courses boys participate in can include an environmental section.

Regarding the diverse environmentally related activities at Michaelhouse, as a concluding remark, the researcher is of the opinion that proper implementation of an environmental management system will guarantee proper management of resources and thus achieve an improved environmental performance as set out by the Michaelhouses' mission statement. The researcher is of the opinion that learners who are exposed to such an environmentally sensitive experiences will be influenced for life and their actions will have positive impact wherever they are. The benefits that may be achieved will impact positively on learners' households and eventually on to the country at large.

6.3 Problems and Limitations

Research such as this, requires frequent interaction between the researcher and the respondents as well as frequent visit and observation to the study area, as the significant outcome lies heavily with observations done over time. Moreover, an

extensive timeframe is a necessity to be able to carry out the aspects mentioned above. In this particular case, it was difficult to carry out the above mentioned aspects because of the distance the researcher travelled to the study area, especially because the researcher relied on either public transport or pre-arranged transportation, which was done irregularly. This had a negative impact because the observations and visits were very limited and the decisions had to be made over limited number of visits over a short period of time. The researcher is of the opinion that frequent visits would have produced a better turn out of the content of this research. To address this issue, a longer period for undertaking such a project would be an advantage.

Furthermore, as indicated from the conceptual framework that EMS requires time to be thoroughly researched and implemented, time constraints posed a huge problem. The researcher had to delay certain phases of the project to accommodate Michaelhouses' events such as school holidays and certain school activities. For example the time when questionnaires were delivered and due to be collected conflicted with the school's examination time and teachers marking and subsequent school vacation. In terms of data analysis, the questionnaires were not analysed in such depth that would have been appropriate, due to time constraints and the large sample size of 165 taken.

To overcome some of the above-mentioned constraints, the following are recommended,

1. There should be following up studies of the same nature, which may actually be conducted by the residents, perhaps the environmental committee members. This will help overcome time constraints and access to the area.
2. As mentioned repeatedly in the content of this research that the success of environmental management programmes relies on full participation of all Michaelhouse community, it is imperative that the community takes part in the actual development of environmental programmes.
3. Having had the approval from the school management of the introduction of environmental education and management programmes in the school, it is important

that the school management and the environmental committee work closely together to execute any form of plan forward of this venture.

4. As indicated in the literature, one of the major problems experienced at Michaelhouse was lack of a governing structure for environmental education and management programmes. The developed Environmental Policy should be on the forefront of all plans devised to help guide environmental developments in the school.

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APPENDICES

Appendix A: Mission Statement

(Adapted from Dr Ardington's (2000) working document)

VISION

It is anticipated that in the year 2010, Michaelhouse will be widely admired as a leading example of excellence in environmental education and management. It will produce environmentally active citizens and be able to manage its administration and estate in an environmentally holistic manner.

MISSION

In order for Michaelhouse to reach its goal, it requires support from the community (learners, teaching staff, administration and estate staff, governors and the old learners). The greatest initial challenge is to change human attitudes from indifference or carelessness to attitudes that reflect the environment as a major 21st century human concern. The second challenge is to assess the schools' present situation from an environmental perspective in all departments and facets of education and management. The third challenge is to make changes that are not only environmentally positive but also economically and socially positive.

BACKGROUND

One of the old learners and a present member of the board for the school motivated the environmental management programme implementation. Traditionally a well-balanced education has sought the answer economic and social questions. Michaelhouse has long prided itself in educating thinking learners who can make their own way in the world; this is so when addressing the economic question. It has encouraged its learners to live by the Christian faith and ethos and to give of themselves beyond their personal interest to individuals and community this is so when addressing the social question. Until recently, it has been observed that the economic and the social activities and progress have always been possible but at the expense of the environmental cost. Environmental degradation is increasing and is in the process threatening the social and the economic progress. For this reason it has become imperative to place the kind of emphasis on the environmental state that has hitherto been given to economic and social status.

CURRENT SITUATION

Michaelhouse can be considered as one of the schools that are certainly moving with the times in regard to the environment. There are several initiatives under way both in and out of the classroom. The syllabi in the science and geography have undertaken extensive modification over the years to incorporate environmental considerations. However these initiatives are somewhat unrelated and fragmented. It is anticipated that with the introduction of environmental management systems/programs, the irregularities could be conquered and lead to a better environmental conditions at the school and around.

THE ENVIRONMENTAL ASSETS

The school consists of varying living environment. It has 1000 hectares of land, which encompasses the built environment (school buildings and staff housing), the man-made environment (parks, school grounds and gardens), and the natural environment (Riverine, grasslands and forests). It is recommended that these assets be regarded as an example of sound environmental practice.

ADMINISTRATION AND MANAGEMENT

It is viewed that in administration there is an opportunity to lead and teach by example every day. The involvement and cooperation of the administration can lead the school in to greater things. For example providing opportunities for the learners and staff to work with external organizations that are environmentally friendly. There are already existing 36 clubs and societies at Michaelhouse. Nine of them explore a direct relevant environmental involvement. Others have less environmental room to maneuver but can all be encouraged to assess their involvement in environmental issues.

CONCLUSION

The principle of goal ownership by all sectors of the school community is considered as very crucial for the environmental management programmes to take off. It must be acknowledged that this mission statement document was a personal perspective and the ideas were owned fully by the author. However the staff has shared and appreciated the author's sentiments regarding implementation of the environmental management programs at the school and anxiously awaiting results.

Appendix B: Environmental Committee Members

Members

Mr. John O Bates - IP, MHS Governor/Old Learner and Chairman of EC.

Mr. John Rockliffe – MHS Estate Manager

Mr. Jonathan Cribbins – MHS Groundsman

Mrs. Heather Cook - MIC Gardens

Mr. George Zaloumis – KZN Nature Conservation Services

Mr. Andrew James – Old Learner/ Indigenous Plant Expert

Dr. Peter Ardington - MHS Governor/ Old Learner

Mr. Dave Pickstone –Biology teacher and Bogstream Developer

Ms. Bridget Ussher Stanley - Secretary

Ms. Keneiloe Molapo - UND Student

Ms. Teboho Lethoba - UND Student

Appendix C: Draft Environmental Policy

Foreword

The Introduction of an environmental policy at Michaelhouse was motivated by the desire for the school to be a leading example of excellence not only in education, but also in all aspects, including environmental management and education.

The policy is the first building block in establishing an Environmental Management System. The policy conditions will be applicable to the entire estate and all the residents of Michaelhouse:

Vision

To have excellence in environmental education and management in the school, which will produce environmentally active citizens and enable the school to manage its environment with the highest management standards attainable.

Goals and Objectives

- *The main goal is to achieve sustainable development, ensuring an environmentally friendly approach at Michaelhouse.*
- *The objectives are,*
- *To become role models and leaders, to teach by example and to involve boys in all endeavours.*
- *To gradually move to indigenous flora without compromising the present aesthetics of Michaelhouse.*
- *To introduce and maintain the highest standards with regard to environmental performance and sensitivity. In this way a well-balanced social, economic, cultural and physical environment can be attained.*
- *To improve the over all environmental performance by encouraging initiatives that will adopt best environmental practices at minimum costs.*

The Policy proclaims the following principles,

Principle 1.

Accountability - The management of the school is accountable for the formulation of the environmental policy, its monitoring and enforcement. The environmental committee of Michaelhouse advises school management on policy and objectives. It is also eligible to administer changes in policy whenever necessary.

Principle 2.

Resources Availability – All the resources renewable and non-renewable are public assets. This principle will guarantee that the whole community will share responsibility for proper use and management of all the resources.

Principle 3.

Capacity building and education – All the residents of Michaelhouse will be required to make use of opportunities to develop a better understanding, skills and effective participation in promoting a sustainable living environment in the school.

Principle 4.

Coordination – The environmental initiatives in the school must be seen as a situation whereby there is an improvement financially, culturally, socially and physically, wherever possible. Environmental policy will be used as a tool to incorporate environmental issues in the school curriculum where appropriate and to improve the mindset of learners.

Principle 5.

Integrated Waste Management – There must be dedicated commitment to integrated waste management. The management must encourage waste reduce, re-use, separation of waste at source, recycling and safe disposal of unavoidable waste.

Principle 6.

Continual Improvement- the introduction of environmental management awareness in the school must not be seen as a task that requires completion but must be a continuous process that requires constant improvement, through problem solving and sharing of responsibilities whenever necessary to attain effective environmental management.

Principle.7

Inclusivity- the environmental management process must consider the interest, needs and values of all the interested and affected parties in decision making to ensure sustainable development. This will include all knowledge including traditional and modern knowledge.

Principle.8

Precautionary- a “better careful than sorry” cautious approach should be applied in environmental management, recognizing the limits of current knowledge of environmental consequences.

Principle.9

Biodiversity- This will include conservation and management of the environment to promote aesthetics in the school environment that are beneficial for all the inhabitants of the school, people, fauna and flora.

Author of first draft: Keneiloe Molapo for Michaelhouse
Author of second draft: Michaelhouse Environmental Committee

Appendix D: Questionnaires

Administration, Caretakers and Teachers

A. Social Profile

Date -----

1. Gender Female Male
2. Age 20- 30 31- 40 41-50 51-60 61+
3. Income level
- <R 5000 R5000-R10 000 R10 000+
4. Level of Education
- Didn't finish school
- High school graduate
- College graduate
- Graduate degree
- Post-graduate degree
5. How long have you been @ Michaelhouse?
- <2yrs 2- 5yrs 6-10 yrs 11-20yrs 20+yrs

6. Present position (Title)

Duties:

7. Previous work experience (Title)

Duties:

B. Need for Environmental Management

1. Do you know what an environmental management system is? Yes No

1a) If yes, please explain

2. Do you think the school needs an environmental management system? Yes No

2a). Explain your choice of answer

3. To what extent would you suggest environmental issues be incorporated in the school?

Environmental days (only) e.g. Abor day	Public holidays	Extra-curricular	Curriculum (Environ. studies)	Environmental education module
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4. Have you seen examples of environmental management exercises, achievements and audits done in other local schools? Yes No

4a). If yes, name the examples

5. Are you personally making a significant contribution to conserving the environment in this school?

No	Sometimes	All the time
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5a). If yes name the contribution

6. List environmental problems in the school?

6a). Which of the resources would you say need priority for management?

(You may tick more than 1 answer indicate 1st preference by numbers)

Water	Electricity	Vegetation	Waste management	School. Facilities
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6b) State reasons why

7. Is there a reason to suspect there might be risks to health or safety regarding environmental problems in the school? Yes No

7a). Explain

7b). With reference to the above question, is there anything that has been done to deal with the risks? Yes No

7c). How do you propose these problems can be addressed (name possible measures)?

8. What factors are likely to inhibit the implementation of the environmental management system in the school?

9. How would you propose to address these inhibiting factors?

1B. Policy Assessment

1. Does the school have an environmental committee? Yes No

2. Does the school have an environmental policy? Yes No

3. Do you know the environmental policy's obligations? Yes No

3a). If yes name a few,

3b). If yes, do you support the environmental policy? Yes No

3c). If yes, when do you want to see it implemented?

4. If your answer to ques.2 is No, would you like to have an environmental policy in place for the school? Yes No

5. How do you think the policy should be implemented?

6. Are there any other policies (guiding principles) in place for the school? Yes No

2B Resources

1. In terms of resource consumption in the school, how would you say the resources are been used?

Over-consumption	Average-consumption	Equal-supply & consumption	Sustainable	Under-consumption
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1a). Explain

1b). How can resources be used wisely to save money and care for the environment?

2. Do you know of any environmentally related projects going on in the school? Yes No

2a). If yes name them

3. Do you know about the rehabilitation of the stream within the school property? Yes No

4. Are there any areas in the school that you would like see rehabilitated? Yes No

4a). If yes, mention

5. Are there any environmental projects you would suggest for the school? Yes No

5a). If yes mention which projects you would suggest?

5b). If No, explain why you would not want any more projects

C Waste management

1. Do you know what waste management entails? Yes No

1a). Please explain

2. Do you support waste management? Yes No

2a) If yes how strongly?

Indifferent	Somewhat support	Neutral	Strongly	Very strongly
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3. Do you know of methods that can be used to manage waste? Yes No

3a). If yes, please mention them,

4. Do you know that waste recycling was once practised in the school and stopped? Yes No

5. Do you think recycling can benefit the school Yes No

5a) Explain

6. Do you have any suggestions of how waste can be managed? Yes No

6a) Explain

7. Do you separate waste? Yes No

7a). If yes, explain how

8. Would you be willing to participate in the recycling and re-use of resources project again?

Yes No

8a) If no, why

What do you think the school can do, to make a success of recycling process?

9. Which of the following, do you think can generate more income in recycling?

Bottles Glass Plastics Paper Tin

10. Do you know where your waste goes (final destination)?

Dumpsite	Landfill	Other
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10a). Mention other _____

11. Do you think waste from the following facilities is potential problem?

(Tick where appropriate)

Facilities	Yes	No	What kind of Waste do you think comes out of these facilities?		Suggested Disposal method		
			Hazardous	Non-hazardous	Recycle	Re-use	Dispose
Chemical							
Science laboratories							
Laundry							
Medical clinic							
Other							

12. Are there any other facilities that you feel require the attention of Management in terms of waste management? Yes No

Mention them

13. Do you think the sewage disposal system in place is efficient? Yes No

Explain

14. Do you think the sewage holding tanks are efficient for the whole school? Yes No

15. Have you experienced odour problems? Yes No

15a). Explain

D. Water Management

1. Which is the main water supply in the school?

Tap water	Boreholes
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2. How efficient is this supply of water?

V. Poor	Poor	Okay	Good	V. Good
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3. Are you happy with the current water supply system? Yes No

3a) If no, why

4. How often is water measured?

Per day	Per month	Per year
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5. How much water is used in the school per day/monthly/yearly? (Estimation)

< 500ltrs	500- 700ltrs	700-900ltrs	900-1000ltrs	>1000 ltrs
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6. What do you think is the quality of water?

Bad	Not so good	Good
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7. Are water issues integrated in school lessons? Yes No

7a). If No, Do you think they should? Yes No

7b). If yes, Explain

8. Do you have water reserves? Yes No

8a). Explain

9. Do you know of any sources of pollution problems in the school? Yes No

9a). Explain

E. Vegetation Management

1. What type of vegetation do you have in the school? (You can tick more than 1 Ans.)

Grasslands Trees Shrubs Other Mention _____

2. Who manages the school grounds?

Learners Caretakers Other Mention _____

3. Which are the most dominant tree species in the school?

Exotic only	Exotics/ indigenous	More exotics/ less indigenous	Less exotics/ More indigenous	Indigenous only
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4. Which species would you prefer as dominant?

Exotic only	Exotics/ indigenous	More exotics/ less indigenous	Less exotics/ More indigenous	Indigenous only
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5. What are the main uses of trees?

Aesthetic	Educational	Leisure	
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6. Do the trees cause any problems? Yes No

If yes, explain

7. Why is it necessary to introduce indigenous trees in the school?

Aesthetic	Educational	Leisure	
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8. Where do you get these indigenous trees?

| Buy | Supplied free by DWAF | Other |

8a). Explain

9. When do you plant them?

Environ Holidays (Abor)	Free Time	School exercise	Other
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10. Are there any trees of cultural/ heritage significance? Yes No

Indigenous Exotic

11. Do you have any suggestions of how the trees can be managed in the school

12. What do you think can be done to improve environmental performance in the school?

THANK YOU VERY MUCH FOR YOUR PATIENCE AND COOPERATION, YOU WILL HEAR ABOUT THE FINDINGS OF THIS SURVEY.

Learners

A. Social profile

Date -----

1. Age >13 13-15 16-20

2. Level of Education

Grade 8 Grade 9 Grade 10 Grade 11 Grades 12 (Please tick)

Subject	Subjects done	Favorite Subjects
Life skills		
Technology		
Geography		
Biology		
Maths		
Science		
History		
Languages		
Music & Arts		
Religion		
Accounts		

B. Need for Environmental Management

1. Do you know what an environmental management system is? Yes No

1a) If yes, please explain

2. Do you think the school needs an environmental management system? Yes No

2a). Explain your choice of answer

3. Do you think there is environmental awareness in the school? Yes No

4. If yes, how do you rate the level of awareness (Tick X the answer)

Very low	Low	Average	High	Very High
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5. To what extent would you suggest environmental issues be incorporated in the school?

Environmental days (only) e.g. Abor	Public holidays	Extra-curricular	Curriculum (Environ. studies)	Environmental education module
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6. Have you seen examples of environmental management exercises, achievements and audits done in other local schools? Yes No

6a). If yes, name the examples -

7. Do you think you are personally making a significant contribution to conserving the environment in this school?

Never	Sometimes	All the time
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7a). If yes name the contribution

8. List environmental problems in the school?

9. Which of the resources would you say need priority for management?

(You may tick more than 1 answer indicate 1st preference by numbers)

Water	Electricity	Vegetation	Waste management	School. Facilities
-------	-------------	------------	------------------	--------------------

9a) State reasons why?

10. Is there a reason to suspect there might be risks to health or safety regarding environmental problems in the school? Yes No

10a). Explain

10b). With reference to the above question, is there anything that has been done to deal with the risks? Yes No

10c). How do you propose these problems can be addressed (name possible measures

10d) What factors are likely to inhibit the implementation of Environmental management system?

10e). How would you propose to address these inhibiting factors

1B. Policy Assessment

1. Does the school have an environmental committee? Yes No

2. Does the school have an environmental policy? Yes No

3. Do you know the environmental policy's obligations? Yes No

3a). If yes, name a few

3b). If yes, do you support the environmental policy? Yes No

3c).If yes, When do you want to see it implemented?

4. How do you think the policy should be implemented?

5. If your answer to ques.2 is No, would you like to have an environmental policy in place for the school? Yes No

6. Are there any other policies (guiding principles) in place for the school? Yes No

2B Resources

1. In terms of resource consumption in the school, how would you say the resources are been used?

Over-consumption	Average-consumption	Equal-supply & consumption	Sustainable	Under-consumption
------------------	---------------------	----------------------------	-------------	-------------------

1a). Explain

1b) How can resources be used wisely to save money and care for the environment? 2. Do you know of any environmentally related projects going on in the school? Yes No

2a). If yes name them

3. Do you know about the rehabilitation of the stream within the school property? Yes No

4. Are there any areas in the school that you would like see rehabilitated? Yes No

4a). If yes, mention

5. Are there any environmental projects you would suggest for the school? Yes No

5a). If yes mention which projects you would suggest ?

5b). If No, explain why you would not want any more projects

3B Environmental Clubs

1. Do you have any environmental clubs in the school? Yes No

If yes, what does the club do?

1a). If yes what does the environmental clubs do?

2. Has the school entered environmental competitions with other schools? Yes No

2a) Explain 3. Have you had competitions among yourselves at school? Yes No

4. Do neighbouring communities get involved in the school activities? Yes No

C. Waste management

1. Do you know what waste management entails? Yes No

1a). Please explain -

2. Do you support waste management? Yes No

2a) If yes, how strongly?

Indifferent	Somewhat support	Neutral	Strongly	Very strongly
-------------	------------------	---------	----------	---------------

3. Do you know of methods that can be used to manage waste? Yes No

3a). If yes, please mention them,

4. Do you think there could be dangerous waste in the school? Yes No

Explain 5. Do you know that waste recycling was once practiced in the school and stopped?

Yes No

8. Would you be participating in the recycling and re-use of resources project again? Yes No

8a) If No, why?

9. What do you think the school can do, to make a success of recycling process?

10. Which of the following, do you think can generate more income in recycling?

Bottles Glass Plastics Paper Tin

11. Do you know where your waste goes (final destination)?

Dumpsite	Landfill	Other
----------	----------	-------

11 a). Mention other _____

12. Do you think waste from the following facilities is potential problem?

(Tick where appropriate)

Facilities	Yes	No	What kind of Waste do you think comes out of these facilities?		Suggested Disposal method		
			Hazardous	Non-hazardous	Recycle	Re-use	Dispose
Kitchen							
Science laboratories							
Laundry							
Medical clinic							
Other							

13. Are there any other facilities that you feel require the attention of Management in terms of waste management? Yes No

Mention them

14. Do you think the sewage disposal system in place is efficient? Yes No

Explain

15. Do you think the sewage holding tanks are efficient for the whole school? Yes No

16. Have you experienced odour problems? Yes No

16a). Explain

D. Water Management

1. Which is the main water supply in the school?

Tap water	Boreholes
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2. How efficient is this supply of water?

V.Poor	Poor	Okay	Good	V.Good
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3. Are you happy with the water supply system? Yes No

If No, why

4. How often is water measured?

Per day	Per month	Per year
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5. How much water is used in the school per day/monthly/yearly? (Estimation)

< 500ltrs	500- 700ltrs	700-900ltrs	900-1000ltrs	>1000 ltrs
-----------	--------------	-------------	--------------	------------

6. What do you think is the quality of water?

Bad	Not so good	Good
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7. Are water issues integrated in school lessons? Yes No

7a). If No, Do you think they should? Yes No

8b). If yes, Explain

9. Do you have water reserves? Yes No

9a). Explain

10. Do you know of any sources of pollution problems in the school? Yes No

10a). Explain?

E. Vegetation Management

1. What type of Vegetation do you have in the school?

Grasslands Tree shrubs Other Mention

2. Who manages the school grounds?

Learners Caretakers Other Mention

3. What are the main uses of trees?

Aesthetic	Educational	Leisure
-----------	-------------	---------

4. Do the trees cause any problems? Yes No

If yes, explain

5. Which are the most dominant tree species in the school?

Exotic only	Exotics/	More exotics/	Less exotics/	Indigenous only
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	indigenous	less indigenous	More indigenous	
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6. Why is it necessary to introduce indigenous trees in the school?

Aesthetic	Educational	Leisure	
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7. Where do you get these indigenous trees?

Buy	Supplied free by DWAF	Other	
-----	-----------------------	-------	--

7a).Explain

8. When do you plant them?

Environ (Abor)	Holidays	Free Time	School exercise	Other
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Mention other

9. Are there any trees of cultural/ heritage significance? Yes No

Indigenous Exotic

10 How are trees managed?

Not managed	Cut & disposed	Cut & used	Cut & sold
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11.Do you have any suggestions of how the trees can be managed in the school?

12. What do you think can be done to improve environmental performance in the School?

THANK YOU VERY MUCH FOR YOUR PATIENCE AND COOPERATION, YOU WILL HEAR ABOUT THE FINDINGS OF THIS SURVEY.

Appendix E: Targeted Environmental Audit

The following questions are rated on a scale of 1-5 and the numbers are given values as follows, (1= no/weak; 2= needs attention; 3=OK; 4=quite good; 5= a strength)

1	2	3	4	5
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Water audit

How many taps in the area?

How many showers?

How many hand basins?

How many toilets?

How many sprinklers?

Assessment of management

1. Students
2. Administration

Efficiency and use of water from the following facilities

Boys' Houses

Staff houses

Labourers' quarters

Kitchen

Laundry

Sanatorium

For each house the use of;

Use of showers

Washing basins

Toilets

Urinals

Baths

Waste audit

How many bins provided for the following areas in the school for waste?

Class-rooms

Offices

Residences

Staff houses

Labourers (singles) quarters

Kitchen

Laundry

Vegetation audit

Too many trees?

Which are most dominant?

Trees causing shades?

Other problems?

Assessment of Own Project

1. Where were most problems identified in the school?
2. Where were these problems most frequent?
3. Where were these problems least frequent?
4. How big was the area where most problems were identified in the school?
5. Which things in the environment help create problems?
6. Describe the impact on the environment?
7. Which things in the environment can be used as resources to solve the problems identified in the school?
8. When do problems occur most often?
9. When do problems occur least often?
10. What is happening when the problems occur most often?
11. Who is present when problems occur most often?
12. Who is present when the problems occur least often?
13. Who is absent when the problems occur most often?
14. Who is absent when the problems occur least often?
15. Do these problems have financial implications?
16. To whom do they have financial implications?
17. What are the implications?
18. To whom does the problem not have financial implications?
19. Are there any financial factors, which can be used as resources for the project?
20. Who is taking the most responsibility in trying to solve the problems?
21. How?
22. Who is taking the least responsibility in trying to solve the problem?
23. How?
24. Who is willing to try and solve identified problems?

Appendix F: Names of the Exotic and Indigenous trees

Exotics at Michaelhouse	Acocks (65) south tall grassveld	Indigenous at Michaelhouse
London Plane +	<i>Acacia seiberiana</i> var. <i>woodii</i>	<i>Apodytes dimidiata</i>
American Plane+	<i>Dombeya cymosa</i>	<i>Prunus africana</i>
<i>Widdringtonia nodiflora</i>	<i>Rhoicissus tridentate</i> ,	<i>Buddleja auriculata</i>
European Oak +	<i>Hippobromus pauciflorus</i> ,	<i>Rapanea melanophloes</i>
American Pin Oak +	<i>Rhus dentata</i> var. <i>gradifolia</i> ,	<i>Calodendrum capense</i>
Cork Oak +	<i>Aloe arborescenes</i> ,	<i>Rhus chirindensis</i>
Swamp Cypress +	<i>Ficus burtt-davyi</i> ,	<i>Canthium mundianum</i>
<i>Acacia melanoxylon</i>	<i>Acacia</i> ; <i>caffra</i> , <i>karoo</i> , <i>nilotica</i> subsp,	<i>Rhus pyroides</i>
European Willow +	<i>kraussiana</i> ,	<i>Celtis africana</i> *
<i>Jacaranda mimosifolia</i>	<i>Cussonia spicata</i> *	<i>Rothmannia globusa</i>
Copper beech +	<i>Maytenus heterophylla</i> *	<i>Conbretum edwardsii</i>
Prunus +	<i>Tarchonanthus camphorates</i> ,	<i>Scolopia mundii</i>
Pride of India +	<i>Euclea crispa</i> *	<i>Conbretum kraussii</i>
Flowering Cherry +	<i>Grewia occidentalis</i> ,	<i>Xymalos monospora</i>
Deodar +	<i>Rhus pentheri</i> ,	<i>Cussonia sphaerocephala</i>
Leyland cypress +	<i>Allophylus dedipiens</i> ,	<i>Zanthoxylum capense</i>
Penny gum +	<i>Ziziphus mucronata</i> ,	<i>Cussonia spicata</i> *
<i>Eucalyptus spp</i>	<i>Celtis africana</i> *	<i>Zanthoxylum davyi</i>
<i>Pinus spp</i>	<i>Pavetta cooperi</i>	<i>Cryptocarya woodii</i>
Tulip tree +	<i>Rhus rehmanniana</i>	<i>Dais cotinifolia</i> *
Poplar +	<i>Buddleja dysophylla</i>	<i>Diospyros whyteanna</i>
Loquat +	<i>Greyia sutherlandii</i>	<i>Dombeya tiliacea</i>
<i>Psidium guajava</i>	<i>Commiphora harveyi</i> , <i>zanzibarica</i>	<i>Ekebergia capensis</i>
Dogwood +	<i>Ozoroa paniculosa</i>	<i>Euclae crispa</i> *
European holley +	<i>Dais cotinifolia</i> *	<i>Greyia sutherlandii</i>
<i>Acacia dealbata</i>	<i>Buddleja saligna</i>	<i>Halleria lucida</i> *
	<i>Jasminum angulare</i>	<i>Ilex mitis</i>
	<i>Cassinopsis ilicifolia</i>	<i>Kiggelaria africana</i>
	<i>Canthium ciliatum</i>	<i>Leucosidea sericea</i>
	<i>Halleria lucida</i> *	<i>Maytenus acuminata</i>

	<i>Olinia sp.</i> <i>Calpurnia woodii</i> , <i>villosa var.intrusa</i> , <i>aurea subsp.</i> <i>Aurea</i> <i>Trimeria trinervis</i> <i>Maytenus peduncularis*</i> <i>Clausena anisata</i> <i>Leonotis ocymifolia vat., raineriana</i> <i>Rhamnus prinoides</i> <i>Rubia petiolaris</i>	<i>Maytenus heterophylla*</i> <i>Maytenus nemorosa</i> <i>Maytenus peduncularis*</i> <i>Ochna holtsii</i> <i>Podocarpus falcatus</i> <i>Podocarpus latifolius</i>
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* = Indigenous trees planted at Michaelhouse and also suitable for the veldtype identified.

+ = Unable to find the scientific names for these Exotic trees.

Appendix G Additional Information

Figure 7.1 Poster by a Grade 8 Learner



Plate 7.1: An illustration of a Toilet-lid Sink



Plate 7.2 Separate Bins for Waste Recycling

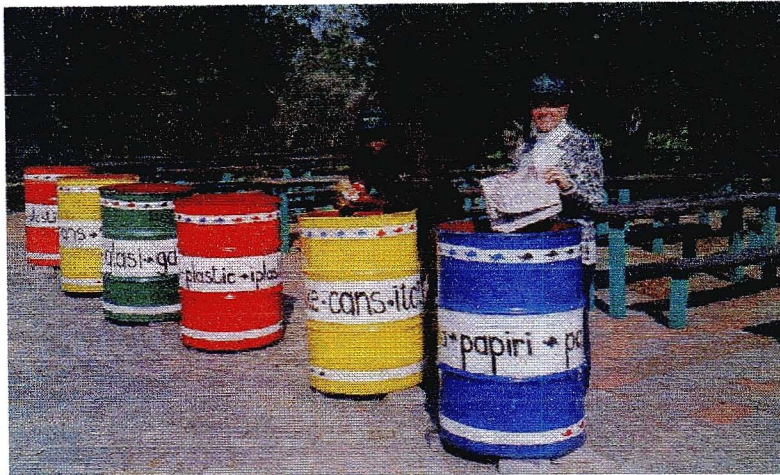


Plate 7.3 Vermicomposting Equipment



Figure.7.2: The Midlands Oribi Reserve

