REVIEW OF LOCAL INSTITUTIONAL ARRANGEMENT FOR ZONE 3 COMMUNITY WETLAND IN SEBOKENG, GAUTENG, SOUTH AFRICA

BY

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Student number: 46559264

DECLARATION

I declare that, *"Review of local institutional arrangement for Zone 3 community wetland management in Sebokeng, Gauteng, South Africa"* is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

…… …….

Signature Date

(MR J S SIYAYA)

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LIST OF ABBREVIATIONS

CARA:	Conservation of Agricultural Resources Act
CAPE:	Cape Action for People and the Environment
CBNRM:	Community Based Natural Resource Management
CBA:	Critical Biodiversity Areas
COJ:	City of Johannesburg
C-Plan:	Conservation Plan
DEA:	Department of Environmental Affairs
DEAT:	Department of Environmental Affairs and Tourism
DPW:	Department of Public Works
DWAF:	Department of Water Affairs
ECA:	Environmental Conservation Act
ECSFP:	The European Commission's Seventh Framework Programme
ELM:	Emfuleni Local Municipality
EMP:	Environmental Management Plan
EPWP:	Expanded Public Works Programme
ESA:	Ecological Support Area
GDARD:	Gauteng Department of Agriculture and Rural Development
GWF:	Gauteng Wetland Forum
HGM:	Hydro-geomorphic
ICDP's:	Integrated Community Development Programmes
IDP:	Integrated Development Plan
IIED:	International Institute for Environment and Development

IUCN:	International Union for Conservation of Nature
LCC:	Local Community Capacity
LED:	Local Economic Development
MEC:	Member of the Executive
NAEHMP:	National Aquatic Ecosystem Health Monitoring Programme
NDA:	National Department of Agriculture
NEMA:	National Environmental Management Act
NGO's:	Non-Governmental Organizations
NRM:	Natural Resource Management
NWA:	National Water Act
NWCS:	National Wetland Classification System
PES:	Present Ecological State
PROVIDE:	The Provincial Decision-Making Enabling Project
PSC:	Project Steering Committee
RHP:	River Health Programme
SANBI:	South African Biodiversity Institute
SAQA:	South African Qualification Authority
SDM:	Sedibeng District Municipality
SMME's:	Small Medium and Micro-sized Enterprises
SRK:	Stephen, Robertson, Kirsten
SSA:	Statistics of South Africa
SSI:	Stewart Scott International
ToR:	Terms of Reference

UNFCCC: The United Nations Framework Convention on Climate Change

Wetland-IHI: Wetland Index of Habitat Integrity

WfW: Working for Water

WMA: Water Management Area

WRC: Water Research Council

WUL: Water Use Licence

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ABSTRACT

The study focused on the role of the local community in the management of wetland. The study was triggered by the lack of participation of the local community in the management of the wetland. It is important to note that wetlands perform a number of ecosystem services, some of which are well recognised, others less so, and are internationally recognised as being one of the most important ecosystems for the conservation of biodiversity. South Africa is a signatory to the international obligations, which makes it a legal responsibility to make sure that wetlands are managed appropriately. It is therefore important for these natural resources to be managed appropriately. Information for generating data was obtained through the assessment of the wetland health and from the investigation of the management of the local community.

In order to achieve the objectives of the study, qualitative method was used to gather the necessary data. The findings indicate that the current state of the wetland is severely modified, which means large loss of natural habitat, biota and basic ecosystem functions has occurred. The results also indicate that the community is ill-equipped to manage the resource appropriately. The findings therefore imply that immediate management interventions must be developed to improve the health of the wetland. In improving the state of the wetland, the study recommends, amongst others, that mitigation measures aimed at improving the wetland health and participation of wetland users be promoted. An establishment of a community-driven and multi-stakeholder intervention mechanism to help the community manage and utilise the wetland properly is also recommended. The study concludes by indicating that the community must comply with the environmental legislation and takes a lead in the management of the wetland, for the aim of restoring the functionality and integrity of the wetland.

Key terms: Wetland delineation, Wetland Integrity Index, wetland functionality, hydrology, catchment, wetland management, Community Based Natural Resource Management, governance, environmental policies, sustainable development.

CHAPTER 1 - INTRODUCTION

1.1 Background information

The number and scale of community activities in the wetlands have grown considerably over the years, to the extent that there are now clearly identifiable national programmes introduced by government. Amongst the government programmes, the National Land Care programmes, Expanded Public Works Programmes (EPWP) and Working for Wetlands (WfW) are the prominent programmes spearheaded by government. Within these national programmes, government aims to provide an enabling framework for communities to manage their resources sustainably and provides certain extension and other services to communities. It can be noted that the community Land Care programmes tend to take place in the environmental sensitive areas such as wetlands.

Wetland ecosystems, like all ecosystems, include biotic (living) and abiotic (non-living) components that interact dynamically over space and time (Mahan, 1997). Wetlands are internationally recognised as important natural ecosystems which, depending on the characteristics of each wetland type, may perform some of the following valuable functions, including (Davies and Day, 1998):

- Provision of habitat to wetland-associated animals and plants, many of which rely exclusively on these areas for breeding, feeding or nursery areas (Cowan, 1995);
- Provision of corridors for movement between terrestrial natural areas, or along river systems;
- Contribution to the perenniality of stream systems, through retention and slow release of waters during low flow periods;
- Flood attenuation – effected by retention of flood waters in wetland soils, and reduction of flood velocities through dissipation of flows through wide, vegetated areas;
- Improving water quality, through uptake and absorption of nutrients and other contaminants often found in surface runoff;
- Trapping sediment and reducing erosion of stream channels;

- Provision of harvestable resources of value to human communities and provision of areas of tourism and or recreational value to human communities (Day and Malan, 2010).

In South Africa, natural resources like wetlands are often central to the livelihoods of people and natural biodiversity (Naledzi Environmental Consulting, 2007). Communities, particularly those living near wetlands, are highly dependent on wetland services and are directly harmed by their degradation (Wetlands International Africa, 2010). According to South African Biodiversity Institute (SANBI), (2012) everyone depends, directly and indirectly, on wetlands. Wetlands International Africa (2010) further argues that, despite their importance, human activities and the changing climate are degrading wetlands faster than any other ecosystem. It is increasingly evident that communal wetlands are widely used throughout South Africa to sustain the livelihoods of the rural poor (Frenken and Mharapara, 2002).

The wise use of wetlands is an integrated strategy for the sustainable and equitable use of wetlands through good governance, land and water use practices that promote healthy wetlands, so as to continue to provide services, products and benefits that are enjoyed by and that sustain human livelihoods (including those of future generations), as well as biological diversity (Pollard *et al.*, 2009).

Despite agricultural activities posing a significant threat to the wetlands, Pierre (2001) cautions that climate change is expected to exacerbate wetland loss and cut wetlands' natural capacity to mitigate negative environmental impacts. Thiam (2010) indicates that protecting and restoring the rich biodiversity of wetlands by improving water resource management is paramount to a country's development. It is therefore essential to strengthen community organisations and local administrations in conservation and wise use of wetlands through community participation and multi-stakeholder networking (Trisurat, 2006). Hence this study is aiming to contribute to the strengthening of the community and promoting improved natural resource management.

It should be noted that institutions and governance systems that address human–environment relations are dynamic (Young, 2009). Community conservation initiatives in communal lands seem to experience challenges and inconsistent governance issues, thereby reducing success

or growth of community based projects. Conservation initiatives for wise use of resources in South Africa are being promoted as an important tool for empowering local communities in many areas. Whether it is an effective and efficient tool for both community livelihood development and conservation goals is a highly debatable and contentious issue (Young, 2009). The study will treat the community engagements as unique to other natural resources, yet keeping an open mind on other areas.

1.2 The study area

1.2.1 Location of the study area

Gauteng Province is home to approximately 12 728 400 people, which is the largest share of the South African population of 24% (Statistics South Africa, 2013). The increase of the population could be attributed to the provinces wealth, as it is the richest province in South Africa (Statistics South Africa, 2001). Despite these relative fortunes, the province is still marred by high poverty rates, inequalities in the distribution of income between various population groups, and unemployment (PROVIDE, 2005). Poverty and unemployment in South Africa are often prone to rural areas, and given that many of the rural inhabitants are linked to agricultural activities, the various departments of Agriculture in South Africa have an important role to play in addressing the needs in rural areas (PROVIDE, 2005). The Gauteng province is divided into three metropolitan municipalities, City of Johannesburg, City of Tshwane and Ekurhuleni Metropolitan Municipality, as well as two district municipalities, namely: Sedibeng and Mogale City, which are further sub-divided into seven local municipalities (McDonald, *et al*., 1999). The District Municipalities are demarcated as directed by the Local Government Municipal Structures Act (1998).

The study area is situated within Sedibeng District Municipality (SDM) in Sebokeng Township, Zone 3 unit. Sedibeng District Municipality is home to 8.0% of the Gauteng province population (PROVIDE, 2005). The Gauteng province has a highly urbanised population; however most of the SDM townships have rural communities on the border, for example Sebokeng, Zone 3. Sebokeng Zone 3 community has a combination of urban and rural communities.

The study area is situated in Sebokeng Township – Zone 3 unit, which falls under Emfuleni Local Municipality (ELM) within the Sedibeng District Municipality in the Gauteng Province, Republic of South Africa (Figure 1). Sebokeng is approximately thirty eight (38) kilometres South-west of Johannesburg. The wetland is located in the South of Sebe Street and North-west of Union Street. It is a tributary of Rietspruit stream. According to GDARD's Conservation Plan (2011), the study area is located within an urban edge.

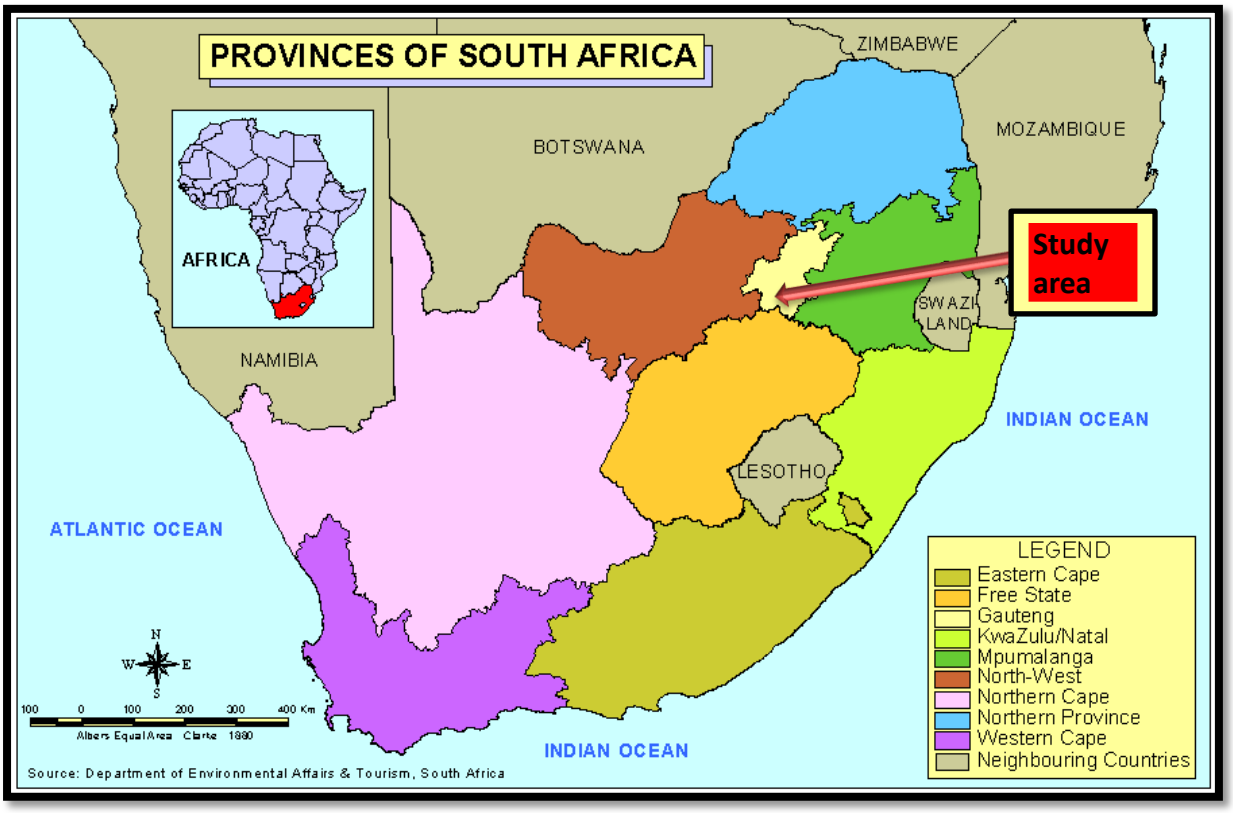

Figure 1: Location of the study area. (Source: Department of Environmental Affairs and Tourism, 2011)

1.2.2 Catchment

The study area is situated in the Upper Vaal Water Management Area (MWA), which is the most important WMA in terms of economic productivity in South Africa (Ochse, 2007). It is important to understand the catchment of a study area because the physical, chemical and biological characteristics of any river are determined almost entirely by nature of the catchment, and activities - anthropogenic and natural - that take place in it (Davies and Day, 1998). Since rivers reflect the health and ill-health of the catchment, it is therefore of cardinal importance to monitor them. The study area also falls within the Rietspruit and Klipspruit in the Upper Vaal Catchment which empties into Loch Vaal and the Vaal Barrage, covering an area of approximately 1120 square kilometres (Showalter *et al*., 2000). The site forms part of the C22H quaternary catchment (Figure 2).

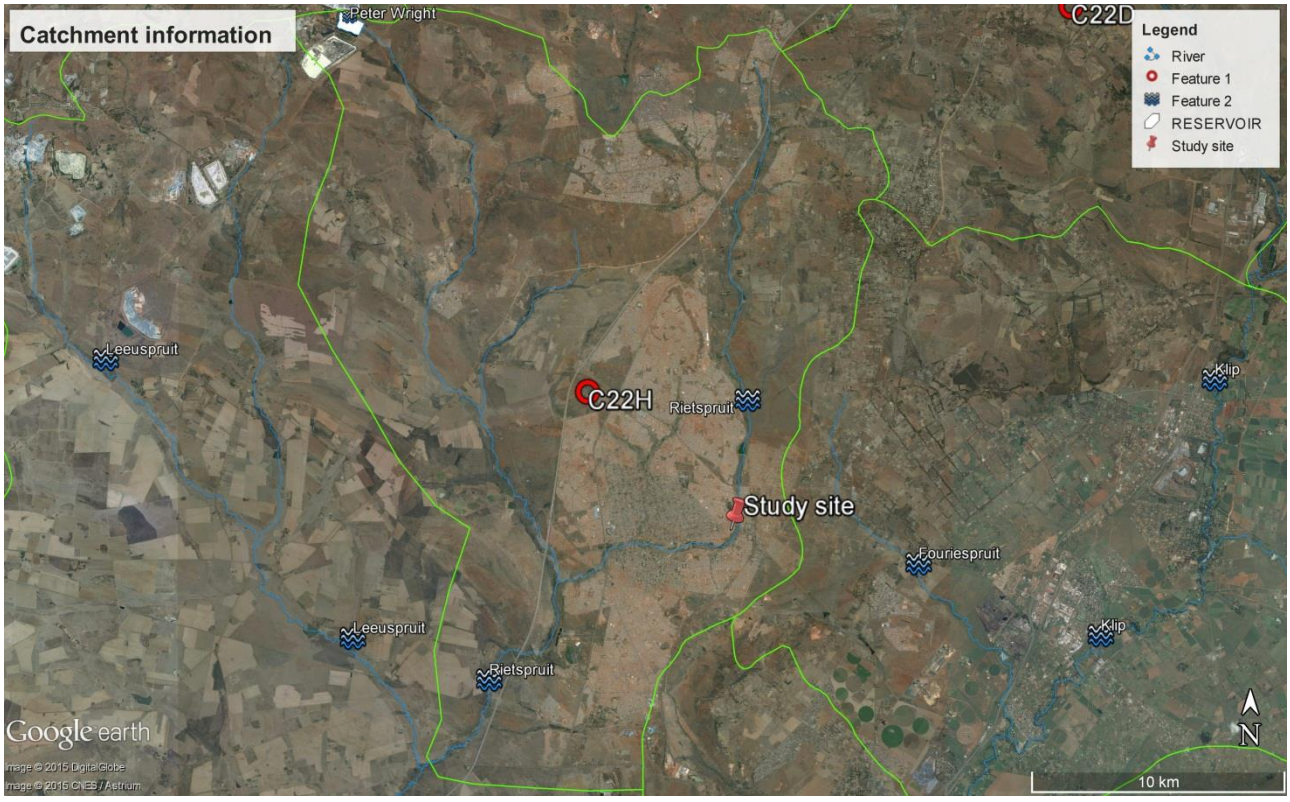

Figure 2: Catchment and hydrological data of the study site (developed from Google Earth map)

1.2.3 Topography

The landscape of the study area consists of gentle slopping plane towards the South Eastern side of the wetland, with hill-slope seepage. Hill-slope seepage wetlands have several functions including supporting biological diversity, water storage, water exchange between surface and underground water (Kotze and Breen, 2000). Kotze and Breen (2000) further argues that hill-slope seepages are normally recipients of sub-surface flow and act as a plug that controls the release of water onto the surface, hence recharging the stream flow. Transitory lateral flow from adjacent hill-slopes to adjacent wetlands, show excess water that escapes vertically through the soil profile initiates the seepage process (Kotze and Breen, 2000).

1.2.4 Climatic conditions

The precipitation in the Vaal area is usually in the form of thundershowers, often accompanied by hail in the summer months followed by dry winters (DWAF, 1999). The mean annual precipitation for the area is between 600 and 750 mm, with the dominant precipitation received during the months of October to March (DWAF, 1999; Grundling and Marneweck, 1999). Heavy rains occasionally fall within short periods during the summer, causing localised flooding. Severe electrical storms, accompanying rainstorms, and hail frost are common, while snow is an exceptional occurrence (DWAF, 1999).

1.3 Problem statement

Most of South Africa's wetlands have decreased in size through human modification and detrimental upstream land uses (DEAT, 1997). Degradation of wetlands often takes place in poor communities where wetlands are burnt or used for grazing and in some areas are replaced with housing developments (SRK, 2000). Over many years, as areas have become populated with human beings that did not realize the significant and important value of wetlands, the wetlands were drained for roads, railroads, industry, cropland, housing, cities and for controlling mosquitos (DEAT, 2013). Sebokeng Township is no exception as development has infringed into the Zone 3 wetland.

Sebokeng is one of the townships that rely on natural resources like wetlands for livelihoods. However, the community does not seem to manage the natural resources appropriately. Community Based Natural Resource Management (CBNRM) projects do not seem to follow the traditional conservation objectives such as biodiversity conservation, or maintenance of ecosystems, as part of their goal or objectives. There is tremendous disturbance on the Zone 3 wetland due to anthropogenic activities. Water Research Council (2011) indicates that almost 50% of wetlands have been lost in South Africa and the conservation of the remaining wetlands is very important. South African government is acknowledging the challenge and intervenes by introducing a range of policies and legislative framework. However, there seem to be a lack of the implementation of these policies from communities. The lack of interest in the implementation of the policies, and the participation of local communities in the management of wetlands can be attributed to a number of issues, including the following:

1.3.1 Little knowledge or ignorance of environmental law by local communities on the management of the wetlands;
1.3.2 Lack of or underestimation of the participation of local communities in the wetland management by government; and
1.3.3 Wetland-users lacking appropriate knowledge, resources and methods for upholding governance of wetlands.

The researcher observed the degradation of the wetland due to anthropogenic activities. Most of the activities that were observed on the wetland were agricultural activities and illegal

disposal of waste. These activities therefore prompted the researcher to investigate the underlining issues causing the degradation of the wetland.

1.4 Aims and objectives of the study

The inspiration for this study came from the observation of the degradation of the Zone 3 wetland and poor wetland management practises by the local community.

The objectives are:

1.4.1 To ascertain preliminary functionality and integrity of the wetland;

1.4.2 To investigate the level of participation of the local community in the management of the wetland; and

1.4.3 To propose management strategies of the wetland by local the local community.

1.5 Research questions

The following research questions were formulated to guide the study. The findings associated with the research questions were summarised in the discussion.

a) What is the preliminary health of the wetland?
b) Who have interests in the wetland?
c) What are the interests of the stakeholders?
d) How does the community manage the wetland?

1.6 Assumptions

The researcher assumes that full participation of the local community and community management forums in the management, can improve governance in natural resource management, consequently improving the wetland functionality and integrity.

1.7 Delineations and limitations

Even though every care is taken to ensure the accuracy of this dissertation, environmental assessment studies are limited in scope, time and budget. The scope of the study will act as a baseline for further studies on the wetland and management thereof by the community.

It is noted that in order to obtain reliable data, the whole Sebokeng wetland area should have been studied, however, due to the limitations of time and budget, the wetland assessment was strictly restricted to Zone 3 wetland. The assessment of the management of the wetland by the community only focused on the community living on the border of the wetland and local community groups.

Soil sampling for the wetland delineation was not undertaken; only the desktop wetland delineation was employed. It should be noted that desktop delineation can be limiting in determining the extent of the wetland and its buffer zones.

Consistent co-operation from the community participating in the research was not guaranteed. The researcher was concerned that some participants could lose interest in the study since the community sometimes prefer remuneration for their participation.

1.8 Overview of the chapters

The dissertation comprises of eight chapters:

Chapter one introduces the study by highlighting the background information of the study area. It also highlights the geographical aspects of the area. The aims, objectives, research rationale and its significance are addressed in this chapter.

Chapter two describes the wetland and its importance, locally, nationally and internationally. The environmental legislation, wetland trends associated with conservation and a broad insight into the context of the study is discussed in this chapter. A theoretical background on the process of participation by local communities in natural resource management is discussed in this chapter. Furthermore, a summary of the participation and management of the wetland by different stakeholders is addressed.

Chapter three describes the methodology of the study, providing insight into the qualitative and quantitative research, procedures associated with survey method and developing and administering a questionnaire. Discussions on how data will be analysed are outlined in this chapter.

Chapter four presents the results and findings of the study. It provides details on the state of the wetland and the community management of the wetland.

Chapter five discusses the findings of the study with reference to the literature reviewed. It also discusses insights gained from the data analysis in more depth, thus providing a more in-depth analysis of the findings presented in chapter four.

Chapter six contains recommendations from the study. The recommendations address possible improvements to strategies that can inform participatory approaches associated with wetland management.

Chapter seven summarises the study and provides conclusion.

Chapter eight comprises of the references that were cited in this study.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

This chapter provides a theoretical background that informs the study. This chapter, amongst others, explains the wetland's importance, legal framework and the wetland health assessment. It also reviews the CBNRM concept, the national and international trends associated with wetlands conservation aimed at protecting wetlands. Furthermore, participation of the local communities in the wetland management is reflected.

2.2 A wetland

2.2.1 What is a wetland

A wetland habitat is defined in the National Water Act (1998) as a "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil." Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils.
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

Wetlands are considered sensitive ecotones that provide numerous goods and services, not only to the communities which are immediately dependent on them, but also to the numerous downstream stakeholders who benefit from the hydrological influences that upstream wetlands have on a catchment through four major wetlands functions, viz. flood attenuation, stream flow regulation, sediment accretion and water purification (RAMSAR, 2002).

Furthermore, wetlands have aesthetic values and significant eco-tourism potential (Millennium Ecosystem Assessment, 2005). According to Heather and Bayley (2006), a wetland ecosystem can be highly productive and biologically diverse thus providing several direct benefits to humans in the form of products, food, resources and indirect benefits from wetland functions such as flood control, nutrient retention and groundwater recharge. Wetlands are unfortunately the most threatened ecosystems on the Earth: over half of the global wetlands have already been destroyed (Mitsch and Gosselink, 2000). According to Cousins *et al.* (2005) between 35% and 50% of the wetlands, and the benefits they provide have already been lost or severely degraded.

2.2.2 Wetland assessment

Wetlands are assessed according to their types. The hydro-geomorphic (HGM) is used to assess wetlands. The hydro-geomorphic approach in wetland classification uses hydrological and geomorphological characteristics to distinguish primary wetland units (SANBI, 2009). The HGM approach is therefore, based on factors that influence how wetlands functions (SANBI, 2009).

A healthy wetland is the one that can support biological communities and has similar physical and chemical characteristics to natural habitats within the same region (Mitsch and Gosselink, 2000). When conducting a wetland assessment, features like wetland type, hydrology, water quality, catchment and geomorphology have to be assessed. The hydrological conditions, which vary from permanent to intermittent flooding, are known to be the dominant factors determining the structure and function of a wetland (Mitsch and Gosselink, 1993). The hydrological regime affects many abiotic factors, including nutrient availability, oxygen supply and the concentration of toxins in the soil. These, in turn, determine the nature of soil development to which plant and animal communities respond, and thus influence ecosystem attributes such as primary productivity, organic accumulation and nutrient cycling (Gosselink and Turner, 1978).

Temporarily flooded soils are dominated by grass species, mixture of species that occur extensively in non-wetland areas and hydro-phytic plant species that are restricted largely to wetland areas (Kotze, *et al*., 1994). Hydrophytic sedge and grass species that are restricted to

wetland areas, usually less than one meter tall, dominate seasonally flooded soils. Permanently flooded soils are dominated by (i) emergent plants, including reeds *(Phragmites australis*), sedges and bulrushes (*Typha capensis*), usually greater than one meter tall; or (ii) floating or submerged aquatic plants (Kotze, *et al*., 1994). Wetland vegetation distribution is limited primarily by spatial variation in oxygen concentration and chemical conditions of the substratum brought about by flooding of the soil, which ranges from intermittent to permanent (Kotze, *et al.*, 1994).

2.2.3 Wetlands importance and their international recognition

In 1975 South Africa became the first African signatory to the Ramsar Convention, which obligates government of this country to protect designated wetlands (Whyte and Shepherd, 1990). The Convention on Wetlands is an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar (Ramsar, 2006). The Ramsar (2006) agreement mission states that conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world, (Ramsar, 2006). Wetlands are therefore commemorated yearly on 02 February. The commemoration day is called World Wetlands Day (WWD). The Ramsar Convention (2006) adopted the concept of ecosystem services, outlined as the benefits people obtain from ecosystems which include products such as food, fuel and fibre, climate change regulations and non-material benefits such a spiritual or aesthetic benefits.

Wetlands play an integral part in the water cycle by allowing surface water to percolate into the ground and help maintain groundwater levels (Broughton, 1996). Wetlands produce and sustain many diverse life forms, especially wetland dependant species as well as rare and endangered species (Begg, 1990). The wetlands most important function is the fulfilment of hydrological and hydro-chemical functions intercepting storm runoff and storing storm water, recharging groundwater, removal of organic and inorganic nutrients as well as toxic materials (Hammer, 1997). Wetlands provide opportunities for wildlife watching, nature photography, outdoor classrooms and laboratories for school children, college students, wildlife biologists, and other researchers interested in wetland ecosystems (Pierre, 2001).

Wetlands are important components of catchments, providing catchment water security and other ecosystem services (Pollard *et al.,* 2009). In communal areas, they particularly represent the challenging intersection between sustainable management and the livelihood needs of people making use of the wetlands (Pollard *et al.,* 2007). However, large areas of wetlands are prime examples of ecosystems that, despite their provision of beneficial services, functions and products, have not escaped the impacts of human activities and unfortunately communities do not value wetlands that much, (Trisurat, 2006). Poor management of wetland resources have also resulted in occurrence of soil erosion (Cousins and Pollard, 2005).

2.2.4 The condition of wetlands in urban South Africa

The Ramsar Convention on Wetlands identified wetlands as one of the most important life support systems on Earth (Cowan, 1995). At the same time, these wetlands and the resources that they supply are coming under increasing pressure, for example through extensive conversion to crop fields (Lindley, 2003). In South Africa, a semi-arid country with few wetlands, it has been estimated that more than half of the wetlands have been destroyed (Breen and Begg, 1989; Lindley, 2003). Bond (2002) identified over-population, overgrazing and poor farming methods as some of the activities that have contributed to erosion, desertification and degradation of wetlands.

It is clear that whilst humanity is becoming increasingly urban, the quality of life is still dependent on nature for its survival (Bolund and Hunhammar, 1999). According to Ramsar Convention (2009), more than 50% of the Earth's population now resides in cities, town and urban settlements and the urban population is predicted to continue to grow at an average rate up to 1.6 % per annum. With increasingly rapid urbanization, wetlands are being threatened in two principle ways (McInnes, 2010):

- Through direct conversion of wetlands, whether planned or unplanned, to urban areas, leading to acute problems associated with polluted drainage, direct habitat loss, overexploitation of wetland plants and animals by urban and peri-urban residents and the increased prevalence of non-native invasive species; and
- Through the watershed-related impacts of urban development, including increased demands for water, increasing diffuse and point source pollution and the need for greater agricultural production to support the burgeoning urban population.

Pressures on water resources, such as groundwater abstraction, and the quality of surface and groundwater, contaminated by pollutants, have been well documented (Hollis, 1990; Kingsford, 2000). According to McInnes (2010), often indirect impacts can result in downstream issues. Eutrophication, caused by excessive concentrations of nutrients, can be damaging to some aquatic life.

2.2.5 Legal framework governing wetland

The natural resources have been protected from the most disruptive human influences through relatively humble technology, such as local laws or cultural or religious taboos preventing overexploitation (McNeely, 1993). McNeely further stated that local people often have an understanding of wetland ecology in their particular context that is far subtler, and sometimes superior to that of outside "experts". However, traditional practices do not necessarily result in environmental sustainability, and they must be assessed objectively in the light of changing population dynamics and pressures on the resource (Gawler, 2000).

The Constitution of the Republic of South Africa (1996) enshrines the right to a healthy environment that is not detrimental to health and well-being for all citizens. It also requires citizens to participate in preventing ecological degradation, promoting ecological conservation, and in securing ecologically sustainable development and use of natural resources for the benefit of current and future generations. Wetlands are an integral part of these natural resources, and are encompassed in the environmental discourses of the constitution.

The Constitution of the Republic of South Africa (1996) is dedicated to the Bill of Rights of South African citizens. The Bill of Rights, *inter alia* focuses on rights such as:

- Everyone has a right to an environment that is protected and not harmful (Section 24).
- Food and water Section 27 (1) (b).
- Basic and further education (Section 29).

South Africa has other various pieces of legislation governing activities in and around the wetland. The influence of the legislation differs in the application and level but can be

divided in two categories, namely authoritative and supportive legislation (Gauteng Department of Agriculture, Conservation and Environment, 2006). Authoritative legislation includes legislations that authorises a specific activity that impacts on wetlands, while supportive legislation indicates guidelines that must be taken into account in the decision-making process. These laws are explained as follows:

2.2.5.1 The National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act (NEMA, 1998) (Act No.107 of 1998) is the principal piece of legislation governing the protection and sustainable utilisation of natural resources, as well as making provision for protected areas. The Act sets out specific principles that have to be adhered to when enforcing environmental legislation (Section 2 of NEMA). The National Environmental Management Act replaced sections of Environmental Conservation Act (ECA, 1989) (Act No. 73 of 1989). These aspects have been replaced by new regulations promulgated under Section 5 of the NEMA. These include a list of activities that may negatively impact on the environment and that must be controlled. The Act places a huge responsibility on government to provide for co-operative governance with respect to natural resources. In order to achieve this, the development of a shared vision between all spheres of government to promote the application and evaluation of best environmental practices in relation to wetland management is required. This shared vision and ways of implementing it, should be communicated to communities, corporate business/ private sector and the general public.

2.2.5.2 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA, 1983) (Act No. 43 of 1983) seeks to provide for the conservation of natural agricultural resources by maintaining the production potential of land, combating and preventing erosion and weakening or destruction of water resources, protecting vegetation and combating weeds and alien invader plant species. The CARA (1983) makes provision for rehabilitation works to be classified as soil conservation works.

2.2.5.3 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act (NWA, 1998) (Act No. 36 of 1998) recognises the importance of water resources and the need to protect them. The Act is one of the Acts that provide a framework to protect water resources including wetlands against over exploitation and to ensure that there is water for social and economic development for the future. The Act also recognises that water belongs to the whole nation for the benefit of all people.

2.2.5.4 Status on the implementation of the policies

While South Africa has progressive environmental legislation, it is currently experiencing challenges relating to the implementation of this legislation (Koch, 2004). The contributing factors may include the following factors (Koch, 2004):

- There is a lack of capacity of those who develop the legislation,
- The legislation is sector specific and wetlands are found in overlapping areas of responsibilities. There is also a contested relationship between National, Provincial and Local Governments as to which level of the state should control and manage wetland resources (Koch, 2004).
- There is likely to be confusion as to which sector should apply its law to maximise the conservation of wetlands because "laws protecting wetlands in South Africa are fragmented and are represented in various acts which are enforced by a diversity of authorities" (Kotze and Breen, 2000).
- Wetlands tend to be managed by different stakeholders' with different interests.

2.2.6 Climate change and wetlands

Climate change is defined by a number of factors, including: temperature, humidity, rainfall, air pressure, wind and severe weather events (Kandji *et al*., 2006). The United Nations Framework Convention on Climate Change (UNFCCC, 2002) defines climate change as a "change of climate that is attributed directly or indirectly to human activity that alters the

composition of global atmosphere and that is in addition to natural climate variability observed over comparable time periods."

There is a need for community projects to be structured in a way that they address climate change problems. This approach would enhance the image of the conservation of resources and would attract more funding and greater support from government institutions. The United Nations Framework Convention on Climate Change (2002) indicates that local people have not been involved, in any significant way, in formal discussion. Climate change will affect more ecosystems such as wetlands and landscapes that the communities inhabit and the ways in which they live will be affected. According to UNFCCC (2002), about 45% of the earth's land mass is devoted to agriculture and agricultural practices account for 13.5% of all greenhouse gas emissions. The majority of these emissions stem from poor agro-business practices in the areas of crop and grazing land management. Indigenous practices, such as rotational farming, gathering, trapping, and the production of basic goods and services, often use environmentally friendly, renewable and/or recyclable resources. Clearly, the local communities have to participate fully in the discussions of mitigation factors so that they can implement the resolutions they understand better.

2.2.7 Programmes aimed at addressing wetland degradation

Government has recently acknowledged the concern of wetlands loss as requiring urgent action as they are very important to sustainable water management (Kotze, undated). Already in South Africa there are numbers of programmes that are taking place focusing largely on wetlands including Working for Wetlands, Mondi Wetlands Project and South African Crane Working Group (Kotze 2006 pers. comm). These programmes have been encouraging the public to participate in the processes of restoring wetlands. The government extension service providers were overloaded with the responsibility of reaching a wide range of the South African populations, extending technologies and working with poor people of the community, yet poor people benefited very little (Snapp and Heong, 2003). However, there has been a paradigm shift in thinking about natural resource management towards participatory management (Critchley and Netshikovhela, 1998). Participatory management has been regarded as a process of reaching out and engaging with many stakeholders (Snapp and Heong, 2003). This change in philosophy achieved some success in transferring power

and responsibility more into the hands of people living on and surviving off the land (Critchley and Netshikovhela, 1998). The primary hope has been that participatory approach will address primary problems associated with poor service delivery in communal areas such as declining numbers of extension personnel, poor access to new information and misunderstanding of issues by the local community (Snapp and Heong, 2003).

2.2.8 Community structures in wetland management

The wider community involved in wetland resource management is often described as the 'stakeholders' (Claridge and O'Callaghan, 1996). Claridge and O'Callaghan (1996) further describe that a stakeholder, or stakeholder group, can be defined as any individual or group who may be affected by, or expresses a strong interest in, the resources or management of a wetland area. Stakeholders may include (Claridge and O'Callaghan, 1996):

- Local user communities - those people who live in the vicinity and directly use the resources, and who, in developing countries, are typically partly in a subsistence relationship with the resources and partly in a market relationship; local communities having an indirect interest in the management of the resource; for example, local communities which rely on some function thereof.
- Community involvement in wetland management, such as flood control or coastal erosion protection, but do not directly use the resources;
- Remote user communities who come from a distance to use the resources and who may be in competition with the local users (or may have a long-standing arrangement with the local community), or may use a different component of the resources;
- Commercial direct users of wetland resources (individuals, groups or legal entities such as companies) who have a purely commercial relationship with the resources;
- Commercial indirect users who sometimes do not realise that they are users of the wetland resource. Examples include companies which discharge wastes into the wetland, or commercial operations harvesting wetland resources 'downstream', such as offshore harvesting of shrimp which spend their larval stages in the wetlands;
- Suppliers and marketers associated with wetland resource users can be a diverse group, including middlemen for wetland products, suppliers of inputs such as fuel and

equipment, providers of credit, etc. This group can be extremely resistant to change in the status quo and often have much better political connections than the local user community;

- Government agencies with responsibility for management of some aspect of wetland resources. This might include a range of agencies with sectoral responsibilities for different resources, for example, fisheries, forestry, and water supply;
- Supporters of wetland communities, such as environment and conservation organisations, social and human rights advocacy groups, development assistance organisations and concerned individuals, and
- End consumers of wetland products.

In response to environmental problems such as the decrease of natural habitat, land degradation, several government institutions and organizations in South Africa have begun to explore community-based approaches to natural resource management. Community Based Natural Resource Management is an approach of natural resource management by, for and with local communities with the objectives of improving livelihood and security for local people, empowering them, and enhancing conservation efforts (Adhikari, 2001). Community-based conservation has three essential characteristics: 1) indigenous peoples and local communities are concerned about the relevant ecosystems that are related to them culturally and or for livelihood; 2) they are the major players in decision making and the implementation of decisions; and 3) management decisions and efforts towards conservation of biodiversity are voluntary (Campbell and Vainio-Matila, 2003).

The CBNRM projects assist government to decentralise development efforts, reduce poverty and stimulate community-based rural development, IUCN (2006). According to Roe *et al.* (2009), CBNRM models work to strengthen locally accountable institutions for natural resource use and management, enabling local groups to make better decisions about the use of land and resources. Because it involves the transfer of authority over natural resources to local people, there should be proper support from local government in terms of capacity building. Roe *et al.* (2009) further clarifies that local community should be co-managing the resources with local authorities, provincial government and national government through engaging in diverse institutional arrangements. It is therefore imperative to be clear on the duties for each stakeholder.

According to 22 and Muzones (1997), there are five basic principles that are required for community-based resource management:

a) Empowerment: the actual transfer of economic and political power from the few to the impoverished many, and the operationalization of community management and control;
b) Equity: communities as a whole, rather than a few individuals, benefit;
c) Sustainability: inter-generational equity, based on the carrying and assimilative capacity of the ecosystem;
d) Systems orientation: the community functions in the context of other communities and stakeholders, just as resources are ecologically linked to wider ecosystems; and
e) Gender-fair: women are involved in the control and management of community resources, and their practical and strategic needs are addressed.

2.3 Sustainable development

The Organisation for Economic Co-operation and Development (undated), defines sustainable development as a development path along which human well-being for today's generation is maximised, while not leading to the decline in future well-being. Sustainable development is about meeting the needs of today without diminishing the capacity of future generations to meet theirs. It therefore implies a broad view of human welfare, a long-term perspective about the consequences of today's activities and overall co-operation to reach viable solutions. The concept of sustainable development provides the ideological underpinning of many stakeholder participation processes in the context of participatory natural resources management (Hemmati, 2000), i.e. where stakeholders engage in a process of dialogue and reach agreement as partners in order to build sustainable solutions for existing and new problems. Participation can be perceived as a tool for effectiveness, new source of investment and to avoid past failures. Investment can be made in local people because local knowledge can be accessible, and establish interactive networks that are essential for the success of projects and corporations at local level (Rahnema, 1992).

2.3.1 Governance of wetlands

The Commission on Global Governance (Hemmati, 2000) defines governance as the sum of the many ways in which individuals and institutions manage their common affairs. Hemmati (2000) emphasises that good governance needs participation of all stakeholders and it should create an enabling environment for all stakeholders to be involved. The following characteristics of good governance are listed in Hemmati (2000):

- participation in a sense that all stakeholders have a voice in influencing decision making process,
- transparency implying that all the procedures and methods should be open and transparent to all stakeholders,
- accountability to the public and other stakeholders,
- effectiveness and efficiency in carrying out roles and responsibilities,
- response in time to address the needs of other stakeholders,
- grounded by the rule of law meaning that all decisions should be within the legal framework, and
- gender equality emphasizing the participation of women in decision-making.

Wise governance understands and balances the immediate needs and rights of people, sustainable use of natural resources, and the rights of future generations to a healthy environment (Pollard *et al*., 2009). Pollard *et al.* (2009) further illustrates that wise use of wetlands is an integrated strategy for the sustainable and equitable use of wetlands through good governance and land- and water- use practices that promote healthy wetlands so as to continue to provide services, products and benefits that are enjoyed by and that sustain human livelihoods (including those of future generations), as well as biological diversity. According to Cousins *et al.* (2005) governance is an over-arching principle that regulates public and private behaviour towards greater accountability and responsibility for the environment. It is important to understand that governance systems created to steer human–environment relations can be and often just as complex and dynamic as the socio-ecological systems they are created to steer (Young, 2009). The statement emphasizes the importance of studying each resource governance systems independently from others. Poor people are the most vulnerable to resource degradation (Cousins *et al.*, 2005). Individual resource user management is not applicable to wetlands, many aspects need better governance.

Governance of natural resources involves the power, processes, rights and responsibilities that are associated with making and enforcing the rules that guide society in relation to natural capital (Pollard *et al.*, 2009). Thus it involves community structures, traditional authorities, civil society and government. Empowering local people to benefit from conservation requires that resource ownership and authority to make policy are devolved from state institutions to lower levels. However, many central governments have been reluctant to devolve resource ownership and policy making, instead decentralizing only administration and management activities (Hackel, 1999). Resource and conservation agencies rarely trust their constituency enough to devolve fiscal responsibility which is a meaningful part of decentralization (Hackel, 1999). Empowering communities requires weakening of bureaucratic controls, which can be threatening to state institutions (Gibson, 1999). Folk *et al*. (2002) emphasize that principle of the Biodiversity Convention stress that the ecosystem approach should consider all forms of relevant information, including scientific and indigenous knowledge.

2.4 Decision making process

According to Thomas and Stilwell (1994), decision making should reside with the resource users so that they are empowered to take charge of their own development. Local communities have in-depth knowledge on ways of doing things; developers should draw on local knowledge through participatory approaches (Thomas and Stilwell, 1994). The management of resources by the community normally manifests through CBNRM projects. According to Nhantumbo *et al.* (2003) CBNRM is a decentralization process aimed at giving grass roots institutions the power of decision-making and rights to control their resources.

Participation has been considered a good thing for giving legitimacy and for eradicating mistrust, particularly in community-based initiatives (Fabricius, 2004). Group participation objectives can be clustered into four specific objective categories, which are, collaboration, community development, organisation and empowerment (Oakley and Marsden, 1984).

2.4.1 Participation of local community in the management of wetlands

According to Jennings (2000), what constitutes genuine participation is the involvement of local communities in the establishment of a programme designed to change their lives in the process of managing and using resources sustainably. Genuine participation where participants focus on their personal meaning and on an alternative construction of knowledge, leads to the discovery of facts and of complex relationships with economic, historic and ideological aspects (Simovska, 2000). Participation needs recognition and use of local capacities and avoids the imposition of priorities from the outside. Karl (2000) defines participation as a process in which people and communities co-operate and collaborate in development projects and programmes and as a process that empowers people and communities through acquiring skills, knowledge and experience, leading to greater self-reliance and self-management.

The above definitions all focus on the participation of stakeholders but do not address the question of who the stakeholders are. Hemmati (2000) defines stakeholders as those individuals or representatives of a group who have an interest in a particular decision, including those that influence a decision as well those affected by it. Zone 3 community is a typical community who has an interest in utilising the wetland. Based on the above, it is clear that the community has to participate in the projects, but the main questions are how will they participate and will they effectively participate?

User communities may include people who live in the vicinity and directly use the resources and remote user communities who come from a distance to use the resources and who may be in competition with the local users (Claridge and O'Callaghan, 1996). Commercial indirect users sometimes do not realise they are users of the wetland resource; for an example, companies that discharge wastes into the wetland. These participatory processes have the potential to enable local communities to express and further develop their knowledge of conserving and using wetlands resources sustainably (Nel and Kotze, 2001).

Although participation is seen as a means of achieving several objectives of social development, there are many obstacles that prevent the practice or implementation of participation. Thomas and Stilwell (1994) indicate the following as some of the obstacles that

can hamper the realisation of participation benefits: insecure land tenure, top-down planning approaches, absence of policy to promote equity, uninformed development agents, inadequate working capital, narrow development focus, weak institutional support and rapidly changing political circumstances, traditional leadership, conflict and civic movements, dependency syndrome and lack of confidence with beneficiaries.

Oakley and Marsden (1984) and Oakley (1995) categorised challenges into operational, cultural and structural. Operational obstacles included over centralised planning, inadequate delivery mechanisms, lack of local coordination, and inappropriateness of initiative technology, irrelevant project content and lack of local structures. Cultural obstacles are considered as resistance to change by the particular community while structural obstacles are about the dominant relations of power and production and all forms of formal and informal structures at different levels (Oakley, 1995).

2.4.2 Participation in Community Based Natural Resource Management

The NEMA (1998), CARA (1983) and NWA (1998) are concerned with the conservation, utilisation and overall management of natural resources such as wetlands. These Acts are aimed at enhancing for equal and sustainable use of resources, and to develop ownership amongst users of natural resources. They also promote decentralisation of power to local stakeholders. Community projects that operate on the communal land usually adopt the CBNRM concept. Community-Based Natural Resource Management is a practice that emphasizes natural resources management (NRM) by, for, and with local communities, and it has three primary objectives (Gibbs and Bromley, 1989):

i. Improving livelihood and security of local people;
ii. Enhancing environmental conservation; and
iii. Empowering the local people.

2.4.3 Involvement of communities in decision making processes

Involvement of local groups in the decision making has been drastically been undermined by government and funding agencies. However Claridge and O'Callaghan (1996) mention that there is a shift of attitudes and mind-sets to acknowledge and integrate local knowledge. By accepting local people as co-experts leads to true shared analysis of problems and shared design of solutions. Claridge and O'Callaghan (1996), however exasperated that sharing of the design of wetland resource management projects among the wider group of stakeholders remains a desirable goal that is seldom achieved. There is a need to investigate challenges that hinder the success of involvement of a wide range of stakeholders. This also explains that each management plan must be tailor-made for a specific project. Different groups are often interested in different aspects of a wetland and the struggle may be obvious, though is less likely when groups are interested in different resources in the wetland (Mermet, 1990). Indeed sustainability of community projects requires strong institutions across different scales with Government providing a leading role (Murphree, 1993).

2.5 Conclusion

The purpose of this chapter was to examine theoretical aspects of wetland management, which forms a framework to the study. The South African conservation related legislation was reflected to recognise the participation of stakeholders at all levels. The chapter indicated that it is important to understand the history, purpose and meaning of local community participation in activities for improving their livelihoods. This chapter highlighted the importance of participation and further discussed the critical elements of stakeholders' participation indicating that participation is very broad concept, which takes many forms and occurs at various levels. This chapter also indicated that there are many reasons why local communities should be involved in activities that affect them. The next chapter will discuss the research design and methodology, explaining the theoretical framework of this research.

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used in assessing the state of the wetland as well as community involvement in managing the wetland. It also discusses requirements procedures in developing and administering a questionnaire. It further provides reflections on the research process.

3.2 Methodology

Two sets of data were obtained for the study, which is the assessment of the wetland and investigation of the management of the wetland by the community. The study followed two aspects of research design, which are non-empirical and empirical studies, whereby literature review and evaluation research were conducted respectively. The implementation of evaluation research aimed to investigate, among others, the state of the wetland, perception of the community to the wetland and how the wetland is managed. The key research questions were descriptive questions that culminated in the gathering of data which was textual in nature. When the aim of a study is to achieve a deeper understanding of a person's subjective perception of, for example, quality of life, a person's individual perceptions, experiences, impressions and actions, then qualitative research methods may be more relevant (Swedish Council on Health Technology Assessment, 2003). Since the study also focused on the analysis of social behaviour, Connole (1998) suggests that a variety of research orientations that highlight the potential of interpretive, qualitative approaches for the analysis be used.

The study followed the qualitative method. Miles and Huberman (1994) indicate that from the perspective of quantitative research, field work generates a bunch of numbers, whilst in the case of qualitative research; field work generates a bunch of words. According to Mouton and Marais (1990) the quantitative approach has an advantage over qualitative approach. The choice of methodological approach for this research was guided by concerns as to how best to address the research problem, objectives and research questions as indicated by Moss (1988).

3.3 Overview of the two types of data sets

The data gathered through the assessment of the wetland and the use of research questionnaires (Appendix 2) is presented and analysed qualitatively. The researcher applied the use of Microsoft Excel (2010) for the analysis. The Microsoft Excel was used to determine the following:

- number of male and female respondents;
- number of respondents who agree or disagree, support or are against a certain idea as contained in the questionnaire; and
- comparison of percentages of respondents.

3.4 Wetland assessment methodology

The wetland assessment included review of topographical maps, aerial photographs and an 'on-site' evaluation of the wetland condition and associated vegetation structure condition. The on-site evaluation of the study area aimed to identify visible impacts on the site, with specific reference to impacts from surrounding activities. Both natural constraints placed on ecosystem structure and functions, as well as anthropogenic alterations to the system, were identified by observing conditions. The assessment was done as follows:

3.4.1 Wetland Health and Integrity Index

The Wetland Health and Integrity Index (DWAF, 2007) was used to assess the functionality of the wetland. The wetland functionality can be divided up into a number of components including ecological value, hydrological functioning, water quality enhancement and socio-economic functionality, all of which can be included in a set of ecosystem goods and services typically offered by wetlands (SSI, 2012). Central to the understanding of the dynamics, state and ecosystem services value of wetlands is the characterisation of wetland hydro-geomorphic types which are defined based on the geomorphic setting of the wetland in the landscape, water source, how water flows through the wetland and how water exits the wetland (Kotze *et al*., 2009).

The primary purpose of this assessment was to evaluate the eco-physical health of wetlands, and in so doing promote their conservation and wise management (Macfarlane *et al.*, 2008). Subsequent to the completion of the field assessment and delineation of the wetland, the Present Ecological State (PES) was determined. The Present Ecological State was determined using the Wetland-IHI method, as described by DWAF (2007). The Wetland-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The Wetland-IHI model is composed of four parts, which are, "hydrology", "geomorphology", "vegetation alteration", and "water quality" (DWAF, 2007).

The Wetland-IHI encompasses the use of two aspects to determine the PES. Firstly, a site survey, where all possible impacts were noted and the scale of the impacts area measured. The information along with the delineation of the wetland was then collated and calculated into the Wetland-IHI Microsoft Excel programme. The Wetland-IHI model is designed for the rapid assessment of floodplain and channelled valley bottom wetland types, for the purposes of determining an index of wetland integrity for the purposes of reporting on the PES of the wetland system.

The results were then combined to calculate the PES score. The integration of the scores from the four units provides an overall PES score for the wetland system being examined. These three parts concentrate on the three main functions of wetland systems namely vegetation, hydrology and geomorphology. The programme then provides the PES in the form of Health category ratings from A (best) to F (worst) (Table 1).

The PES Category was determined to assist in the formulation of the recommendations, mitigation, and rehabilitation measures to achieve the desired PES Category. The findings and discussions of the study are elaborated on in detail in the results and discussion chapters, respectively.

Table 1: Descriptions of the A-F ecological categories (Kleynhans *et al.*, 2005)

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	Unmodified, natural.	Protected systems; relatively untouched by human hands; no discharges or impoundments allowed.
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Some human-related disturbance, but mostly of low impact potential
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality.
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	

3.4.2 Wetland classification

The wetland was classified based on the characteristic attributes adopted from the "practical field procedure for identification and delineation of wetlands and riparian areas", (DWAF, 2005). The attributes include:

- The presence of plants adapted to or tolerant of saturated soils (hydrophytes);
- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation; and
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing within 50 cm of the soil surface.
- Topographical location of the wetland in relation to the landscape.

The wetland was classified according to the proposed National Wetland Classification System (NWCS) developed by the South African National Biodiversity Institute (SANBI. 2009). The classification system identifies eleven broad hydro-geomorphic units:

a) Channelled valley bottom wetland;
b) Un-channelled valley bottom wetland;
c) Floodplain wetland;
d) Exhorheic depression with channelled inflow;
e) Exhorheic depression without channelled inflow;
f) Endorheic depression with channelled inflow;
g) Endorheic depression without channelled inflow;
h) Flat;
i) Hill-slope seep with channelled outflow;
j) Hill-slope seep without channelled outflow; and
k) Valley head.

The wetland was assessed and characterised according to the category or type it was deemed to fall under, as this is linked to the functions (i.e. goods and services) it can render. The characteristics of different hydro-geomorphic (HGM) types included in the proposed National Wetland Classification System (SANBI, 2009), outlined in Table 2, were used to classify the wetland.

Table 2: Characteristics of different hydro-geomorphic (HGM) types included in the proposed National Wetland Classification System (SANBI, 2009)

HGM Type	Landscape setting	Hydrological Characteristics		
		Inputs	**Throughputs**	**Outputs**
1. Channelled Valley Bottom Wetland	Valley floor	• Overland flow from adjacent valley-side slope • Lateral seepage from adjacent hill-slope seeps • Channel overspill during flooding	• Diffuse surface flow • Temporary storage in depressions • Short-lived concentrated flows during flood events	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation
2. Un-channelled Valley Bottom Wetland	Valley floor / plain	• Concentrated or diffuse surface flow from upstream • Channels and tributaries • Overland flow from adjacent valley-side slopes • Lateral seepage from adjacent hill-slope seeps • Groundwater	• Diffuse surface flow, • interflow, temporary storage of water in depressions, • Possible short lived concentrated flows during high-flow events	• Diffuse or concentrated surface flow, • Infiltration and evaporation (particularly from depressional areas)
3. Floodplain Wetland	Valley floor / plain	• Channel overspill during flooding (predominantly) • Some overland flow from adjacent valley-side	• Diffuse surface flow • interflow temporary storage of water in depressions • possible short-lived concentrated flows during	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation (particularly from depressional

		slopes (if present) • Lateral seepage from adjacent hills-lope seeps (if present)	flooding events	areas)
4. Exorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
5. Exorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
6. Endorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
7. Endorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
8. Flat	Plain / bench	• Precipitation • Groundwater	• Containment of water • Some diffuse surface flow and/or interflow	• Evaporation • Infiltration
9. Hillsope Seep with channelled outflow	Slope	• Groundwater • Precipitation (perched)	• Diffuse surface flow • Interflow	• Concentrated surface • Flow
10. Hillslope Seep without	Slope	• Groundwater • Precipitation	• Diffuse surface flow	• Diffuse surface flow

channelled outflow		(perched)	• Interflow	• Interflow • Evaporation • Infiltration
11. Valley Head Seep	Valley floor	• Groundwater • Diffuse surface flow • Precipitation	• Diffuse surface flow • Interflow	• Concentrated surface flow

3.4.3 Wetland delineation and historical imagery analysis

Although the primary driving force behind all wetlands is water, due to its dynamic nature varying daily, seasonally and annually – it is not a very useful parameter for accurately identifying the outer boundary of a wetland (DWAF, 2005). The object of the delineation procedure is to identify the outer edge of the temporary zone. This outer edge marks the boundary between the wetland and adjacent terrestrial areas (DWAF, 2005).

Prior to conducting the physical site survey, an initial desktop survey was conducted using Google Earth map timeline function to detect changes in visible vegetation gradients. An initial image for the site was taken in year 1938. This image shows the existence of the wetland before human settlement on Zone 3. Other images analysed were from year 2004 until 2014. These latest images show the shrinking of the wetland due to mushrooming of development along the edge of the wetland. The desktop survey of suspected wetland areas was undertaken by identifying wetness signatures on the digital base maps. The mapping was undertaken in ArcGIS, using 1:50 000 topo-cadastral maps and Google Earth aerial photographs of the study area, to identify surface water features and delineation of the wetland.

Subsequently, all identified areas suspected to be wet were further investigated in the field. The field survey was undertaken to assess the wetland in terms of the extent of the wetness of the soil, vegetation and catchment. Furthermore, all observations, both positive and negative aspects, were noted. Subsequently, a desktop delineation of the wetland was conducted. The wetland was delineated in order to recommend management interventions. The outer boundaries of the wetland were also delineated. The outer boundary of the wetland is defined as “the point where the indicators are no longer visible” (DWA, 2005).

3.4.4 Sensitivity Mapping

The ecological features and sensitive areas of the study area were assessed with the use of GDARD's sensitivity map. The sensitivity map guides activities that could be undertaken in the wetland.

3.4.5 Recommendations

Recommendations were developed to address and mitigate impacts associated with the activities taking place in the wetland. These recommendations also include general management measures which apply to the wetland as a whole.

3.5 Management of the wetland

The management of the wetland by the community was investigated. A questionnaire was used as a research tool to collect such data. The researcher followed the process flow outlined in Figure 3 for the administration of the questionnaire. Questionnaires were written in simple English to make easy for respondents to understand.

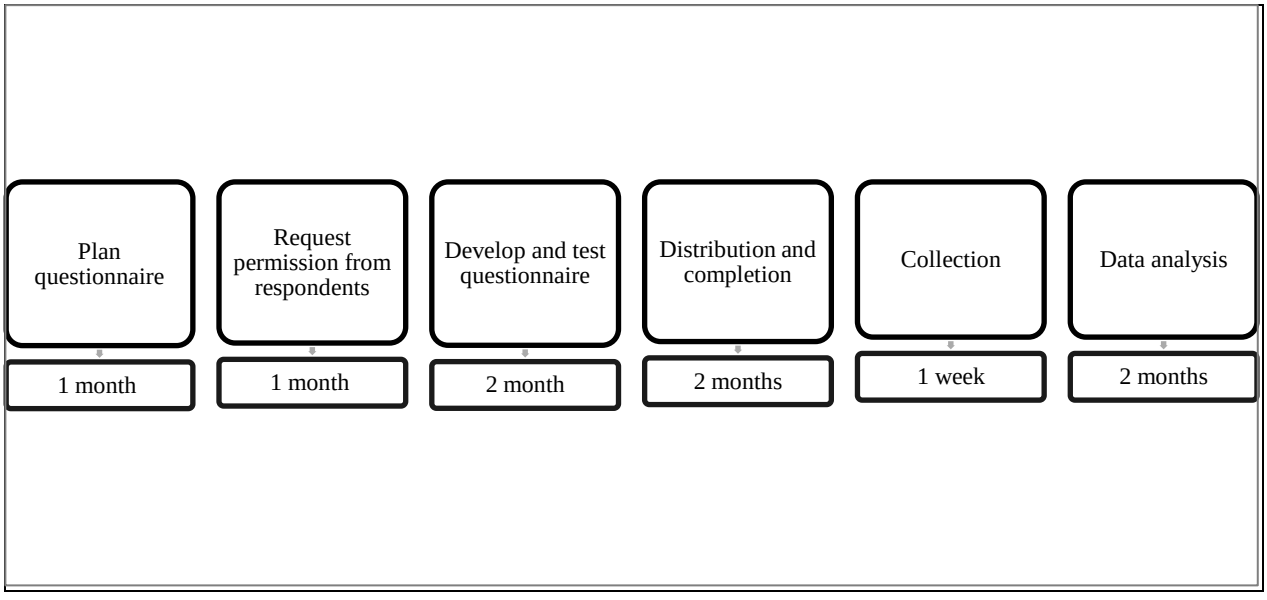

Figure 3: Process flow for the administration of the questionnaire

The questionnaire (Appendix 2) was aimed at assessing basic attitudes and opinions of the local community towards the wetland. It also aimed at gathering information on the roles played by the community in the management of the wetland. Prior to the distribution of the questionnaires, it was initially piloted with the researcher's colleagues to seek any ambiguity that could arise from the questions. The pilot exercise aimed at assessing the wording, excessive complexity and the length of the questions. The questionnaire comprised of different kinds of open-ended and closed questions.

Subsequently, all questionnaires were hand-delivered to the respondents. The questionnaires were hand delivered at the respondents' homesteads. All respondents were given a two-week period to complete. After collecting the questionnaires, data was screened and transferred to the Microsoft Excel 2010 spread sheet. The data was then presented in the form of Tables and graphs.

3.5.1 Sample selection

The research could not give the questionnaires to the whole population of Zone 3 because of time and economic reasons. In this case, it was convenient to allow a certain part of the population, a sample, chosen in an appropriate way to obtain later conclusions for the whole population. The sample was derived from the population, which is the local community neighbouring the wetland. According to Kitchin and Tate (2000), the total of all possible people who display the characteristic the researcher is interested in, is the population. In defining a sample, Kitchin and Tate (2000), argue that a sample can be viewed as a subset of measurements drawn from a study population in which the researcher is interested on.

The researcher investigated three sampling methods, which are probability, purpose and no-rule sampling (Barreiro and Albandoz, undated). Subsequently, probability sampling was chosen as an appropriate technique to be used for the study. Probability sampling entails that each sample has the same probability of being chosen (Barreiro and Albandoz). To further streamline the selection process, random sampling was selected, because it guarantees that all the possible samples taken from the population have the same probability of being chosen (Patton, 1990).

The sample was selected without replacement, which means that once an individual is sampled, that person is not placed back in the population for re-sampling.

The questionnaire survey was used to obtain actual data from this sample. The number of respondents was determined using the formula outlined in Table 3. The sample of the neighbouring community consisted of the population of approximately 200 homesteads; therefore, 32% of the population which is 64 homesteads was sampled (Table 3). In order to fairly select 64 homesteads from 200 homesteads, every third house on a block of houses was selected to be part of the sample. Each of the selected homesteads received one questionnaire.

Table 3: Population sample size (Stoker 1985) as quoted by Nkalanga (2013)

Population	**Percentage suggested**	**Sample (number of respondents)**
20	100%	20
30	80%	24
50	64%	32
100	45%	45
200	32%	64
500	20%	100
1000	14%	140
10 000	4.5%	450
100 000	2%	2000
200 000	1%	20000

3.5.2 Observations to confirm the questionnaire

The researcher conducted observations for the CBNRM projects. The researcher conducted observations as both the passive and participant observer. Participant observation method enabled the researcher to establish rapport by blending into the community. Ferreira *et al.* (1988) argue that being a participant observer implies that the investigator's intentions are known by those who are being observed. As such, people can sometimes show what an investigator is looking for and the nature of interaction can lead to bias. The researcher,

nevertheless, found it to be a useful technique for gaining an understanding of relations amongst stakeholders. This enabled the researcher to conduct natural conversations by being interested in learning more about the project members. The observations enabled the researcher to assess non-verbal expression of feelings and to determine how much time is spent on various activities.

The observation method was used despite the limitations that come with it. Leedy and Ormrod (2005) argue that it is difficult to observe things such as attitudes, motivating factors and intentions. The researcher was aware that if people are alert their actions are being observed, they tend to behave differently. The researcher believed that, the more time he spent with the community groups, the more at ease they were going to become, and eventually act naturally.

3.5.3 Archived material

This study also used document analysis to generate qualitative information on the management of the wetland. Archived documents such as CBNRM project management reports, meeting minutes and best practice manuals were analysed. Document analysis for research can be used in different kinds of studies with different objectives (Ferreira *et al.*, 1988). Any form of document including diaries, letters, photos, memos, biographies, graffiti, memoirs, notes, memorials, videos and films can be used as documents in qualitative research (Ferreira *et al.*, 1988). The Gauteng Wetland Forum (GWF) minutes were analysed. The community projects' management minutes were reviewed to determine previous management practices and interventions on contentious issues. The minutes were also used to understand engagements of CBNRM projects with government. The examination of the attendance registers aimed at ascertaining project member turn-over. This was to assist the researcher in determining how long a project member stays in the programme. Photographs and standard operational manuals were also reviewed to understand if the projects conformed to the practices.

3.5.4 Analysis

The researcher commenced with the data analysis early during the process of data collection. Data was categorized, ordered and summarised to obtain answers to the research questions. The purpose of the analysis was to reduce the data to an intelligible and interpretable form so that the relations of research problems can be studied, and tested, and conclusions drawn. Data analysis is a multipronged process that every researcher embarks on to make sense of the data: break it down, study its components, investigate its importance, and interpret its meanings (Patton, 1999; Bailey, 2007). The analysis of data helps to structure the production of the final dissertation.

The data was analysed through a grounded theory approach to generate a framework for understanding management of the wetland and interests of stakeholders in the process of conserving wetland resources (Dick, 2002). This framework is developed to inform capacity building initiatives in support of wetland projects. Grounded theory method consists of systematic inductive guidelines for collecting and analysing data to build a theoretical framework that explains patterns and issues emerging from the collected data (Charmaz, 2000). The results of this process are reported in the form of analytic statements that reflect theory developed on community-based wetland management in this study. After each data generation key issues were noted and different sources were constantly compared according to emerging categories.

3.6 Data display

The data was presented by arranging it into Tables, graphs and Figures. The basic tool that was used for displaying data is the Microsoft Excel spread-sheet. Where it was required for further clarification, bar graphs were generated from the data to illustrate links between the data elements.

3.7 Limitations of the methodology

Water quality and toxicity indexes were only assessed by employing the Wetland Index of Habitat Integrity model. The study did not collect water samples for in-depth analysis in a laboratory because of budgetary constraints.

The research used questionnaires even though they are regarded as a poor method in detecting how truthful are the respondents in answering the questions (Leedy, 1989). In order to eliminate biasness, the researcher compared the respondent's answers to the information gathered during observations and documentation analysed.

3.8 Conclusion

This chapter provided an overview of the study's mode of inquiry and the associated techniques used for data generation, recording and analysis. An in-depth discussion and description of the study area provided the background for the study and determined the type of instruments to be used in the data gathering process. The next chapter provides the results for the research in terms of the management of the Zone 3 wetland.

CHAPTER 4 – RESULTS

4.1 Introduction

This chapter seeks to present the results of the study. It provides an analysis of the data to highlight research findings. Subsequent to the to the data gathering, classification, ordering and narrative presentation of the data was undertaken.

4.2 Data presentation

The data presented in this chapter was obtained through the assessment of the wetland and through questionnaire survey.

4.3 Wetland health assessment

For the purposes of this study, wetland health is defined as a measure of the deviation of a wetland from its natural or reference condition (Macfarlane *et al*., 2009). The assessment therefore aimed to ascertain the current condition of the wetland.

Photographs on site were taken to provide visual indications of the conditions at the time of assessment. Factors which were noted in the site visual assessments included the following:

- Stream morphology;
- Erosion potential;
- Signs of physical disturbance of the area,
- Signs of impact related to water quality, and
- Other life forms reliant on aquatic ecosystems.

4.3.1 Wetland classification

The wetland system of the study area falls within a valley floor landscape unit and contains a channelled valley bottom wetland feature (Figure 6). Characteristics of the channelled valley-bottom wetlands are outlined in Table 1.

4.3.2 Wetland delineation

Google Earth images indicate that the wetland occurs naturally in the study area. Initial image that was taken in 1938 shows the presence of the wetland (Figure 4). Other Google Earth images dating from year 2004-2014 were also studied. All images clearly indicate the presence of the wetland.

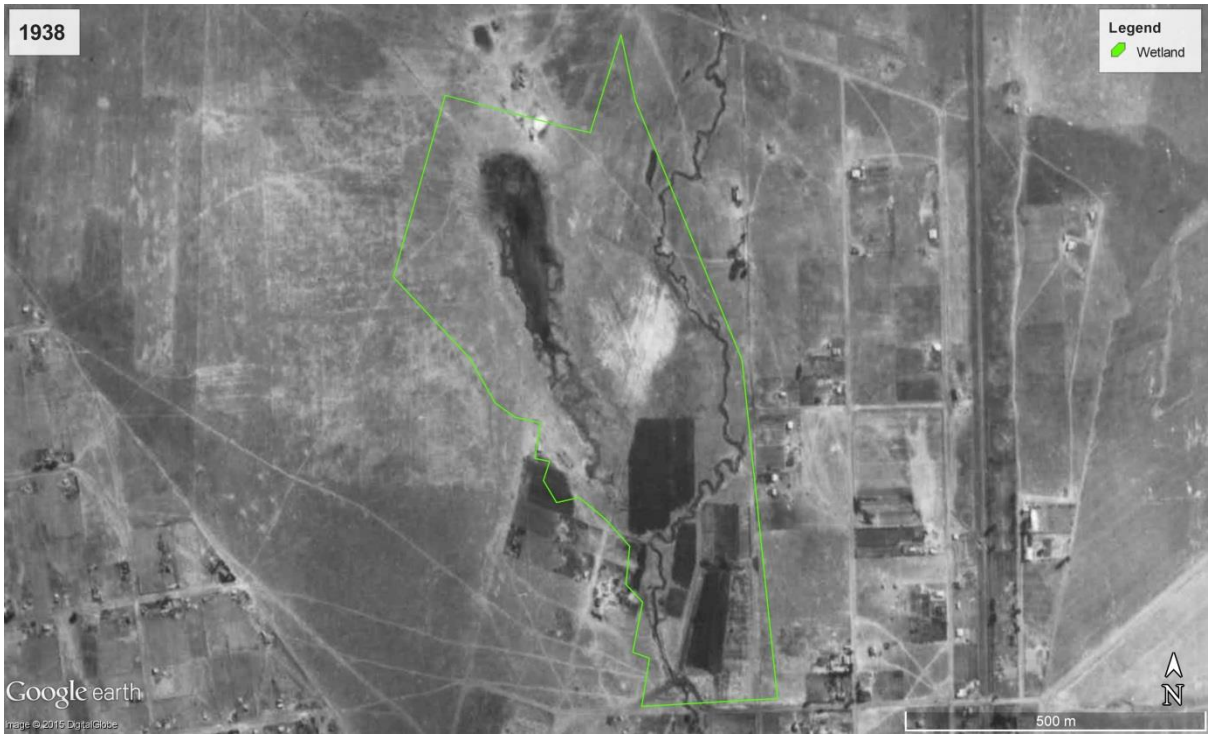

Figure 4: Google Earth image of the study, taken in 1938

Subsequent to the desktop assessment, a field survey was conducted to confirm and identify wet areas on site. The survey was also aimed at delineating the wetland. The field survey results indicate that the wetland is mostly wet on the western part of the wetland (Figure 5), with drainage channels reflecting signs of saturation.

Figure 5: Desktop delineation of possible wetland system occurring on the study site

Figure 6: Wetland buffer zones delineation (32 meter)

After investigating the findings of the wetland health, a suitable buffer zone was considered for the wetland feature (Figure 6). A 32 meter buffer zone in terms of NEMA (1998) and NWA (1998) is prescribed for areas which fall within the "urban edge". The buffer implies that all activities within the system should be kept to a minimum. This also means that, there should be no unnecessary activities in the wetland that could affect the wetland health. This is deemed sufficient to maintain the Present Ecological State of the wetland. The results indicate that the agricultural activities by CBNRM projects are in the 32 meter buffer zone. The three CBNRM that utilise the wetland are: Phaphamang Environmental Project, Setsing Women's Project and Wetland Integrated Project (Figure 7). All three projects undertake their activities on the edge of the wetland in the 32 meter buffer zone (Figure 7).

Figure 7: Location of CBNRM projects in relation to the wetland

4.3.3 Hydrology

The composition (hydrology, geomorphology and vegetative aspects) is impacted by anthropogenic activities present, which include: housing developments, disposal of building and household rubble, transformation of the wetland for agriculture, input of sewage and other associated pollutants into the wetland. The above-mentioned anthropogenic activities

contribute to the alteration of the wetland hydrological system. The hydrology Present Ecological State is based on the catchment and the wetland effects. According to the Wetland-IHI, the hydrology of the wetland falls under PES category D (Table 4 and Appendix 1 A). The results indicate that the hydrology of the wetland is **"seriously modified"** (Table 5). The hydrology of the system is altered due to the existing development in the vicinity of the wetland. The majority of the development is within a 32 meter buffer zone as well as in the wetland itself. Water flow is restricted and channelled at the Southern side of the wetland due to the crossing of the road.

4.3.4 Geomorphology

The results indicate that sedimentation and erosion are moderate. There is however moderate erosion on the Rietspruit stream, which runs on the Northern side of the wetland, parallel to Sebe Street (Figure 6). A gully on the corner of Sebe and Union streets is visible. This is where the channel deepens and widens the culverts constructed for rehabilitation. According to the Wetland-IHI, the geomorphology of the wetland falls under PES category C (Appendix 1 B). The score indicates that the wetland is **"moderately modified"** (Table 6).

4.3.5 Wetland vegetative characteristics

According to DWAF (2005), vegetation is the primary indicator, which must be present under normal circumstances. Vegetation distribution within wetlands is very closely linked to the flooding or saturation regime (Sivest, 2012). The most commonly occurring vegetative form in the wetland is the *Cyprus* species. The species is mostly found on the left-hand bank of the site. Other aquatic plants (hydrophytes) found in the wetland; are water-loving grasses (*Imperata cylindrica*), reeds (*Phragmites* species.) and bulrush (*Typha capensis*).

4.3.6 Vegetation alteration

Vegetation alteration from the impacts of land use activities within the wetland was assessed. The Wetland-IHI results indicate that the wetland vegetation falls under PES Category D (Appendix 1 C). The category indicates that the vegetation is **"moderately modified".** The

assessment of the vegetation indicates that the vegetation is impacted by agricultural activities, cattle grazing and trampling in some sections of the wetland.

4.3.7 Water quality

In order to establish water quality of the wetland, the Wetland-IHI results obtained from research conducted by the Department of Water Affairs and Forestry (DWAF, 2009) was used. The PES of the water quality is a D category, largely due to extensive agricultural activities with highly elevated nutrients and salts. Two of the major impacts dominating the Vaal Catchment are water quality impacts and changes in the flow regime (DWAF, 2009). The prominent impacts on the water quality is the changes in the flow regime range from too little flow, but the most severe impacts are from too much flow and changes in seasonality which mainly relate to transfers, releases, irrigation return flows, mining and urban runoff (DWAF, 2009).

Given that a portion of the catchment in which the wetland is located has been used for agricultural activities, it is possible that there has been a change in the quality of water reaching the wetlands. The state of the water quality for Rietspruit of the Upper Vaal catchment is severely impacted (DWAF, 2009). The water quality is impacted on by point discharges from industries, wastewater treatment works, mine dewatering, irrigation return flows and diffuse sources such as runoff from mining and industrial complexes, agriculture and urban areas (DWAF, 2004). It can therefore be concluded that water quality of the wetland is an unacceptable state, mitigation measures have to be developed to improve the quality of water.

4.3.8 Other impacts on the wetland

The aspect of the impact on the wetland was to assess the wetland's functionality and health. The impacts had over time cumulated and compounded and lead to the transformation of the riparian areas. The drainage channels and riparian areas proved to be impacted by human activities. The biggest concern on the study site is the threat that the sewage poses to the pollution of the system. Sewage is a possible pollutant by pathogens and increase heavy metals as well as pollution by particle matter in the aquatic system. The increased flows

associated by the treated water release is also of concern as it can create erosion in the system and associated sediment pollution due to the increased flows scouring the system.

Community infrastructures such as the football pitch and kids playing areas have a physical effect on the wetland, transforming or causing loss of wetland habitat that importantly can result in an impact on wetland state and functionality. The delineation of the wetland indicates that the school, football pitch and other houses are constructed in a wetland (Figure 8). Results also indicate that houses on the Western side of the wetland were built within the 32 meter buffer zone.

Figure 8: Impacts in the wetland

4.3.9 Determining the recommended PES Category using the Wetland-IHI

The Wetland-IHI assessment was undertaken in which four aspects, namely hydrology, geomorphology, water quality and vegetation alteration were assessed to ascertain the overall "health" of the wetland feature. It was used to determine the PES status of the wetland. Impacts related to geomorphology and water quality are considered significant and therefore

the wetland feature attained scores reflecting a PES category D (**largely modified**) (Table 4 and Table 5). The results indicate that the wetland is a largely modified ecosystem, indicating that a large loss of natural habitat, biota and basic ecosystem functions has occurred.

Table 4: Results and attributes used in the calculation of the PES of the wetland feature

OVERALL PRESENT ECOLOGICAL STATE (PES) SCORE					
	Ranking	**Weighting**	**Score**		**PES Category**
DRIVING PROCESSES:		**100**	**2.1**	***Confidence Rating***	
Hydrology	1	100	2.5	*2.9*	**D**
Geomorphology	2	80	1.6	*3.3*	**C**
Water Quality	3	30	2.4	*1.7*	**D**
WETLAND LANDUSE ACTIVITIES:		**80**	**2.3**	***3.2***	
Vegetation Alteration Score	1	100	1.9	*3.2*	**D**
Weighting needs to consider the sensitivity of the type of wetland					
(e.g.: nutrient poor wetlands will be more sensitive to nutrient loading)					
OVERALL SCORE:			**2.1**	***Confidence Rating***	
	PES %		**43.6**		
	PES Category:		**D**	***1.4***	

Table 5: Determination of the Ecological Category (SANBI, 2009)

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.
B	80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

4.3.10 Wetland sensitivity

According to the Gauteng Conservation Plan V3 1.0.12 (GDARD, 2011), the wetland is an Ecological Support Area (ESA) (Figure 10). The ESA's are supporting zones or areas which must be safeguarded as they are needed to prevent degradation of Critical Biodiversity Areas (CBA's) and formal Protected Areas (CAPE, 2010). The C-plan indicates that the upper part of Rietspuit River is an important area (Figure 9).

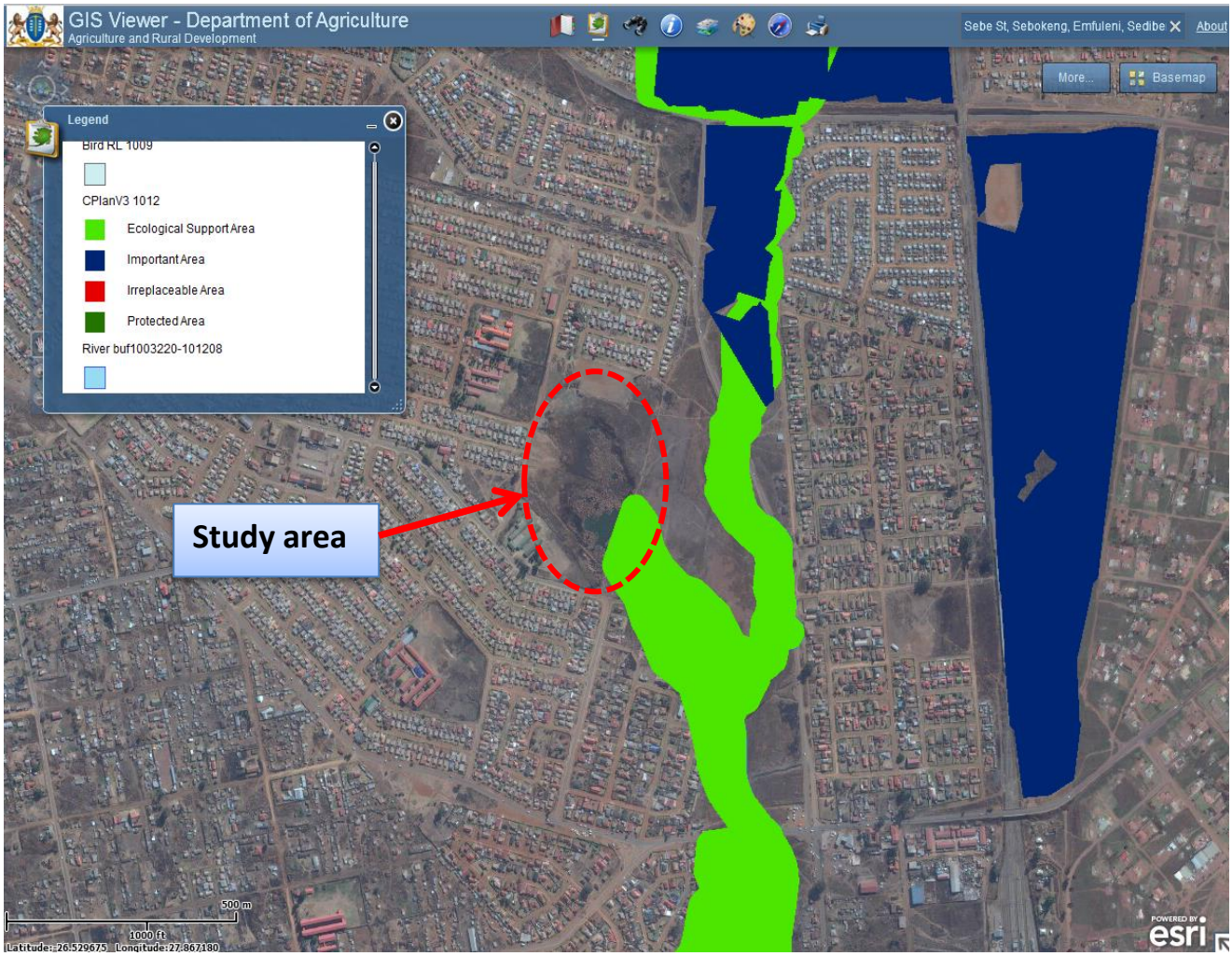

Figure 9: Sensitivity map of the study area (Sourced from GDARD C-plan V3 3.1.0.12).

4.4 Management of the wetland

The participation of the community in the management of the wetland was assessed through a questionnaire survey. Questionnaire responses are analysed below.

4.4.1 Questionnaire response analysis

Of the 64 questionnaires distributed to the community for completion, 52 responses were received, making the response rate to be 81.2% (Table 6). The total number of the responses from the age group ***21 – 35*** is 24, contributing 46%. It can be noted that the majority of the responses were received from this age group. The age group of ***18-20***, contributed 17

responses, which is 33%. The responses from age group of ***36 and above*** was 11, contributing 21% (Table 6).

Table 6: Analysis of the community responses

	Age groups	Number of respondents	Response percentage
1	18-20	17	46%
2	21-35	24	33%
3	36 and above	11	21%
	Total number of respondents	**52**	**100%**

In terms of the sex ratio of the sample population, it is notable that the majority of the respondents are females (n = 37), making up 71% of the respondents sampled, whilst the male respondents (n = 15) constituted the remaining 29%.

4.4.2 Educational background

Of the 52 respondents, 16 indicated that they have completed a degree or a diploma; 22 respondents completed Grade 12; 10 respondents completed Grade Eight and four respondents indicated that they did not achieve any of the above listed Grades (Figure 10).

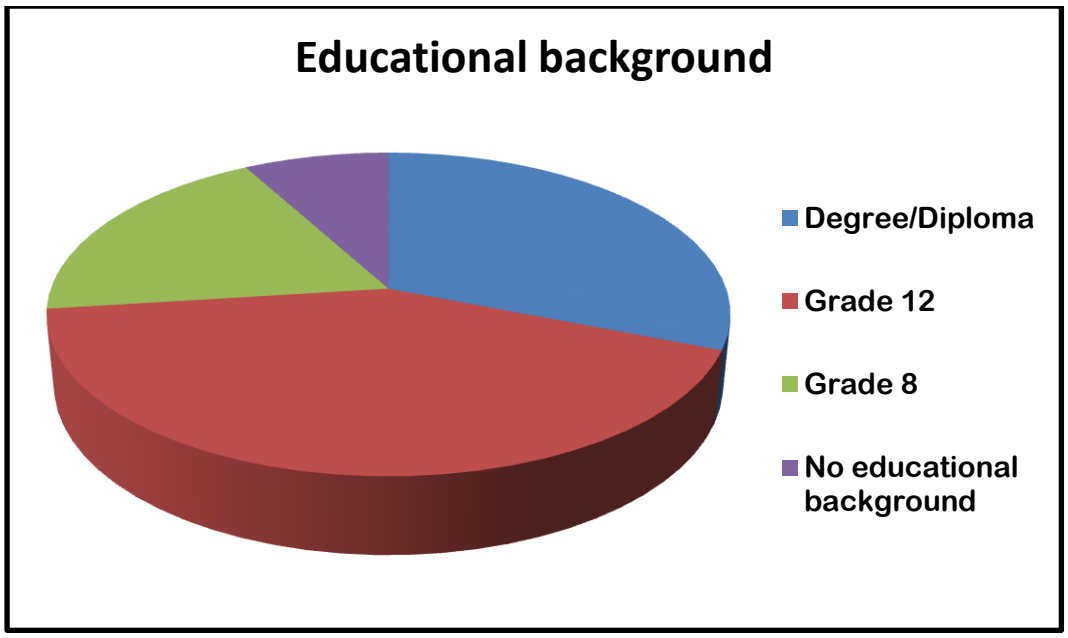

Figure 10: Community educational background

4.4.3 The socio-economic description of the study population

According to Statistics South Africa (2001) poverty is defined as the number of people living in households with an income less than the poverty income line. Poverty income varies according to the household size – the larger the household, the larger the income required to keep its members out of poverty. According to the 2006-2011 prices, the poverty line reported by Statistics South Africa (2008) indicate that poverty income levels ranged from R551 for one individual to R2 349 for a household of eight members or more. According to the study, 14 respondents indicated that their monthly income is between **R551- R1 500** and the percentage is 27. Respondents with income of between **R1 501 – R2 349** are 17 with a percentage of 33. Respondents with income of **R2 350 and above** are 21 with a percentage of 40 (Figure 11).

The statistics support the view that almost half of the people living in the study area earned below the breadline. Analysis of all the community earnings indicates that the socio-economic living condition of the community of Zone 3 is relatively low (Figure 11).

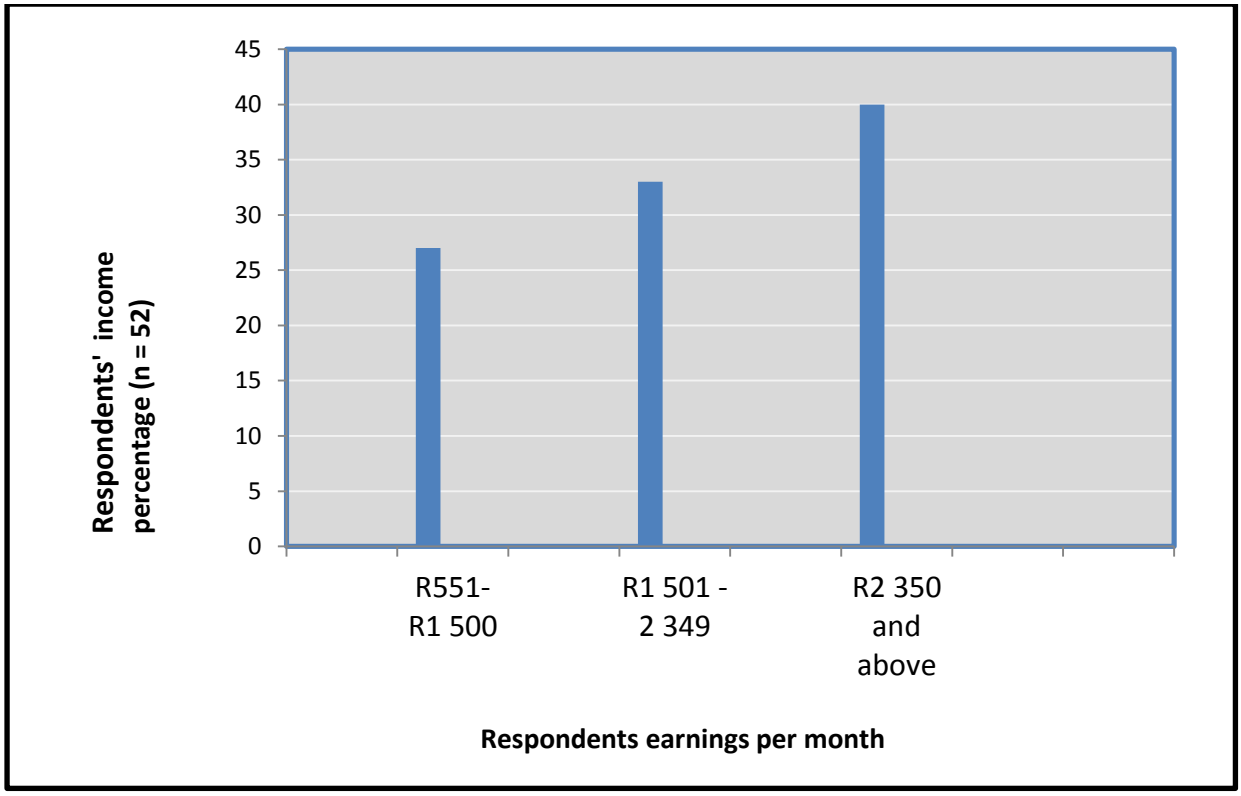

Figure 11: Summary of respondents' earnings per month

4.4.4 Wetland value

Questions 6 aimed to understand if the community appreciates (values) the wetland. Out of 52 respondents, 34 responded **"Yes",** indicating that the community values the wetland, and 18 responded **"No",** indicating that the community does not value the wetland (Figure 12). The percentages are 65 and 35, respectively.

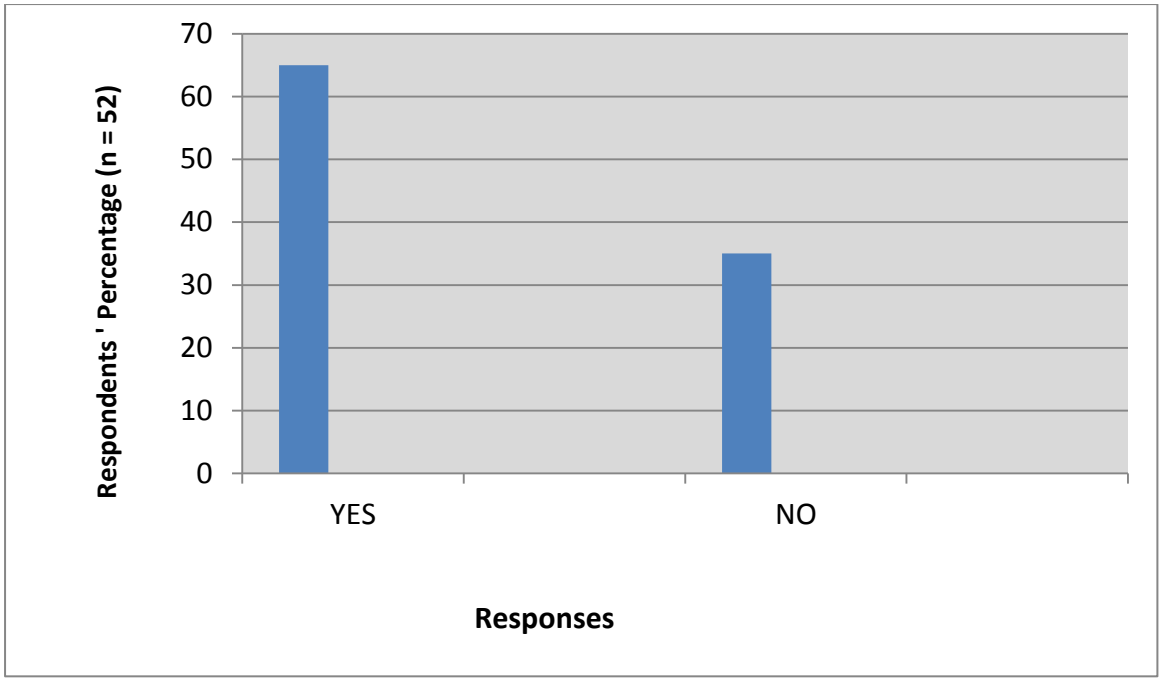

Figure 12: Response percentage

Furthermore, question 6 probed respondents to rate how much the community values the wetland. The rating was 1 to 5. 1 represents low and 5 represents high. Results of the assessment of the how much the community values the wetland is as follows: Rating 1: n = 9 respondents; Rating 2: n = 6 respondents; Rating 3 n = 18 respondents; Rating 4 n = 12 respondents; and Raring 5 n = 7 respondents (Figure 13).

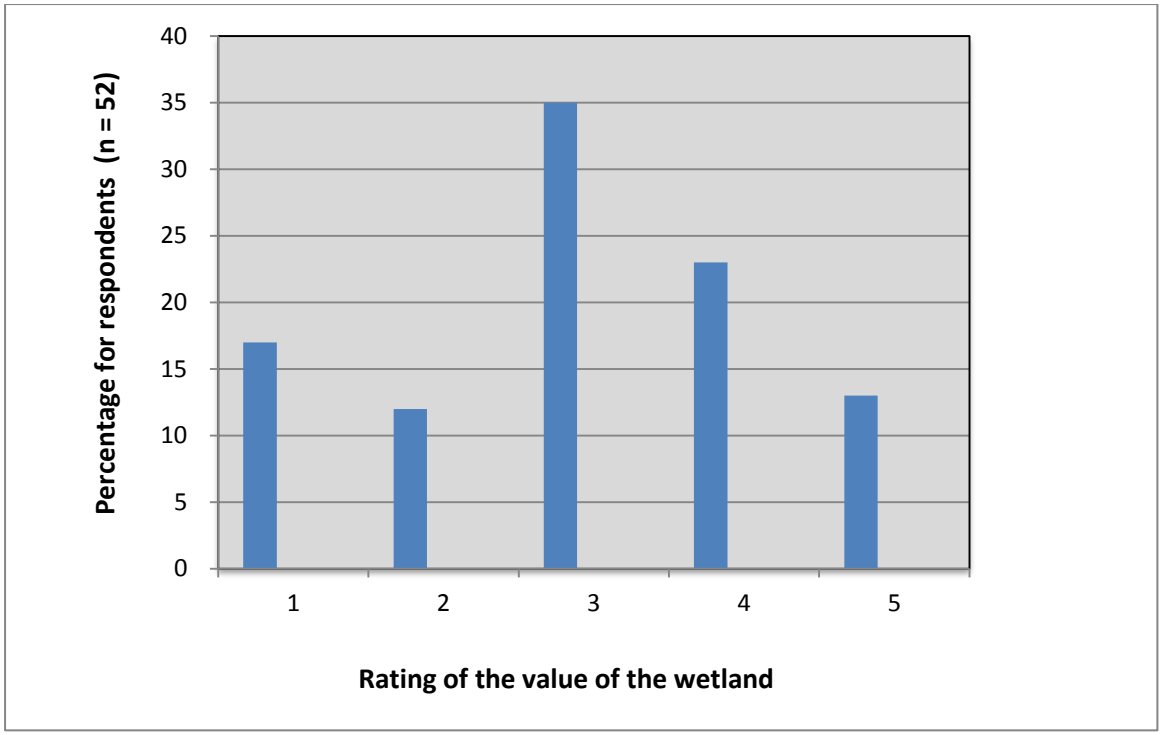

Figure 13: Rating of the value of the wetland by the community

Question 7 aimed to understand how many community members were working for community projects. Thirty five respondents responded "Yes", meaning they are working for the CBNRM projects and seventeen indicated "No", meaning they were not working for the projects.

Question 8 probed respondents to indicate if they were satisfied with working for CBNRM projects. Out of 35 respondents, 11 indicated "Yes" and 24 indicated "No" (Figure 14). The results show that the majority is not satisfied with working for CBNRM projects.

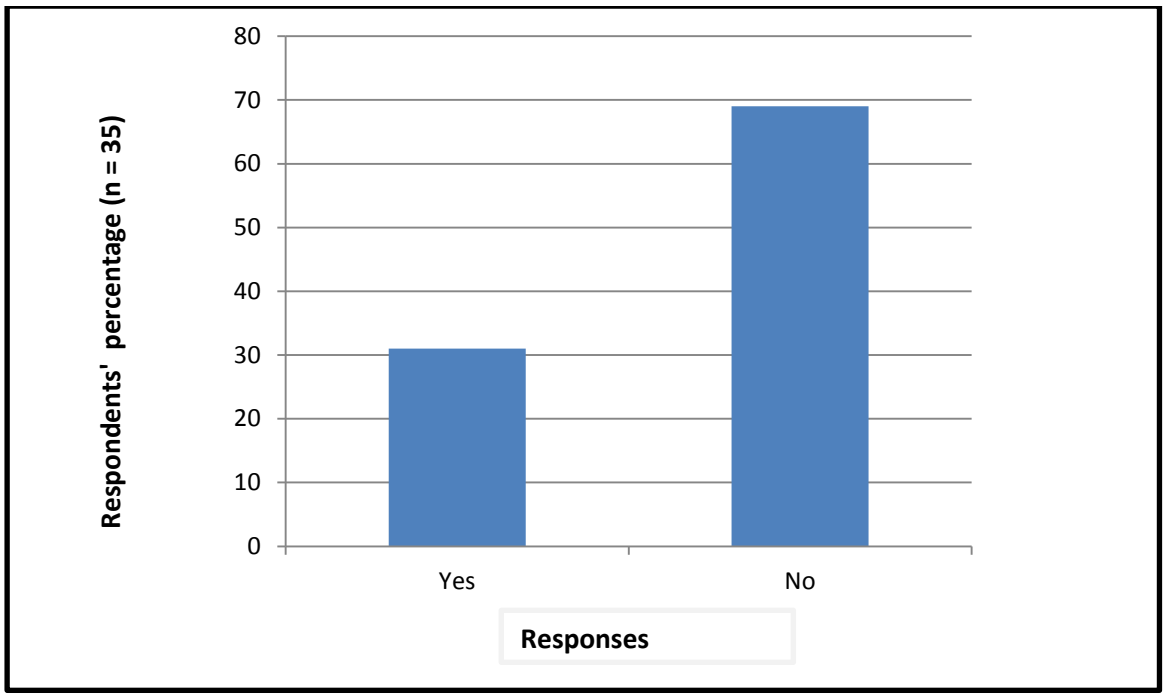

Figure 14: Respondents percentage

4.4.5 Community perception of the wetland

Question 9 seeks to ascertain if the respondents have witnessed any environmental problems. Out of 52 respondents, 41 indicated **"Yes",** which means that they had witnessed environmental problems in the wetland and 11 indicated **"No"** (Figure 15). It was to get respondents indicating that they have not witnessed any pollution, since there is a lot of pollution evidence in and around the wetland. Nevertheless, it can be said that some members of the community disregard the wetland and do not perceive it as a living ecosystem.

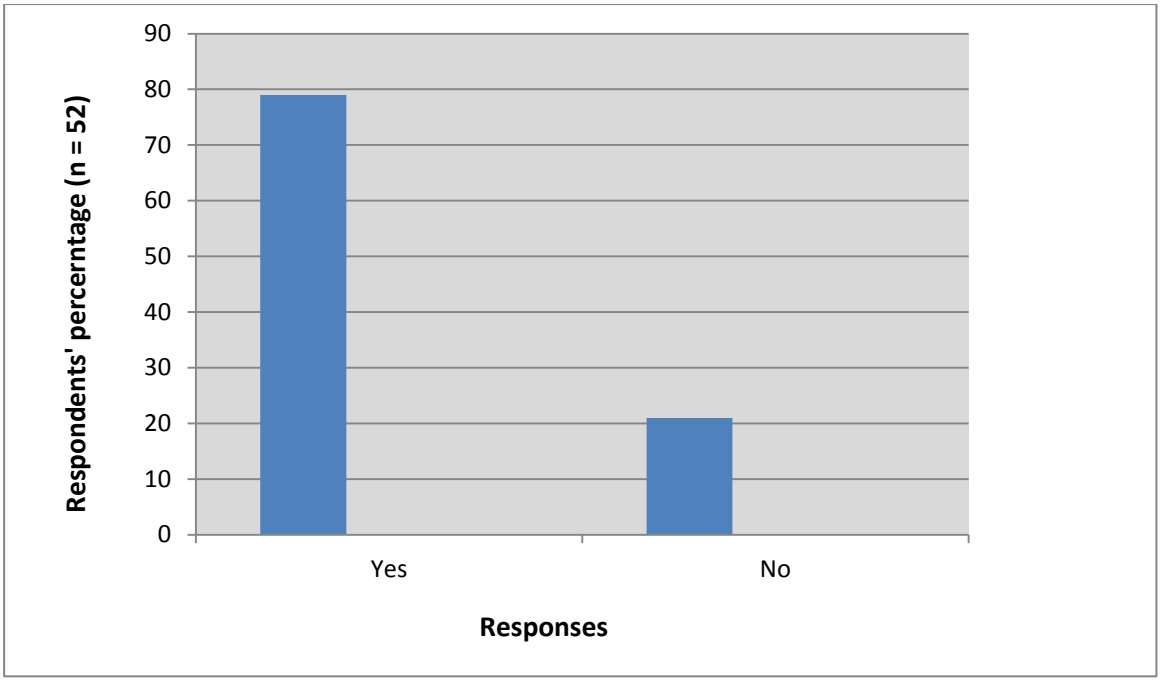

Figure 15: Responses percentage in relation to environmental problems

According to the researcher's assessment of the environmental problems, the following challenges were observed: dumping, water pollution, vegetation loss and soil erosion. The community was probed to rate the levels of the above-mentioned issues. Out of 41 responses, 18 indicated dumping, 13 indicated water pollution; 6 indicated loss of vegetation and 4 indicated soil erosion (Figure 16).

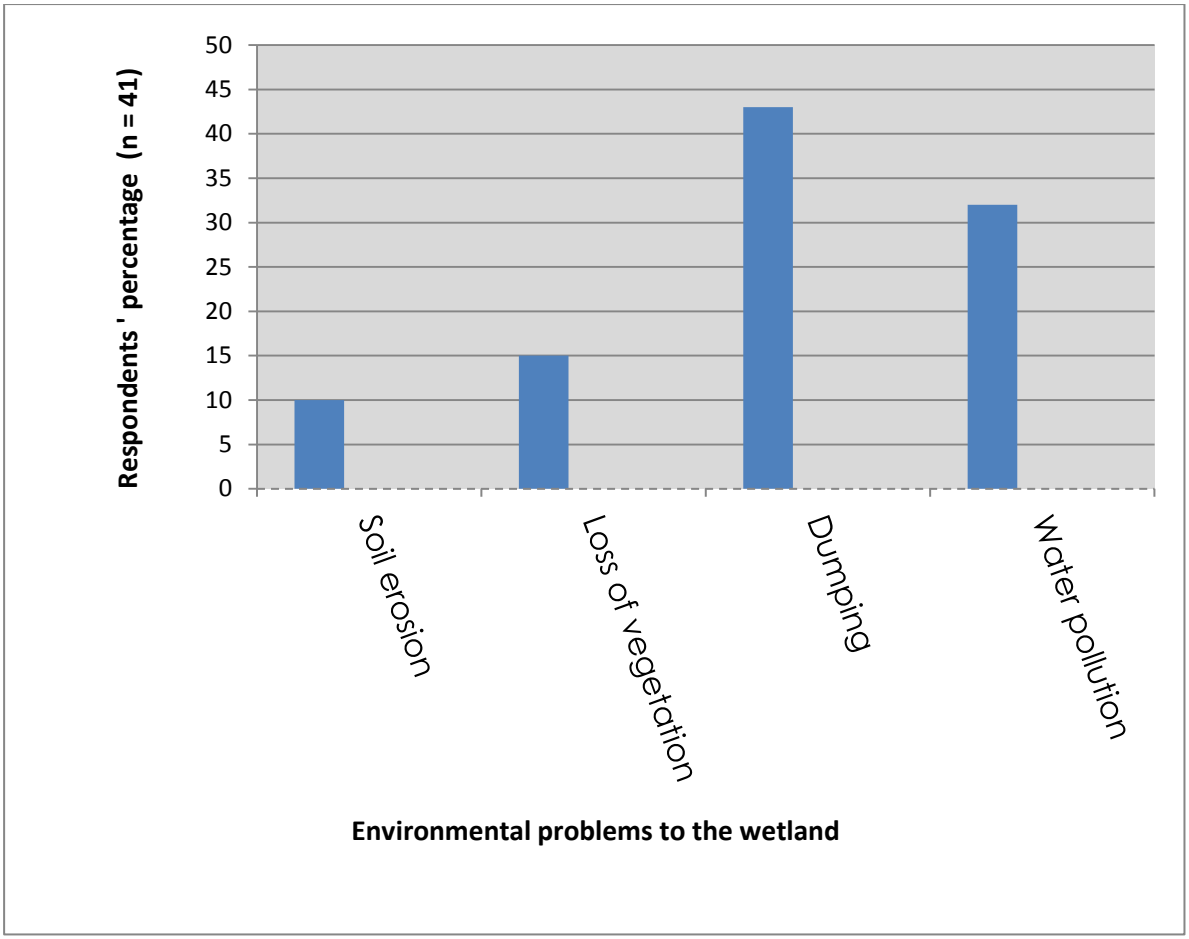

Figure 16: Rating of the impacts on the wetland

4.4.6 Wetland management by the community

Question 10 aimed to understand if the community contributes to the management of the wetland. Out of 52 respondents, 43 indicated "**Yes**" and nine responded by saying "**No**" (Figure 17). The majority of the respondents indicated that the community takes part in the management of the wetland.

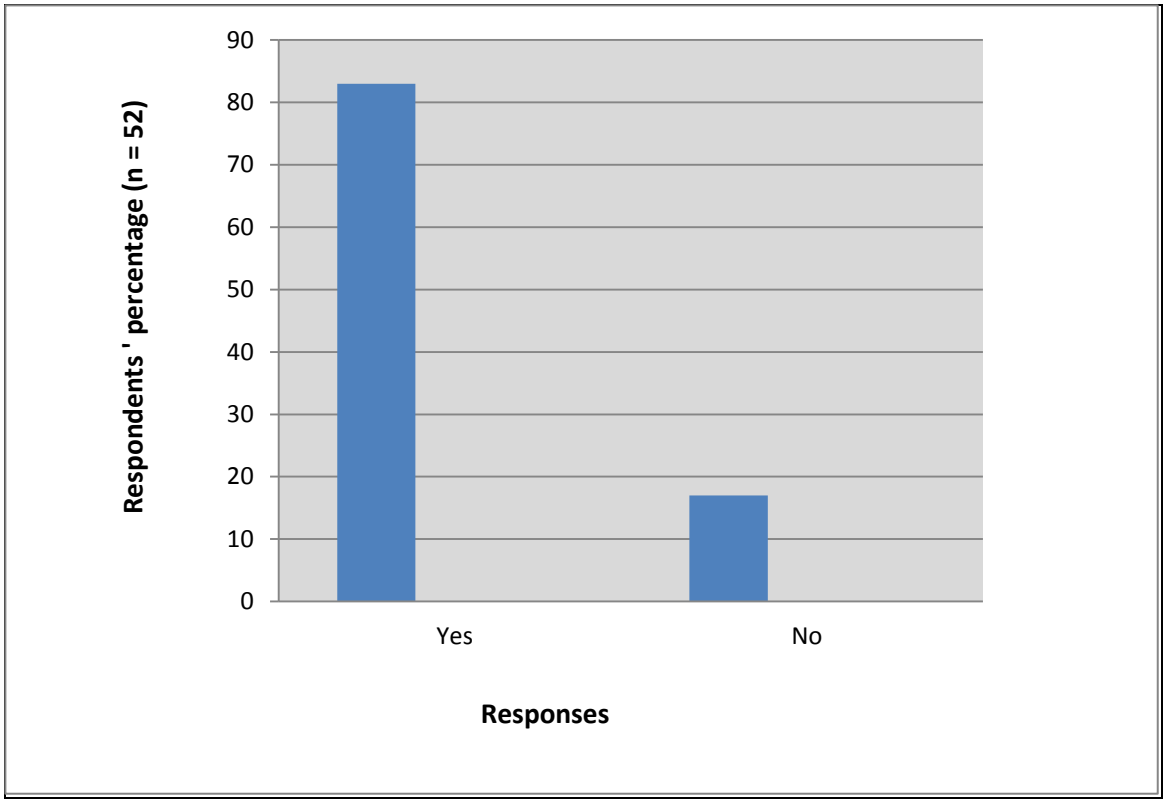

Figure 17: Responses to the management of the wetland by the community

Question 11 seeks to understand how the community contributes to the management of the wetland. The responses are summarised as follows:

- The community should be provided with more reliable funding for CBNRM projects.
- Interactions between government and the community must be improved.
- The community should guard the wetland from illegal dumping and other illegal activities. It further recommends that perpetrators should be prosecuted.
- The community should lead in the management of the wetland, not government.
- Safety around the wetland must be improved.

4.5 Analysis of archived material

The assessment of archived material was obtained from CBNRM projects. The material included minutes of meetings and attendance registers and project operational manuals.

4.5.1 Meetings

During the observation period that the researcher undertook, it was observed that one of the avenues that the CBNRM projects interact with each other is through Project Steering Committee (PSC) meetings. The PSC meetings are convened quarterly by each project individually. Each PSC meeting is attended by government representatives (National, Provincial and Local) or funders and members of the CBRNM projects. All projects in this regard are funded by government. The study established that PSC's were the most viable platform to raise project management issues. The results however indicate that the attendance by government is low (Table 7).

Table 7: Attendance frequency of external partners to PSC meetings observed over a one year period (Statistics obtained from meetings' attendance registers)

PROJECT NAME	DPW	GDARD	SDM	ELM	RWF
Phaphamang Environmental Organization	50%	50%	50%	0	25%
Setsing Women's Project	0	50%	50%	0	0
Integrated Wetlands Project	50%	50%	50%	0	0

The level of participation in decision making was assessed through the CBNRM projects. The PSC meetings are used to discuss management of the wetland and progress of CBNRM projects. Minutes of the meetings investigated indicate that there is little discussed regarding management of the wetland, but the emphasis is on the progress of the projects, especially financial management.

4.5.2 Communication

The results indicate that the level of communication between CBNRM projects is poor. By communication, it is meant the mutual relationships between the three projects under study in terms of sharing ideas and pursuance of development. The community seem to live in isolation from one another and the wider wetland society. The findings of this research indicate that these communities have a very poor perception of the problems encountered by other communities. Poor communication and interaction could be due to their possible disinterest in others' challenges.

The results also indicate that communication interactions are merely between a particular CBNRM project and the authorities (government as a funding agent). The mode of communication is mainly through meetings, letters and telephonic discussions. The interaction amongst the three groups is when government convenes a mass meeting involving all projects or when there is an awareness campaign. Government showed little desire to drive the processes of integrating the three CBNRM projects.

4.5.3 Community capacity building and environmental awareness campaigns

The researcher undertook to understand environmental awareness campaigns, as he is of the view that campaigns would assist in the management of the wetland. The results indicate that awareness campaigns are undertaken in *ad hoc* basis, by any organization that has resources to do so. During the researcher period, only two environmental awareness campaigns were undertaken. One environmental awareness campaign was in a form of an event, which was to commemorate Environmental Day. The event was coordinated by Rand Water. The event was held at the Zone 3 wetland. It was attended by the Zone 3 community, CBNRM project members and government representations. The aim of the event was outline the importance of the environment and how the community can participate in the management. The campaign also aimed at educating the community about good conservation practices and implementing them at a homestead level. This included recycling; composting and appropriate disposal of waste.

The other environmental awareness campaign that was undertaken by Phaphamang Environmental Organisation was a "door to door" homestead visits. The campaign was undertaken by the project members over a period of three days. It involved distribution of environmental pamphlets and raising awareness on the state of the environment and the wetland. Phaphamang Environmental Project reported that 132 households were visited within a period of three days and 323 environmental pamphlets were distributed. Based on the above, the impact was positive. The researcher is however of the view that the impact was minimal and consistent awareness campaigns can be undertaken to change people's mind-sets.

4.5.4 Partnerships

The results indicate that the community projects do not interact with each other, whereas they are in a very close proximity from one another. Results also indicate that partnerships forged by the local community are strictly with the funders (government). There is no indication of partnership with other wetland-users. From the Gauteng Wetland Forum (GWF) records, it is noted that representatives from Phaphamang Environmental Organisation sometimes attend the forum meetings. However, it could not be ascertained as to how much partnership was forged with the forum. Even though, the partnership might be in an infancy stage, the initiative is commendable as GWF can assist the organisation with technical advice in wetland management.

4.5.5 Conflict management

Since the CBNRM projects are located in the jurisdiction of ELM, the researcher expected that consultations of the municipality with the CBNRM groups should have been implemented by the Local Municipal Authority. Contrary, the results indicate that consultations for the Municipality are undertaken by Sedibeng District Municipality. This arrangement could be the reason why the community project is not receiving much support from the ELM. From the researcher's opinion, this might be the reason why the community projects are not included in the Integrated Development Plans (IDPs).

Another conflicting issue amongst the project members is the lack of tools for the community projects. The researcher noted that tools/implements for community projects are not adequate, and sometimes they are not appropriate for certain tasks. This results to the community projects to share tools. Sharing of tools exposes the projects to conflicts as the tools are not equally shared amongst the projects and some projects are failing to return them to others on agreed time frames.

4.5.6 Community and government mandates

The responsibilities of all stakeholders are illustrated in Table 8. The study observed that stakeholders are not performing their duties optimally. The Gauteng of Agriculture and Rural Development, Sedibeng District Municipality and Emfuleni Local Municipality do not show leadership regarding the development of procedures for cooperative governance. Capacity building for the stakeholders is conducted in an *ad hoc* manner and it is having little impact to the participants. The researcher noted government organised training sessions for project members on the government's sole discretion. The training sessions are not adequate in equipping the community to manage community projects by themselves.

Table 8: Summary of the responsibilities of government and communities in wetland management

	TASK	RESPONSIBILITY
1	Develop procedures for co-operative governance	GDARD, EPWP and SDM
2	Build capacity and understanding of wetland functioning and importance	GDARD, EPWP and SDM
3	Initiate wetland assessment and wetland management and rehabilitation programmes	GDARD, EPWP, SDM and Community
4	Lobby key national and provincial decision makers	GDARD, EPWP and SDM
5	Facilitate awareness programmes and wide participation of the community	GDARD, EPWP, SDM and Community
6	Provide recognition of the community projects for conserving significant natural resources	GDARD, EPWP and SDM
7	Provide incentives for conservation of natural resources	GDARD, EPWP and SDM
8	Establish the Catchment management forums representing the full range of interests in the Catchment	GDARD, EPWP, SDM and Community
9	Facilitation of improved co-operation among community members and enhanced security of natural resources	GDARD, EPWP, SDM and Community
10	Provide resources for wetland rehabilitation	GDARD, EPWP and SDM
11	Facilitate provision of jobs through natural resource management and capacitate individuals involved	GDARD, EPWP and SDM

4.5.7 Implementation of environmental management policies

The study established that implementation of environmental management policies is not a priority for the community. For instance, the National Water Act (1998) stipulates that abstraction of water from a watercourse must have a Water Use Licence (WUL). The WUL is issued by the Department of Water Affairs. During the study, a 15 meter pipe with a diameter of 45 centimetre was observed abstracting water from the wetland. The pipe is used by Phaphamang Environmental Organization in diverting water from the wetland.

Furthermore, the community infrastructure such as the school, soccer field and houses are built within the wetland and its buffer (Figure 7). This activity is in contravention of GDARD's policy. The policy requires that any development should not infringe to the 32 metre buffer zone of a wetland.

4.5.8 Governance

Results indicate that there is no cohesion or governance structure by the community and other agencies having interest in the wetland. Due to the lack of cooperative governance within the community, lobbying of other key national and decision makers has not been explored. This could only be achieved once the community projects have formed themselves in a structured and recognised entity.

4.6 Conclusion

This chapter presented the results of the wetland assessment, questionnaire analysis and level of participation of the community in the wetland. The next chapter will focus on the analysis of data and recommendations with regards to communal wetland management.

CHAPTER 5 - DISCUSSIONS

5.1 Introduction

The study was set to ascertain the preliminary wetland health and to investigate the level of participation by the local community in the management of the Zone 3 wetland. The study aimed to propose measures in improving the wetland health and participation of the local community. This chapter presents discussions for the data outlined in chapter four. The data interpretation was necessary to justify the results and ensure finality.

5.2 The wetland

5.2.1 The wetland's functionality

The results indicate that the wetland is a channelled valley bottom wetland. A channelled valley bottom wetland is characterised by a flat valley-bottom wetland area with a channel running through it (SANBI, 2009). The wetland also has a depression on the Southern side of Sebe street. The filed survey results indicate that the wetland is wet on the western part of the wetland with drainage channels reflecting signs of saturation.

A healthy wetland ecosystem can be defined as a wetland, including all of its biological, chemical and physical parameters and their interactions that are providing ecological and economic functions (Mitsch and Gosselink, 2000). The results indicate that the study area is indeed a wetland that is worth conserving. Although it is impacted upon by a number of threats, mentioned in Chapter four, it is still a viable wetland system that serves some wetland functions. For example, it forms part of the Rietspruit wetland system that provides connection with the Elsburgspruit wetland system. The study also indicates that the wetland under study is a channelled valley bottom. According to Kotze, *et al.* (2005), channelled valley bottom wetlands often resemble floodplain. However, these wetlands differ in characteristics by possessing less active sediment deposition and are void of oxbows and other floodplain features such as natural leeves and meander scrolls (Kotze, *et al.,* 2005). Channelled valley bottom wetlands tend to be narrower and have somewhat steeper gradients

and the contribution from lateral groundwater input relative to the main stream flow is generally greater (Kotze, *et al.*, 2005).

In the context of the physical transformation of the wetland by a development such as the school and the football pitch, it is important to note that the impact is likely to not only be limited to the wetland itself, but to a much wider area, especially downstream of the wetland. This development could impact on the hydrology in terms on the flow and the quantities of water down-stream.

5.2.2 Hydrology

The disposal of rubble and infilling in the wetland clearly impacted on the hydrological regime of the system and the quality of water. According to Kotze and Breen (2000), infilling generally has a very high and permanent impact on wetland functioning. Water flow patterns in the wetland are altered and the natural vegetation is lost. Rietspruit and Klip Rivers' water quality state of this portion of the Upper Vaal catchment is severely impacted and improvements in present state cannot occur without addressing water quality related problems, e.g. through implementation of the Integrated Water Quality Management Plan set up for the Vaal (DWAF, 2009).

Damming of the lower part of the wetland for rehabilitation purposes may alter the hydrology of the surface water feature by draining the wetland, subsequently increasing the time water takes to pass the wetland. The increase of velocity of water can induce erosion in the wetland. It is recommended that, rehabilitation activities undertaken by the community should be completed within a very short period of time to reduce soil erosion and siltation to the wetland. Once rehabilitation activities take extended period of time, chances of erosion increase dramatically.

5.2.3 Vegetation alteration

The destruction of riparian wetland habitat and vegetation may impact on the alteration of the hydrological regime. The study indicates that the wetland vegetation loss is mainly due to the invasion of the CBNRM projects to the vegetated areas of the wetland. These projects require extensive soil preparation for planting garden produce required which is a necessity for the

area to be denuded of wetland vegetation. This requirement results in the loss of vegetation through soil erosion, thereby causing siltation downstream. The wetland vegetation is also diminishing due to dumping of domestic garbage such as plastics and concrete materials to the wetland site. The alteration of the hydrology of surface water feature can alter the vegetative composition of a wetland, by allowing pioneer non-wetland plant species to establish themselves in an area where the wetland has been channelised and the water table has been lowered, thus desiccating the wetland (SSI, 2012).

5.2.4 Water quality and quantity

The results indicate that water quality of the wetland is seriously impacted. The impact on the water quality is linked to the physical disturbance of the wetland areas as it affects basic habitat function and ecosystem services such as surface flow attenuation (water quantity) and surface flow filtration (water quality risk of surface water / groundwater pollution). It is therefore imperative that management interventions are developed and implemented to improve water quality. It should be noted that management interventions should not only focus on the wetland itself, rather with the catchment as a whole.

5.2.5 Present Ecological State (PES) of the wetland

The results of the wetland assessment indicate that the PES state of the wetland is un-acceptable (largely modified), meaning that a large loss of natural habitat and biota and basic ecosystem functions has occurred. According to GDARD's C-Plan 3 (2011), the wetland is an Ecological Support Area. This means, the wetland is important for ecological processes and sustainability in the long term. Based on the state of the wetland, it is important to note that an appropriate management plan must be developed in order to propose mitigation measures.

5.3 Wetland management

One of the aims of the study in using the questionnaire was to ascertain the community's perception and its role in wetland management. The stakeholder analysis was conducted to determine how factors such as gender, age and the level of literacy influenced participation and influence to decision making processed. The study discovered that women dominated over males on the participation on project management. This dominance was due to the bigger number of women in all CBNRM projects and better level of literacy of women than men. The number of participants from the groups consistently varied as some project members joined and some left for better opportunities. This is however a concern as this affects the level of engagement by the community in decision making.

5.3.1 Community participation in the management of the wetland

The study established that participation of the community in the management of the wetland is low. International Institute for Environment and Development (IIED, 1994) argues that low participation of the community should be regarded as failure of the community projects. Community-based projects are dynamic and levels of participation and institutional relationships change over time. In the reality of field-based activities, projects do not always start with the level of full community participation desired by theory, but increased participation often develops as the project progresses, provided that outside agencies apply an adaptive management approach which is constantly aiming at promoting the maximum participation possible. In the context of Zone 3 wetland management, the community projects have been active for over five years, however, participation of the local community is not improving, and instead it is declining. According to Table 9, the typology of the community is in levels 2 and 4. The community is passively participating and more interested in participating for material incentives. It is important that the attitude of the community be changed so that it can move to the most desired levels (6 and 7), where by the community take control and take action independently of external institutions.

Table 9: Levels of participation (Source: Pretty, 2005)

	Typology	Characteristics
1	Manipulative participation	Participation is a pretense, with representatives in power who are unelected.
2	Passive participation	People participate by being told what to do, usually by external people. People's responses are not listened to.
3	Participation by consultation People	Participate by being asked questions, which do not have to be listened to, and external agents define problems, gather information and control analysis.
4	Participation for material incentives	Participate because labour is rewarded with food, cash or other incentive. People are not involved in the process of learning.
5	Functional participation	External agencies see participation as a means of lowering costs. People may be involved in decision making, but only after major decision are made by external agents
6	Interactive participation	People participate in joint analysis and the formation and strengthening of local institutions. Participation is a right. Multiple perspectives are sought. Communities begin to take control of local decisions
7	Self-mobilization	People take action independently of external institutions. Though they may seek the

	advice or help from external actors, they retain the control of decisions and resources. May or may not challenge existing power.

The wetland is either unmanaged ‘open access’ or certain areas are managed by community groups safeguarding their interests. The management of the wetland is ‘fragmented’ as it does not include the whole wetland system. Each CBNRM project focuses its efforts on the area of interest while excluding other areas. The groups do not even have adequate resources and skills for proper management. The protection measures employed by the community do not necessarily complement the wetland regulations and policies. The community does not prioritise compliance with the environmental policies as an urgent matter. It is recommended that government departments lead in promoting implementation of policies. The study indicates that all spheres of government do not take responsibility for leadership in the management of the wetland. The government departments are only interested on areas where they have infrastructure to protect, like sewage pipes. An integrated plan to manage the whole Rietspruit wetland system passing through Sebokeng must be developed to mitigate the degradation of the wetland.

5.3.2 Awareness about the wetland and its importance

There is minimal engagement of the local community projects with the community through awareness and outreach programmes. This is involves “door to door” campaigns and awareness at neighbouring schools. This exercise is not sufficient; a more coordinated awareness strategy needs to be developed. The responsibility lies with the community to promote and improve awareness with all stakeholders.

5.3.3 Community based natural resource projects

The community working in the wetland is a diverse entity with social divisions based on gender and livelihood needs. Each group has its own interests and needs. The benefits derived from the wetland were strictly shared amongst group members. Benefits derived from the projects are mostly produce from the gardens and the income derived from selling the

harvest. Accessing ecological benefits from wetland proved to be difficult as the community did not perceive the wetland as a living ecosystem. However educational programmes by the neighbouring school proved to be benefiting from the wetland in terms of wetland bird life.

According to Laban (1993), people will undertake natural resource management activities only when:

- They see clear tangible benefits (products, services or income);
- They have necessary competency (knowledge, technology);
- It is based on local indigenous knowledge;
- There is a guarantee of using products and services;
- There is unobstructed access, and property rights over resources; and
- Individuals' interests are backed by strong local organizations.

According to Zone 3 wetland management, many of the abovementioned areas could not be clearly determined. For instance, clear tangible results were not easily distinguishable as people would see results in terms of produce they obtained from gardens but ecological services derived from the wetland were not easily observed. The group members also lack necessary competency and knowledge of protecting natural resource management. Access to the natural resources was not guaranteed as the projects did not have property rights over the resources. The municipality and government remained the sole title holder of the land that was used by the local community with no chances of the community owning it. Local organization was very weak resulting to individuals' interests not backed by strong local organizations.

5.3.4 Institutional arrangements and sustainability of community projects

Communication within the wetland users and government agencies is a bigger threat in the sustainability of the projects. The community groups do not have platform to address its own issues affecting the sustainability of the projects. Although each project convened PSC meetings for discussing their issues, but there is no platform to discuss the issues collectively. All spheres of government are not 'visible' enough. Some pertinent issues are raised by the community, but most of them 'evaporate' before reaching the relevant decision makers in all spheres of government. This could be due to the inconsistency in engaging with community

projects and little commitment from government. During the study, most of the issues that were supposed to be addressed by the Local Authority were addressed by the District Municipality. It is clearly noticeable that there is a gap in terms of the responsibilities that should be undertaken by the two levels of the Municipal structures. According to Municipal Systems Act (Act 32 of 2000), Sedibeng District Municipality should be responsible for overseeing activities undertaken by Local Municipalities, while Emfuleni Local Municipality should be responsible for improving co-operation, mutual assistance and undertaking social and economic development and provision of resources. The community has to engage the District Municipality to release some of the duties to the Local Municipality.

The community does not have the required resources and skills to manage natural resources completely on its own. Co-management by all parties is however feasible, but there is gross failure in the integrated management by all agencies. This might be due to the lack of trust and confidence amongst parties. Government agencies should take charge in bringing all stakeholders together and strategizing together with the community groups at how to implement the co-management plan.

Results indicate that the wetland is in a poor condition. In order to restore the wetland's ecological integrity, an integrated approach has to be undertaken. More delays in developing the plan, the wetland will further degrade in an unacceptable manner and threatening to loose the corridor for aquatic species relying on Rietspruit wetland.

Management approaches need to be acknowledged, one of which is the bottom up approach, which is driven by a desire to resolve problems that are apparent within the community, such as local conflict over wetland use (Trisurat, 2006). The other is a top-down approach, in which national or provincial agency attempts to enlist community cooperation to attain the Ramsar or other national legislation objectives that the agency has perceived to be important, such as preserving national and global wetland values. These management approaches can be managed through improved dialogue between all role-players.

This study involved engaging with the CBNRM project members and the community neighbouring the wetland, through observations and analysis of archived material. Most of the participants seemed to be interested in the study and provided valuable information. Although some of the community members did not believe that the research would bring any

assistance to them, they however cooperated anyway and issued the information. The Project Leaders seemed to more knowledgeable about the projects' proceedings and had minimum information pertaining to environmental issues that concerned wetland management. Project Leaders relied more on government agencies in advising on how to apply the environmental policies. The knowledge on applying environmental policies was gained through special workshops and meetings organised by government agencies and other concerned environmental organizations. The application of the policies was not a priority for the project members. They felt some policies were hindering their productivity; for example, the National Water Act (1998) prohibits any development that within a watercourse unless it has a WUL. For the projects to gain better produce, they had to be in the fertile wetland soil, which is the contravention of the legislation.

With no integrated wetland management system for the wetland, functional, operational and regulatory overlaps occur. For example, separate water monitoring systems are operated by the Department of Water Affairs and the National Department of Environment (DEAT); each ministry has its own planning body that often works independently of other such bodies. Other different provincial and local departments manage and control similar areas at the local level. There is a need for outlining responsibilities for all spheres of government.

5.3.5 Community involvement in decision making

Lack of consultation and involvement of the community in decision-making bares the community's voice in the management of the projects. Results indicate that, the community is being planned for, rather than planning with them and this disempowers the community socially. Chapter 16 of the Municipal Systems Act (2000) says that a municipality must develop a culture of community participation. It further elaborates that a municipality must develop a culture of municipal governance that complements formal representative government with a system of participatory governance. The municipality must therefore encourage and create conditions for the local community to participate in the affairs of the municipality. Most of the group members and community members failed to articulate their challenges in a systematic way and it could be that they felt intimidated by the structures and the level of engagement.

Government departments play a strong role in determining the nature of the shifts in control and the types of power that were transferred. In most instances government retains decision making authority, leaving project groups responsible for day-to-day management decisions. Government conduct to retain authority on decision making is due to the fact that government is a funder for most of the community projects. The study observed that there is pressure from government officials to provide noticeable results within a minimum space of time. Government's financial year operates for a twelve month cycle and the plans are designed for a twelve month period. In terms of capacitating groups from lowest level of participation to the highest, twelve months is a short period to obtain practical results. It is therefore advisable that planning and implementation of CBNRM projects should be given considerable amount so as to obtain desirable results.

5.3.6 Implementation and integration of environmental policies to the natural resource projects

The results indicate that the integration of environmental policies is not a priority for the community. The only time the community is made aware of the policies and regulations, it is when government of other environmental organizations convened a workshop on policies. These workshops are mostly initiated by the concerned organizations when it suits their schedule. The workshops are convened on an *ad hoc* basis. The study indicates that the workshops do not add any value to the community because they are not 'diluted' enough for easy comprehension. The researcher advised the community groups to propose this kind of gathering rather waiting for government to organise them. Brandon, (1998) argues that government policies or their inefficient application are the root of most threats encountered by CBNRM projects. Brandon (1998) further illustrates that the most effective CBNRM programmes are those which have political support from National Government. This has manifested in Zone 3 wetland as the policies seemed to be ineffective and there is lack of political support from the National Government.

The activities of the local community appear to be concerned with the community development issues rather than the wetland management. This is however a good start as it would train and grow the community to focus on building local level community management institutions which can, on behalf of local people, manage the wetland

sustainably. The study established that the community is interested in the management of the wetland to derive benefits from it. It is therefore advisable that a number of conditions need to be met, which include:

- clearly defined boundaries of the area managed (delineation of the wetland);
- appropriate rules for exploiting the resource and for conserving it;
- the people affected by the rules must be able to participate in changing them;
- effective resource monitoring procedures must be in place and monitors of rules must be resource users or accountable to them;
- conflict resolution mechanisms must be in place;
- the right of resource users to devise their own institutions should be recognised by external authorities (government and other NGO's); and
- resource users must have the right of exclusion of outsiders from using the resource (adapted from IIED 1994).

5.4 Weaknesses and strengths of the wetland management system

5.4.1 Weaknesses of the wetland management system and remediation measures

- Project members have little knowledge on the environmental policies. The minimum knowledge of the land-users on environmental legislation affects the wetland integrity. Training and workshops on environmental policies should be provided to assist in capacitating the members for the integration of environmental policies into the community projects.

- Some community members perceived the wetland as an undesirable system, due to its secluded nature and the usage as the dumping area. It is therefore imperative that the wetland is incorporated in the community structures. Government and project members should intensify awareness programmes and lobby the community to be custodians of the environment.

- Project Leaders are not adequately capacitated in terms of managing the projects. Management skills are mostly lacking in the financial and human resources management.

The Project Leaders should also to be capacitated on the technical skills for operations in a wetland. The capacitation for the leaders would improve the management of the community projects.

- The inconsistency of funding of community projects is a challenge. Since CBNRM project members do not have reliable income in terms of stipends, they tend to explore other job opportunities that provide income. A long term programme that would create reliable job opportunities whilst dealing with the rehabilitation of the wetland should be developed.

- The lack of participation of Emfuleni Local Municipality in the community projects seem to impede on the success of the management of the projects. Although Sedibeng District Municipality is participating in the programmes, but the participation of the Local Municipality would increase the interaction with the community and escalate the discussions to the District Municipality.

- The community projects generate a reasonable amount of garden produce. The harvest is however seasonal, and there is a shortage of storage facilities to store the produce before it is shipped to the market. The community projects should acquire more storage facilities as that would maximise the profit.

5.4.2 Strengths of the wetland management system

- The community projects are well known to government and reasonable funds have been provided for their operations. Since the projects are recognised, the community members should organise themselves and treat CBNRM projects as business. The activities can embrace the 'Green jobs' strategy, which is promoted by government. There is a need to capitalise on this strategy as it would attract more funding from government and interested NGO's.

- The community groups are already exposed to lower levels of decision making platforms, while their participation in high level decision making platforms is marginalized. It is therefore easy to upscale their participation in decision making in

order to make meaningful contributions to the discussions and decision making processes.

5.5 Conclusion

The discussion has revealed the dire state of the wetland and recommended how the local community can participate in the wetland management in order to improve the wetland health. It was established that the community management has strengths which it can capitalise on and improve on the weaknesses. The discussions embraced that there is a need for a structured and proper communication amongst the community projects and other stakeholders.

CHAPTER 6 - RECOMMENDATIONS

6.1 Introduction

This chapter highlights the recommendations of the study. The recommendations include how the wetland integrity can be improved and how the community can improve their contribution to the management of the wetland. This chapter further recommends future research.

6.2 In order to maintain the wetland ecosystem and improve its functionality, it is recommended that:

- The community stops the illegal disposal of waste in the wetland. Furthermore, all waste disposed of at the wetland must be collected and disposed of at a licenced landfill site. The stoppage of disposal of waste will improve water quality and aesthetic value of the wetland.

- All new development footprints should not further infringe into the wetland.

- The community should act as a "watchdog" for future developments that infringe into the wetland.

- Environmental management policies should be stringently adhered to by all wetland users.

- Cooperation amongst organisations enforcing environmental laws must be improved.

- A national policy on wetlands should provide an opportunity for ensuring that future management of wetlands resources is taking place in an integrated approach (Kotze and Breen, 2000).

- Wetland management demands a comprehensive management structure and dedicated community groups. It is therefore important that a strategic plan for the management of the wetland be developed. It is imperative that all relevant stakeholders participate in the development process. According to World Wide Fund for Nature (2005), the ambition of

many projects requires a commitment to dialogue and the collaboration with a diverse range of stakeholders. The dialogue that is open and transparent is critical for the long term success. There should be an emphasis on addressing multi-sectoral dimensions of development programmes. The processes should also focus on reducing conflicts over the utilisation of natural resources. The marginalised groups have to be encouraged to raise their concerns and inputs.

- Wetland Management Committee should be established to oversee and coordinate the wetland activities. This approach would assist in decentralising the powers by delegating them to a wide range of managing structures. The Wetland Management Committee could coordinate the delineation of the wetland and environmental awareness campaigns. The awareness campaigns should also aim at changing the community mind-set and provide an understanding that wetlands are not just 'wastelands' rather ecosystems that can support the community's livelihoods. The Committee could upscale the community efforts by adopting the 'Protect Wetlands Using Regulatory or Voluntary Measures' principle which provides a review of regulatory and non-regulatory options for local governments. A combination of approaches could also be employed.

- The community establishes agricultural and environmental support systems regulated by government departments responsible for the conservation of the wetland (GDARD, SDM and ELM).

- The authorities should aim to assist the community projects in developing agricultural and environmental best practices guidelines. The guidelines and requirements should include preparation of the land, soil erosion control measures and biodiversity conservation. The environmental management support system should focus on the establishment of local environmental governance structures (wetland action groups or environmental protection groups) that have taken responsibility for managing the natural resources and general environmental conservation.

- The distribution of responsibilities among government institutions should clearly be defined.

6.3 In order to ensure that the community participates in the management of the wetlands, it is recommended that:

- A full project assessment for each community project focussing on environmental, social, and legal aspects should be undertaken. The proposed assessments should guide the projects' operations to ensure that the project concept is viable for the wetland site and complies with environmental regulations. Legal aspects relating to the exploitation of the environment, such as permits, land tenure and environmental impact assessment need to be addressed.

- The community groups treat community projects as businesses, in order to gain the respect they deserve from the community and funders. The business plans should be developed and communicated to all role-players including funders and government authorities.

- There is a need to improve data and information use, to develop management support tools. Improved links between information generation and decision-making, particularly at the local level, would better address the needs of local communities. The development and adoption of new methods and tools for information capture and management would increase the sustainability of wetland practices (Oh *et al.* 2005).

- Community projects receive the necessary support of Local Government structures, and that these agencies recognise value in the contribution of these projects to existing plans, such as IDPs. "Buy in" by Local Government structures can ensure that the projects obtain long term support particularly in respect of business mentoring and SMME creation. The business plans should also be accompanied by meaningful budget plans.

- Government assigns and dedicate government officials to support the community groups and coordinate communication and other government responsibilities.

- Special training for leaders should be provided to focus on financial management, record keeping and environmental policies.

- Communications and information transfer are critical for participatory process in any multi-stakeholder natural resource management project. When outsiders are coming to an area to start an initiative, it is crucial to follow the right procedure, preferably work with the local chief. This will ensure that the chief understands their intentions and asks the villagers to interact, cooperate and participate in that initiative (Traynor, 2005). It is recommended that training at individual, community and government levels should be strengthened to support the groups to gain the necessary skills and knowledge they need to practice improved sustainable natural resource management. Special training for leaders should focus on financial management, record keeping and environmental policies. Leaders should be trained and supported on the proceedings and processes when working government and NGO's.

- Stakeholders (local and outsiders) design a flexible strategy for development, with clear rules and regulations that recognise the local socio-economic context. The views and ideologies of the local stakeholders should be the main thread of the participatory activities. This may encourage participation and ownership of initiatives by local people. Documentations such as management guidelines should incorporate the traditional values and practices; and local rules and regulations. The participation should be seen as a process in which stakeholders exercise initiatives stimulated by their own thinking and over which they have specific control (Huizer, 1997).

- The community groups get exposure to more decision making platforms to maximise their participation and confidence. The community groups should strive to improve their communication skills as that would obtain recognition from government and be acknowledged as core-partners in the programmes.

- Capacity building and training is very critical for empowerment and social change of local communities. Appropriate educational processes should be used to mobilise prior and new knowledge and build competence. Awareness programmes have to be intensified and focus on the integration of the wetland system to the community systems.

- The concept of empowerment through the establishment of business ventures has been dealt with by Huizer (1997), who indicates that business initiatives that are imposed from

above by official development agencies and which have been formed under strong governmental backing are not true businesses. The effort to make them stand on their own and convert them into authentic businesses has generally not been successful. The challenge is to develop a strategy that focuses on the growth of short-lived business to persist in time after the development project is over. Some of this can be achieved by capacity building, but not all, as there are other structural factors that influence business success.

- Water infrastructure such as water pipes that are damaged and leaking should be repaired. The community should also have an emergency plan to promptly repair leaking pipes should damages occur.

- Zone 3 Wetland Committee should be established to oversee management and utilisation of the wetland. The Committee would oversee the management of the wetland. This would guarantee the sustainability of the wetland ecosystems.

- It is imperative to develop local co-management systems. Production in wetland areas relies on common property resources. Although a process of private land-use has been implemented, many wetlands remain common property, making access to and control over them major issues, especially for rural communities. Recent trends suggest co-management of wetlands is a way of addressing conflicts over resources and of developing and promoting good management practices to various wetland stakeholders (Oh *et al.*, 2005).

- The local community projects need to be institutionalised so that they are seen as a mainstream activity.

6.4 Recommendations for future research

To further investigate and refine governance and management practices, the following is recommended:

- It is imperative that on-going research continues to study and recommend to the authorities on ways of engaging the community dealing with community wetlands.

- Future research on CBNRM projects and pressures imposed by such projects on the environment. Additional research to further refine the ideas and findings of this dissertation would be required including both theoretical and empirical work. Future research should focus on wider Sebokeng community wetlands to ascertain interconnectedness of the whole wetland system.

- In order to avoid liabilities for huge rehabilitation capital of wetlands, more research is required to improve the knowledge base for wetlands and their management. The studies should focus on evaluating the wetland value in monetary terms, to validate the investment efforts.

- Further research could also address impacts of the community projects on ecological processes and biodiversity. It could also uncover environmental consequences and how they can be mitigated.

6.5 Conclusion

The recommendations outlined in this chapter addressed possible improvements and strategies on the participatory approaches of not only Zone 3 wetland but also water resource management. The recommendations discussed in this chapter are not exhaustive; hence more research on specific issues is advisable.

CHAPTER 7 – CONCLUSION

Introduction

This chapter summarises the results of the study in relation to the formulated objectives and makes conclusions.

The aim of the study, as stated earlier was to investigate the participation of the local community in the management of Zone 3 wetland. Specifically the objectives of the study were to:

a) To assess the functionality and the integrity of the wetland;
b) To investigate the level of participation of the local community in the management of the wetland; and
c) To propose management strategies for the community, in order to improve the integrity of the wetland.

According to the Wetland-IHI results, the wetland feature as a whole attained a score reflecting a PES category D (severely modified). The results obtained from the wetland assessment indicate intermediate levels of ecological service provision, with a significant transformation observed largely due to infilling and poor water quality. It is therefore important for the community to act immediately in order to avoid deterioration of the wetland system.

The study was able to establish the level of the participation of the local community in the management of wetlands. The results indicate that the participation of the local community is minimal and needs to be improved. Local community should take ownership of the resource and actively lead in its management. It is evident that the CBNRM projects are aimed at improving the socio-economic status of the community. The study indicates that local community land-use practices impact negatively on the wetland. While it is accepted that socio-economic development is needed in the area, it cannot occur at the expense of the water resource system. A range of management strategies and control measures are required to deal with the current situation.

Regardless of many practical failures, reduced support from government, and critical criticism that CBNRM projects efforts have faced in the wetland during the past two years of the research, many benefits to wetland users which include training in permaculture, financial management skills and training in resource management and land use planning have been partially obtained. This still needs nurturing and instilling of the acquired skills to the wetland-users.

Despite frustration and lack of capacity of the community in participating in the decision making, there is still an opportunity to revive local governance which would inspire the community to take ownership of the natural resources. Government has to acknowledge the successes the community has achieved so far, for the sake of protecting the environment and improving the livelihoods. Various user groups, local government and provincial government stakeholders have to work together to formulate a community-based strategic wetland management plan which would be implemented by all stakeholders. The local and district municipalities political support should assist in the integration of CBNRM projects into local and district IDP's. The study raised the importance of community-based organisations to merge with local government structures and development processes. Non-Government Organizations should play their important facilitatory and capacity building role in many of the cases, helping to bridge divergent views between local people and government agencies and manage conflict within or among communities (Shackleton *et al*., 2002).

Shackleton *et al*. (2002) further states that the paradigm shift in conservation and natural resource management away from costly state-centred control towards approaches in which local people play a much more active role must be strengthened. Local environmental knowledge can be a powerful source of authority (Gawler, 2000). Gawler (2000) further argues that the community should embrace protection of natural resources through relatively humble technology, such as local laws or cultural or religious taboos preventing overexploitation. These reforms purportedly aim to increase resource user participation in natural resource management decisions and benefits by restructuring the power relations between central state and communities through the transfer of management authority to local-level organisations. It should be understood that moving government agencies away from rigid top-down habits to participatory approaches generally takes a sustained effort over a

very long time, and development agencies and NGOs should be prepared for a long-term commitment (Gawler, 2000). Resource management policies will need to be harmonized among regional, national, provincial, and local levels.

The above results have achieved the objectives and the hypothesis has also been reasonably confirmed. It can therefore be concluded that the participation of the local community in the management of the natural resources should not be under-estimated, and the community should be capacitated so as to participate fully. Underlying the idea of community-based resource management is the recognition that humans are part of the ecological system, and not separate from it (Gawler, 2000). Gawler (2000) further states that today's wetlands, including those which are considered to be the most pristine, are the result of complex interactions among physical, biological and human forces over time.

The study also established that there are no policies in place that would be favourable for local people. Despite the lack of promotion of government for local community participation, the study was able to propose interventions for all sectors to improve local community participation. The future lies in the continuation of learning from good work that will improve the standard and integrity of the wetlands whilst taking into cognisance the importance of socio-economic issues. Participation of the community in the wetland management should assist in better understanding of not only local people's short and long term needs, but the desires of outsiders. Participation techniques and decision making should also focus on finding better ways of collaboration between government, experts and local people, and include many multi socio-economic perspectives during planning and policy development.

The study concludes that coordinated efforts to manage the wetland have to be strengthened, to increase the understanding of the functioning of the wetland system, with the emphasis on good wetland management benefits, both wetland ecosystem health and community benefits. The local community should explicitly understand that failure to manage the wetland appropriately would deprive them from the benefits that are provided by wetlands.

This study was conducted to meet, at least partially, the need for a more enlightened approach to the management of wetlands in Sebokeng area. The researcher hoped to contribute to a

holistic framework for wetlands management by providing a clear understanding of the importance of participation of the local community and institutional systems involved in the management of natural resources. It is also hoped that the knowledge generated from this study will be shared among other communities in the Gauteng Province in order to prepare a common approach to improved local wetland management.

Hopefully, the outcomes will make a meaningful contribution to meeting the balance between natural resource use and conservation in communal areas of South Africa. However, more needs to be done at all levels – local, provincial and national to learn from co-management and participatory experiences, and to develop supporting policies and the capacity to implement them.

CHAPTER 8 - LIST OF REFERENCES

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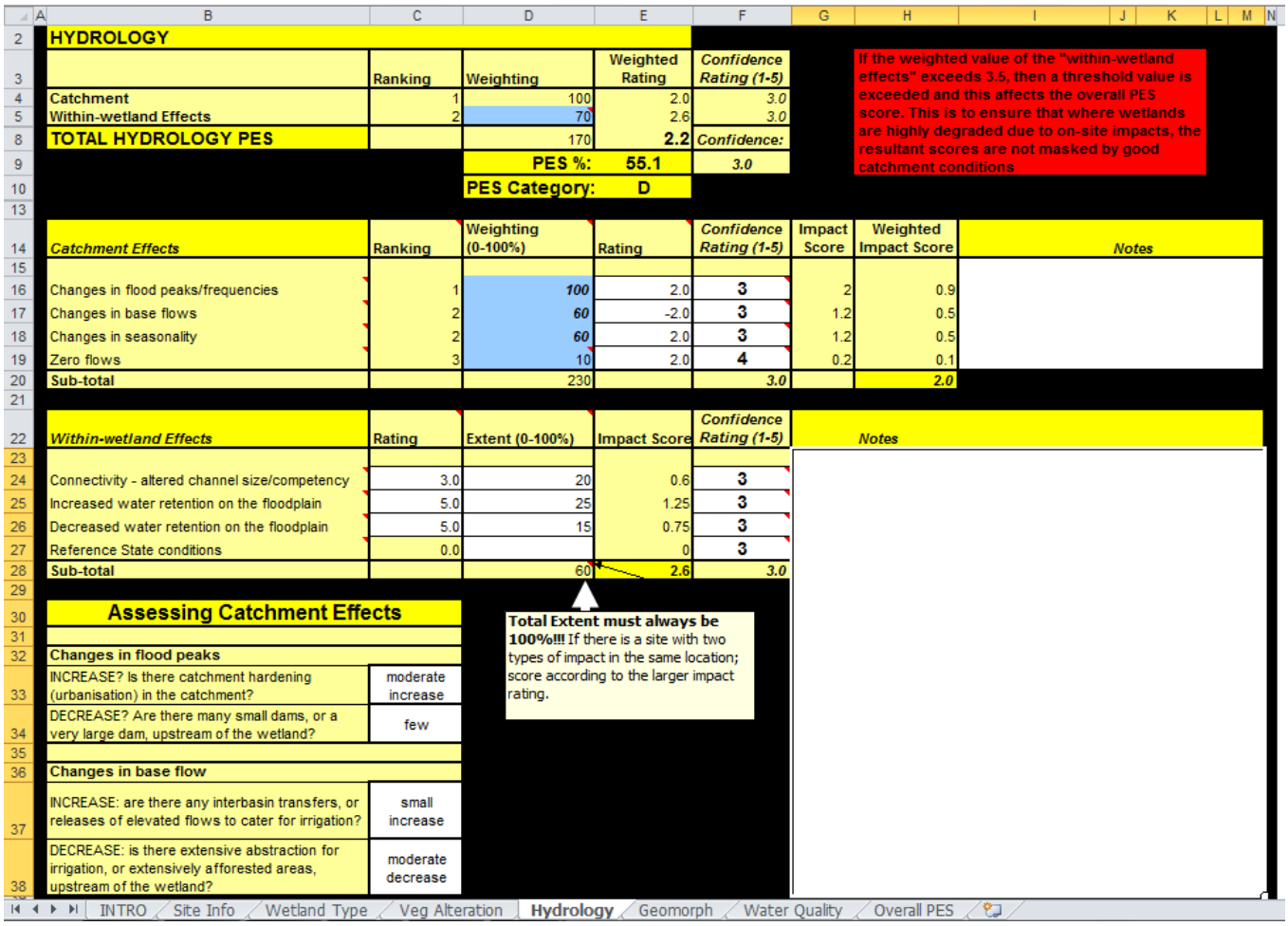
APPENDIX 1: WETLAND-IHI RESULTS

Appendix 1 A: Wetland Hydrology calculations



HYDROLOGY

	Ranking	Weighting	Weighted Rating	Confidence Rating (1-5)
Catchment	1	100	2.0	3.0
Within-wetland Effects	2	70	2.6	3.0
TOTAL HYDROLOGY PES		170	**2.2**	Confidence:
		PES %:	**55.1**	3.0
		PES Category:	**D**	

If the weighted value of the "within-wetland effects" exceeds 3.5, then a threshold value is exceeded and this affects the overall PES score. This is to ensure that where wetlands are highly degraded due to on-site impacts, the resultant scores are not masked by good catchment conditions

Catchment Effects	Ranking	Weighting (0-100%)	Rating	Confidence Rating (1-5)	Impact Score	Weighted Impact Score	Notes
Changes in flood peaks/frequencies	1	100	2.0	3	2	0.9	
Changes in base flows	2	60	-2.0	3	1.2	0.5	
Changes in seasonality	2	60	2.0	3	1.2	0.5	
Zero flows	3	10	2.0	4	0.2	0.1	
Sub-total		230		3.0		2.0	

Within-wetland Effects	Rating	Extent (0-100%)	Impact Score	Confidence Rating (1-5)	Notes
Connectivity - altered channel size/competency	3.0	20	0.6	3	
Increased water retention on the floodplain	5.0	25	1.25	3	
Decreased water retention on the floodplain	5.0	15	0.75	3	
Reference State conditions	0.0		0	3	
Sub-total		60	2.6	3.0	

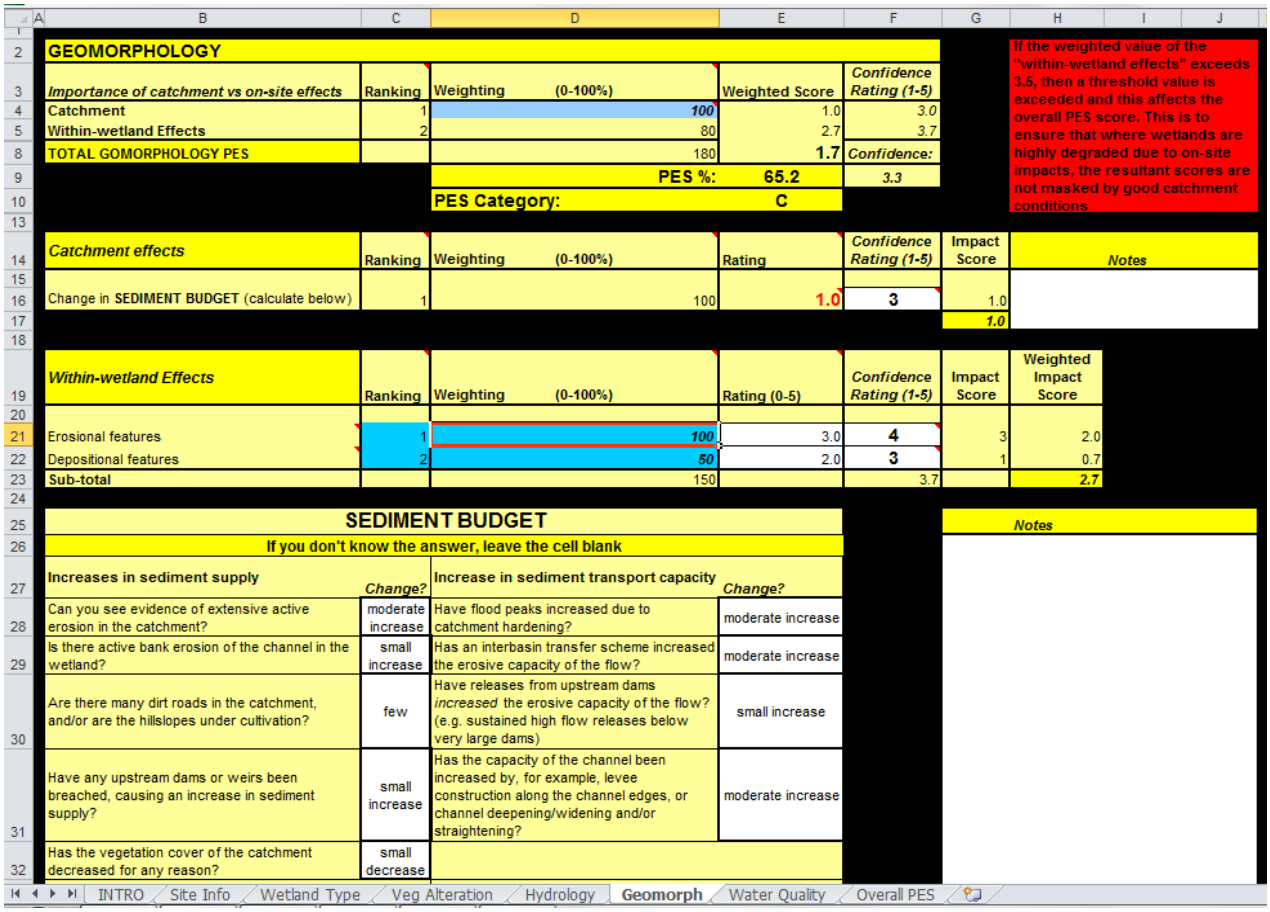
Total Extent must always be 100%!!! If there is a site with two types of impact in the same location; score according to the larger impact rating.

Assessing Catchment Effects

Changes in flood peaks	
INCREASE? Is there catchment hardening (urbanisation) in the catchment?	moderate increase
DECREASE? Are there many small dams, or a very large dam, upstream of the wetland?	few
Changes in base flow	
INCREASE: are there any interbasin transfers, or releases of elevated flows to cater for irrigation?	small increase
DECREASE: is there extensive abstraction for irrigation, or extensively afforested areas, upstream of the wetland?	moderate decrease

INTRO | Site Info | Wetland Type | Veg Alteration | Hydrology | Geomorph | Water Quality | Overall PES

Appendix 1 B: Wetland Geomorphology calculations



GEOMORPHOLOGY

Importance of catchment vs on-site effects	Ranking	Weighting (0-100%)	Weighted Score	*Confidence Rating (1-5)*
Catchment	1	*100*	1.0	*3.0*
Within-wetland Effects	2	80	2.7	*3.7*
TOTAL GOMORPHOLOGY PES		180	1.7	*Confidence:*
		PES %:	65.2	*3.3*
		PES Category:	C	

If the weighted value of the "within-wetland effects" exceeds 3.5, then a threshold value is exceeded and this affects the overall PES score. This is to ensure that where wetlands are highly degraded due to on-site impacts, the resultant scores are not masked by good catchment conditions

Catchment effects	Ranking	Weighting (0-100%)	Rating	*Confidence Rating (1-5)*	Impact Score	*Notes*
Change in **SEDIMENT BUDGET** (calculate below)	1	100	1.0	3	1.0	
					1.0	

Within-wetland Effects	Ranking	Weighting (0-100%)	Rating (0-5)	*Confidence Rating (1-5)*	Impact Score	Weighted Impact Score
Erosional features	1	*100*	3.0	4	3	2.0
Depositional features	2	*50*	2.0	3	1	0.7
Sub-total		150		3.7		2.7

SEDIMENT BUDGET

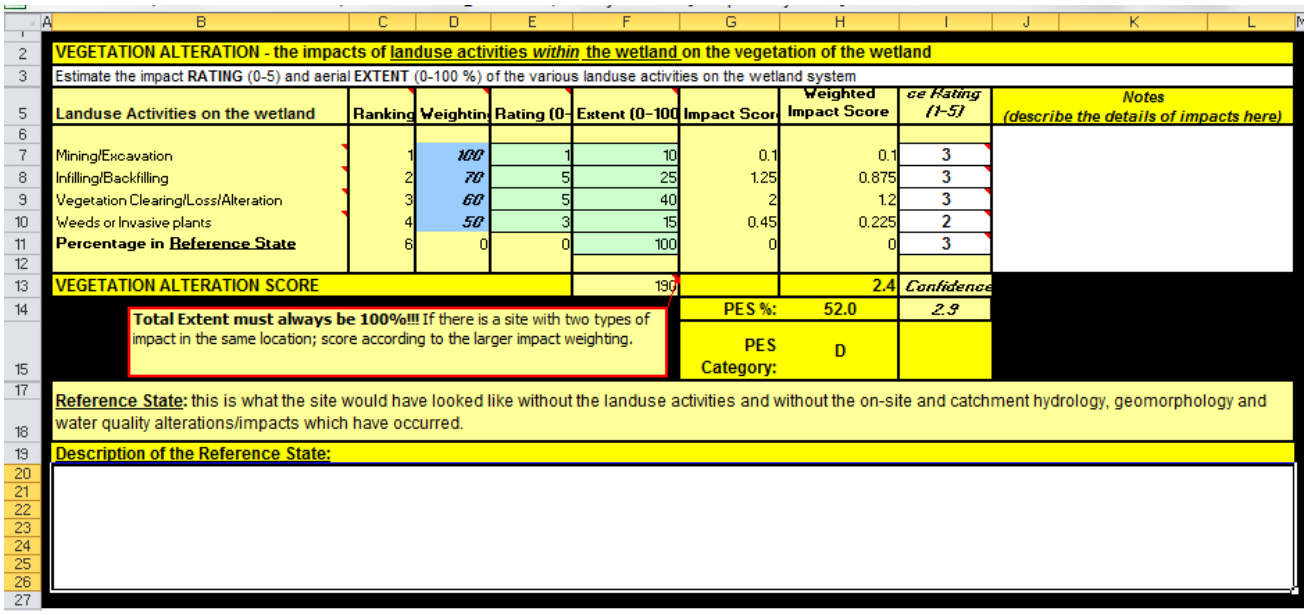
If you don't know the answer, leave the cell blank

Increases in sediment supply	*Change?*	Increase in sediment transport capacity	*Change?*
Can you see evidence of extensive active erosion in the catchment?	moderate increase	Have flood peaks increased due to catchment hardening?	moderate increase
Is there active bank erosion of the channel in the wetland?	small increase	Has an interbasin transfer scheme increased the erosive capacity of the flow?	moderate increase
Are there many dirt roads in the catchment, and/or are the hillslopes under cultivation?	few	Have releases from upstream dams *increased* the erosive capacity of the flow? (e.g. sustained high flow releases below very large dams)	small increase
Have any upstream dams or weirs been breached, causing an increase in sediment supply?	small increase	Has the capacity of the channel been increased by, for example, levee construction along the channel edges, or channel deepening/widening and/or straightening?	moderate increase
Has the vegetation cover of the catchment decreased for any reason?	small decrease		

Notes

INTRO | Site Info | Wetland Type | Veg Alteration | Hydrology | **Geomorph** | Water Quality | Overall PES

Appendix 1 C: Vegetation alteration calculations



VEGETATION ALTERATION - the impacts of landuse activities *within* the wetland on the vegetation of the wetland

Estimate the impact **RATING** (0-5) and aerial **EXTENT** (0-100 %) of the various landuse activities on the wetland system

Landuse Activities on the wetland	Ranking	Weighting	Rating (0-	Extent (0-100	Impact Score	Weighted Impact Score	ce Rating (1-5)	Notes (describe the details of impacts here)
Mining/Excavation	1	100	1	10	0.1	0.1	3	
Infilling/Backfilling	2	70	5	25	1.25	0.875	3	
Vegetation Clearing/Loss/Alteration	3	60	5	40	2	1.2	3	
Weeds or Invasive plants	4	50	3	15	0.45	0.225	2	
Percentage in Reference State	6	0	0	100	0	0	3	
VEGETATION ALTERATION SCORE				190		2.4	Confidence	
					PES %:	52.0	2.3	
					PES Category:	D		

Total Extent must always be 100%!!! If there is a site with two types of impact in the same location; score according to the larger impact weighting.

Reference State: this is what the site would have looked like without the landuse activities and without the on-site and catchment hydrology, geomorphology and water quality alterations/impacts which have occurred.

Description of the Reference State:

APPENDIX 2

RESEARCH QUESTIONNAIRE FOR THE COMMUNITY

Part A: Biographical information			
Q1	Gender	**M**	**F**
Q2	Age	15-17	
		19-35	
		35 and above	
Q3	Education level		
	Completed Degree/Diploma		
	Completed Grade 12		
	Completed Grade 8		
	None		
Q4	What is your income per month?	1000-1500	
		1501-2500	
		2501 and above	

Part B: Community project information			
Q5	Do you work for one of the community projects		
	Phaphamang Environmental Organization		
	Setsing Women's Project		
	Integrated Wetland Project		
Q6	As a community member, do you think the community values the wetland?	**Yes**	**No**
If "yes", please rate as to how much the community values the wetland. 1 means "low" and 5 means "high" **1 2 3 4 5**			

Q7	If you working for one of the above projects, are you satisfied for working for the project	**Yes**	**No**
Q8	If you answered "Yes" in question 7, please answer question 8. Are satisfied with working for the community projects?	**Yes**	**No**
Q9	Have you witnessed any environmental problems arising from the project	**Yes**	**No**
If "yes" which one (mark with using X)			
	Soil erosion		
	Loss of vegetation		
	Dumping		
	Water pollution		

Part C: Wetland management information			
Q10	Does the community contribute to the management of the wetland	**Yes**	**No**
	If "Yes" please the rate the level of contribution of the following stakeholders 1 means "low" and 5 means "high" (put relevant number on the box) **1 2 3 4 5**		
	Zone 3 Community		
	Phaphamang Environmental Organization		
	Setsing Women's Project		
	Integrated Wetland Project		
	Municipality		
	GDARD		
	National Department		

Q11	How can the community contribute to the management of the wetland

Thank you for participating in the programme.