AN EVALUATION OF THE CONSEQUENCES OF ENVIRONMENTAL IMPACT ASSESSMENTS (EIAs) ON KWAZULU-NATAL'S BIODIVERSITY TARGETS

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DECLARATION

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I, Dinesree Thambu, Registration Number 200274260, hereby declare that the thesis entitled:

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ABSTRACT

Despite the array of regulatory mechanisms for biodiversity protection, there are several threats to biodiversity and the services it provides. These include habitat transformation and fragmentation and poor land-use decision-making and planning. While Environmental Impact Assessments (EIA) are considered a support tool for sustainable development, they are undertaken on a case-by-case basis resulting in the *ad hoc* approval of development that have the potential to conflict with landscape planning process. Therefore EIAs either impact positively or negatively on future conservation planning initiatives. Given the *ad hoc* approval of EIAs, it was assumed that the outcome of many EIAs negatively impact upon KwaZulu-Natal's ability to achieve its conservation targets, particularly as most of the province's biodiversity is located outside existing protected area networks. The aim of this research was to determine whether EIAs contribute towards or hinder the potential for KwaZulu-Natal to achieve its conservation targets, given the lack of feedback mechanisms to integrate EIA decisions into strategic spatial frameworks (as the impacts of decisions at a landscape level are unknown). To address the objectives of this study, both qualitative and quantitative research methods were used. Quantitative methods utilized a structured questionnaire (to obtain primary data) aimed at individuals who work with EIAs on a daily basis, which was complimented by qualitative research methods that entailed in-depth assessments of EIAs and specialist study reports (to obtain secondary data). The analysis revealed that while EIAs inadvertently contribute towards KwaZulu-Natal achieving its conservation targets, inadequate assessments, poor decision-making or lack of monitoring potentially negatively affect KwaZulu-Natal's ability to meet its conservation targets. Secondly, that strategic data collection methods, would allow for data contained within EIAs to be utilised in spatial conservation planning during periodic plan updates, thereby improving data quality and accuracy of plans. Hence, EIAs can bridge the information-implementation gap at strategic planning levels, given that data contained within EIAs be included into the updating process of strategic plans. The key recommendations that emerged from this study are that guidelines are required for the Terms of References for biodiversity specialist studies, compliance monitoring be undertaken in conjunction with the appropriate specialist authority where necessary and that feedback loops are created allowing for EIAs to inform strategic plans.

LIST OF ACRONYMS

BEA	-	Biodiversity in Environmental Assessment
BotSoc	-	Botanical Society of South Africa
BII	-	Biodiversity Intactness Index
CBD	-	Convention on Biological Diversity
CD	-	Conservation Development
DAEARD	-	Department of Agriculture, Environmental Affairs and Rural Development
DEA	-	Department of Environmental Affairs
DTP-KSIA	-	Dube Trade Port – King Shaka International Airport
EA	-	Environmental Authorisation
EBSP	-	Ezemvelo Biodiversity Stewardship Programme
ECA	-	Environmental Conservation Act
EIA	-	Environmental Impact Assessment
Ezemvelo	-	Ezemvelo KZN Wildlife
GIS	-	Geographic Information System
IUCN	-	International Union for Conservation of Nature
MEA	-	Millennium Ecosystem Assessment
NEMA	-	National Environmental Management Act
NEMBA	-	National Environmental Management: Biodiversity Act
NEMPAA	-	National Environmental Management: Protected Areas Act
NGO	-	Non-government Organisation
PA	-	Protected Areas
PCA	-	Principal Component Analysis
SAIEA	-	Southern African Institute for Environmental Assessment
SCP	-	Systematic Conservation Planning
USA	-	United States of America

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CHAPTER ONE:

INTRODUCTION

1.1 Preamble

The aim of this chapter is to introduce the study by outlining the rationale for this study and contextualising the research problem. This chapter also highlights the premise of the study and further defines the parameters under which the study has been undertaken, by listing the aims and objectives of the study. The chapter concludes by describing the outline of the study.

1.2 Rationale for the Study

The advent of agriculture, approximately 10,000 years ago, was the first indication of the vast transformation of the earth's natural ecosystems, primarily to satisfy man's nutritional needs (Chavas, 2009). Today the risks to biodiversity have been extended to various types and magnitudes of threats. Turpie (2003), for example, notes that land transformation, alien invasive species and climatic change are gaining momentum as some of the most urgent threats to biodiversity. According to Samways (2009: 2949) "large scale landscape transformation and contingent habitat loss are among the greatest threats to ecological integrity and ecosystem health", and hence biodiversity.

The importance of biodiversity is largely attributed to two factors. Firstly, biodiversity is essential to the functioning of ecosystems which "collectively determine the biogeochemical processes that regulate the Earth system" (Loreau *et al*., 2001), and secondly, the services provided by well-functioning ecosystems, which is reliant on biodiversity, are important to human well-being (Naidoo *et al*., 2008). Costanza *et al*. (1997: 253) note that the services provided by ecological systems "contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet". Natural resources, for example, are consumed both indirectly (nutrient and water cycling, soil formation and retention, resistance against invasive species, pollination of plants and climate regulation) and directly (food security, energy security, access to clean water and the provision of raw materials) by humans (Millennium Ecosystem Assessment - MEA: 2005). The loss or impairment of these free services results in the purchase of alternatives which are costly to society. For instance the value of the ecosystem services provided by the entire biosphere in 1997 was estimated at an average of "US$ 33 trillion per year (which was 1.8 times greater than the global gross national product at the time and was an underestimate)" (Costanza *et al*., 1997: 259). Although the value of the global ecosystem has not been recently recalculated, Costanza *et al*. (1997) assert that the more stressed or scarce an ecosystem becomes, the more it increases in value. It can therefore be assumed that the present value of the global ecosystem is significantly larger than in 1997.

Over recent years there has been a growing realisation of the importance of biodiversity and the environment in general. This realisation led to the establishment of an array of regulatory mechanisms ranging from statues (Acts, Ordinances and Regulations) to policies, norms and standards. The focus of these is centred on protecting and regulating the use of biodiversity. However, regardless of the plethora of regulations, there are several threats to biodiversity and the services it provides to humankind (Ezemvelo, 2009a). The most significant of these are habitat transformation and fragmentation, poor decision-making and planning, land degradation, alien plant encroachment, poaching, pesticides, pollution, and more recently, climate change (Ezemvelo, 2009a).

At a global level, the response to the depletion of biocapital (also referred to as biological wealth), has been to achieve a target of 10% biodiversity, as set by the International Union for Conservation of Nature (IUCN) within the Convention on Biological Biodiversity, one of the key outcomes of the Rio Earth Summit in 1992. While this target suggests that "the world's governments are setting aside more land for environmental protection", Jenkins and Joppa, (2009: in press) state that "…the world [has] not [met] the 2010 target of protecting 10% of all the world's major ecosystems". In addition, it has been acknowledged by many ecologists that "the degree to which biodiversity is represented within the existing network of protected areas is unknown" (Rodrigues *et al*., 2004), and therefore the current global protected area (PA) network cannot guarantee the persistence of the earth's biodiversity (Pierce *et al*., 2005).

In the South African context the situation is slightly more complex. Being a developing country and young democratically, social upliftment and economic development is a crucial component of the country's growth. However, this growth is dependent upon the use of natural resources therefore the challenge is to ensure that this use is sustainable and does not erode South Africa's ability to conserve its biodiversity. In response to the need to reconcile environment-development concerns, at both global and national levels, two particular planning tools have become quite prominent, namely Environmental Impact Assessments (EIAs) and Regional Ecological Land-Use Planning.

EIAs are considered as one of the support tools for sustainable development, with the end result being that which achieves a balance between local socio-economic, political and ecological priorities (Southern African Institute for Environmental Assessment-SAIEA, 2003). The purpose of an EIA "is to identify how the activities of [a] proposed development will impact on the various components of the environment…[and] it entails the identification and analysis of impacts, as well as a prediction of the significance of the impacts…both positive and negative" (SAIEA, 2003: 06). The outcomes of the EIA process are to provide decision-making authorities with sufficient information on the likely consequences of the proposed activity, should it be approved (SAIEA, 2003).

EIAs within Africa have been in existence since the 1970s, albeit undertaken on an *ad hoc* basis and only when encouraged by multilateral agencies, non-government organisations (NGOs) or other donors (SAIEA, 2003). In the late 1980s, South Africa instated the Environmental Conservation Act (Act No. 73 of 1989) (ECA) which identified activities that required EIAs, however it was only until 1997 that the regulations set out under Sections 26 and 28 of the Act (that is the procedures on how to undertake an EIA) were promulgated. In the late 1990s the National Environmental Management Act (Act No. 107 of 1998) (NEMA) was gazetted and gave effect to the White Paper on Environmental Management Policy (July, 1997), as well as repealed those sections within the ECA that pertained to EIAs. However, the more robust EIA sections within NEMA did not come into effect until much later and ECA regulations were upheld in the interim (SAIEA, 2003).

EIAs are undertaken solely on a case by case basis and approvals occur on an *ad hoc* basis. While EIAs do consider other available strategic planning tools (such as Integrated Development Plans, Land Use Management Plans and so on), individuals can apply to deviate from these. Therefore EIAs have the potential to either positively or negatively impact upon future conservation planning initiatives. The trend of undertaking EIAs in an *ad hoc* fashion is also evident within the context of South Africa.

South Africa has also followed other global trends in terms of spatial frameworks, for example, by adopting a Systematic Conservation Planning (SCP) approach. By utilising scientific and computer-based techniques (which are defensible) the most appropriate network of conservation areas can be identified (Knight and Cowling, 2007), and hence the most appropriate areas to achieve the country's conservation targets determined.

This research uses South Africa's province of KwaZulu-Natal as a case study to evaluate how EIAs impact on conservation targets. In KwaZulu-Natal, both planning tools (that is, EIAs and SCP) are utilised by the conservation authority for the province, namely Ezemvelo KZN Wildlife (Ezemvelo). Ezemvelo is mandated to conserve biodiversity under the KwaZulu-Natal Nature Conservation Act (Act No. 09 of 1997) and has been tasked by the Minister of Agriculture, Environmental Affairs and Rural Development, to manage KwaZulu-Natal's PAs and provide an advisory function to the provincial Department of Agriculture, Environmental Affairs and Rural Development (DAEARD) on biodiversity issues outside the PA network.

In terms of the EIA process, Ezemvelo is a commenting authority that aims to ensure that biodiversity outside the PA network is appropriately safeguarded through the process. In addition, Ezemvelo has developed (and maintains) the "provincial spatial framework for the conservation of biodiversity … [that] identifies the most efficient configuration of areas in the province that [would] secure biodiversity at an acceptable level" (Ezemvelo, 2009b: 19). This spatial framework is referred to as The Provincial Biodiversity Conservation Plan.

While it is acknowledged that spatial frameworks and other planning tools (such as Strategic Environmental Assessments) feed into the EIA process, according to the SAIEA (2003) EIAs should feed back into larger scale plans similar to regional and or transboundary initiatives. Therefore the purpose of this study is to assess how EIAs relate to spatial frameworks, that is, to assess if the outcome of the EIA process achieves the goals set by the spatial framework or not, as well as to determine if and how the outcomes of an EIA should be integrated into the regional planning tools, such as the spatial frameworks.

1.3 Contextualisation of the Problem

Ezemvelo (in terms of their mandate at a provincial level) contributes towards South Africa's international obligation to meet the biodiversity target of 10% (IUCN recommendation with global applicability). However, there is a strong possibility that the prescribed 10% biodiversity target may be too little and runs the risk of creating unnecessary duplication and redundancy of conservation efforts (Blackmore, 2010), given that 53.4% of KwaZulu-Natal's biodiversity is located outside of the provinces PA network (Ezemvelo, 2009a: 36). Thus a significant proportion of the provinces biodiversity is at risk by those threats identified above. In addition, at the current rate of transformation, KwaZulu-Natal will be completely transformed between 37 to 48 years, thereby increasing the pressure to meet the conservation goals and targets of the province sooner rather than later (Jewitt, 2010).

While Ezemvelo is mandated to conserve biodiversity within KwaZulu-Natal through various initiatives, including commenting on EIAs, there are in fact several challenges that still need to be over come in order to safeguard and manage biodiversity sustainably. As such, this study builds on the challenges faced by Ezemvelo KZN Wildlife and provides recommendations to address these challenges. Some of the challenges faced by Ezemvelo are that (Ezemvelo, 2009a):

- the provincial conservation authority acts in an advisory capacity to other government departments on development applications and thus, is not the authority that decides on land-use and land transformation activities.
- biodiversity is not seen as a priority in the political realm or the economic growth environment.
- biodiversity is a competing land-use and has to contend with other land uses such as agriculture, urban and industrial activities, and
- KwaZulu-Natal's PAs network is inadequate to protect the provinces important biodiversity and therefore development between PAs, which would include areas of conservation significance, need to be appropriate and sustainable.

1.4 Study Premise

Given that EIAs are undertaken on a case by case basis and while some approved developments may be environmentally sustainable, it is assumed that the outcome of many EIAs negatively impact on KwaZulu-Natal's ability to achieve its conservation targets. However, should the contrary be identified (commensurate with a null hypothesis - Popper, 1959) from this research, in that EIAs inadvertently safeguard biodiversity, it will further endorse the need to bridge the information – implementation gap, so as to allow for more informed strategic planning. It is anticipated that both out-comes would result in useful recommendations for a practical way forward.

1.5 Aim of Research

The aim of this research is to determine whether EIAs are inadvertently contributing towards or hindering the potential for KwaZulu-Natal to achieve its conservation targets. Given that the current protected network is insufficient to safeguard biodiversity and that EIAs are undertaken on case by case basis, the impact of decisions made are unknown at a landscape level, as there is currently no feedback mechanism to integrate the EIA decision into the spatial framework, and hence consequences for achieving biodiversity targets are unknown. It is therefore critical to assess how developments outside the PA network impact upon KwaZulu-Natal meeting its provincial biodiversity target.

1.6 Objectives

The objectives of this study are as follows:

- To assess a subset of EIAs (located within a coastal and inland municipality and approved between 2005 and 2008) to evaluate their contribution to conserving biodiversity in KwaZulu-Natal.
- To identify the potential value of EIAs in conserving KwaZulu-Natal's biodiversity through spatial analysis.
- To determine whether EIAs can bridge the information-implementation gap at strategic planning levels.

It is anticipated that there would be two major outcomes of this research. The first is to identify the contribution EIAs make towards meeting biodiversity targets (whether it be positive or negative), by assessing the decision-making process and hence the outcomes of EIAs. The second is to forward recommendations, based on the findings of the point above, to bridge the gap between information and implementation, that is to use the information contained within EIAs to inform strategic plans (such as spatial frameworks), rather than just strategic plans informing EIAs, which is in line with the recommendations made by the South African Institute for Environmental Assessments (SAIEA, 2003).

The above objectives will be accomplished by answering the following key questions:

- What percentage of EIA decisions provide for the safeguarding of biodiversity?
- What percentage of EIA decisions provide for safeguarding of biodiversity in areas known to be sensitive to transformation?
- What percentage of development has complied with the EIA decision?
- What proportion of the non-compliant developments have had intervention and is compliance in place or possible?
- What is the perception of conservation and environmental authorities of the effectiveness of EIAs to safeguard biodiversity?

- How does the EIA decision modify the spatial framework?

1.7 Outline of Chapters

This dissertation consists of six chapters. Chapter two contextualises the conceptual framework of this study which draws on the contextualisation and discussion of biodiversity within the political ecology and landscape ecology perspective and highlights the importance of adopting transdisciplinary studies in biodiversity assessments. Chapter three discusses the literature review upon which this study is based and focuses on the importance of biodiversity, the legal framework within which biodiversity lies, as well as environmental planning tools (namely EIAs and systematic conservation plans). The fourth chapter details the study area, with particular reference to the uMgeni and eThekwini Municipal areas, as this allowed for an assessment of both inland and coastal biodiversity hotspots, as well as describes the methodology used to undertake the study. Chapter five presents the results and forwards the discussion based upon the results obtained. Lastly chapter six draws conclusions by indicating how the objectives of the study have been met. In addition, it integrates the key points emanating from the previous chapters and provides recommendations for a way forward.

1.8 Conclusion

In conclusion, given the value of biodiversity, the threats to biodiversity and the several challenges faced by KwaZulu-Natal to conserve representative samples of biodiversity, the need to determine the effect EIAs have on KwaZulu-Natal's ability to meet its conservation targets are critical at a landscape planning level. Through the clarification of the issues raised by the key questions, and hence the objectives and aims of this study, the effect EIAs on the province's ability to meet its conservation targets, can be determined.

CHAPTER TWO:

CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter contextualises the conceptual framework upon which this study is based. The study draws largely from the framework of political ecology by linking key aspects of environmental change to the policies and institutions engaged in implementing biodiversity conservation. Currently, it is widely accepted that biodiversity related conflicts are situated within complex ecological, economic and social contexts, however studies often emphasise only one of these aspects (White *et al.*, 2008: 242), which is inadequate in analysing complex human-ecological systems. In the social sciences biodiversity conflict is assessed and understood through stakeholder participation, while within the natural sciences, ecologists and/or specialists consider their role as providers of impartial information with technical management solutions (White *et al.*, 2008). Therefore, this study attempts to bridge the gap between these two disciplinary approaches, to understanding the relationship between the EIA process (through stakeholder perceptions of the value of biodiversity and the decision making process) and meeting conservation targets (based on spatial and technical information). Closely linked to political ecology is landscape ecology. The latter addresses the relationship between spatial patterns and ecological processes by providing indications of the most ideal ecosystem patterning to support biodiversity conservation (and sustainability). The chapter advocates these conceptual approaches as a transdisciplinary approach, upon which this study is based.

2.2 Theoretical Analysis

2.2.1 Political Ecology

Political ecology is considered a diverse and transdisciplinary field, that is, it "…embraces the interactions between the way nature is understood and the politics and impacts of environmental action" (Adams and Hutton, 2007: 147). Political ecologists also delve deeper into what appears to be simple conflicts over resources and have identified a "broader process of change within specific historical contexts (Turner, 2004).

Transdisciplinary represents a form of interdisciplinary where the "questions cross disciplines" (Lattuca, 2001: 81). These questions have two important characteristics: they are "designed to identify similarities in structures or relationships among different natural and/or social systems" (Lattuca, 2001: 116) and they do not borrow "theories, concepts, or methods . . . from one discipline and apply them to another, but rather transcend disciplines and are therefore applicable in many fields" (Lattuca, 2001: 83).

Simon (2008) highlight's that the field of political ecology is diverse and still evolving, and while rooted in development studies, it aims to integrate natural and social science analysis. Adams and Hutton (2007: 149) add a further dimension, by stating that political ecology has also been described as the field which "… explicitly address the relations between the social and the natural, arguing that the social and environmental conditions are deeply and inextricably linked… and that the way nature itself is understood is political". It is further acknowledged by Escobar (1999, cited in Adams and Hutton 2007: 149) that ideas about nature, including those in scientific research, are "…formed, shared and applied in ways that are inherently political". As a result, the following three sub-sections highlights the evolution of the idea of nature, with particular reference to conservation; political ecology's influence on environmental action; as well as the criticism made against political ecology.

2.2.1.1 Political Ecology of Conservation

"Political ecologists contend that the way nature is understood has profound political significance" (Adams and Hutton, 2007: 152), in the context of conservation, laws govern the use of nature to the extent that there is a division between nature and human society (Adams and Hutton, 2007). This notion of the detachment of humans from nature has deep historical roots that lie in colonial social structures and capitalism, which treats nature as a resource to meet human needs and lacks intrinsic value (Adams and Hutton, 2007). According to Adams and Hutton (2007: 152-153), it is this approach to nature that has "…underpinned the development of science and the ambition of European imperialism from the sixteenth century… [which tightened the] 'government' of nature".

An example of the treatment of nature as a commodity is that of the forestry industry, which was developed in the eighteenth century in Prussia (now North-central Europe, including Northern Germany and Northern Poland). It was the 're-expression' of the natural woodlands (that included the complex interactions of wildlife and people) into a simplistic management unit, which allowed for the calculation and measurement of productivity and in turn resulted in defining nature in terms of sustainable yields (making it a renewable resource) and facilitated forestry management (Adams and Hutton, 2007). It is through this historic backdrop, and similar scenarios around the world, that nature could then be "…classified, counted, and (at least in theory) to be controlled by government bureaucracies set up to optimize relations between state, society and nature" (Adams and Hutton, 2007: 153).

Conservation has also been manipulated in a similar way to forestry, as nature is regularised through power and knowledge, and it is through the establishment of PA that the divisions between humans and nature are further polarized (Adams and Hutton, 2007). An example of this is that of the United States of America (USA), where settlers and natives were physically removed from areas that were identified as nature, as in the case of the establishment of Yellowstone and Yosemite National Park (Adams and Hutton, 2007). In colonial Africa the same segregation of humans and nature occurred through British colonial conservation, particularly given the ideas of wilderness (that is, free from modern or present day human influence) embracing the concept or popular perception of 'an unspoiled Eden' which is often attached to the idea Africa (Adams and Hutton, 2007).

The idea of 'wilderness' continues today, this concept underlies the science based planning approach to conserve natural areas and identify potential PAs. Adams and

Hutton (2007: 167) eloquently explain that "[i]deas of nature are laid out on the ground of PAs, and the needs, rights and interests of people are moulded to fit the resulting conservation landscape. All this takes place against the backdrop of a wider assault on nature through processes of industrialisation, urbanisation, pollution, and the conversion of terrestrial and marine ecosystems to industrial purposes". In other words, political ecology criticises the conservation planning approach (due to the lack of consideration of social issues), while the current risks associated with transformation and disturbance to the natural environment, leaves decision makers with a complex dilemma on how to impartially balance social and environmental issues. In addition, techno-centric solutions (that is conservation planning) cannot accurately reflect the realities of human use of the environment (Adger ***et al.***, 2001).

This is not to say that PAs do not provide benefits to society, as they provide ecosystem services at local, regional and national levels, such as nutrient and water cycling, soil formation and retention, resistance against invasive species, regulation of climate; direct services include food security, protection from natural disasters, energy security, access to clean water, raw materials and recreational enjoyment and so on (MEA: 2005). It has also been recorded that approximately "70% of the protected areas worldwide are inhabited or regularly used by local people" (Nygren, 2004: 189). PAs also contribute to the tourist industry, creating opportunities for local communities to share in the revenues and benefits received from tourism such as direct employment, profit-share schemes, or locally owned commercial activities (Adams and Hutton, 2007). However, Walpole and Thouless (2005 cited in Adams and Hutton 2007), note that the economic benefits received by the locals are usually less than those predicted. Hence, this economic disparity can lead to the widening of the gap between people and nature and biodiversity conflicts.

Adams and Hutton (2007) identify several trends pertaining to the political ecology of international biodiversity conservation that need to be addressed and which will assist in clarifying the societal environmental dilemma. Firstly, that conservation research must extend beyond its science base and include other disciplines and actors (Adams and Hutton, 2007). Secondly, that biodiversity conservation has significant social impacts, which leads to the third issue that conservation planning needs to adopt social impact assessment methods (Adams and Hutton, 2007). Trend four pertains to the politics of global conservation, and the power that it yields to delineate landscapes, which result in the control of access and rights to land and therefore there is a need to acquire participatory and inclusive social learning methods (Adams and Hutton, 2007). The fifth, and final trend, is that of the influence of neoliberal thinking within the field, for example that conservation organisations lobby for grants and donors, aided by the scientific generation of terminology, such as 'hotspots', to assist in marketing the conservation sector, particularly given that "most biodiversity exists outside formally protected land, much of it private" (Adams and Hutton, 2007: 169), which requires soliciting of donors and the public sector.

2.2.1.2 Political Ecology and Environmental Action

Political ecology has also been described as a method which allows for the analysis of "…power relationships among actors in the way decisions are made and benefits shared…" (Berkes, 2004: 624). In this context, conservation planning tools guide decisions which result in environmental action. One of the challenges with regards to conservation planning is aligning the integration of local institutions that best fit with conservation goals. Berkes (2004) argues that biodiversity conservation in many countries is often delegated to weak government agencies and institutions, and hence results in biodiversity conflicts. This is of particular concern as local and traditional rights are the core to the political ecology research agenda (Clapp, 2004).

What political ecology alludes to is cross-scale conservation. According to Berkes (2004) both ecosystems and social systems are organized hierarchically, and require horizontal linkages (across space, in terms of networks of communities, NGO and government agencies) and vertical linkages (across various levels of organisations). As such, conservation of this nature calls for a bottom up approach, which yields local solutions with little government regulation (Berkes, 2004). Through the utilisation of this approach and principle, one would more likely be in a position to address the conservation problem at hand.

According to McCarthy (2002) political ecology has ten major themes, namely: access to and control over resources; the effects of limited state capacity; marginality; integration of scales of analysis; ambiguities in property rights and the importance of informal claims to resource use and access; the disenfranchisement of legitimate local users and uses; the effects of integration into international markets, the centrality of livelihood issues; and the imbrications of all these with colonial and post-colonial legacies and dynamics. This study is largely embedded within the first two themes, as EIAs affect access to and control of resources; and the EIA process, monitoring, law enforcement and resource management is governed by the state, hence the effects of limited capacity within the state would have extensive and far reaching implications for natural resource management. Much like the study undertaken by Nygren (2004) which investigates the struggles over resources, it is anticipated that this study will uncover the plurality of environmental perceptions, through the analysis of stakeholders' understandings of nature, and how this varied understanding contributes towards environmental conflicts, as well as lends itself to solutions.

2.2.1.3 Critique of Political Ecology

While the benefits of applying the political ecology approach are both demonstrable and numerous as with all discourses, the emergence of constructive criticisms have been noticed. Peterson (2000), for example notes that ecology is frequently overlooked in favour of human socio-economic and cultural systems, pitting it more in line with political economy approach to natural resource management. The author argues that the complexity of any given biodiversity (patterns, processes and goods and services) determines the options and alternatives available to communities. In addition, it is these alternatives that dictate the politics, economics, and management of biodiversity (Perterson, 2000). As a result, Peterson adopts a resilience approach to political ecology, and defines it as "combining the concerns of ecology and political economy that together represent an ever-changing dynamic tension between ecological and human change, and between diverse groups within society at scales from the local individual to the Earth as a whole" (Perterson, 2000: 324-325).

Clap (2004) asserts that a second argument made against political ecology is that of the criticism political ecology makes against spatial conservation strategies, as conservation areas are perceived to restrict rights and resource use. According to Clapp (2004), within the framework of political ecology, conservation areas are not analysed by their ability to protect threatened species or ecosystems, but instead focus on which societies benefit or suffer. For example Neumann (1998), cited in Clapp (2004), noted that parks, particularly those in Africa, restricted traditional access to areas which resulted in traditional land uses being deemed unlawful within that area. Political ecology further contends that societies are 'evicted' and their cultural landscapes restraint in order to achieve a utopian wilderness, rather than environmentalists attempting to protect remnants of nature (Clapp, 2004). Some political ecologists have highlighted that the USA's United States Wilderness Act of 1964 neglected to consider local societies (Kay, 2002 cited in Clapp, 2004) and Sluyter (2001 cited in Clapp 2004), takes this notion one step further by stating that these actions of disparity could be considered racist.

However "[t]hese critics reject the notion of wilderness because they consider that it separates human from nature, when humans have influenced all ecosystems and functioned as keystone predators in many" (Clapp, 2004: 841), which alludes to point that the demands and needs of an increased human population cannot be sustained if resources are not afforded the opportunity to regenerate. Therefore, conservation areas have the ability to be benchmarks for natural process, "as they provide a baseline or scientific control against which the effects of intensive landscape transformation can be compared" (Clapp, 2004: 842), as increased population leads to increased transformation to satisfy the increased demand of resources. In other words, these benchmarks allow for a "comparative sense, for drawing conclusions about the effects of humans in wildlife communities and ecosystems…" (Arcese and Sinclair, 1997 cited, in Clapp, 2004: 842).

The third critique made against political ecology, is that political ecology believes that conservation areas should be isolated in space and time rather than adapting over time. Political ecologists expect conservation areas to be "characterized by stability and predictability" (Clapp, 2004: 842), obviating the consideration of the influence of the surrounding landscape. However, Clapp (2004: 843), provides evidence in support of conservation areas, by asserting that they act as 'biodiversity reservoirs' providing opportunities for the re-population of threatened species, they provide the ability to maintain connectivity within the broader landscape and they provide spaces to leverage adaptation resulting from extraordinary conditions such as climate change.

It is with this response of political ecology, which further endorses the need for spatial conservation strategies to identify conservation areas; and appropriate and efficient corridors within the landscape. The second theoretical framework adopted in this study is landscape ecology, which is founded on the principles of both spatial analysis and assessments at the landscape level.

2.2.2 Landscape Ecology

Troll (1971 cited in Wu, 2007: 1433) defines landscape ecology as the "study of the main complex casual relationships between the life communities and their environment [which]…are expressed regionally in a definite distribution pattern (landscape mosaic, landscape pattern)". The concept of landscape ecology therefore accepts both social and biophysical perspectives, including patterns and processes (Wu, 2007). An example of pattern and process is that of vegetation distribution, where fire, an agent of change, results in the creation of a particular vegetation 'pattern' (as opposed to grazing), and fire would be considered the 'process', as it is the mechanism by which the vegetation pattern would be created (Li and Wu, 2004). According to Pearson and McAlpine (2010), the pressure that human agents place on the world's landscape, is increasing at a rapid rate, and coupled with global climatic change, creates a need for sustainable landscape management and planning. This need creates the perfect platform for landscape ecology to address this challenge, as well as justifies landscape ecology's place within this study. Hence the sub-sections that follow briefly present the evolution of landscape ecology, discussing the criticisms made against landscape ecology as well as its advantages, and describe the application of landscape ecology.

2.2.2.1 Evolution of Landscape Ecology

The paradigm of landscape ecology has evolved differently across the world. Central and Eastern Europe focused on "landscape planning, management, conservation and restoration…emphasis[ing] the interactions between human activities and land resources [which] necessitated the development of holistic, interdisciplinary…approaches" (Wu and Hobbs, 2002: 363). The reason for this direction can be attributed to the rapid loss of diversity within the European regional landscape, as well as the need for landscape policy (Antrop, 2007). In addition to the attention being paid to the rapid decline in ecological (natural capital) and heritage (cultural capital) value, Europe also experienced a distinctive need to plan for the future, given the increase in urbanised society, which operates under the premise of sustainable development and participatory planning (that is, incorporating both biophysical and social perspectives) (Antrop, 2007).

In North America, landscape ecology focused on "spatial heterogeneity and its effects on ecological processes [in terms of] quantitative methods…spatial pattern analysis and modelling" (Wu and Hobbs, 2002: 364), which has largely been a result of influences from patch dynamics and the theory of island biogeography (Wu and Hobbs, 2002). Landscape ecologists, particularly in the USA, concentrated on the interaction between spatial patterns and disturbances, and more often than not, the 'disturbance factor' was humans, however, more recently their attention has expanded to consider urban sprawl (Antrop, 2007).

However, both the abovementioned views are practiced internationally, and it is widely accepted that both are currently being merged, as "developments in [landscape ecology] in recent years clearly indicate the necessity and feasibility of integrating these two perspectives into a more comprehensive one that is holistic and with scientific vigor" (Wu and Hobbs, 2002: 364). Wu (2007) indicates that the goal of landscape ecology "has been to promote interdisciplinary and integrative studies of landscapes…to improve our understanding of the world of landscapes… [and] to provide solutions to the plethora of problems occurring in our landscapes" (Wu, 2007: 1433). The first president of the International Association of Landscape Ecology states that “landscape ecology should be regarded both as a formal Bio-Geo- and Human Science and as a holistic approach…” (Zonneveld, 1982 cited in Naveh, 2000: 8).

2.2.2.2 Criticisms and Advantages of Landscape Ecology

Over the past two decades not all expectations of this interdisciplinary theme have been met (Li and Wu, 2004). This sub-section discusses both the criticisms faced by landscape ecology, as well as the advantages it provides as a conceptual framework once these concerns have been addressed.

Li and Wu (2004) highlight that there are at least three types of problems that can be attributed to the lack of landscape ecology to meet their expectations, however only the first of the three key issues, namely the conceptual flaws in landscape pattern analysis, will be discussed as this pertains directly the research presented in this study. Li and Wu (2004) found that not all relationships fall within the typical pattern and process scenario (as explained section 2.2.2 in terms of vegetation pattern and fire). In fact, some relationship scenarios are non-interactive, for example “vegetation pattern (habitat distribution) affects, but is not generated by bird population dynamic” (Li and Wu, 2004: 391), that is, avifaunal presence is determined by the availability of particular vegetation patterns, but the population of avifauna does not create that particular vegetation pattern. As such, the authors call for ‘proof of existence’ to identify either the interactive or “one-directional relationship between spatial pattern and process” (Li and Wu, 2004: 391). In addition, landscape indices were deemed ecologically irrelevant, as they are based on mathematical constructs and are generally assumed rather than established (Li and Wu, 2004). However, provided that all relevant species or habitat variables are incorporated into a spatial pattern analysis, Li and Wu (2004) indicate that then only can ecological relevance be identified. A further point made under the conceptual flaws in landscape pattern analysis by Li and Wu (2004), is that of scale, that is, differentiating between scale in observation and scale in analysis. Due to the difficulties associated with collecting data at different scales (for example constraints pertaining to time, resources, weather conditions, etcetera), data is often manipulated to generate surrogate data. Therefore, Li and Wu (2004) err on the side of caution, by recommending that awareness be created with regard to pattern and scale issues. As a result, this study aims to identify and resolve these three problem areas, by identifying pattern and process relationships (or lack thereof), ensuring all relevant species or habitat variables are incorporated into a spatial pattern analysis and bring awareness to the limitations faced as a result of differing scales between observation and analysis (this is discussed in detail in Chapter Four: Study Area and Methodology, Section 4.3).

A second criticism of landscape ecology is that it has not achieved the ability to bridge the knowing-doing gap Antrop (2007). According to Antrop (2007), landscape ecologists focus largely on land use or land cover and processes of change, and very little attention to societal issues, which is what planners or implementers have to consider and deal with. As a consequence, "the difficulty landscape ecologists [face, is how] to pass their message to other disciplines, and in particular to applications" (Antrop, 2007: 1442). In other words, the practical application of landscape ecology in planning and policy making is inadequate, and one of the main problems lies in the lack of ability of landscape ecologists to communicate with non-landscape ecologists.

Opdam *et al*. (2002: 769) argue that the future of landscape ecology lies in its ability to "understand how landscape pattern is related to the functioning of the landscape system, placed in the context of (changing) social values and land use". It is further argued that this understanding can be achieved and appropriate decision-making undertaken if future landscapes, planners, managers and politicians are involved an iterative planning process, such as the one indicated in figure 2.1.

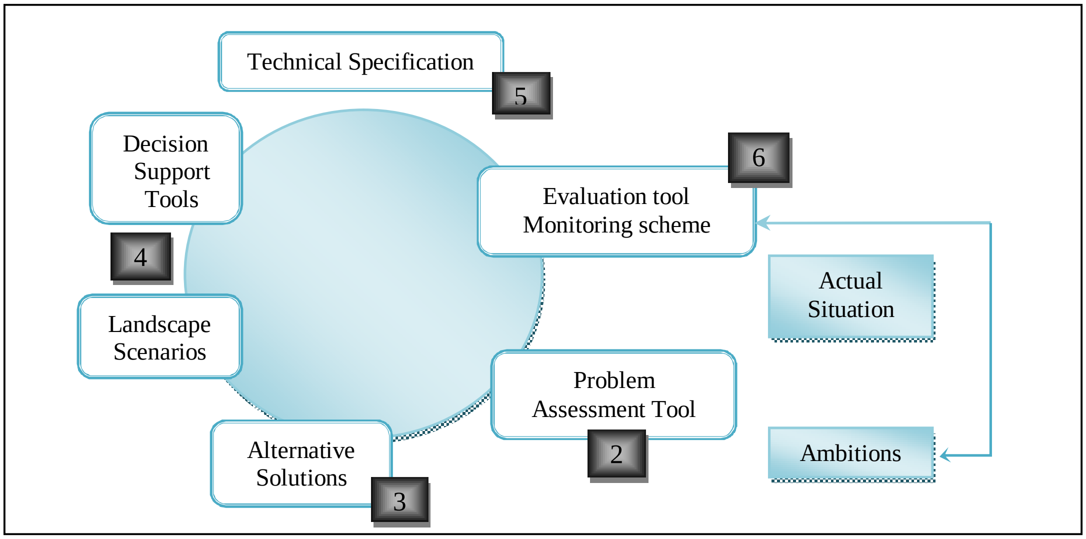

Figure 2.1: Planning Cycle (adapted from Harms *et al*. (1993 cited in Opdam, 2002:770))

The process incorporates the following steps (Harms *et al*. (1993, cited in Opdam, 2002: 769-770):

- the first step is to identify the 'problem definition' which, as in the case of both Opdam's (2002) research and this study, is conserving habitat networks in a landscape that is human dominated, and includes identifying goals and indices to measure success.
- at this point an assessment tool is required (step two), which can be in the form of a geographic information system (GIS) model "which can determine the potential of the landscape for a set of target species".
- step three requires the identifying of potential solutions and the success of any solution will be determined by the current social and economic contexts within the landscape.
- the fourth step entails the assessment and comparison of the proposed alternative options in the landscape, that is, the information obtained from step one must be used in a prognostic way to predict which option would best achieve the conservation target, and this is guided through the use of landscape scenarios and decision support tools.

- when the best option has been selected, step five calls for technical specifications which guide the design and construction of the new landscape plan.
- the final step (that is, step six), is to determine the success of the plan after implementation through assessments, evaluations and monitoring, and to confirm the model's prediction, as well as allow for improvements to be made should certain goals not be met. The crux of this study is embedded within step six, and will be discussed in more detail in the literature review and study area and methodology chapter.

Pearson (2010: 1152) highlights the following limitations to landscape ecology:

- While landscape ecology's aim is to solve landscape suitability problems (through its transdisciplinary nature), its application has hitherto been limited in planning sustainable landscapes. As a result, definitive management objectives and actions, which focus on creating spaces in which "biophysical, socio-cultural and economic processes interact is required" (McAlpine *et al*., 2010 cited in Pearson, 2010: 1152). It is envisaged that the value society places on ecosystem goods and services, would necessitate collaborative partnerships and adaptive management in the maintenance of biodiversity.
- The inefficiencies of current landscape ecology to engage effectively with the socio-economic and policy realms, which is detrimental to the goal of sustainable landscapes. The authors call for the consideration of community values of landscapes and the inclusion and participation of all stakeholders involved, which would provide a robust socio-ecological landscape based on participatory planning.
- Landscape ecology lacks rigorous methodologies and context specific understandings to facilitate future change detection as well as to identify key drivers of change to particular ecosystems. The authors advocate for the identification and quantification of drivers by integrating this data with spatial and temporal analysis.

In essence, the arguments made by Pearson (2010), call for a more effective landscape ecology which contributes towards sustainability. In addition, this call strives towards bridging the knowing-doing or science-practice gap, and develops and maintains multifunctional landscapes Pearson (2010).

2.2.2.3 The Application of Landscape Ecology

In order to ameliorate the relationship between science and practice and achieve landscape development, Termorshuizen and Opdam (2009) state that the pattern and process relationship should be expanded to include value. 'Landscape development' refers to all phases within the decision making process on landscape change, such as assessments, target setting, design, implementation and monitoring, and 'value' refers to the value of the landscape to society, as more often that people are not considered part of the landscape and are instead seen as the cause of negative change in the landscape (Termorshuizen and Opdam, 2009).

To achieve the abovementioned task, that is include value into the pattern and process relationship, local stakeholders are guided to define "common future values…to identify a landscape structure that will support those values" (Termorshuizen and Opdam, 2009: 1044). However, in order to involve stakeholders within this decision making process, all actors need to have a understanding of the generic nature of scientific knowledge, which will enable them to interpret how indicators of landscape function relate to ecological, social and economic values and benefits (Termorshuizen and Opdam, 2009). However, Termorshuizen and Opdam (2009), noted that stakeholders that were involved in local landscape planning were not being appropriately guided through the process, as there was uncertainty with regards to how stakeholders used "the pattern and process information, whether they tend[ed] to focus on functions or on the spatial structure, and how they deal[t] with value" (Termorshuizen and Opdam, 2009: 1044). To this end, Termorshuizen and Opdam (2009: 1046) designed a conceptual framework for application, referred to as the structure-function-value chain (illustrated in figure 2.2) "[t]he outcome of the change process need[ed] to ensure that structure, function, and value in equilibrium and that profits accruing to landscape users equal costs + income to suppliers".

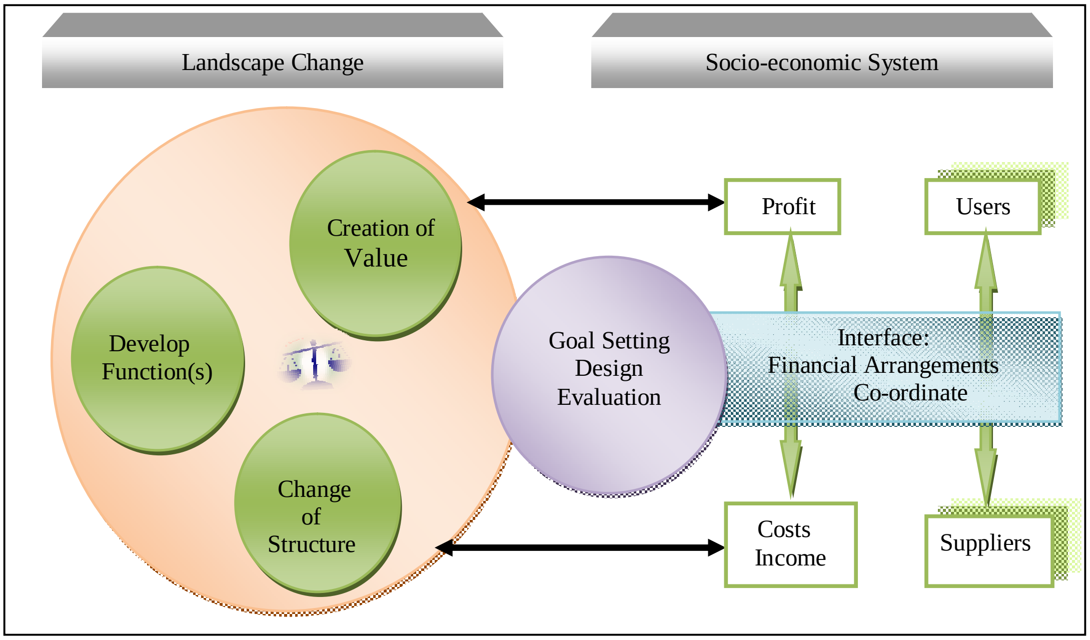

Figure 2.2: A Conceptual Framework for Collaborative Landscape Development (adapted from Termorshuizen and Opdam, 2009: 1046)

Termorshuizen and Opdam (2009) explain this process by beginning with the landscape change side of figure 2.2, where stakeholders (for example farmers, nature conservation organisations, etcetera) choose priority functions and which values the landscape function must provide (through negotiation and agreement), within the context of site specific aspects, existing policies, available space, and so on, to generate a landscape structure that improves the services selected. The Socio-economic side of the above figure illustrates the relationship between those stakeholders that provide services and those that use services, and these are linked to financial arrangements. In essence, this framework is therefore considered within a market situation of demand and supply, which creates the conditions for a sustainable landscape development (Termorshuizen and Opdam, 2009). An example of this framework in practice would be that, "the suppliers earn income and incur costs of changing the landscape and managing it: users gain profit in the form of quality of life (health, recreation) or save money because the landscape takes over regulatory functions (for example water supply, waste treatment)" (Termorshuizen and Opdam, 2009: 1047).

However, the abovementioned framework is in its infancy stages and teething issues, need to be identified and rectified. An example of one such issue is, given that local stakeholders are responsible for determining the value of the services, discrepancies may arise, such as the level of water purification verses the level of biodiversity protection of a particular system or landscape (Termorshuizen and Opdam, 2009). Termorshuizen and Opdam (2009), therefore conclude that the structure-function-value chain framework should function as a tool for learning and communication, which should move landscape ecology closer towards sustainable development. It is therefore with this point in mind, that this study considers this framework and utilise those aspects that are deemed applicable, to endeavour to bridge the gap between knowing and doing (or science and practice).

In addition to the abovementioned framework, for bringing the 'knowers' and 'do-ers' closer together to achieve landscape sustainability, decisions (undertaken by the do-er or implementer) on landscape change need to consider the three dimensions of the landscape concept, namely eco-physical (that is pattern and process), social (based on perception, land use, etcetera) and economic dimensions (based on the landscapes ability to produce economic value), and through the understanding the relationship between these dimensions, can sustainable landscape decisions be made (Termorshuizen *et al.*, 2007). Termorshuizen defines decision-making, in this context, "on attributing targets for nature conservation, quality of life or economic welfare to the landscape region…it includes the assessment of ecological, social and economic values and their interactions [as well as the] allocation of land use functions" (Termorshuizen *et al.*, 2007: 374 and 376).

However, Termorshuizen *et al.* (2007) highlights that decision-making is currently bias towards social and economic functions, as ecological functions of landscape do not receive the same level of attention. This disparity could be attributed to the difficulty of sourcing indicators to measure ecological sustainability from scientific literature and the lack of knowledge transfer between the eco-physical and landscape planning domains (Termorshuizen *et al.*, 2007). This argument is supported by Nassauer and Opdam (2008: 633), who acknowledges that while landscape ecology has advanced "in describing landscape pattern and in understanding pattern:process relationships, it has made less profound gains in affecting landscape decision making". Antrop (2005: 187) also supports this notion, by stating that landscape sustainability is a utopian goal.

Therefore Termorshuizen *et al.* (2007) argues that through the development of science based tools, to integrate ecological sustainability principles into landscape planning solutions, there will be an improvement of the transfer of knowledge between landscape ecology and planning, provided that non-ecologists are able to use it and they are appropriate for different plans at various scales. Termorshuizen *et al.* (2007), therefore concludes that two possible tools could be developed to integrate landscape ecology into planning, the first being a guideline tool, which would assist in ensuring ecological quality of landscape plans, and the second would be an instrument tool, for assessing that ecological quality. In addition, a "prerequisite for… effective implementation is that the criteria will be acceptable for a variety of public and private stakeholders…[and] need to be appropriate in the context of the organizational and procedural arrangements of the decision-making process" (Termorshuizen *et al.*, 2007: 382 and 383).

2.3 Conclusion

Both political ecology and landscape ecology have been described as transdisciplinary approaches. While it is acknowledged that both the abovementioned approaches have been subjected to both constructive and justified criticisms, the varied and valid advantages that both contribute toward their respective disciplines (as highlighted throughout this chapter) balance out each of their negatives. In other words, political ecology fills in the gaps where landscape ecology may fail and landscape ecology satisfies any lack in political ecology, which allow this study to be based upon a truly transdisciplinary approach.

CHAPTER THREE:

LITERATURE REVIEW

3.1 Introduction

Due to the theoretical paradigm shifts over the past few decades, as discussed in Chapter Two, there have been various global and local responses to safeguard biodiversity. The chapter begins by explaining the importance, threats and status of biodiversity. The chapter then highlights and interrogates several pieces of legislation, policies and conventions that have emerged as a result (or as a response) to the increasing awareness of the importance and value of biodiversity. The EIA process and SCP, respectively, as two specific responses to safeguard biodiversity are then critiqued. The chapter also looks at alternative approaches to safeguarding biodiversity through land-use change. Finally, the chapter concludes by summarising the key issues that have emerged from the literature, in terms of its contribution towards this study.

3.2 Biodiversity

Biodiversity, also referred to as biological diversity, has been assigned a plethora of definitions. According to the National Environmental Management: Biodiversity Act 2004-NEMBA (Chapter 1, Section 1), biodiversity is defined as:

the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.

It can be more briefly described as the variety of structure, function and composition within the heterogeneity among genes, species, and ecosystems (Biggs *et al.*, 2006), or more simply defined as:

everything from the smallest living organisms both marine and terrestrial… (including humans); as well as…the water, air and soil upon which we all rely [on] for our existence, as well as the habitats, the networks and links between them all…

(Ezemvelo, 2009a: 2).

Within the EIA context, the legislated biodiversity definition is used. Therefore, for the purpose of this study, biodiversity is defined according to the NEMBA definition.

3.2.1 Importance and Value of Biodiversity

The importance of biodiversity is largely attributed to two factors. Firstly that biodiversity is essential to the functioning of ecosystems which "collectively determine the biogeochemical processes that regulate the Earth system" (Loreau *et al*., 2001), and can also be referred to as biodiversity's inherent value. Secondly, the services provided by well-functioning ecosystems, which is reliant on biodiversity, are important to human well-being (Naidoo *et al*., 2008). This aspect is the focus of the remainder of this section, as this study considers whether biodiversity is appropriately safeguarded against anthropogenic activities through the EIA process, so as not to negatively impact upon the very resource that forms the basis of human existence.

Humans receive various commodities and services from ecosystems, otherwise known as ecosystem goods and services, in both indirect and direct forms. For example, according to the MEA (2005), indirect services obtained by humans include nutrient and water cycling, soil formation and retention, resistance against invasive species, pollination of plants (including crops) and regulation of climate, which lead to direct services, such as food security, vulnerability to natural disasters, energy security, access to clean water, raw materials, recreation and spirituality.

Figure 3.1 indicates the relationship between biodiversity, ecosystem services and human well-being, and demonstrates that "biodiversity is both a response variable affected by global change drivers and a factor modifying ecosystem processes and services and human well-being" (MEA, 2005: 28). Hence figure 3.1 illustrates that the consequences of species loss would not only affect the functioning of ecosystems, but will decrease the availability of services that humanity relies on.

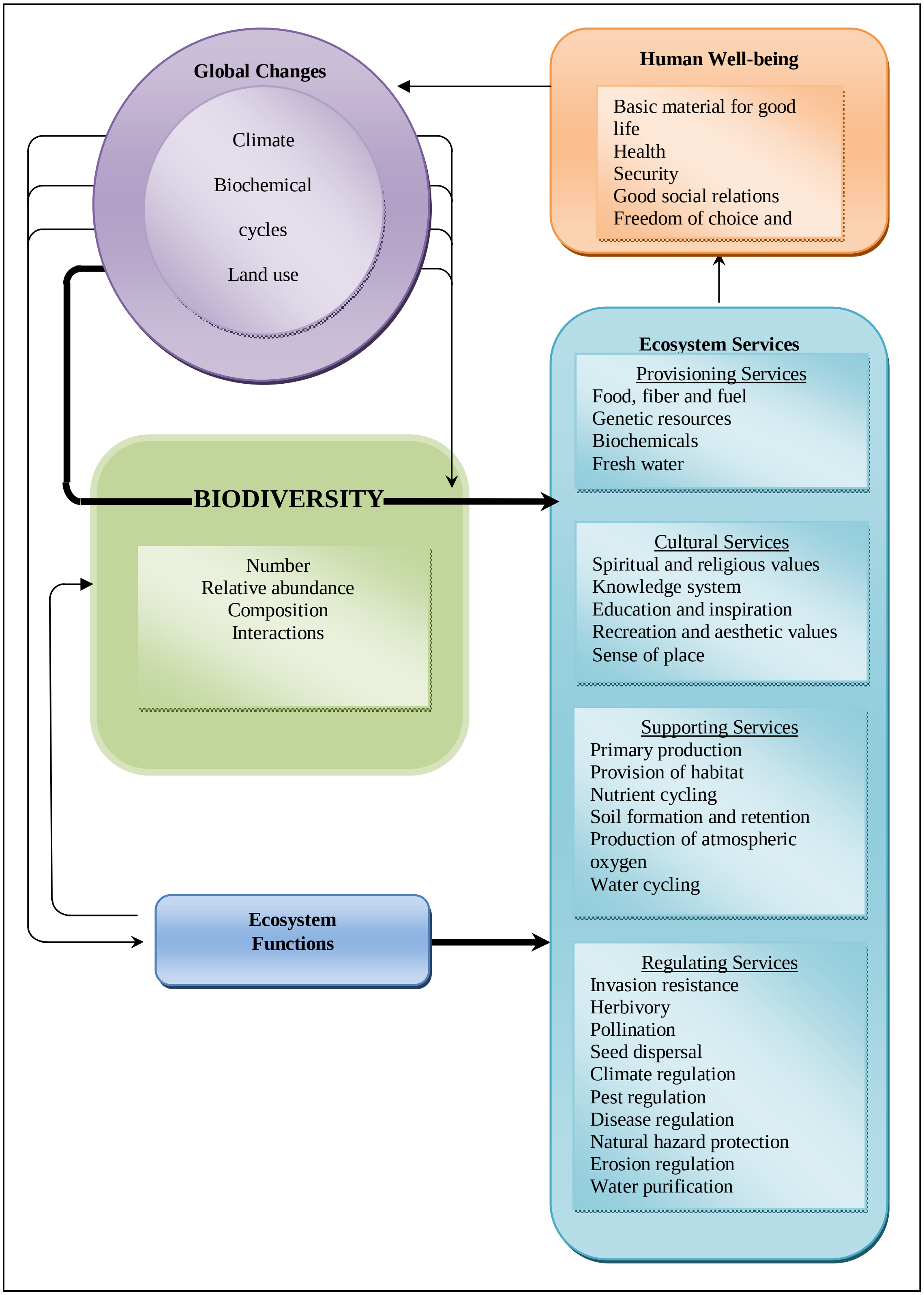

Figure 3.1: Biodiversity, Ecosystem and Human Well-being Relationship (adapted from MEA, 2005: 28)

In addition, the MEA (2005) indicates that ecosystems and their services are referred to as biocapital (also known as biological wealth) given that many economies are dependent upon natural resources, and are therefore regarded as capital assets. In 1997, Costanza *et al*. (1997) demonstrated that the value of the ecosystem services provided by the entire biosphere (that is, earth) was estimated at an average of US$ 33 trillion per year, which was 1.8 times greater than the global gross national product at the time and was regarded an underestimated value. It is important to note that although the value of the global ecosystem has not been recently recalculated, given that the more stressed or scarce an ecosystem becomes, so too does its value increases (Costanza *et al*.; 1997) and given inflation over the past 13 years, it is therefore reasonable to presume that the value of the global ecosystem today is significantly larger than in 1997.

Within the South African context, ecosystem goods and services, across various scales have recently been calculated to contribute significantly to the country's economy. At a national scale, the uKhahlamba-Drakensberg Park (a World Heritage Site), supplies 25% of the country's water and "adds value of R2.6 billion (low value: example agriculture and households) to R5.5 billion (high value: example industry) to South Africa's economy" (Ezemvelo, 2009a: 8). At a provincial scale, and according to 2006 pricing, KwaZulu-Natal's natural systems provide ecosystem goods and services to the value of R151 billion (Ezemvelo, 2009a).

A study conducted on Durban's open-space system reveals the huge costs to its citizens, from developing and maintaining alternatives to natural ecosystem services. The potential replacement costs of ecosystem services that are currently utilised free of charge, for example, should wetlands no longer provide flood attenuation relief by absorbing large volumes of water and dissipating the energy associated with it, the cost associated with building and maintaining flood attention structures would have to be borne by society in the form of rates (Roberts *et al*., 2005).

The results of Durban's open-space system valuation analysis indicates that should the services of the open-space system cease, the municipality would need to spend approximately R3.1 billion per annum to replace those services (Roberts *et al*.; 2005).

While this figure is considered to be conservative, it also does not take into account Durban's tourism sector which is largely based on the city's 'sun, sea, beach and sub-tropical environment', and would thus need to add a further R3.3 billion (annual tourism turnover) to the services value, bringing the total to R6.4 billion per annum (Roberts *et al*.; 2005).

However, it is important to note that maintaining only 'useful' species (that is, the minimum amount of species required to maintain an ecosystem), cannot ensure an ecosystem's long-term resilience and hence its ecological integrity (Biggs *et al*.; 2006). According to Biggs *et al*. (2006), maintaining the elements and processes of a system would protect the wholeness of an ecosystem, thus the ecological integrity of that ecosystem would be maintained, thereby ensuring its long-term resilience and ability to provide services into the future. Furthermore "loss of biodiversity, including reductions in the extent or condition of ecosystems, in the abundance or distribution of populations of individual species, or in genetic diversity within populations, therefore has adverse implications for ecosystem services and human well-being" (Biggs *et al*.; 2006: 277). This notion is further supported by Loreau *et al.* (2001), who highlight that if only those species which are essential for ecosystem functioning are protected, then that ecosystem may only function under a constant set of conditions, however should an ecosystem be required to function within a changing or dynamic environment (for example seasonal changes or global climatic change), then a larger suite of species is probably essential to maintain the stability of ecosystem processes. As such, this study will broadly assess how ecosystem services are considered within the EIA process, as well as provide an indication of the general perception of both ecosystem services and biodiversity.

3.2.2 Biodiversity Threats

A generic definition for threats to biodiversity has been described by Salafsky *et al*. (2008: 897) as:

[t]he proximate human activities or processes that have caused, are causing, or may cause the destruction, degradation, and/or impairment of biodiversity… [t]hreats can be past (historical), ongoing, and/or likely to occur in the future.

Friedmann (2010) has identified five principal pressures that cause biodiversity loss globally, namely habitat change, overexploitation, pollution, invasive alien species and climate change. However, there is wide acceptance that "large scale landscape transformation and contingent habitat loss are among the greatest threats to ecological integrity and ecosystem health" (Samways *et al*., 2009: 2949), and hence biodiversity. At its most severe, human induced biodiversity threats are contributing significantly to increased extinction rates, which in turn are eroding the environmental services on which humanity depends" (Brooks *et al*., 2006).

Chavas (2009), notes that humans have been altering the earth's ecosystems for over 10,000 years, since the development of agricultural practices, to meet their sustenance requirements. In European Neolithic settlements (approximately 7000-9000 years ago) the first agricultural land-uses included forest grazing and alternate husbandry (that is, alternating between pastures and arable fields), and land-use types as well as species and habitat diversity increased until the 19th century (Poschlod, Bakker and Kahmen, 2005). However, from approximately 1850 onwards "changes in land use ha[d] caused a decrease in biodiversity [and] [f]rom the view point of landscape ecology, this was the beginning of the 'abolition of the wilderness'" (Poschlod *et al*.; 2005: 94). These changes included the intensification of farming, development of mineral fertilisers which negated the need for rotational crops, livestock housing replaced low-intensity grazing, lowlands were afforested with non-indigenous species, while wetlands and peatlands were drained for agricultural purposes and peat was extracted on a large scale basis for fuel (Poschlod *et al*.; 2005). In addition to the changing agricultural practices, the associated management regime also changed which resulted in “major impacts on species richness and composition” (Poschlod *et al*.; 2005: 95). In other words seasonal variations and frequency of activities that include grazing, burning and mowing influence species composition.

At present, however, the risks to biodiversity are extensive and vary in magnitude. At a global scale both indirect and direct anthropogenic drivers cause biodiversity loss. An example of an indirect driver would be increased human populations which lead to increased consumption of ecosystem services and therefore increased pressure on biodiversity (MEA, 2005). Polasky *et al*. (2008) supports this example three years later with his statement that: “[e]xpanding human population and economic growth have led to large-scale conversion of natural habitat to human-dominated landscapes with consequent large-scale declines in biodiversity”.

An example of a direct anthropogenic driver is land-use change through the physical transformation and modification of landscapes. The abstraction of water from rivers, the trawling of the sea floor, decrease in coral reefs, as well as “climate change, invasive alien species, overexploitation of species, and pollution” (MEA, 2005: 8) all provide stark examples of direct human changes to biodiversity. Land-use change is considered to be the most substantial driver of changes to biodiversity, particularly at a global level where it is predicted that land-use change (which would result in habitat loss and consequent species extinction) will have the largest impact by the year 2100 (Sala *et al*., 2000). Foley *et al*. (2005), support this notion, by highlighting that land-use change activities impact both global and regional climates, decreases biodiversity, fragments biodiversity, overexploits indigenous species and degrades soil and water. As a result, Foley *et al*. (2005: 570) state that “[a]lthough land-use practices vary greatly across the world, their ultimate outcome is generally the same: the acquisition of natural resources for immediate human needs, often at the expense of degrading environmental conditions”. Helm *et al*. (2006: 72), states that “[h]abitat loss is the primary environmental cause of biodiversity decline at local, regional and global scales”, particularly as habitat loss results in habitat fragmentation which negatively impacts biodiversity dynamics.

At a regional and local scale the threats to biodiversity are exactly the same. Examples of some of the major threats to biodiversity include land transformation and fragmentation (lawful and unlawful), land degradation (as a result of poor land management), insect/pest/herbicides, alien invasive species, water/land/air pollution (including fertilisers), poaching and climate change (Ezemvelo, 2009a). Table 3.1 below outlines the threats to biodiversity and provides a brief description of the associated issue.

Table 3.1: Biodiversity Threats, adapted from Salafsky *et al*. (2008) and Ezemvelo (2009a)

Threat	Example	Description
Land Transformation and Fragmentation	Residential, Agricultural, Mining, Power/Water Supply, Waste Water Treatment Works, Transportation, Industry, Commercial and Recreational facilities	Various land-uses impact ecosystems by transforming the landscape and fragmenting natural areas.
	Poor Decision Making	Through reactive process like EIAs, poor planning has detrimental impacts on the environment as well as the community it aimed provide facilities to. For example: building houses within a floodplain negatively impacts the services provided by the floodplain, by decreasing the floodplain's ability to control flooding, as well as resulting in damaging effects both on the houses build in the floodplain and downstream users.
Land Degradation	Poor Land Management	Unsustainable land management practices can lead to irreversible loss of biodiversity. For example inappropriate irrigation can deplete the water table, lose top soil and alter soil chemistry due to fertilisers.
Insect/Pest/Herbicides	Biocides	While the intention of these mixtures is to target 'pests', they have the ability to kill other species with the same characteristics as the target species. In addition, while some small species may not die from exposure to biocide, larger species which consume these smaller species may die as a result of accumulated toxins.
Alien Invasive Species	Both Plant and Animal species	Non-indigenous species that are invasive outcompete indigenous species for the same resources. As a result, wildlife becomes threatened and in some instances local extinction is possible.
Pollution	Waste material, fertilisers and effluent (which result in nutrient loading) and air-borne pollutants	Pollution of resources, particularly water, ultimately results in the slow poisoning of ecosystems and hence on humanity itself.
Poaching	Both Plant and Animal	Poaching of species threatens biodiversity, ecosystem functioning and has the potential to result in local, regional and global extinction.
Climate Change	Increased Frequency and Intensity of weather events	Altered weather patterns threaten vulnerable species, as habitat composition can change. Intact (not fragmented) biodiversity can buffer climate change, for example consolidated dune forests protect the coast line from large waves, recent destruction of the east coast coastline in South Africa was largely due to the lack of intact coastal dune forest

It is also important to note that certain land-use activities may result in one or more of the biodiversity threats listed above, particularly if appropriate planning and management has been neglected. Therefore land-use change or land transformation is considered the most significant risk to biodiversity and hence the focus of this study.

3.2.3 Status of Biodiversity

Over the years there has been a global increase in the acceptance of the value and importance of biodiversity. The result has been a significant increase in the establishment of PAs internationally, which has been heralded as "the first line of defence in the global effort to protect biodiversity" (Jenkins and Joppa, 2009: in press). A PA is defined by the IUCN (cited in CBD, 2005: 7) as "[a]n area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means", and is considered to be the fundamental foundation of conservation strategies (CBD, 2005).

Figure 3.2 indicates the cumulative growth rate of IUCN PAs globally from the early 1900s till the year 2010 (CBD, 2005: 3). There has been a 0.4 percent increase in the rate of protection per year, since 1997 (Jenkins and Joppa, 2009). In 2004 there were more than 105,000 PAs which was estimated to cover 20 million km^2, equating to approximately 12% of the total land surface (CBD, 2005). In addition, by 2004, 0.5% of the ocean surface also achieved protection status (CBD, 2005).

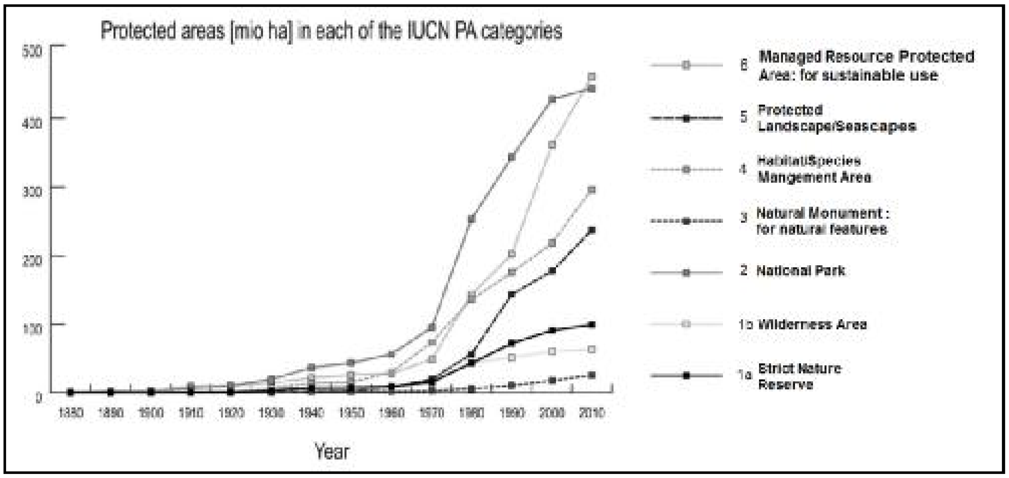

Figure 3.2: Cumulative Growth Rate of IUCN PA Categories (one to six) coverage (adapted from CBD, 2005: 3)

According to an analysis of the 2009 World Database on Protected Areas, undertaken by Jenkins and Joppa (2009), 12.9% of the earth's land surface is currently protected. Figure 3.3 below (colour coded against the IUCN categories) illustrates the distribution of various PAs around the world. **I**t, however, excludes: PA's that are not nationally gazette; 10 638 PA's that have no data; and PA's from UK that are subjected to data restrictions.

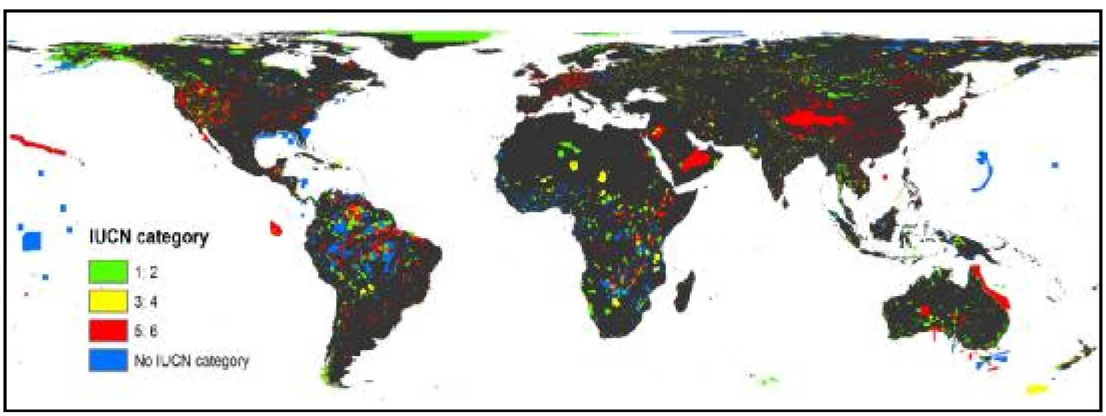

Figure 3.3: Global PAs, (Jenkins and Joppa 2009: 13)

While figures 3.2 and 3.3 suggests that governments globally are committing more land towards the protection and conservation of biodiversity, these still fall short of the 2010 targets of protecting 10% of all the world's important ecosystems, as set by the CBD in

2002 and the IUCN during the Rio Earth Summit in 1992 (Jenkins and Joppa, 2009: in press). In addition, it has been acknowledged by many ecologists that "the degree to which biodiversity is represented within the existing network of protected areas is unknown" (Rodrigues *et al*., 2004), and therefore the current global PA network cannot guarantee the persistence of the earth's biodiversity (Pierce *et al*., 2005). One of the main reasons for PA inadequacies, is that biodiversity is unevenly distributed (Brooks *et al*., 2006, CBD, 2005 and Rodrigues *et al*., 2004), therefore a majority of the world's biodiversity is located outside of existing PA networks (Langholz and Krug, 2004). To this end, the CBD (2005) asserts that the effective protection of biodiversity lies not within the proclamation of PAs, but in the effectiveness of its management.

The World Parks Congress in 2003 undertook a gap analysis that "demonstrated that at least 300 critically endangered species, and at least 237 endangered and 267 vulnerable species of bird, mammal, turtle and amphibian have no protection in any part of their ranges" (CBD, 2005: 6). Given that a significant portion of the world's biodiversity is located outside of PA networks and that pressures and threats from human activities are increasing, biodiversity has significantly declined in the past four decades (Butchart *et al*., 2010). In a global biodiversity assessment undertaken by Butchart *et al*. (2010), it has been established that there has been significant decreases in population trends for vertebrates, specialist bird habitats, forests, mangroves, seagrass beds, coral reef conditions and none show a decrease in the rate of decline. In addition, the study highlights that there has been increasing trends of biodiversity pressure, particularly with regards to human consumption of ecological assets, alien species population and climatic change and no indication of reduction in rate of increase (Butchart *et al*., 2010).

The study by Butchart *et al*. (2010) argues that the rate of habitat fragmentation has also increased, given that 59% of global river systems are fragmented by dams and reservoirs and Atlantic forest patches are less than 0.5 km^2. This assumption is supported by an earlier study undertaken by Helm *et al*. (2006) who, through an assessment of alvar grasslands, established that on average alvar grassland connectivity has been decreasing since 1930. Helm *et al*. (2006: 74) concluded that "consequences of habitat loss and fragmentation become apparent in terms of greatly reduced local and regional species richness…[which result in] a slow response to environmental change" and can lead to increased extinction rates.

In an assessment of the Mediterranean biome, which covers 2% of the earth's land area and is recognised as a global conservation priority, approximately 4.3 percent is formally protected, which is less than 50% of the global target for ecological systems (Cox and Underwood, 2011). The Mediterranean biome covers some of the world's major cities such as Rome (Italy), Santiago (Chile), Los Angeles (Californias, USA), Perth (Australia) and Cape Town (South Africa), and it is expected that "as the world population continues to grow…the natural area of this diminutive biome will likely continue to shrink" (Cox and Underwood, 2011: 14508). The diagram below (figure 3.4) illustrates the land cover status within each of the five Mediterranean regions and highlights the extent of transformation and impact upon each biome, as well as the potential for further protection.

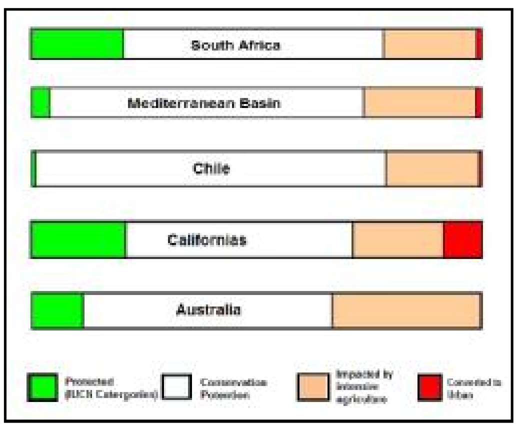

Figure 3.4: Proportion of Land Cover within the World's Mediterranean Regions, adapted from Cox and Underwood (2011e: 14508)

The study by Pierce *et al.* (2005) indicates that the current global PA network is inadequate to protect the earth's biodiversity. This is endorsed by Polasky *et al.* (2008: 1506), three years later, who states that "the amount of area protected currently is relatively limited and is insufficient to sustain all of biodiversity".

At a regional scale, South Africa, which is made up of 2% of the earth's land surface, has approximately 10% of all plant species (Ezemvelo, 2009a). These include an estimated at 24 500 indigenous plants which is double the amount found in all of Europe and has approximately 6500 more plant species than the USA (Ezemvelo, 2009a). South Africa also includes "7% of the reptiles, birds and mammals… [as well as] three of the world's 34 biodiversity hotspots: Cape Floristic Region, the Succulent Karoo and the Maputoland-Pondoland region" (Biggs *et al.*, 2006: 277). However, the Biodiversity Intactness Index-BII (a tool designed to meet the biodiversity change indicator requirements of the CBD) for South Africa, which considers various land-uses and their impact on wild organisms populations (but excludes climate change impacts), indicates that there has been a decline of approximately 16% of plants and vertebrates since pre-colonial times (figure 3.5).

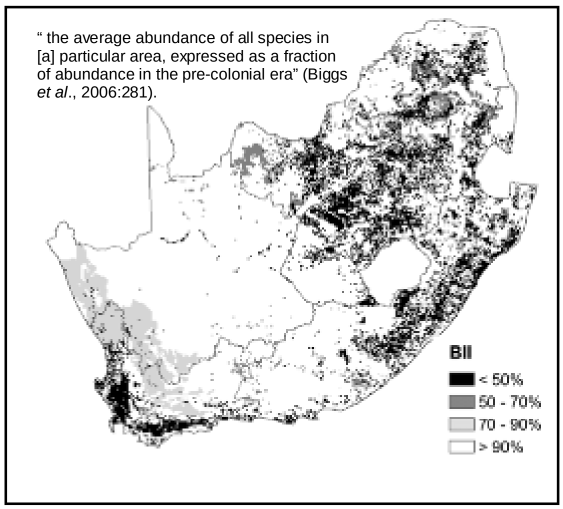

Figure 3.5: Values of BII in the Pre-colonial Era (adapted from Biggs *et al.*, 2006: 281)

The province of KwaZulu-Natal, within South Africa, has approximately 6000 plant and animal species (many of which are locally endemic) (Ezemvelo, 2009a). The uKhahlamba-Drakensberg Park alone contains approximately 2153 plant species and 430 animal species, of which 295 are birds, 60 are mammals, 49 are reptiles and 26 known species of amphibians (Ezemvelo, 2009a). KwaZulu-Natal contains 110 state PAs, which covers approximately 8.1 percent of the province (estimated at more than 551 000ha) and a further 16.5% of the province is conserved under private game ranches, natural heritage sites and conservancies (Ezemvelo, 2009b). However, approximately 53.4% of important biodiversity lies outside of the provinces PA network (as indicated by the red areas in figure 3.6 below) and requires an additional

17% of KwaZulu-Natal's land to meet the province's conservation target (Ezemvelo, 2009a). With the current rate of land transformation within KwaZulu-Natal, it is predicted that the remaining untransformed landscape (outside PAs) will be lost between 37 to 48 years, thereby increasing the pressure to meet the conservation goals and targets of the province sooner rather than later (Jewitt, 2010).

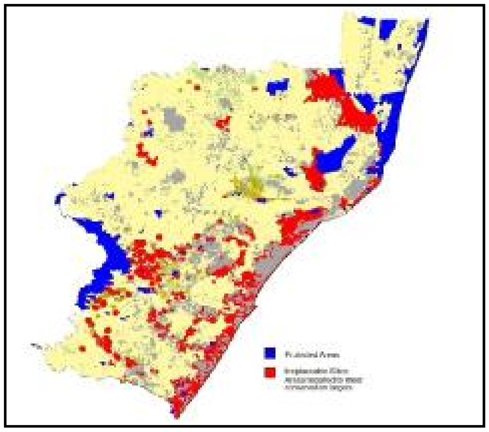

Figure 3.6: Terrestrial Conservation Plan for KwaZulu-Natal (Ezemvelo, 2007)

Cox and Underwood, (2011: e14508) state that from international to local scales, "there is wide agreement that more land must be protected rapidly, and that protection should be expanded outside reserves". Butchart *et al.* (2010: 1168), for instance indicates that "efforts to address the loss of biodiversity need to be substantially strengthened by … fully integrating biodiversity into broad-scale land-use planning [and] incorporating its economic value adequately into decision making". Hence the following section discusses the policy and legislative responses that have emerged to facilitate the inclusion of biodiversity into the decision-making process as well as into broad-scale land-use planning.

3.3 Legal Framework

3.3.1 Background

Prior to 1970 there were several pieces of environmental legislation that emerged around the world however these legislative achievements were reactive and undertaken on a piecemeal basis (Kidd, 2008). According to Kidd (2008), while the concept of protecting the environment had been around for many centuries, the political and legal focus on environmental issues improved and increased in the nineteenth century, largely as a response to the industrial revolution. A few of the events that catalyzed this shift were the Torrey Canyon Disaster of 1967, where 120000 tons of oil spilled from a tanker along the western approaches of the United Kingdom; 20 million Americans participating in Earth Day of 1970; the promulgation of the USA's National Environmental Policy Act, which was deemed proactive rather than reactive and the Stockholm Conference on the Human Environment in 1972 which produced 24 principles that were considered the first general text of international environmental law (Kidd, 2008).

Kidd (2008: 12) highlights that:

> *the last twenty-five years, most developed countries have enacted legislation which integrates environmental concerns, for example the United Kingdom's Environmental Act of 1990, New Zealand's Resource Management Act of 1991 and, in South Africa, the Environmental Conservation Act of 1989, which has subsequently been largely replaced by the National Environmental Management Act 107 of 1998.*

However, biodiversity and environmental issues are not bound by political boundaries (for example watersheds or global warming are shared by most or all counties), therefore international laws allow for global environmental problems to be appropriately addressed and managed (Kidd, 2008). The Stockholm Conference, for example, made provision for states to develop international law to allow for the management of trans-boundary activities, Clause Six of the Stockholm Declaration, for example advocates strategic planning and management of the environment, adopting a long-term outlook and including the consequences of environmental mismanagement to society and biodiversity (Barnard *et al.*, 2006). In 1987, the Brundtland Commission (World Commission of Environment and Development) published a report entitled 'Our Common Future' which investigated and laid out a conceptual framework to implement the environmental principles of the Stockholm Declaration and presented the sustainable development concept (Barnard *et al.*, 2006: 225). This progression continued, in 1992 the United Nations Conference on Environment and Development issued Agenda 21 (at the Rio Conference), a detailed implementation programme or action plan aimed at dealing with sustainability at a local level (Barnard *et al.*, 2006). In 2002, the World Summit On Sustainable Development included a commitment to significantly decrease extinction rates of threatened species by 2010 (Barnard *et al.*, 2006).

3.3.2 International Context

While there are several international agreements that South Africa is party to, the United Nations CBD, signed in 1993, is considered a landmark convention, as it reconciles environmental objectives and development needs, by aiming to conserve biodiversity and ensure the sustainable use of biological resources (Ezemvelo, 2009b). The "aim of the CBD is to effect international cooperation in the conservation of biological diversity and to promote the sustainable use of living natural resources worldwide" (Barnard *et al.*, 2006: 228). Table 3.2 outlines some of the treaties and conventions that South Africa has signed, ratified or acceded to, which regulate international environmental management and directly or indirectly affect the decision-making process and broad-scale land-use planning within South Africa.

Table 3.2: Conventions and Treaties to which South Africa is Party, adapted from Kidd (2008) and Barnard *et al*. (2006).

Date	Treaty / Convention	South Africa Status
1993 - Signed 1995 -Ratified	Convention on Biological Diversity – CBD	- White paper on conservation and sustainable use of South Africa's biodiversity was published in 1997. - A biodiversity and tourism declaration for a sustainable tourism base. - Regional co-operation with all role players in Southern Africa to ensure importance of conservation and sustainable use of biodiversity.
1975 - Signed 1975 - Ratified	RAMSAR Convention – Wetlands of International Importance especially as Waterfowl Habitat	- South Africa has 15 RAMSAR sites, with several others under consideration. - Wetland Conservation Bill has been proposed
1997 - Ratified	World Heritage Convention – both cultural and natural heritage	- South Africa has four World Heritage Sites: . Ukhahlamba-Drakensberg Park . iSimangaliso Wetland Park . Cradle of Human Kind . Robben Island
1991 - Acceded	BONN Convention – Conservation of Migratory Species of Wild Animals	- Trilateral agreement being negotiated between Namibia, Botswana and South Africa. (But none of South Africa's immediate neighbours have signed the convention). - Developing national policy for the conservation of Migratory Animals. - Aim to ratify African-Eurasian Migratory Waterbird Agreement
1973 - Signed 1975 - Ratified	Convention on International Trade in Endangered Species of Wild Fauna and Flora – CITES	- South Africa adopted measures to combat smuggling of species to protect biodiversity and to ensure the sustainable utilisation of species.
1982 - Acceded	United Nations Law of the Sea Convention – UNCLOS	- Implementation to fall within the function of Marine and Coastal Management.

In addition to the above, in September 2000, South Africa became one of the 147 signatories to the Millennium Declaration, which has also been adopted by 189 nations during the United Nations Millennium Summit (Ezemvelo, 2009b). The Millennium Declaration listed eight goals, which "bring together the responsibilities of developing and developed countries to focus on global challenges and addressing them through partnerships for sustainable development" (Ezemvelo, 2009b: 9). Of the eight Millennium Development Goals, Goal Seven: Ensure environmental sustainability, contributes to the backdrop of to this project and is discussed further in the section below.

3.3.3 National Context: South Africa

3.3.3.1 Environmental Rights

A principal piece of legislation in South Africa, superseding all others, is the Constitutional Act of 1996 (Ezemvelo, 2009a). In terms of the environment, section 24 of the South African Bill of Rights states the following:

> ***24. Environment***
>
> *Everyone has the right –*
>
> *(a) to an environment that is not harmful to their health or well-being; and*
>
> *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –*
>
> *(i) prevent pollution and ecological degradation;*
>
> *(ii) promote conservation; and*
>
> *(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*
>
> (Constitution of the Republic of South Africa, Act 108 of 1996, Section 24).

According to Kidd (2008: 20) paragraph (a) refers to the fundamental human right, while paragraph (b) "is more in the nature of a directive principle requiring the state to take a positive step towards the attainment of the right". In other words the state is mandated to protect the environment by using reasonable legislative and other measures and "incorporates the notion of intergenerational equity, which is internationally recognised and…that as 'members of the present generation, we hold the earth in trust for future generations'" (Kidd, 2008: 22).

3.3.3.2 The Environmental Conservation Act, Act 73 of 1989

The ECA was instated in the late 1980s and focused on environmental conservation (Kidd, 2008). It was only until 1997 that a list of activities that required EIAs and the regulations set out under Sections 26 and 28 of ECA, which detailed the procedures on how to undertake EIAs, were promulgated (Kidd, 2008 and SAIEA, 2003). However, when the 1996 Constitution of the Republic of South Africa was enacted, it became evident that the ECA did not give effect to Section 24 of the constitution and hence the need for a new framework environmental Act was required (Kidd, 2008). In response to this need the NEMA was developed.

3.3.3.3 The National Environmental Management Act, Act 107 of 1998 and Amendment Act 8 of 2004

The NEMA aims to give effect to Section 24 of the Constitution at a framework level (Kidd, 2008), by providing the framework to develop and implement national norms and standards as well as comprehensive environmental management principles (Ezemvelo, 2009b). The NEMA is therefore considered the first level of legislative measures to protect the environment and biodiversity (Ezemvelo, 2009a) and its "principals apply to the actions of all organs of state that may significantly affect the environment" (Kidd, 2008: 35). All the principles set out in NEMA (Section 2) pertain directly to this study, in terms of their aim to safeguard biodiversity through a decision making process. However, the most pertinent chapter of the NEMA, is Chapter Five (amended by Act 8 of 2004), which addresses Integrated Environmental Management and details the EIA procedures. Given that the EIA process forms a large component of this study, the EIA procedure will be discussed in detail within Section 3.4.2.

3.3.3.4 National Environmental Management: Biodiversity Act, Act 10 of 2004

The CBD is enacted through the National Environmental Management: Biodiversity Act (NEMBA), (Ezemvelo, 2009b). The objectives of the NEMBA, which is line with the aims of the CBD, are to:

provide for the management and conservation of South Africa's biodiversity…; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.

(Kidd, 2008: 93).

The NEMBA also calls for biodiversity planning, just as the NEMA calls for integrated environmental planning (Kidd, 2008). The highest level of biodiversity planning is the National Biodiversity Framework (which must be prepared by the Minister), the second level of biodiversity planning is Bioregional Plans which details the measures for appropriately managing and monitoring biodiversity within a defined bioregion (that is specific biogeographic area) and has to be signed by the Minister (Kidd, 2008). The third level of biodiversity planning is Biodiversity Management Plans, which are aimed at conservation management for ecosystems, indigenous species and/or migratory species, and can be developed by the state or any other individual (Kidd, 2008). The NEMBA also allows for the coordination and alignment of the bioregional plans with those developed under the NEMA (Kidd, 2008). Kidd (2008) states that planning and the integration of management plans and research by public and private initiatives are key aspects in biodiversity conservation. The author cautions, however, that while the theory of integration is accepted and understood, biodiversity planning is lagging in terms of practice (Kidd, 2008). If there is a nagging worry about [biodiversity planning] it is how well it will work out in practice". It is anticipated that this study will attempt to determine the validity of this concern within the context of EIAs.

3.3.3.5 The National Environmental Management: Protected Areas Act, Act 57 of 2003

The primary purpose of the National Environmental Management: Protected Areas Act (NEMPAA) pertains to the "protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscape and seascapes" (Ezemvelo, 2009a: 48). However, objectives (c)-(f) of Section 2 of the Act, highlights the importance of appropriate planning adjacent to PAs, as land-use activities that are incompatible with PAs will result in undermining both the objectives and aims of NEMPAA, which relates to this study.

3.3.4 Local Context: Province of KwaZulu-Natal

Prior to 1994, the Nature Conservation Ordinance, Ordinance 15 of 1974, applied to KwaZulu-Natal. "The Ordinance provided for, inter alia, the protection of various species, powers of enforcement and regulation of hunting" (Ezemvelo, 2009a: 48).

Subsequent to 1995, during the legal reform within South Africa's governing legislation, the KwaZulu-Natal Nature Conservation Management Act, Act 9 of 1997 was instated and supplemented the Nature Conservation Ordinance (Ezemvelo, 2009b). The Act provides for "inter alia, direct management of nature conservation within the province and to establish protected areas" (Ezemvelo, 2009a: 48).

3.3.5 Legal Mandates

There three key departments which enforce the legislation described above in terms of safeguarding biodiversity through the EIA process. Firstly, the Department of Environmental Affairs (DEA) is the National Department which develops plans, initiatives and programmes to effect international obligations and enforces the NEMA, NEMBA and NEMPA. The second is the DAEARD, the Provincial Department which enforces NEMA at a local scale. Lastly, the KwaZulu-Natal Nature Conservation Service: Ezemvelo KZN Wildlife (Ezemvelo) is the Provincial Conservation Authority which enforces the Nature Conservation Ordinance and the KwaZulu-Natal Nature Conservation Management Act. In addition, Ezemvelo enforces provincial conservation aspects of NEMBA and NEMPA. The relationships between the various departments are illustrated in figure 3.7.

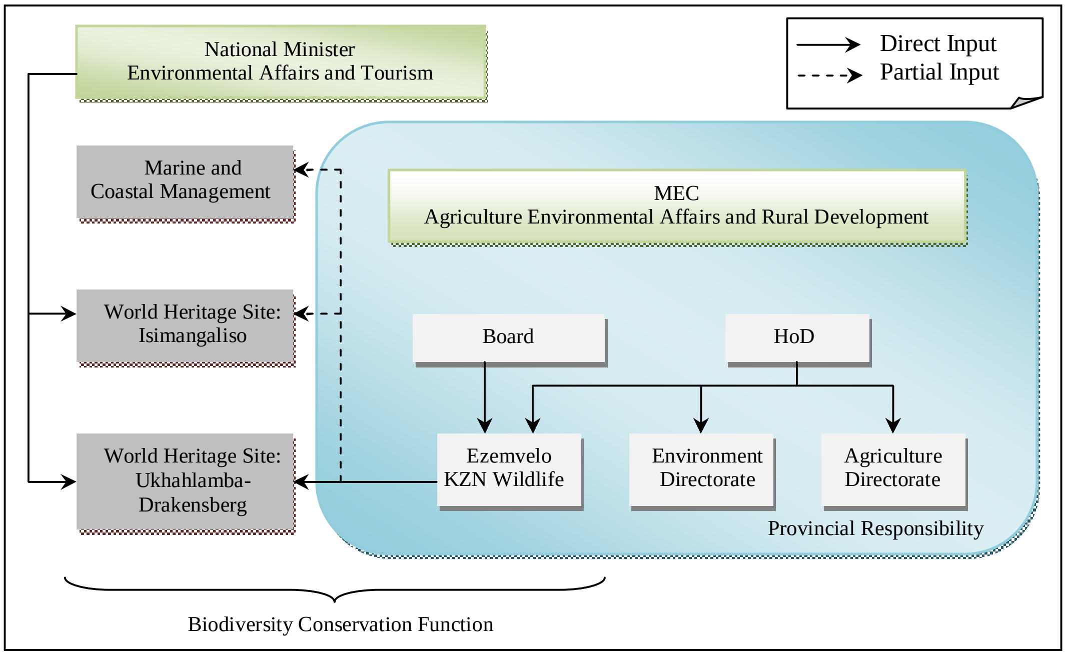

Figure 3.7: Relationship between Government and nature conservation departments in KwaZulu-Natal (adapted from Ezemvelo 2009a: 7)

The mandate of the DEA is derived from various pieces of legislation and cover aspects of tourism, environmental quality and protection, marine and coastal management, biodiversity conservation, as well as sector services, environmental awareness and international relations (DEA, 2010). While the DEA is the lead agent for environmental management within South Africa, the Minister of Environmental Affairs and Tourism, in terms of the EIA process, has delegated the responsibilities of authorising development activities to the provinces, hence making the provincial environmental department the competent authority in terms of the EIA regulations (SAIEA, 2003), projects that are of national importance or traverse more than one province are exempted from the latter.

The DAEARD is the competent authority in terms of the EIA regulations, which refuse or authorise development activities within KwaZulu-Natal (SAIEA, 2003). The DAEARD (2010) objectives are aligned to its legislative mandate, which, ***inter alia.***, include:

- develop and implement environmental legislation and policy, strengthen environmental governance and facilitate effective public/community participation,
- promote environmental empowerment and capacity building, promote natural and community based sustainable resources use and management (which would promote sustainable job creation),
- facilitate environmental information management for informed decision making and facilitate environmental impact mitigation to promote sustainable development and a safe, healthy and sustainable environment throughout the province of KwaZulu-Natal.

The mandate of Ezemvelo is to manage and conserve biodiversity both inside and outside the PA network of KwaZulu-Natal, by applying and enforcing international, national and provincial legislation (Ezemvelo, 2009b: 9). With regards to Goal Seven of the Millennium Development Goals: Ensure environmental sustainability, the following specific indicators have been defined and are applicable to Ezemvelo:

- *Target 7a: Integrate the principles of sustainable development into (country) policies and programmes; reverse loss of environmental resources*
- *Target 7b: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss*

(Ezemvelo, 2009b: 9).

In terms of the EIA process provincial legislation states the following for provincial conservation department, namely Ezemvelo KZN Wildlife:

> ***23. Powers, functions and duties of the Conservation Service***
> *The primary function of the Conservation Service is nature conservation inside and outside protected areas, and to this end the Conservation Service must…undertake to provide support* - …
>
> (e) *for a process to ensure comment can be made on land-use changes outside protected areas where such changes could detrimentally affect ecological processes and biodiversity in the province*

(KwaZulu-Natal Nature Conservation Management Act, Act 9 of 1997, Section 23).

As a result of their legal obligations, these departments are involved (either in part or fully) with two significant responses to safeguarding biodiversity, namely the EIA process (which integrates biodiversity into decision making processes) and conservation planning (which aims to integrate biodiversity into land-use planning).

3.4 Environmental Impact Assessments

3.4.1 Background

The Stockholm Conference of 1972 initiated the emergence of EIAs internationally and "[p]rinciple 17 of the Rio Convention [which is a key outcome of the Rio Earth Summit] states that 'environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority'" (Kidd, 2008: 195). In addition, various other conventions have advocated for the introduction of EIAs into the decision making process, such as RAMSAR, BONN. In addition, article 14 of the CBD, stipulates that signatories to the convention shall implement EIAs to projects that have the potential to negatively impact biodiversity (Gontier *et al.*, 2005 and Slootweg and Kolhoff, 2003). Further, numerous biodiversity specific guidelines, to assess biodiversity issues within EIAs, have been published around the world by, for example, the Council on Environmental Quality (USA in 1993), the Canadian Environmental Assessment Agency (in 1996), the International Association for Impact Assessment (in 2001) and Direction régionale de l'environnement de Midi-Pyrénéés (France in 2002), (Gontier *et al*., 2005).

EIAs within Africa have been around since the 1970s, they were undertaken on an *ad hoc* basis and only occurred when encouraged by multilateral agencies, NGOs or other such donors (SAIEA, 2003). Due to the lack of appropriate legislation and local policies "donors and developers generally followed their own procedures and criteria in determining which projects to subject to EIA, and how such EIAs were to be conducted" (SAIEA, 2003: 20).

In the late 1980s, South Africa instated the ECA which identified activities that required EIAs, however it was only until 1997 that the regulations set out under Sections 26 and 28 of the Act (that is the procedures on how to undertake an EIA) were promulgated. In the late 1990s the NEMA was gazetted and gave effect to the White Paper on Environmental Management Policy, as well as repealed those sections within the ECA that pertained to EIAs. However, the more robust EIA sections within NEMA did not come into effect until much later and ECA regulations were upheld in the interim (SAIEA, 2003).

3.4.2 The EIA Process

EIAs are considered as one of the support tools for sustainable development, with the end result being that which achieves a balance between local socio-economic, political and ecological priorities (SAIEA, 2003). The purpose of an EIA "is to identify how the activities of [a] proposed development will impact on the various components of the environment…[and] it entails the identification and analysis of impacts, as well as a prediction of the significance of the impacts…both positive and negative" (SAIEA, 2003: 06). The outcomes of the EIA process are to provide decision-making authorities with sufficient information on the likely consequences of the proposed activity, should it be approved (SAIEA, 2003). Sands (2003 cited in Kidd, 2008) provides a comprehensive definition of EIAs, which also entail its response to strategic requirements and the involvement of the public as either a recipient of or a contributor to environmental impacts:

> *a process which produces a written statement to be used to guide decision-making, with several related functions. First, it should provide decision-makers with information on the environmental consequences of proposed activities and, in some cases, programmes and policies, and their alternatives. Secondly, it requires decisions to be influenced by that information. And, thirdly, it provides a mechanism for ensuring the participation of potentially affected persons in the decision-making process.*

While the EIA process may vary from country to country, figure 3.8 illustrates the basic steps within the process (SAIEA, 2003). In addition, and pertaining to this study, the importance of the consideration of biodiversity in the EIA process in underscored.

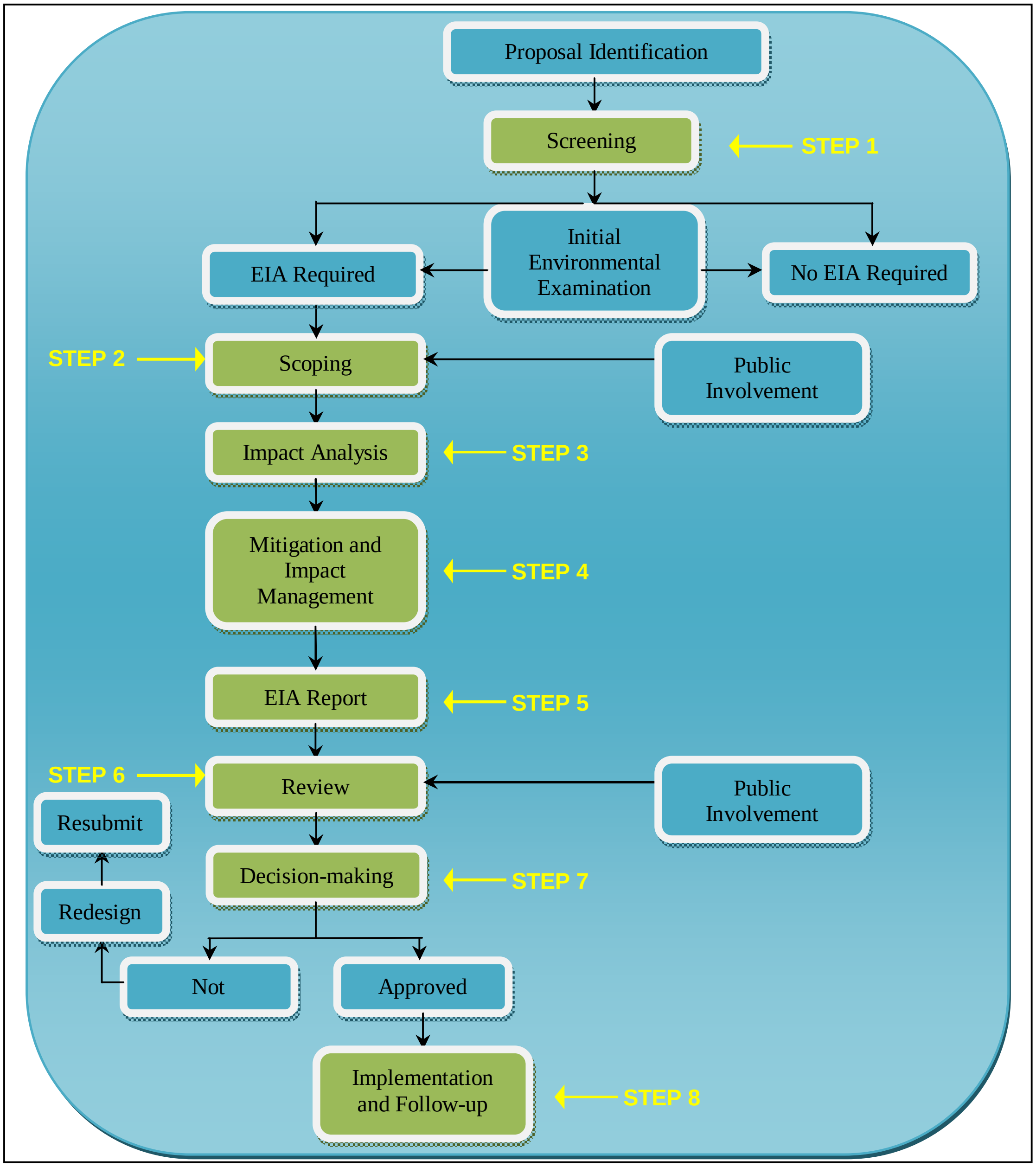

Figure 3.8: Basic Steps in the EIA Process (adapted from SAIEA, 2003: 7)

The first phase, screening, determines the level of assessment required for the proposed project (that is once the proposal identification has been confirmed) in terms of whether an EIA (or Basic Assessment Report - a lower detail level of impact assessment) needs to be undertaken or not (SAIEA, 2003). In terms of considering biodiversity issues at the screening phase, two key questions need to be answered on genetic, species and ecosystem diversity levels (Slootweg and Kolhoff, 2003: 667):

“ • Does the intended activity affect the physical environment in such a manner, or cause such biological losses that it influences the chance of extinction of cultivars, varieties, populations of species, or the chance of loss of habitats or ecosystems (i.e., leading to the loss of biodiversity – issues related to the conservation of biodiversity)?
- Does the intended activity surpass the maximal sustainable yield or the maximum allowable disturbance level of a resource, population, or ecosystem (i.e., leading to a reduction or loss of use functions derived from biodiversity – issues related to sustainable use of biodiversity)?”

Scoping is the next step, and identifies key issues that need to be investigated, in both nature and extent, and involves interaction with government departments as well as the public (SAIEA, 2003). The purpose of the scoping report is to form the basis of the terms of reference for the EIA and ensure that the final EIA is useful to government (for decision-making) and comprehensible to the public (SAIEA, 2003 and Slootweg and Kolhoff, 2003).

The analysis or impact assessment phase, which follows from the scoping phase, identifies and analyses the nature and extent of the impact that would occur from the proposed activity, as well as predict the significance of the impact (SAIEA, 2003). This assessment considers both positive and negative impacts (SAIEA, 2003).

The fourth phase of the EIA process identifies mitigatory measures, in the form of avoiding or minimising negative impacts and enhancing positive impacts (SAIEA, 2003). In addition to the above, Slootweg and Kolhoff (2003) suggest that the following general framework (figure 3.9) would assist in determining the biodiversity impacts that may occur as a result of a proposed activity and would provide for an iterative mechanism for considering biodiversity issues within the scoping, impact assessment and mitigatory measure phases.

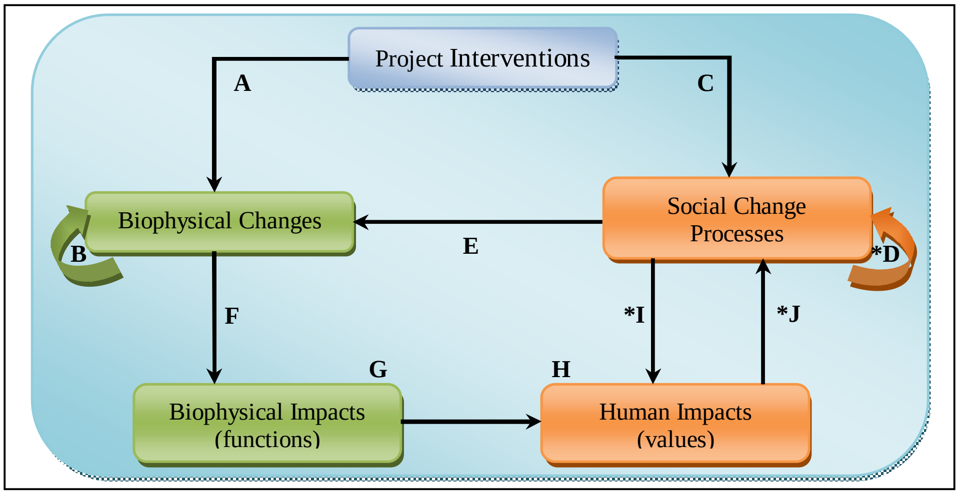

Figure 3.9: General Impact Assessment Framework (adapted from Slootweg and Kolhoff, 2003: 659)

According to Slootweg and Kolhoff (2003: 667), figure 3.9 illustrates that:

- Step one requires a description of the type of project, the nature, magnitude, location, timing, duration and frequency.
- Step two describes the anticipated biophysical changes (such as impacts upon both biotic and abiotic factors - A), as well as second-order impacts (such as down-stream impacts or cumulative impacts - B).
- Step three entails the description of biophysical changes as a result of social change from the proposed project (C and E).
- Step four determines the spatial and temporal scale that the biophysical change influences (F).
- Step five describes the ecosystems and land-uses that would be influenced by the changes identified (F).
- Step six determines if the changes to the ecosystem or land-use affect components of biodiversity (such as composition and temporal or spatial structure – G).
- Step seven identifies current and potential functions and non-use functions, as well as determines its value to society, in consultation with stakeholders (G and H).
- Step eight determines which function would affect the proposed project, while considering mitigatory measures.

- Step nine defines mitigatory measures for each alternative identified.
- Step 10 determines which issues are relevant to the decision-making process and can be investigated further.
- Step 11 indicates the degree of severity of the impacts identified.
- Step 12 identifies the necessary surveys required to obtain detailed information about the biodiversity within the area.

Those steps pertaining to Social issues are not within the scope of this study and therefore these processes are not discussed. The social steps are those processes which have been marked with an asterisk in figure 3.9.

In the fifth phase, following from the mitigation, the EIA report integrates the findings of both the impact assessment and mitigation analyses which is used to inform the decision-making authorities (SAIEA, 2003). The next phase, the review calls for the authority to decide if there is sufficient and appropriate information presented within the report, and includes other relevant government departments, independent specialists and the public as well, so as to "improve rigour and ensure that relevant information is captured and reflected…prior to finalisation and decision-making" (SAIEA, 2003: 6). The following phase, decision-making, requires the authority to either grant approval or refuse the proposal. Should approval be granted, various conditions may be applicable (to ensure the sustainability of the project) and would need to be included into the project's management plan (SAIEA, 2003), Should the proposal be refused, the applicant may appeal the decision to seek relief (NEMA, Section43). The last phase of the EIA process requires that a Management Plan (which should include an environmental management plan) be used to "ensure that the mitigation actions and the monitoring requirements recommended in the EIA are systematically implemented throughout all phases of the project" (SAIEA, 2003: 6).

3.4.3 Biodiversity Challenges within the EIA Process

On an international scale, it is widely acknowledged that EIAs are not as effective as they should be, as Gontier *et al.* (2005) highlights several general shortcomings of EIAs from European studies on EIA processes. These studies indicate that EIAs are vague and overly descriptive, and its focus is confined to “single development actions and on-site changes, and [a] lack of assess[ing]… ecosystem level[s] and…spatial and temporal scales of ecological process”. Furthermore, several authors, namely, Atkinson *et al*., 2000; Byron *et al*., 2000; Geneletii, 2002; Thompson *et al*., 1997 and Treweek *et al*., 1993, cited in Gontier *et al*. (2005: 270) agree that EIAs lack “adequate methodologies for accurate, systematic and quantified predictions of impacts on biodiversity”. According to Young *et al*. (2004: 1654), “cumulative or interactive effects and effects extending beyond the planning area as well as direct effects in some cases can be particularly challenging to analyse and …is not taken into account [in EIAs]”.

While Africa is also facing many of the challenges facing the shortcomings of EIA in general, the SAIEA has identified further issues which need addressing, some of which include: “capacity-building for administrators, practitioners and the public; monitoring of compliance with EIA recommendations; sharing of ‘best practice’ across the region; linking EIA with the full project life cycle; harmonisation of legislation within the region; and strengthening the links between EIA, SEA [Strategic Environmental Assessments], regional planning and other high level decision-making processes” (SAIEA, 2003: 9). These shortcomings of the EIA concur with the findings of Brownlie *et al.* (2006: i-ii), which are elaborated on in Table 3.3. The authors argue that the intention of an EIA is to ensure that future generations have and enjoy the resources that current generations experience, and not as a process which seeks to keep people in poverty by obstructing development (SAIEA, 2003).

In 2005 the SAIEA undertook a Situation Assessment (which formed part of the International Association of Impact Assessment’s Capacity Building in Biodiversity in Impact Assessment Project) to identify the key challenges that hinder the integration of biodiversity issues within the EIA process (Brownlie *et al*., 2006). The main findings of the Situation Assessment were split into two categories, namely those that pertained to biodiversity information and those that related to decision-making impediments such as the interpretation and use of the biodiversity information (Brownlie *et al*., 2006), and are listed in Table 3.3.

Table 3.3: Biodiversity Challenges within the EIA Process (adapted from Brownlie *et al*. 2006: i-ii)

Biodiversity Information Challenges	**Decision-making Impediments**
Biodiversity input received too late in EIA process to influence proposal.	The need to realise short-term socio-economic benefits.
Relevance of biodiversity information provided in EIAs are not made explicit.	General lack of clear guidelines or criteria on which to base decisions, resulting in inconsistencies in decision-making (e.g. how to apply sustainability principles such as the Precautionary Principle).
Lack of sufficient biodiversity information (as a result of either lack of data or effort).	Inadequate consultation and co-operation between authorities.
Biodiversity is perceived to be irrelevant or could be conserved elsewhere.	Lack of experience within government departments to thoroughly review environmental and specialist reports.
Implications of information gaps, risks or uncertainty are not made explicit in terms of irreversibility of impact, loss of resource, etc.	Cumulative effects are seldom addressed at project-level EIAs, hence developments approved on a piecemeal basis, without the broader picture being considered.
Biodiversity information is site specific and does not address landscape-scale effects on ecosystems and processes.	Authorisations are vague. Many of the associated conditions of approval are impossible to implement or audit and are vulnerable to legal challenge.
Insufficient consideration of indirect and cumulative effects.	Compliance monitoring is seldom, if ever, followed up by authorities.
Economic value of ecosystem goods and services is seldom addressed.	
The Terms of Reference for many EIA reports and specialist studies are frequently poorly defined.	
Criteria used to determine the significance of impacts is questionable, as they are not linked to a broader strategic context (e.g. policies, frameworks, conservation plans, etc.)	
Linkages between biodiversity, ecosystem services and human wellbeing (particularly dependence on resources) are seldom clearly described and hence the effects on these linkages (and dependent communities) are not addressed.	
There is an inappropriate reliance on environmental management plans and programmes for effective mitigation (so-called ‘proper management will fix all ills’ approach).	

In addition to the above discussion, EIAs within South Africa have been perceived as “a limited tool for influencing decisions on changes in land use” (de Villiers *et al*., 2008: 1), as more strategic planning tools appear to be better suited to mainstream biodiversity issues, such as SEAs, Land Use Management Plans and so on (de Villiers *et al*., 2008).

3.4.4 The Way Forward for EIAs

In response to the plethora of problems related to both biodiversity data and decision-making in EIA, several key recommendations have been discussed. According to the SAIEA (2003), EIAs could reach their full potential if key challenges were addressed. In terms of biodiversity issues, one of the key challenges would be to improve EIA implementation, as it is only through regular monitoring of agreed-upon mitigatory measures can their effectiveness be assessed and appropriate remediation measures be implemented should they be required (SAIEA, 2003).

The second key challenge would be to improve the links between EIAs and strategic plans. For example, in South Africa's Western Cape, the Botanical Society of South Africa (BotSoc) launched the BotSoc's "Biodiversity in Environmental Assessment (BEA) project from the premise that SCP [systematic conservation planning – a strategic conservation tool] and EIA had considerable, if untapped, mutual benefit. The BEA project postulated that EIA could help to secure priority habitat and ecological corridors outside protected areas, and conservation plans could be used to overcome many of the failings of EIA towards biodiversity" (de Villiers *et al.*, 2008: 2 and 3). A review of BotSoc's comments (which were based on conservation plans, legislation, environmental guidelines, and so on) had indicated that most of the main problems identified within the Situation Assessment undertaken by SAIEA (referred to above) were being highlighted, which included: "the failure to consider ecological process issues and the bigger conservation context (e.g. laws and biodiversity plans); poor or no consideration of alternatives; passing off baseline surveys or sensitivity studies as a 'biodiversity assessment'; failure to provide effective recommendations on ecosystem management; and undue reliance on environmental management plans to manage significant impacts on biodiversity" (de Villiers *et al.*, 2008: 3). Sixty percent of EIA authorisations included BotSoc's comments, with the greatest prospect of addressing biodiversity issues, if these issues were raised early on in the EIA process (de Villiers *et al.*, 2008: 3).

In addition, while it is acknowledged that strategic plans, spatial frameworks and other planning tools should feed into the EIA process, according to SAIEA (2003: 336) EIAs should feedback and be integrated into larger scale plans, similar to regional and or transboundary initiatives, to improve strategic planning. It is therefore one of the objectives of this study to determine whether EIAs can bridge the information-implementation gap at strategic planning levels.

According to Gontier *et al*. (2005: 282) the use of GIS based ecological models (that is spatial strategic plans) "have the potential to address several shortcomings of today's biodiversity assessment[s]". These spatial plans make quantifying impacts possible, allow for the visualisation uncertainties and take into account wide-spread, off-site and long-term effects (Gontier *et al*., 2005). In addition, "the spatial and temporal scales of ecological process can be taken into account, and impacts of changes such as habitat fragmentation can be quantified and predicted" (Gontier *et al*., 2005: 283). Therefore, in consideration of the view points above, this study draws on systematic conservations planning as one of the response tools to safeguard biodiversity.

The literature has thus far drawn attention to two key aspects. Firstly, PAs alone are insufficient to maintain the persistence of biodiversity and there is the need to integrate biodiversity issues into the policies and practices of land-use decision-making outside PAs. Secondly, the need to integrate site-specific EIA and broader frameworks and spatial plans, In view of these two aspects, the next section reviews current best practices in alternative conservation initiatives, drawing largely on systematic conservations planning (SCP) as a best fit response tool to safeguard biodiversity.

3.5 Alternative Conservation Methods

Given the inability of PAs to meet current biodiversity targets (as described in Section 3.2.3) alternative methods to conserve biodiversity, which strengthen the PA network and thereby provide opportunities to meet conservation targets, are required. Two alternative options to PAs that were identified during the literature review of this project were Private Nature Reserves at a global scale and Stewardship Sites at a local scale.

3.5.1 Private Protected Areas

Private PAs are essentially privately owned nature reserves and have been in existence for many centuries in various forms (Langholz and Krug, 2004). Currently private nature reserves are more commonly legally recognised contracts or servitudes on private land that protect biodiversity in the long term (Ezemvelo, 2008). It is reserved for critically important sites, especially those that contain examples of threatened ecosystems or contain unique and exceptional biodiversity features (Ezemvelo, 2008).

Colombia has approximately 100 private reserves, Brazil has greater than 100 private reserves and Chile has one of the largest private reserve which has an area of 270,000ha (Langholz and Krug, 2004). Amongst the industrialised nations of the world, the United Kingdom has an extensive network of small reserves and the USA has the largest private nature reserve network in the world which consists of more than 1,300 reserves that range in areal extent from 1.3ha to 130,000ha (Langholz and Krug, 2004). Southern Africa also contains several hundred private parks, including some that are greater than 100,000ha (Langholz and Krug, 2004).

3.5.2 Stewardship Sites

At the local scale, Stewardship Sites in South Africa were created to develop partnerships with landowners to secure representative samples of biodiversity on private and communal land for use by and benefits to present and future generations (Ezemvelo, 2008). Stewardship Sites in KwaZulu-Natal are managed through the Ezemvelo Biodiversity Stewardship Programme (EBSP) and have four principals: to recognise the role private and/or communal landowners play in the conservation of biodiversity; to reward those landowners contributing to biodiversity conservation through financial benefits; to provide incentives for landowners to become involved and see the relevance of conserving biodiversity; and lastly to use current environmental legislation to back up the programme(Ezemvelo, 2008).

While some stewardship sites have the potential to be private nature reserves, the EBSP offers other alternatives to contribute towards biodiversity conservation which have less legal standing and are therefore more flexible (Ezemvelo, 2008). For example, Conservation Areas is a voluntary option with no defined period of commitment and is therefore a flexible category. Any natural land which has rare or endangered habitats is suitable to fall into this category (Ezemvelo, 2008).A second stewardship option is Biodiversity Agreements, which are negotiated legal agreements between the conservation agency and a landowner for conserving biodiversity in the medium term (Ezemvelo, 2008). This option is suitable for conservation worthy land which is in a relatively pristine condition, including small isolated fragments. A third option is Protected Environments, which are provided for in the recently promulgated Protected Areas Act 2004 and replace Protected Natural Environments (Ezemvelo, 2008). Protected Environments are the most flexible but least secure type of PA, however, only the Minister or MEC may issue regulations restricting inappropriate development or other activities that may affect a Protected Environment (Ezemvelo, 2008).

While Private PAs and Stewardship Sites would contribute towards existing PA networks, they are effective at strategic planning levels and do not address practical alternative conservation options at a project level. That is, given that Private PAs and Stewardship Sites are voluntary options (Ezemvelo, 2008). and therefore cannot be implemented as conditions into an Environmental Authorisation (EA), these options are not applicable at an EIA level. However the concept of Conservation Development (CD), which has emerged internationally, can and has been used at project levels (Milder, Lassoie and Bedford, 2008).

3.5.3 Conservation Development

Milder *et al*. (2008: 71) describes CD as “projects that combine land development, land conservation, and revenue generation while providing functional protection for conservation resources… [and] is created through a process of ecologically based planning and design”. To this end, CD ensures the conservation of land in perpetuity by relying on the revenue of the development to finance the conservation initiative and includes various techniques, development densities and conservation benefits (Milder *et al*., 2008).

Milder *et al*. (2008) further indicate that while CD techniques have been applied over many years, there has not been much critical evaluation of its conservation effectiveness. As a consequence Milder *et al*. (2008) prescribed a set of indicators (Table 3.4) that can be used to measure conservation success, by evaluating the post-development scenario against the predevelopment scenario.

Table 3.4: Indicators of Conservation Success (adapted from Milder *et al*., 2008).

Indicator:	**Description**
1. Land Alteration:	Quantifies the net change in developed/altered land as a result of the development.
2. Edge Effect:	Quantifies the net change in the portion of the site affected by the proximity of the development
3. Spatial Configuration and Connectivity:	
a. Perforation:	Quantifies the net change in perforated habitat, as a result of the development, and is measured as a percentage of the total site.
b. Fragmentation:	Measures fragmentation minor barriers (e.g. driveways, roads) and major barriers (e.g. swaths of developed land).
c. Off-site Connectivity:	Assesses the degree to which the development maintained or compromised spatial connections on the site and on adjacent natural areas.
4. Impervious Surfaces:	Quantifies the net change in the percentage of each site covered by impervious surfaces.
5. Riparian Buffers:	Quantifies the distribution of widths of the vegetated buffer zone around wetlands, streams and rivers.
6. Impacts to Site Conservation Targets:	Evaluates the degree to which the development protects site-specific/provincial conservation targets.
7. Restoration:	Assesses the developments success at restoring key ecological attributes of the site's/province's conservation targets.
8. Land Management:	To measure effectiveness of current and future land management. The criteria to measure effectiveness are:
	a. Presence of adequate funding for on-going management activities.
	b. Presence of organisation with conservation expertise responsible for stewardship
	c. Presence of baseline documentation and regular monitoring of the site's biodiversity
	d. Presence of activities to stabilise or improve the viability of conservation targets
	e. Presence of agreements (e.g. MoU, MoA, Stewardship Agreements) requiring ecologically based management of private land
	f. Evidence of ecologically sensitive land management by private land owners.

A study on using housing estates as a potential conservation tool, undertaken by Grey-Ross *et al*. (2009), for example, proved to be an effective conservation initiative. The study utilised indicators such as density, placement of houses and ecological management of natural habitats, (all within the ambit of Milder *et al.*'s (2008) indicators) to measure conservation effectiveness. The assessment of the Wedgewood Estate in KwaZulu-Natal, used in Grey-Ross *et al.* (2009) study, demonstrated that this particular estate appeared to be a useful tool for conservation, as it has allowed for the natural ecosystem process on the property to continue, as well as successfully protecting an endangered species (Oribi) to the point that viable breeding populations exist (Grey-Ross *et al.*, 2009).

3.6 Systematic Conservation Planning

3.6.1 Overview

It is widely accepted that "strict protection will not secure the persistence of the world's biodiversity" (Pierce *et al.*, 2005: 411), as highlighted in section 3.2.3, and hence the need to integrate biodiversity issues into the policies and practices of land-use decision-making outside PAs is critical (as highlighted in section 3.3). It is with spatial prioritization (commonly referred to as systematic conservation planning) that limited conservation resources can be allocated appropriately, by effectively identifying where important areas for conservation are located, to safeguard critically important biodiversity (Knight *et al.*, 2010: 1).

SCP emerged in the early 1980s and has influenced the way in which conservation is planned (Pressey *et al.*, 2007). It is through the use of scientific and computer based techniques, which are defensible, that the most appropriate network of conservation areas can be identified (Knight and Cowling, 2007), hence allowing for the alleviation of immediate development pressures from priority conservation areas (Knight *et al.*, 2006). In addition, the spatial prioritisation in SCP allows for limited conservation resources to be allocated appropriately, by identifying the location of critically important areas for biodiversity conservation (Knight *et al.*, 2010).

3.6.2 Framework for SCP

SCP is the "process of locating, configuring, implementing and maintaining areas that are managed to promote the persistence of biodiversity and other natural values…[which] is inherently spatial" (Pressey *et al.*, 2007: 583). According to Margules and Pressey (2000) there are six main characteristics of SCP:

- SCP requires the identification of key features which can be used to conserve more than one biodiversity feature (that is surrogates or umbrella features).
- SCP is based on definitive goals which lead to quantitative and operational targets.
- SCP acknowledges the contributions of existing PAs towards conservation targets.
- SCP identifies locations and designs for new protected areas that would complement existing PAs. Fifth, criteria for implementing conservation action on the ground are adopted.
- SCP objectives and mechanisms to maintain reserves are applied.

The framework for SCP is explained in Margules and Pressey's (2000: 244) six stage process (figure 3.10), caters for feedback mechanisms to be utilised, and presents a powerful case for adaptive management. Steps one to four produce maps which guide decision-making, while steps five and six address implementation challenges which may arise, and hence affords decision-makers the ability to modify conservation plans in the light of new knowledge (Margules and Pressey, 2000).

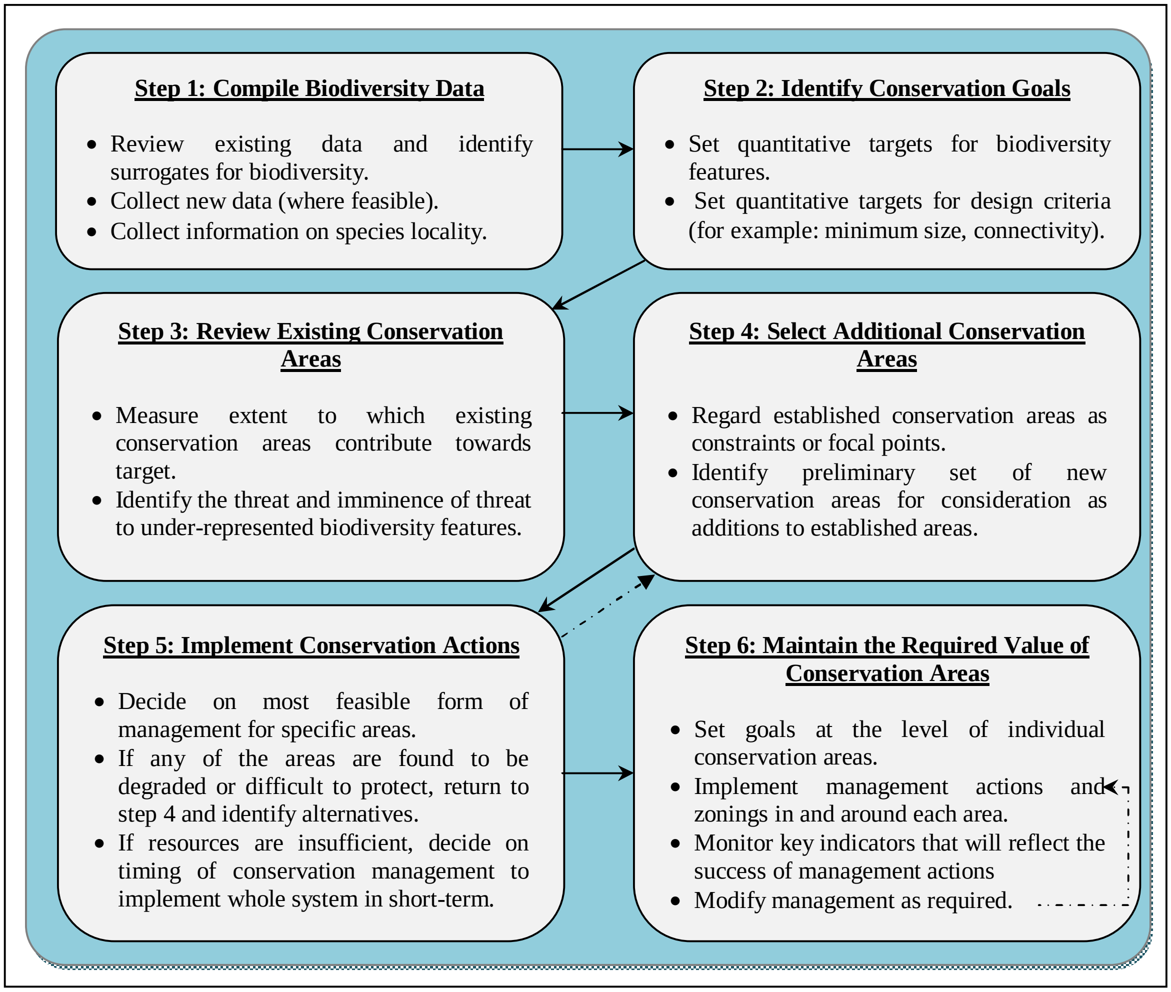

Figure 3.10: Stages of SCP Process (adapted from Margules and Pressey, 2000: 245)

In the case of KwaZulu-Natal, figure 3.11 illustrates the provincial SCP for 2007 and 2010. The 2007 map was based on best available data (including the National Landcover dated 2000, at a 200m^2 scale) and depicted information on a 1km^2 grid scale. While the 2007 map was useful to indicate where conservation action and resources should be concentrated, due to the coarse scaling of the plan (which does not take into account topography), the representation of both critical and non-critical areas for conservation are occasionally misleading (Escott, 2011). The 2010 map is visually different from the 2007 map, as data that was used in the 2007 map has been updated (for example, the KwaZulu-Natal Landcover dated 2005, Spot 5 Imagery dated 2005 at a 20 m^2 scale, land transformation, species modelling, species sightings and so on), to include additional information such as species, ecological corridors, etcetera and polygons (ranging from 15ha – 100ha, with an average of 45ha) based on water catchments were used instead of 1km^2 grid cells to improve accuracy (Escott, 2011). In figure 3.11, PAs are depicted in blue in the 2007 map, and green in the 2010 map. Red indicates those areas that are critical to meet conservation targets and all other shades have varying degrees of biodiversity priorities in both maps (Escott, 2011).

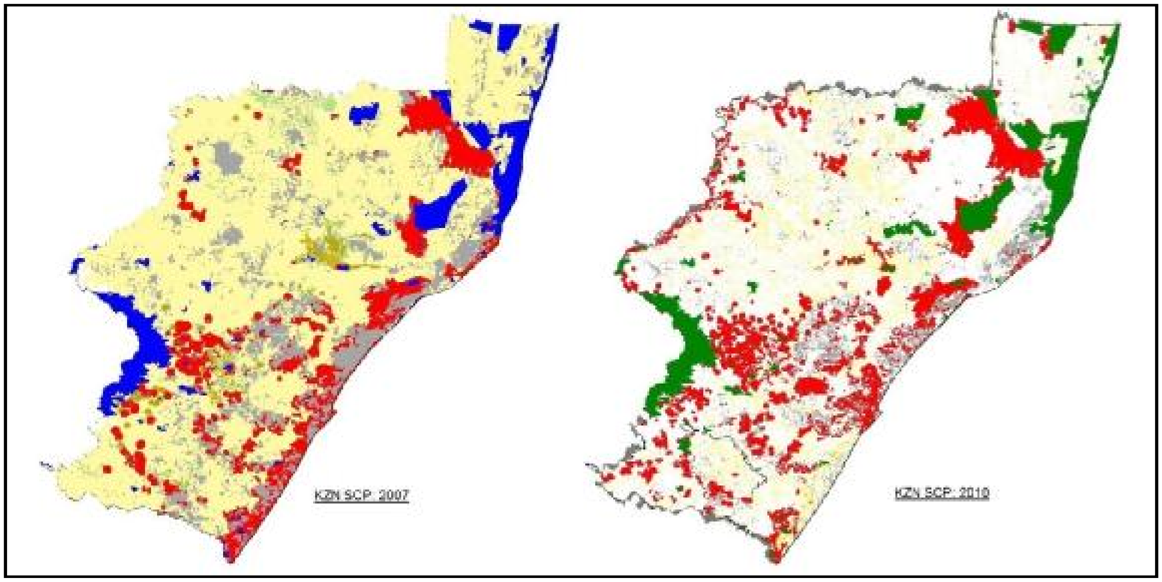

Figure 3.11: Kwazulu-Natal's Terrestrial Conservation Plan for 2007 and 2010 (Ezemvelo, 2007 and Ezemvelo, 2010)

The SCP for the Msunduzi local municipality within KwaZulu-Natal (illustrated in figure 3.12) below has the same colour coding as the 2007 KwaZulu-Natal SCP. This plan includes 56 animal species, 20 plant species and 8 vegetation types (McFarlane, 2008). According to McFarlane (2008) targets for all but four biodiversity features included in the Msunduzi Municipality plan could still be achieved and highlighted that further species loss could be prevented if the remaining habitats within the municipality were appropriately safeguarded.

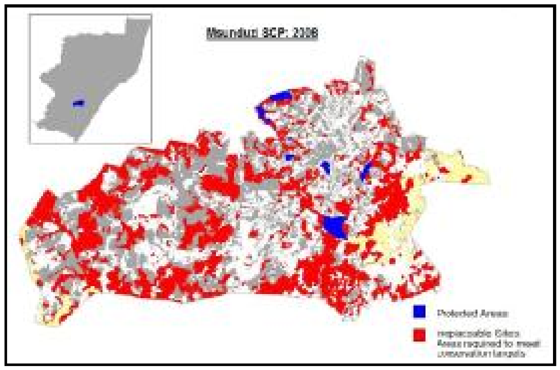

Figure 3.12: Msunduzi Municipality Irreplaceability Map (McFarlane, 2008)

3.6.3 Challenges

Pressey *et al*. (2007) highlight that there are three broad challenges facing conservation planning, firstly, that biodiversity processes need protection, these pertain to ecosystem services, regardless of whether they are explicitly recognised. Secondly, that planning situations should involve dynamic threats, as many SCPs assume that “threats to biodiversity are absent or static” (Pressey *et al*., 2007: 583), meaning that SCPs are ‘snap shots’ in time which do not take into account the impacts upon biodiversity during the development of the SCP. In other words, by the time the SCP is complete, the data used to develop the plan is outdated and impacts upon biodiversity will have occurred, as threats to biodiversity are not static. The third challenge involves “practice catching up with science…[as it is] increasingly important for practitioners to be kept abreast of new methods…[and] requires scientists to take on additional roles [such as] communicating more effectively with practitioners and other stakeholders; explaining science more transparently; and engaging in long-term collaborations to promote effective implementation” (Pressey *et al*., 2007: 590).

In addition to the above, “spatial conservation prioritizations often assume that land is available for acquisition” (Guerrero *et al.*, 2010: 1) and do not consider the influence of people in terms of their willingness-to-sell or manage appropriately for conservation. Guerrero *et al*. (2010: 7) argue that “people’s preferences and choices are dynamic and can change with time given the influence of a diversity of external factors”, and hence identified priority areas may not necessarily have the opportunity to be safeguarded.

Therefore it is crucial that SCPs are user-friendly and useful for authorities and all stakeholders (Pierce *et al*., 2005) and alternative methods to conserve biodiversity are adopted.

In terms of the EIA process, Gontier (2006: 351) highlights that there needs to be a move from "a descriptive approach of the environment to a more functional approach that has potential to be translated into practice", which therefore requires the integration of ecological modelling (such as SCPs) and the assessment process. Gontier (2006: 351) further indicates that "in order to reach the integration objective, EIA[s]…have to face the challenge of moving from a multidisciplinary approach to a transdisciplinary one…[which] requires not only that the different disciplines are part of the same process but also that cooperation and exchange are achieved beyond the discipline boundaries in order to reach a common goal". It is anticipated that the challenges referred to by Gontier (2006) will be addressed within this study, as a transdisciplinary approach forms the bases of this study (as described in Chapter Two) and is required to answer the key questions and achieve the objectives listed in Section 1.6.

3.6.4 Benefits

According to Pressey *et al*. (2007: 583) SCP has enormous potential to rise to the challenges, "partly through science and partly through closer connections between scientists and practitioners". In terms of the latter, an operational model for conservation planning which caters for feedback loops at both the assessment and management stages is required. The operational model based on Knight *et al*.'s (2006) study provides a useful example of such a model (figure 3.13).

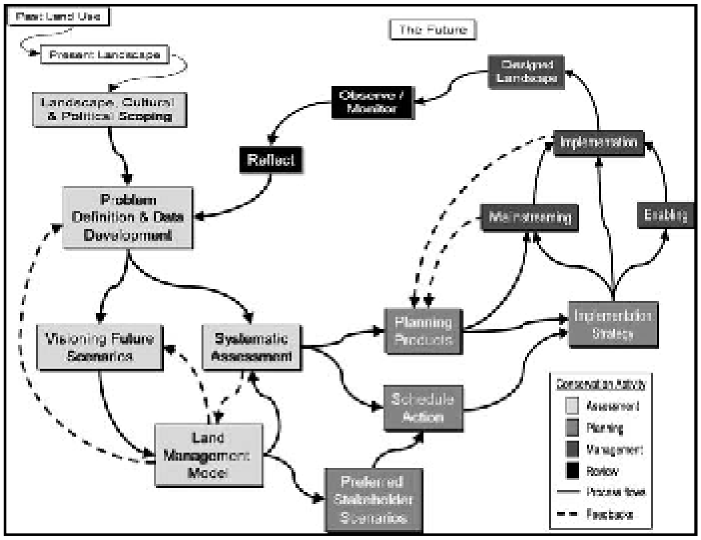

Figure 3.13: Operational Model for Conservation Planning (Knight *et al.*, 2006).

It is important to note that this study will only focus on the Implementation-Planning Product feedback loop, by using the implementation of SCPs within the EIA process to feedback into the Planning Product, to assist in the evaluation of whether EIAs can bridge the information-implementation gap (which is the third objective of this project).

According to Knight *et al.* (2006: 415):

> *[c]onservation planning initiatives provide opportunities to alleviate immediate development pressures from priority conservation areas, providing more time to arrange for management interventions that maintain conservation values if they can incorporate meaningful information on priority conservation areas into existing land-use planning processes…This information also provides an opportunity for a regional-scale context to be integrated into local-scale decision making.*

Therefore it is concluded that SCP can guide the EIA process in terms of identifying appropriate mitigatory measures, potential alternative design layouts and alternative sites for land-use activities that may impact priority conservation areas, until such time that strategic plans can be implemented. This notion of integrating SCPs and EIA is supported by de Villiers *et al.* (2008: 4) who states that "early reference to conservation plans…in project-level impact assessments appeared to improve the chances that biodiversity would be dealt with 'adequately' in the EIA process and, by implication, the ensuing official decision".

3.6.5 Role of SCP within this Project

In considering both the challenges and benefits of SCPs, there is a concern that with the lack of monitoring biodiversity losses and gains that arise from EAs, it is difficult to determine the effectiveness of mainstreaming biodiversity (de Villiers ***et al***., 2008). In other words, an assessment of the biodiversity losses and gains that arise from the EIA process is required to determine if EIAs can adequately safeguard biodiversity and effectively mainstream strategic, ecosystem-scale conservation considerations into individual, reactive projects (de Villiers ***et al***., 2008).

Hence, for the purposes of this study, the KwaZulu-Natal provincial SCP (both the 2007 and 2010 versions) and both of the municipal SCPs will be interrogated to determine what contribution EIAs have made to conserving biodiversity in KwaZulu-Natal, as well as identify the potential value of EIAs in conserving KwaZulu-Natal's biodiversity (that is, the second two objectives of this study).

3.7 Conclusion

In light of the need to conserve biodiversity, the substantial provincial, national and international legal sanctions and the available tools (described in Sections 3.4, 3.5 and 3.6), it is concluded that there is an evident and critical need to assess how developments outside the KwaZulu-Natal PA network impact upon the province's ability to meet their conservation targets.

CHAPTER FOUR

STUDY AREA AND METHODOLOGY

4.1 Introduction

The aim of this chapter is to contextualise the study area of this project into the broader physical landscape, to assist in the understanding of how land-use change impacts the environment (in particular biodiversity) and how environmental and biodiversity sensitivities influence the EIA process. In addition, this chapter describes the methods and sampling procedures undertaken to obtain both the secondary and primary data and considers the severity of the limitations encountered within this study.

4.2 Study Area

This section describes the physical and biophysical aspects of eight sites within the study area of KwaZulu-Natal, as well as illustrates how these aspects have influenced the progression of layout plans through the EIA process. The following information has been primarily extracted from Environmental Scoping Reports, EIA Reports and specific specialist reports submitted to the DAEARD or the DEA for environmental authorisation.

The uMgeni and eThekwini municipalities have been used to form the focus of this research (figure 4.1) as uMgeni allows for an assessment on the impacts on inland biodiversity, while eThekwini contains coastal biodiversity. These two areas therefore reflect a subsample of EIAs undertaken, as well as a subsample of biodiversity and associated ecosystems within the province. The information provided below has been used in Chapter Five to determine what contribution (either positive or negative) the activities being undertaken on the site have or are making to the conservation of biodiversity.

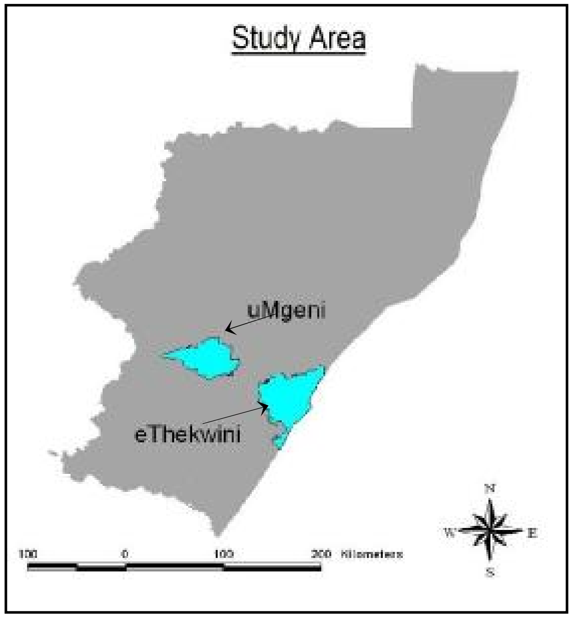

Figure 4.1: Study Area

4.2.1 uMgeni Municipality

The four sites investigated within uMgeni Municipality are Shawlands Farm, Fernhill Estate, Brookdale Estate and the Hilton Estate (figure 4.2). Shawlands Farm has an agricultural land-use, while Fernhill, Brookdale and Hilton are residential estates. These are described in detail below.

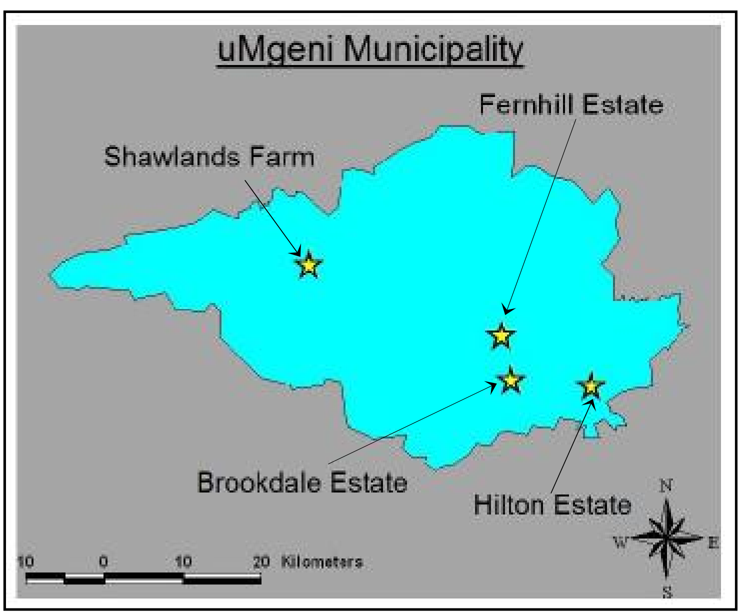

Figure 4.2: Distribution of the Four Study Sites within uMgeni Municipality

4.2.1.1 Site 1: Shawlands Farm

Shawlands Farm is situated on Sub of Farm Onverwaght No. 2004 and is located at approximately 29° 24' 15"S and 29° 58' 24"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2929 BD: Nottingham Road (figure 4.3) (Botha, 2004). The property is 2480 hectares and is primarily surrounded by natural veld, both dryland and irrigated agricultural crops and pastures, as well as commercial tree plantations comprised of Pine, Wattle and Gum (Botha, 2004).

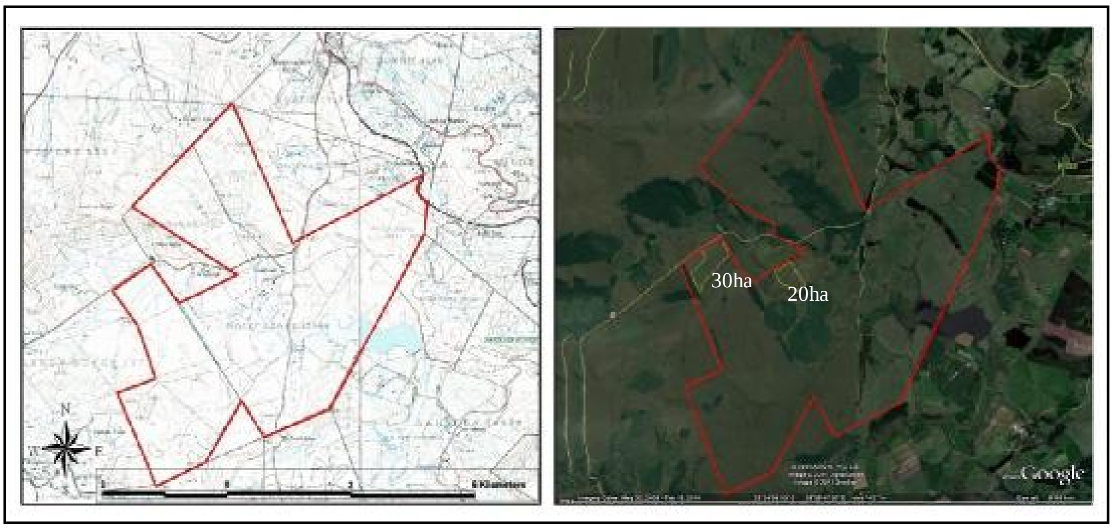

Figure 4.3: Site 1: Location of Shawlands Farm

4.2.1.1.1 Biophysical Characteristics and Features

The highest point of the 50 hectare area applied for cultivation within the EIA is 1460 amsl and the lowest point is 1420 amsl, which indicates a very gentle slope (Botha, 2004). The terrain of the entire property (that is all 2480 hectares) supports a spring, extensive wetlands and several rivers and streams, as can be seen in figure 4.3 (Botha, 2004). While the natural vegetation for the area falls within Moist Highland Sourveld, according to the Acocks classification system (Botha, 2004), the 2480 hectare property consists of commercial timber which covers 27 hectares, dryland crops and pastures of approximately 180 hectares, alien invasive species covers 20 hectares and the remaining 2253 hectares consists of wetlands and natural bush and veld (Botha, 2004).

Due to the vast expanses of natural land on the property (2253 hectares) the property was confirmed and predicted to support several species of fauna (for example Oribi [Ourebia ourebi], Wattled Crane [Bugeranus carunculatus]) and flora (three Kniphofia species), which are threatened species (Longmore, 2004 and 2005). Furthermore, the property supports two active breeding sites for Wattled Crane (which are critically endangered), one pair of breeding Blue Cane (Anthropoides paradise) and one pair of breeding Grey-Crowned (Balearica regulorum) (Coverdale, 2004).

4.2.1.1.2 Ecological or Conservation Value of the Site

The 2004 provincial systematic conservation plan identified the area as being of high conservation significance and irreplaceable (as the irreplaceability value was 1) (Appendix 1a), and the features contributing to this value were present on the application site (Longmore, 2004 and 2005). In addition, the provincial conservation organisation highlights that although Moist Highland Sourveld was not a threatened vegetation type, it has not been well conserved over its overall distribution and hence large tracts of gently undulating grasslands are a rare occurrence (Longmore, 2005). Therefore, the overall ecological and conservation value of the site is considered critical as it contributes significantly towards the province's conservation goals and targets (Longmore, 2004).

4.2.1.1.3 Progression of Layout Plan through the EIA Process

In keeping with agricultural zonation of the property, an EIA application was submitted to increase the viability of beef production on Shawlands Farm, by requesting permission to cultivate 50 hectares of virgin veld to permanent pastures and minimal crops (Appendix 1b). However, as a result of the presence of critically important biodiversity features present on Shawlands Farm, the initial layout was amended to exclude all sensitive areas and a revised layout (excluding 20 hectares of the initial proposal) submitted to DAEARD (Appendix 1c) and approved (DAEARD, 2005).

4.2.1.2 Site 2: Fernhill Estate

Fernhill Estate is located at 29° 29' 08.54"S and 30° 11' 36.23"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2930 AC: Howick (figure 4.4 below) (Ferendinos: 2006). The Estate is situated on Subdivision 466 of Remainder 409 of the Farm Allemanskraal No. 950 and covers 14 hectares, which is adjacent to Fernhill Hotel (north-west) and opposite Midmar Nature Reserve. The Gauteng to Durban railway forms the north-eastern boundary of the Fernhill Estate, while the Department of Water Affairs offices are located along the south-east boundary (Ferendinos, 2006).

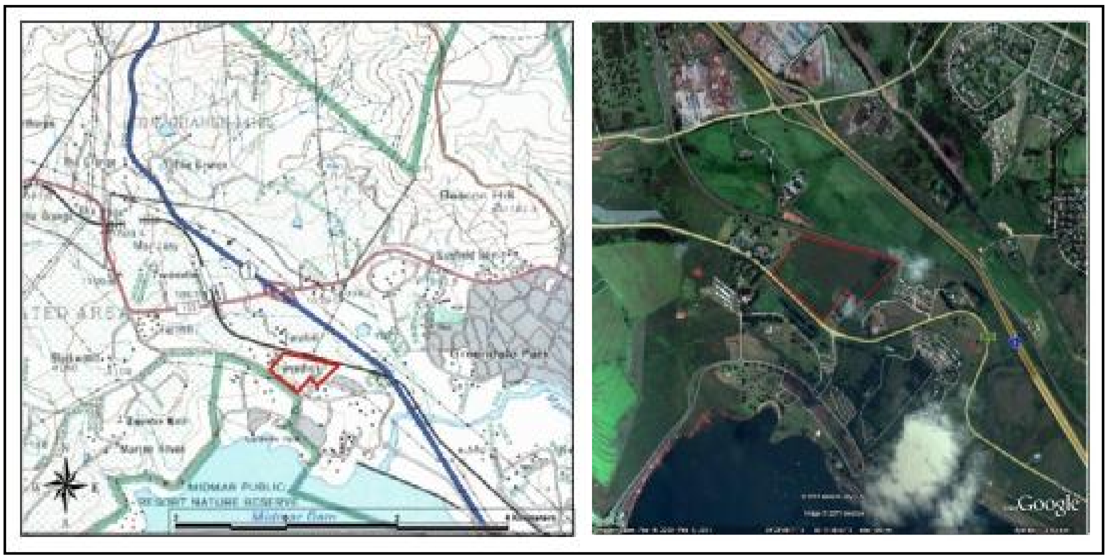

Figure 4.4: Site 2: Location of Fernhill Estate

4.2.1.2.1 Biophysical Characteristics and Features

The Fernhill Estate property gently slopes towards the north-eastern boundary of the property and does not lend itself to any prominent topographic features such as valleys or hills (Ferendinos, 2006). The site is underlain with Drakensberg dolerite, with intrusions of shales and sandstone of the Ecca Group (Ferendinos, 2005). Due to the topography of the site and given the boundary of the property no watercourses were present (figure 4.3). The natural vegetation for the area falls within Camp’s Bioresource Group 5, Moist Midlands Mistbelt, which has an endangered threat status, and is classified as Southern Tall Grassland Veld, Type

65, according to the Acocks classification system (Ferendinos, 2005). However due to the agricultural practices undertaken on the property, no natural vegetation is present on the site (Ferendinos, 2005 and 2006). Although no natural vegetation occurs on the property, two KwaZulu-Natal endemic chameleon species are present on the property, namely the Midlands Dwarf Chameleon (Bradypodion thamnobates) and Bourquin's Dwarf Chameleon (Bradypodion bourquini) (Ferendinos, 2006).

4.2.1.2.2 Ecological or Conservation Value of the Site

While the provincial systematic conservation plan identified the site as being of high conservation significance (as the irreplaceability value was 0.8), the features contributing to this value were found not to be present on site (Appendix 2a). However, both Ezemvelo and the Environmental Consultant highlights that the area has the potential to support the Midlands Dwarf Chameleon and Bourquin's Dwarf Chameleon, as these species were raised as a concern on a neighbouring property (Ferendinos, 2006). According to Ezemvelo's preliminary response to the EIA application "less than 2% of the chameleons' habitat is under formal protection making it imperative for conservation of these species to occur on privately held land" (Thambu, 2006: 2). This statement was supported by the specialist appointed to assess the conservation potential of the dwarf chameleons on the site (Londt, 2006). Therefore the overall value of the site was deemed significant due to the presence of two KwaZulu-Natal endemic chameleon species.

4.2.1.2.3 Progression of Layout Plan through the EIA Process

The property was originally zoned and used for agricultural purposes (Ferendinos: 2006). In 2006 an EIA application was submitted to DAEARD to rezone the property to residential and construct a 100 unit housing estate on the 14 hectare site (Appendix 2b). The proposal included a gatehouse and associated infrastructure, such as the internal road network and pipelines (Ferendinos: 2006). However, due to the presence of the Midlands Dwarf Chameleon and Bourquin's Dwarf

Chameleon, the initial layout proposed in the EIA (Appendix 2b) would have a negative impact on both populations of chameleons (Londt, 2006). Londt (2006: 5) recommends that "every effort should be made to retain as much suitable habitat as possible on this property". To achieve this recommendation, portions of the property have been set aside as a chameleon sanctuary, as well as an ecological corridor to allow for the movement of chameleons in an out of Fernhill Estate (Londt, 2006). In addition, a specialised plant list was developed for the landscaping of the Estate, to allow for the development of a sustainable sanctuary for the chameleons (Londt, 2006). As a result, a revised layout (which took into account the requirements of the biodiversity sensitivities of the site) was redeveloped and submitted and approved by DAEARD (Appendix 2c).

4.2.1.3 Site 3: Brookdale Estate

Brookdale Estate is located on the Remainder of Farm Brookdales No. 935, at approximately 29° 32' 10"S and 30° 12' 15"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2930 CA: Merrivale (figure 4.5) (Konigkramer, 2007). The property is 34.6 hectares and is bounded by Midmar Dam Nature Reserve on the north, south and western sides, while the Main Road 617 runs along the eastern boundary (Konigkramer, 2007).

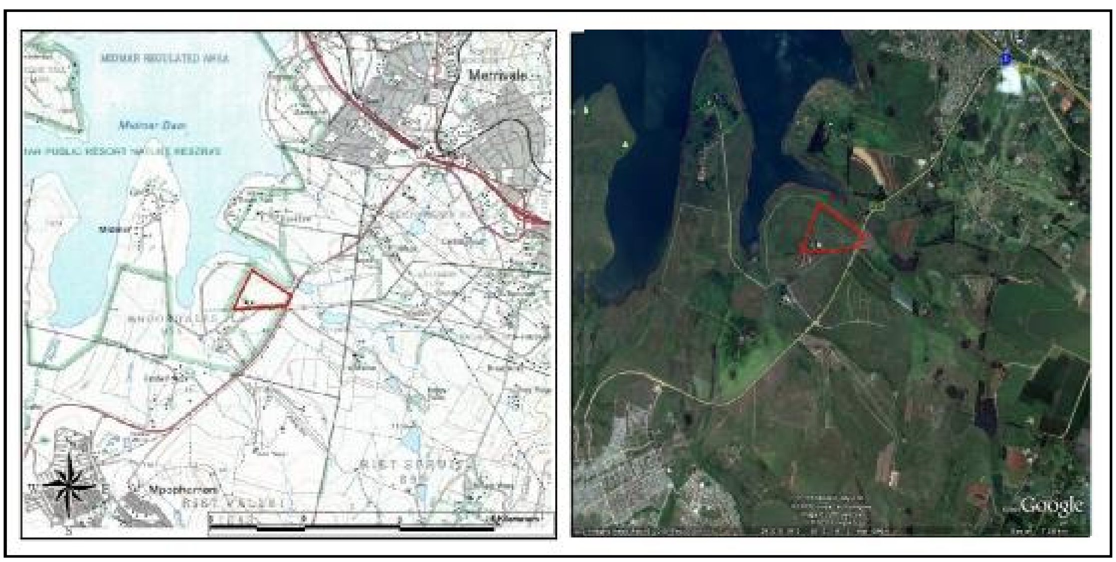

Figure 4.5: Site 3: Location of Brookdale Estate

4.2.1.3.1 Biophysical Characteristics and Features

Brookdales Farm and the surrounding area experience hot summers (between December and March) with an average daily maximum of 28°C and average daily minimum of 17°C (Konigkramer, 2007). Winter is mild to cold (between June and August) with an average daily maximum of 23°C and average daily minimum of 4°C (Konigkramer, 2007). During spring and summer, hot north-westerly berg winds precede cold conditions which cause unpredictable weather patterns (Konigkramer, 2007).

The property slopes gently from 1112m amsl to 1083 amsl, average gradient of 1:25 (Greene, 2007) towards Midmar Dam Nature Reserve and therefore results in the natural drainage of the site towards the dam (Konigkramer, 2007). In terms of geology, Brookdales Farm is located within a region which is comprised of dark grey Shales and Siltstones of the Volksrust Formation of the Ecca Group, which when weathered appear light yellow and khaki in colour (Schreiner, 2006). The area around Midmar Dam Nature Reserve is also extensively intruded by Dolerite, which is evident in the northern portion of the property (Schreiner, 2006). Due to the topography of the property a wetland is present in the south-eastern corner of the site, which flows in a north-westerly direction (Schreiner, 2006).

The natural vegetation of the area is located within Moist Midlands Mistbelt (an endangered vegetation type), however this property is characterised by secondary grassland as it had been previously cultivated more than 20 years prior to 2007 (Konigkramer, 2007). A small stand of Wattle trees occurred in the north-west corner (Konigkramer, 2007). Although the potential exists for the occurrence of red data species on the site, given the disturbed nature of the site (as a result of historic extensive farming) the likelihood of the presence of species of conservation significance is considered low (Konigkramer, 2007).

4.2.1.3.2 Ecological or Conservation Value of the Site

The 2007 systematic conservation plan for the province did not highlight this area as an area of conservation significance (Appendix 3a), and no on-site biodiversity concerns were identified (Konigkramer, 2007). However, given that the property is adjacent to a PA which contains an important water body, namely Midmar Dam, a change in land-use would have to be compatible with the adjacent conservation area and associated impacts appropriately mitigated, and be in-line with the aims and principles of the Midmar Controlled Area of Sub-division Policy (Thambu, 2007).

4.2.1.3.3 Progression of Layout Plan through the EIA Process

While the property was originally zoned for agricultural purposes, the land had not been cultivated for more than 20 years prior to 2005 (Konigkramer, 2005). Towards the end of 2005 an EIA application was submitted to DAEARD to establish 16 subdivisions, which would be sold as permanent or holiday homes to private landowners (Konigkramer, 2005). In June 2006 the proposal was amended to create 45 subdivisions which would be sold as permanent or holiday homes to private landowners, but would be fenced to form a residential estate (Appendix 3b) (Konigkramer, 2006). The proposal included areas of opens space along the boundaries adjacent to Midmar Dam Nature Reserve, as well as associated infrastructure, such as the internal road network and pipelines (Konigkramer, 2006). In 2007 the proposal was revised to accommodate 50 subdivisions, which catered for 45 freestanding residential plots, one medium density subdivision for seven flats, one subdivision for a lodge site, one subdivision for a homeowners office; boat storage area; clubhouse and parking, and two conservation subdivisions (Konigkramer, 2007).

However, due to the location of the property adjacent to a Midmar Dam Nature Reserve and the absence of adequate information to assess the impacts of the medium density housing, lodge, boat storage area, clubhouse and parking (as these were added towards the end of the EIA process), the revised proposal was not approved (DAEARD, 2007). A second amended proposal (Appendix 3c) was approved, as it was considered to be in-line with the Midmar Controlled Area of Sub-division Policy which aimed to protect the agricultural and water resources of the areas surrounding Midmar Dam (DAEARD, 2007a).

4.2.1.4 Site 4: Hilton Estate

Hilton Estate is located at 29° 32' 33.86"S and 30° 17' 41.88"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2930 CB: Pietermaritzburg (figure 4.6) (Bowd, 2007). The Estate is situated on Rem of Erf 330 of Hilton Farm, which is approximately 18.5 hectares in extent (Bowd, 2007). A Mondi wattle plantation borders the northern boundary, Hayfields Road runs along the eastern boundary and low density housing lies adjacent to the south and west boundaries (Bowd, 2007).

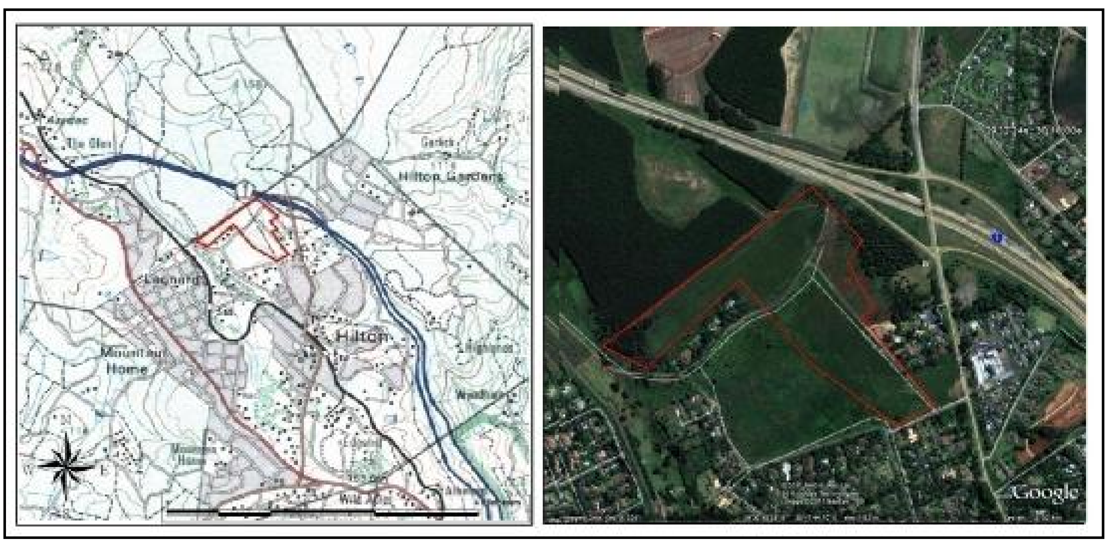

Figure 4.6: Site 4: Location of Hilton Estate

4.2.1.4.1 Biophysical Characteristics and Features

The area within which the property is located is subject to a mean annual rainfall of 800mm to 1280mm and a mean annual temperature of 17.5°C (Bowd, 2007). This region is also subject to occasional droughts, hail, frost and heavy mist and hot north-westerly berg winds precede cold conditions which cause unpredictable weather patterns (Bowd, 2007). The property slopes from 1155m amsl into a basin at 1125m amsl (le Roux, 2005). The eastern portion of the property slopes gently to form a east to north-east facing slope, with a gradient ranging from 1:9 to 1:12, along a north-westerly drainage line (Bowd, 2007). The western portion of the property has a south-westerly spur which slopes gently at a 1:20 gradient along the crest, however the south-western and south-eastern boundaries of the property have a steeper gradient of up to 1:5 (Bowd, 2007). In terms of geology, the property is underlain by shale of the Volksrust Formation, which is weathered to various degrees, however it is mostly described as completely or highly weathered (Bok, 2005). Due to the characteristics of the site, the wetland system that flows through the property are divided into three hydrogeomorphic wetland types, namely channelled valley bottom wetland (the main drainage line), hillslope seepage wetland which feeds the watercourse (along the north-eastern slope) and a valley bottom wetland without a channel (the central wetland perpendicular to the main drainage line (Milne, 2006). This wetland feeds into the Gwen Spruit, which eventually feeds into the uMgeni River (Bowd, 2007).

The natural vegetation of the property is classified as Camp's Bioresource Group 5 – Moist Midlands Mistbelt, an endangered vegetation type with very few pristine areas remaining in the landscape (le Roux, 2005 and Bowd 2007). While the northern portions of the property contain fragments of good quality Mistbelt grassland, the portion of property along Cowan Road had lost some species but could easily be rehabilitated and the north-east portions were very disturbed (Bowd, 2007). Several species of mammal, birds, reptiles, amphibians and invertebrates were predicted to occur in the area, while no species of special conservation significance were identified, the property did support a diversity of animal species worth conserving such as 10 mammals, 68 recorded bird species, three reptiles and eight amphibian species (Grobler, 2007).

4.2.1.4.3 Ecological or Conservation Value of the Site

The 2007 provincial systematic conservation plan did not classify this area as being of conservation significance, as the property fell within an urban node (Bowd, 2007) (Appendix 4a). However the study undertaken by Grobler (2007) indicates that the property did support species worthy of conservation and that the rehabilitation and appropriate management of the grasslands and wetlands would improve the condition of the site for these species. Grobler (2007) further highlights the conservation importance of the site by identifying and delineating a suitable conservation corridor that would link the Hilton property to the Hilton Vlei, which also supports species of conservation significance.

4.2.1.4.3 Progression of Layout Plan through the EIA Process

Originally 40% of the property was zoned educational, 30% was zoned public open space, 10% private open space and 20% special residential. Hence, the proposal for the EIA application was to rezone the property to special area to establish 77 residential subdivisions and two common subdivisions (Bowd, 2006a). The 2006 Draft Environmental Scoping Report acknowledged the need to conserve the Moist Midlands Mistbelt grassland and amended the proposal to 50 residential subdivisions and two private open spaces (Appendix 4b) (Bowd, 2006b). However, due to the outcome of the biodiversity assessment undertaken by Grobler (2007) the initial layout (Appendix 4b) had to be amended to take into account the recommendations of the biodiversity assessment and resulted in an amended layout (Appendix 4c) (Bowd, 2007). The amended layout (Appendix 4c) was considered appropriate to accommodate a conservation corridor that would link the Hilton property to the Hilton Vlei and hence approved by DAEARD (DAEARD, 2008a).

4.2.2 eThekwini Municipality

The four sites investigated within eThekwini Municipality (figure 4.7) are Hillcrest Retirement Village, Wiltshire Cold Storage Complex, Broadlands Housing Estate and Dube Trade Port and the associated King Shaka International Airport (DTP-KSIA). These are described in detail below.

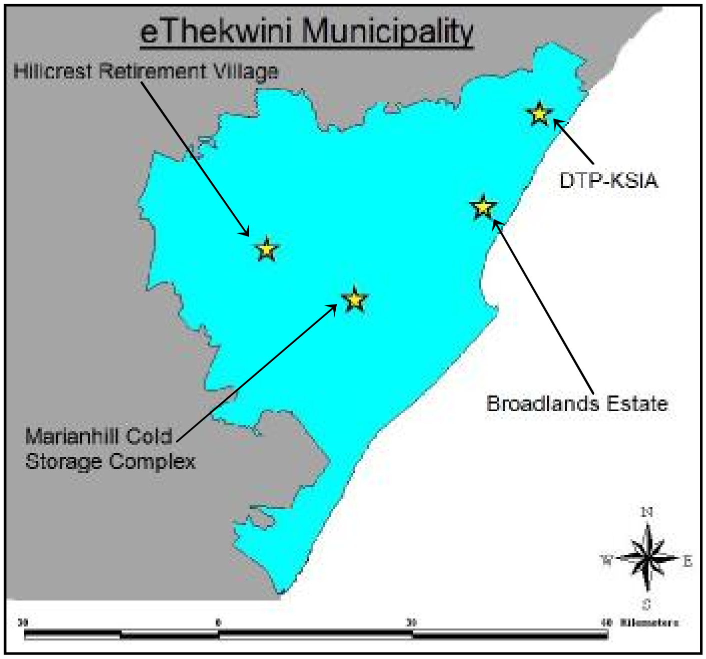

Figure 4.7: Distribution of the Four Study Sites within eThekwini Municipality

4.2.2.1 Site 5: Hillcrest Retirement Village

Hillcrest Retirement Village is situated on Rem of Erf 98 on the Farm Assagay No. 0007, which is approximately 10 hectares in extent, at 29° 47' 13.91"S and 30° 44' 29.93"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2930 DC: Hammarsdale (figure 4.8 below) (Donkin, 2006). Residential developments are located along the south-east, west and north boundaries and are a mixture of medium density and smallholdings (Donkin, 2008).

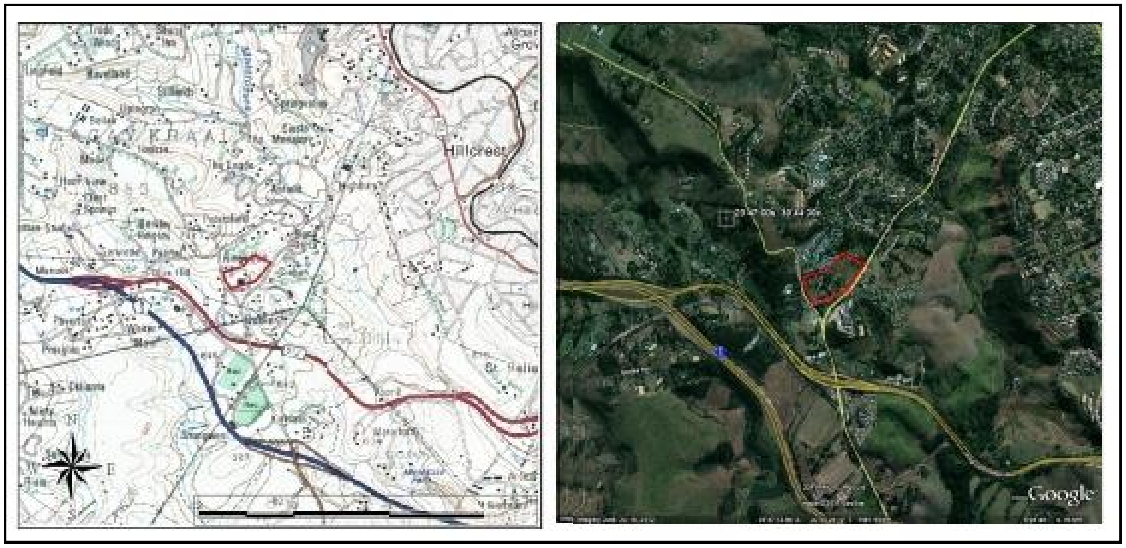

Figure 4.8: Site 5: Location of Hillcrest Retirement Village

4.2.2.1.1 Biophysical Characteristics and Features

The property lies on a watershed which slopes gently in a north and south direction (Sansbury, 2007), and is underlain with weathered sandstone which becomes thicker and moister towards the north-east and results in highly erodible soils (Sansbury, 2007). Due to the topography of the property no wetlands or watercourses were identified on site, other than the subsurface flow due to the watershed (Sansbury, 2007 and Donkin, 2008). While the natural vegetation of the area is KwaZulu-Natal Sandstone Sourveld, approximately 50% of the property was invaded with alien invasive species and the remainder was transformed due to the presence of a coffee shop, nursery, small trader establishments, equestrian structures and a farm house (Donkin, 2008). Therefore, due to the transformed and degraded state of the remaining natural vegetation on the property, no species of conservation significance were identified (DAEARD, 2008b).

4.2.2.1.2 Ecological or Conservation Value of the Site

The 2007 provincial systematic conservation plan indicates that the area is of high conservation significance and irreplaceable (as the irreplaceability value was 1)

(Appendix 5a). However, due to the transformed and degraded state of the property no features of conservation significance were identified (DAEARD, 2008b).

4.2.2.1.3 Progression of Layout Plan through the EIA Process

The initial EIA application proposed to rezone the property from agriculture to residential, to construct 142 units and a frail care facility, as depicted in Appendix 5b (Donkin, 2008). However, due to the lack of sensitive features on the property negated the need to amend the layout, the initial layout (Appendix 5b) was approved by DAEARD (DAEARD, 2008b).

4.2.2.2 Site 6: Marianhill Storage Complex

Marian Storage Complex is located at 32 Wiltshire Place on Rem of Erf 17783 and Erf 6952 of Pinetown, which is approximately 6.24 hectares in extent, at 29° 51' 28"S and 30° 51' 54"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2930 DD: Durban (figure 4.9 below) (Granger, 2007a). The site is bounded on the east by the Marian Industrial Park, west of the Mhlatuzana River, north of Wiltshire Road and south of the Durban Electricity Substation (Bodenstein, 2007).

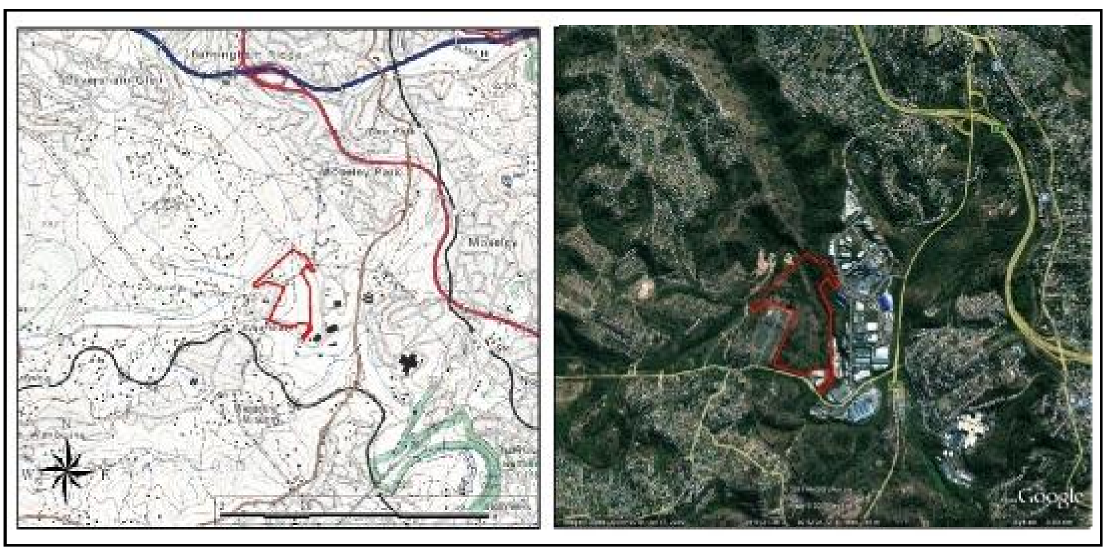

Figure 4.9: Site 6: Location of Marianhill Storage Complex

4.2.2.2.1 Biophysical Characteristics and Features

The area within which the property is located, is subject to a mean annual rainfall of 730mm (Granger, 2007b). The daily mean temperature in summer is approximately 24°C and 15°C in winter, extreme temperatures occur between June and August, but the area is described as 'frost free' (Granger, 2007b). The site is located within the Mhlathuzana Valley and has a gentle slope, approximately 1:3, which ranges from 110m amsl to 220m amsl (Granger, 2007b). In terms of geology, the Marianhill Storage Complex is situated on weathered sandstone bedrock of the Natal Group, which is overlaid by fill, colluvial, alluvial and residual soils (Granger, 2007b). The surface soil is predominately a medium to fine sandy loam, except towards the river banks where the sand content increases, and showed evidence of subterranean channels up to approximately 180m from the river bank (Granger, 2007b).

Due to the topography, the area forms a hillslope seepage wetland, which results in the presence of a wetland on the Marianhill Storage Complex site (Ellery, Garden and Grenfell, 2007) and lies to the west of the Mhlatuzana River (Bodenstein, 2007). The natural vegetation of the area is Ackocks Veldtype No. 1, a grassland mosaic of the Coastal Forest, palm and thorn veld. While the grassland was disturbed due to inappropriate management, the site displayed a high diversity of grass and forbs, with very little alien invasive species being present along the fringes of the forest patches (Bodenstein, 2007). In addition, given the presence of both wetland and terrestrial habitats, the property was predicted to support several faunal species, such as reptiles (particularly the critically endangered Bradypodion melanocephalus, commonly known as the Black-headed Dwarf Chameleon), amphibians and invertebrates (Granger, 2007b). While, no faunal species of high conservation significance were identified, Flap-necked chameleons were identified (Bodenstein, 2007).

4.2.2.2.2 Ecological or Conservation Value of the Site

The 2007 provincial systematic conservation plan indicated that the area was of high conservation significance (as the site was considered irreplaceable) (see Appendix 6a: Marianhill Storage Complex - SCP 2007) (Ezemvelo, 2007). The features contributing to the conservation plan's irreplaceability value for the area were the vegetation type, one millipede species and one plant species (Granger, 2007b). Although the area was historically disturbed and few faunal species of conservation significance were identified, the wetland was classified as being in extremely good ecological and hydrological condition, as well as performing important wetland functions for the surrounding area (Ellery, Garden and Grenfell, 2007). In addition, it was noted that due to the high diversity of grass and forbs, within the grassland (although not pristine) was also in good condition (Bodenstein, 2007) and the forest patches present on the site supported species of conservation significance (Longmore, 2007).

4.2.2.2.3 Progression of Layout Plan through the EIA Process

The initial EIA application proposed to construct a cold storage facility (including loading, off-loading and parking areas) on land that was zoned for light industry, as depicted in Appendix 6b (Granger, 2007a). The initial layout had the potential to impact upon sensitive ecological features, particularly the grassland, forest, Mhlatuzana River and associated wetlands (Granger, 2007a). However, as a result of the ecological sensitivities identified during the EIA process, a revised layout was developed (Appendix 6c), to accommodate a 20m wetland buffer, 10m stream buffer, an ecological corridor to link the grassland to the wetland and the grassland to the forest (Granger, 2007a). While the amended layout was approved by the DAEARD, the development still encroached upon 611m^2 of forest (Granger, 2007a).

4.2.2.3 Site 7: Broadlands Estate

Broadlands Estate is located at 17 Mount Edgecombe Drive, on Erf 2657 Broadlands, at approximately 29° 43' 45.12"S and 31° 02' 30.12"E, as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2931 CA: Verulam (figure 4.10 below) (Tsoene, 2006). The property 10.57 hectares in extent and is situated within an area that contains several residential complexes, such as The Gardens, Somerset Park, Umhlanga Ridge, La Lucia Ridge, Ilala Ridge (Tsoene, 2006), and is bounded to west by The Mount Edgecombe Golf Estate (Kujawa, 2005).

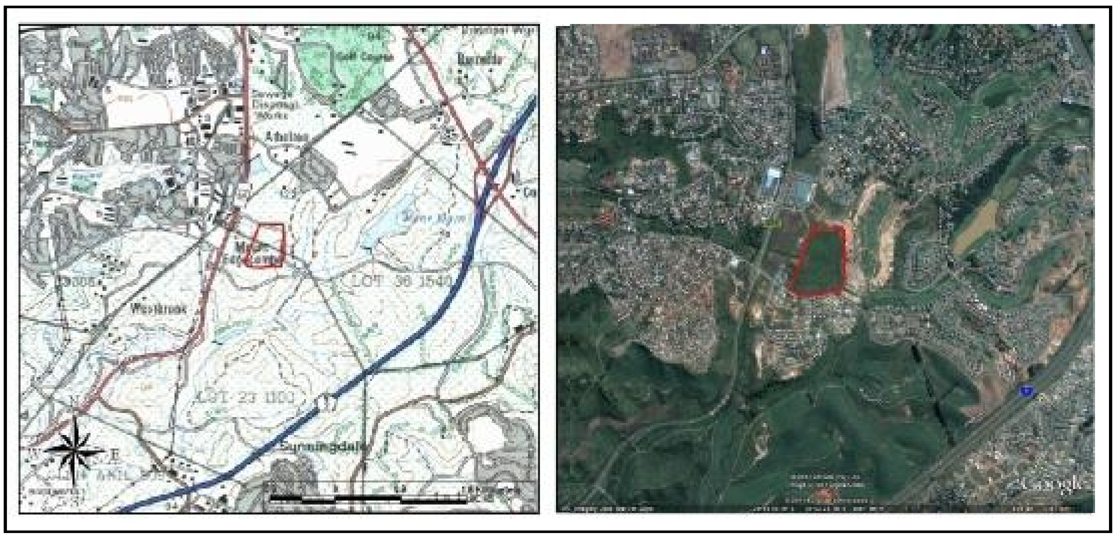

Figure 4.10: Site 7: Location of Broadlands Estate

4.2.2.3.1 Biophysical Characteristics and Features

The property slopes in a south-south easterly to south-easterly direction and has a gradient which ranges from 3° to 10° (Kujawa, 2005), and is underlain by residual soils of the weathered Vryheid Formation sandstone (Kujawa, 2005). In addition, some fill material was identified, which was underlain by “moist, dark, green grey, loose to medium dense, fine to medium grained, clayey sand containing some organic matter” (Kujawa, 2005: 4). Due to the topography on the property, three streams drain the site in a north to south, north-west to south-east and an east to west direction (Tsoene, 2006). The wetlands associated with these streams cover a large proportion of the property (Tsoene, 2006).

The natural vegetation of the area falls within the Moist Coast Forest, Thorn and Palm Veld Bioresource Group (Tsoene, 2006). However, the property had been moderately to highly disturbed and infested with alien invasive vegetation (Tsoene, 2006). Due to the disturbed state of the site, no faunal species of conservation significance had been identified during the EIA process.

4.2.2.3.2 Ecological or Conservation Value of the Site

The 2007 provincial systematic conservation plan indicates that the area is of high conservation significance (as the site is considered irreplaceable) (Appendix 7a). The features contributing to the conservation plan's irreplaceability value for the area are the natural vegetation, a threatened plant species and threatened retile species (Ezemvelo, 2007). However, due to the degraded state of the property, the only feature of conservation significance identified was the wetland (Currin, 2006).

4.2.2.3.3 Progression of Layout Plan through the EIA Process

The initial EIA application proposed to construct 172 middle income housing, of medium density, on Erf 2657 Broadlands which was in line with the 'activity' zonation for the property (Appendix 7b) (Nevette, 2006). However, due the presence of the three streams and their associated wetlands, the layout plan for Broadlands was amended (Appendix 7c), to take into account a 10m buffer from the seasonal wetlands and drainage lines, and exclusion of any development or open water bodies within the wetlands and their buffers (DAEARD, 2007b). As a result of amendments, DAEARD approved the revised layout.

4.2.2.4 Site 8: Dube Trade Port and the associated King Shaka International Airport

The Dube Trade Port and associated King Shaka International Airport (DTP-KSIA) is situated on the Farm La Mercy No. 15124, which is 2060 hectares in extent, at approximately 29° 36' 00"S and 31° 07' 12"E as indicated on the Surveyor General 1:50 000 Topographical Map Sheet 2931 CA: Verulam (figure 4.11 below) (Mander, 2006). The property is bounded by the Provincial Road R102 and agricultural land on the east, the N2 forms the western boundary and agricultural land occurs on both the northern and southern boundaries of the property (Mander, 2006).

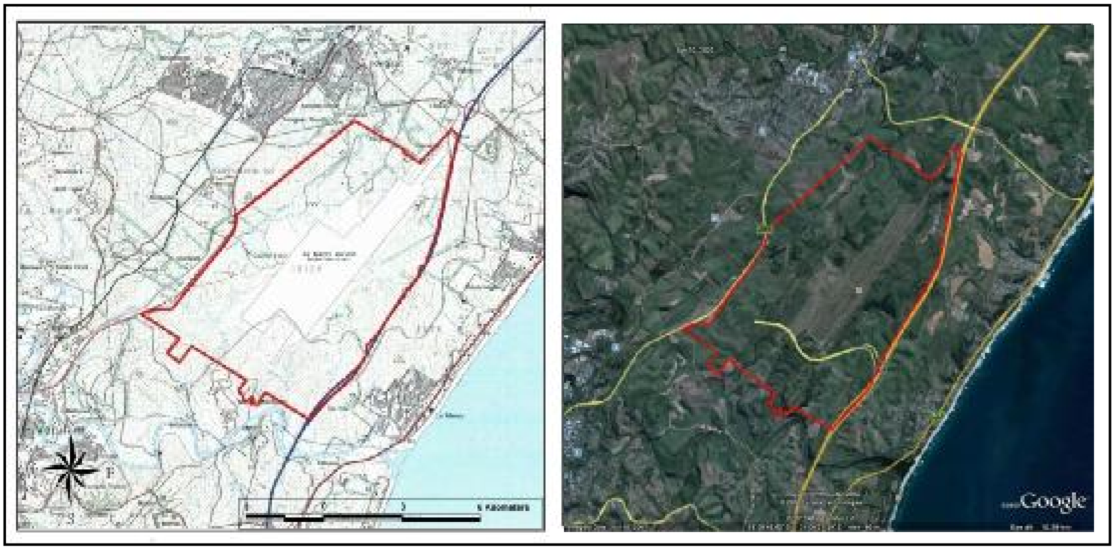

Figure 4.11: Site 8: Location of DTP-KSIA

4.2.2.4.1 Biophysical Characteristics and Features

The area within which the property is located is subject to a mean annual rainfall of approximately 900mm to 1100mm and “is generally warm to hot with mild winter nights” (Mander, 2006: 180). The DTP-KSIA site is situated at approximately 119 amsl with rolling hills and valleys, however in 1976 earthworks were undertaken within the central area to create a platform (Mander, 2006). In terms of geology, the property is underlain by Vryheid Formation shale and sandstone, with intrusions of dolerite in the west and capped with Berea Formation sands in the east (Mander, 2006). As a result of the topography and soils, the water table is considered to be low (Mander, 2006). The property is located on the watershed of the Tongaati River catchment and the Mdloti River catchment and is considered to be in close proximity to the Tongaati and the Mdloti estuaries (Cowden and Kotze, 2007). Due to the topography, geology and size of the property, extensive wetland systems of approximately 332 hectares are present (Mander, 2006 and Cowden and Kotze, 2007).

The natural vegetation of the area falls within the Moist Coast Forest, Thorn and Palm Veld Bioresource Group, however due to the extensive disturbance since the 1970s there are only remnant patches of indigenous vegetation (Mander, 2006). The indigenous vegetation on the property is secondary and had been established as a result of remnant seedbanks and isolated pockets of indigenous species (Mander, 2006). In addition, the several stands of secondary woodland-forest patches (comprising of Albizia adianthifolia) identified on site, was of particular conservation significance as detailed by Hines and Nichols (2007).

Due to the presence of extensive wetlands and patches of indigenous vegetation, several faunal species were identified (Mander, 2006). Three invertebrates, a KwaZulu-Natal endemic mollusc, a regional endemic millipede and a rare regional endemic earthworm, were identified and recorded on the property (Mostovski and Davies, 2007). There were approximately 21 amphibian species identified on the site, of which four are threatened (Hemisus guttatus and Afrixalus spinifrons are vulnerable; and Hyperolius pickersgilli and Natalobatrachus bonebergi are endangered) and two are endemic (Harvey, 2007). The property supported approximately 26 reptile species, of which the Bradypodion melanocephalus (Black-headed Dwarf Chameleon) had been confirmed on site (Lambiris, 2006). Approximately 224 avifaunal species were surveyed on the property, of which 12 were threatened (one endangered, four vulnerable and six near-threatened) (Piper, 2007). In addition, a significant population of Barn Swallows roost in close proximity to the property which have international importance, as this particular roost is one of the largest recorded in Sub-Saharan Africa, as stated by Prof. A Moller (Mander, 2007). There were 20 mammalian species recorded on the property, which included two threatened species, a Blue Duiker which is vulnerable and a Serval which is near-threatened (Taylor, 2007)

4.2.2.4.2 Ecological or Conservation Value of the Site

The provincial systematic conservation plan indicates that the area is of moderate to high conservation significance (as the site was considered irreplaceable) (Appendix

8a). The features contributing to the conservation plan's irreplaceability value for the area are the natural vegetation, a threatened plant species and threatened retile species (Ezemvelo, 2004). While those specific features were not identified on the property, due to the remnant patches of secondary vegetation, the amphibians which are of both local and national importance and the Barn Swallow roost which is of international importance, the ecological value of this site ranges from local to international levels.

4.2.2.2.3 Progression of Layout Plan through the EIA Process

At the early stages of the EIA application, the initial proposal sort authorisation for four elements, namely the King Shaka International Airport, the Trade Zone (export and cargo terminal), the Support Zone (business parks, hotels and commerce) and the Agri Zone (130 hectares for agricultural production and export) (Appendix 8b) (Manders, 2006).

While mitigatory measures were developed to address the impacts identified, it was only towards the end of the EIA process that an onsite mitigation plan was developed, which mapped out the areas that need to be set aside to safeguard biodiversity identified during the EIA investigations (Appendix 8c) (Manders, 2007).

4.3 Methodology

In order to meet the objectives of this study, the use of both secondary (discussed in section 4.3.1) and primary data (discussed in section 4.3.2) was required. This section details the research methods utilised for the collection of data.

4.3.1 Secondary Data Collection

This study drew on a wide range of concepts and tools, namely, biodiversity; legislative frameworks; EIA processes; SCP and various conservation options. The secondary data that formed the basis of the literature review was obtained from reviewing and interpreting information from several sources, such as academic articles (hard and electronic copies); books; internet resources; journals (hard and electronic copies); and unpublished reports.

The outcome of the literature review highlighted the need for alternative conservation methods (that is, other than PAs), and drew on the concept of CD. As a result of the extensive use of this approach to developments internationally, indicators had been identified to assess the effectiveness of CD. In addition, the literature review also highlighted several potential weaknesses within the EIA process, in terms of assessing biodiversity issues. Therefore, both the indicators for CD and the list of biodiversity assessment weaknesses within the EIA process, were incorporated into the following:

- The questionnaire (in the form of a table) (Appendix 9); and
- The analysis:
  - Ø to evaluate the contribution of a subset of approved EIAs in conserving biodiversity; and
  - Ø to identify the potential value of EIAs in conserving biodiversity.

4.3.1.1 Sampling Procedure and Analysis

The sampling procedure used to select the EIA applications for the case studies is illustrated in figure 4.12. The sample population consisted of those EIA applications that were submitted to the provincial authorising department for approval and had been authorised between 2005 and 2008. The sample frame for the EIA applications, were those applications that were submitted to the conservation authorities for review and comment, as these applications were identified as having potential biodiversity issues. Those EIA applications which were identified as having high biodiversity issues (as classified by the conservation authority's Applications Register Database) or identified as having a high conservation value (as determined by the 2007 provincial systematic conservation plan), formed the sample unit for the EIA applications.

At the first level of sampling, non-probability quota sampling (also referred to as purposive sampling) was used to select the municipalities within which the study sites would be selected. In other words, specific areas were selected to undertake sampling. The use of quota sampling (as used in this study) allowed for representativeness (Teddlie and Yu, 2007) across the province. To achieve this, both an inland and coastal municipal study areas were selected to provide for a representative subsample of both biodiversity and EIAs within the KwaZulu-Natal province. There are 11 district municipalities within KwaZulu-Natal, six are inland and five are coastal. uMgungundlovu represents 16% of the inland district municipalities and eThekwini represents 20% of the coastal municipalities.

At the second level of sampling, a random number table (generated within Microsoft Excel) was used to select four sites with each district municipality (Teddlie and Yu, 2007). That is, a table which contains numbers which are not selected by any type of pattern, hence stochastic. The EIA applications were categorised into two groups, namely those with high biodiversity issues (33 in uMgungundlovu and 34 in eThekwini) and those with high conservation value (33 in uMgungundlovu and 31 in eThekwini). To ensure that there were representative samples of EIAs with high biodiversity issues and high conservation value, within both inland and coastal municipalities (to obtain the sample size), it was estimated that two sites within each category, hence four sites within each municipality, would be appropriate. Approximately 6% of applications with high biodiversity value and approximately 6% of applications with high conservation value formed the representative sample for uMgungundlovu. The use of the random number table for the uMgungundlovu district resulted in these four applications falling within the uMgeni Local Municipality. In the case of eThekwini, the representative sample was also made up of approximately 6% of applications with high biodiversity value and approximately 6% of applications with high conservation value. The 10% sampling rule was not applied due to the limited number of applications available for sampling (see Section 5.3 for limitations encountered). The EIAs of the eight applications, which were identified using the random number table, were sourced from Ezemvelo KZN Wildlife's Land-use Change Application Register Database (accessed April 2010).

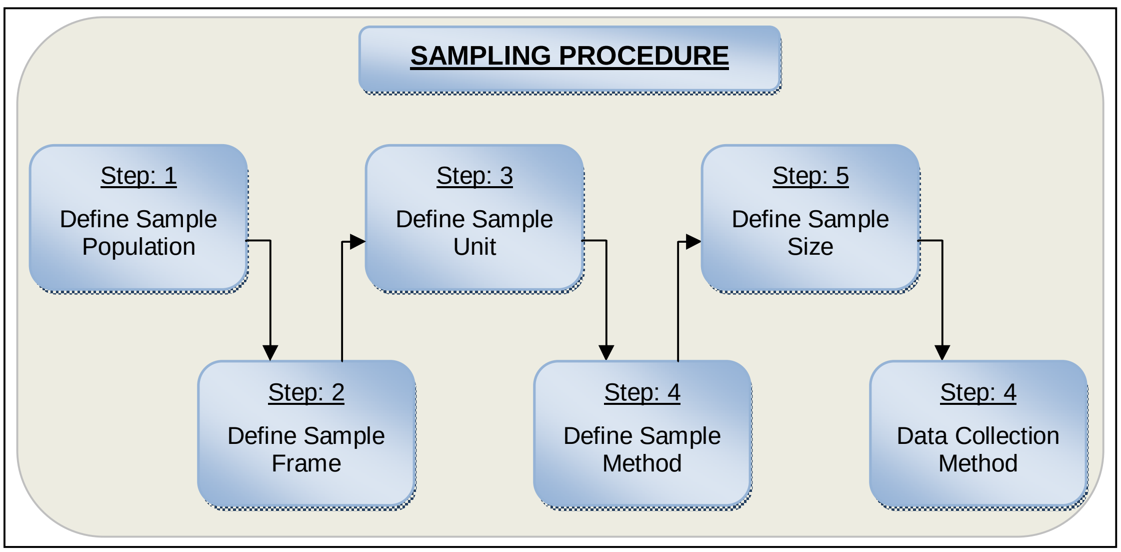

Figure 4.12: Sampling Procedure

In terms of analysis, the EIAs and EAs were reviewed and assessed against the broad categories within which the CD indicators are identified. The questionnaires and Google Earth images were used to corroborate if the anticipated outcomes of the EIA and conditions of the EA were achieved, by comparing the details within the EIA report with the responses from the questionnaires and the images from Google earth.

4.3.2 Primary Data Collection

4.3.2.1 Questionnaire Design

To obtain the primary data for this research project, a structured survey in the form of a questionnaire (Appendix 9) was designed to determine the perception of the state of biodiversity in KwaZulu-Natal; the effectiveness of EIAs to safeguard biodiversity; and the successfulness of approved EIAs to safeguard biodiversity.

Both close-ended and open-ended questions were utilised. Close-ended questions allowed for predefined alternatives to be selected by the respondent that were pertinent to the study. The advantage of this type of questioning is that they are easy to answer by the respondents and the coding method is easy to implement by the researcher. However, the disadvantage is that the respondents are limited in their reply and important information may be lost (Kitchin and Tate, 2000). To address this disadvantage, the use of open-ended questions provided the respondents with an opportunity to reply in an unconstrained manner, which allowed innovative responses to be captured. In addition, this type of questioning allows the respondents to answer freely, by not limiting them to prearranged categories and therefore a full, unconstrained reply is received from the respondent, but the disadvantage is experienced by researcher during the coding these responses (Kitchin and Tate, 2000).

4.3.2.2 Sampling Procedure and Analysis

The sampling procedure followed for primary data collection was the same procedure followed for secondary data collection (illustrated in figure 4.12). The sample population consisted of environmental organisations (government and non-government), government departments, environmental and planning consultants within KwaZulu-Natal and/or South Africa. The sample frame describes the elements of the sample population. The individuals that work for environmental organisations (government and non-government), government departments, environmental and planning consultants, form the sample unit for the questionnaires.

A non-probability sampling method was used for the collection of primary data. At the first level of sampling, a quota sampling technique was used to identify six groups of individuals, as only certain groups of people within a company or organisation would work with EIAs. This sampling technique is also referred to as Stakeholder Sampling, as the major stakeholders who are involved in administering or providing input into EIAs are vital given the context of this research (Given, 2008). While the selection of the group of people is predefined, the individuals within the group were selected randomly, to maintain objectivity.

The snowballing technique (a form of sequential sampling), was used at the second level of sampling to allow for more individuals involved in the EIA process to respond, as there are a limited number of individuals working with EIAs. While this technique has the potential to present a biased view (in that certain individuals could be excluded from the study), the technique allows for the most suitably qualified individuals to respond to the questionnaire, thereby generating more accurate data (Kitchin and Tate, 2000). When a sample population has a high number of sampling units, the 10% rule applies, (that is, 10% of the total number of units must be sampled). However, due to the limited number of individuals that work with EIAs (particularly in government departments and NGOs), the 10% rule could not be applied (this too justifies the use of the snowballing technique). While it was estimated that five individuals from each group would be appropriate, generating a sample size of 30 individuals (to provide a representative response to the questions), individuals from predefined organisations together with those chosen from snowballing sampling yielded a total of 69 persons. The researcher, in anticipation of responses from at least 30 individuals, distributed questionnaires to all 69 persons.

Questionnaires were e-mailed to all respondents, as a result of time, distance and cost constraints, this method not only conserved both time and costs, but allowed respondents to answer questions at their convenience (due to work or prior commitments). Table 4.1 below indicates the number of questionnaires that were distributed to the designated groups, as well as the number of responses received.

Table 4.1: Sampling Data

Groups	No. of Questionnaires Submitted	No. of Responses Received
Developers / Planning Consultants	5	2
Environmental Consultants / Specialists	27	9*
Municipalities	7	3
Provincial Department of Agriculture, Environmental Affairs and Rural Development	12	6*
Ezemvelo KZN Wildlife	13	9*
NGOs	5	4
Total	69 (100%)	33 (47.8%)

* Due to the snowballing technique responses were also received from individuals that were not on the original distribution list (Section 4.3.3 provides more detail)

To analyse the data collected from the questionnaire, a master code sheet was created by transferring 'word' data into 'number' data by placing questionnaire responses into numbered categories; the master codes were transferred into Microsoft Excel and recoded; and the recoded data was then analysed by using methods such as means, frequency and principal component analysis (PCA).

4.3.3 Limitations and Data Accuracy

4.3.3.1 Limitations

Several obstacles had to be overcome in order to allow for sound and defensible research. These limitations were:

i. Time. While the period available to collect data was approximately four months (January to April), the exclusion of weekends and public holidays results in approximately 80 working days available for interviews. However, all respondents were working during the week and had pre-arranged engagements (or vacations, particularly in January and April), therefore their available time to meet was limited;
ii. Distance. The individuals within the target groups were spread across the province, as consultants, developers and NGOs are not necessarily based in close proximity to the study area (some are located in other municipalities or provinces).
iii. Lack of responses. Due to the above two points, many of the individuals within the targeted groups did not respond within the stipulated four month period nor were available to meet for interviews.
iv. The use of the snowballing technique. The number of respondents from the consultant and conservationist groups was approximately doubled.
v. Not being able to visit the sites. Due to time constraints and unforeseen circumstances (for example, rehabilitation not commenced and the undertaking of unlawful activities).
vi. While it was anticipated that the municipal systematic conservation plans would be utilised to identify the resultant changes upon strategic plans, the eThekwini plan was not available and the sampling method for the uMgungundlovu District Municipality resulted in the four EIAs being located within the uMgeni Municipality, which does not yet have a systematic conservation plan.
vii. Potential conflict of interest. Five of the eight EIA applications evaluated for this study were assessed by the researcher as an employee of Ezemvelo KZN Wildlife.

4.3.3.2 Data Accuracy

The above limitations were overcome by:

i. The use of e-mail to distribute questionnaires, as this reduced the difficulty of time, distance and availability of respondents.
ii. Extending the period for respondents to reply to questionnaires by three months, as this provided additional time to those respondents who could not reply within the initial four month period. This proved very successful as three additional responses were received, over and above the expected 30 responses.
iii. Assessing the balance of respondents between the targeted groups. It is considered that the number of conservationist respondents will be balanced by the number of consultants, thereby preventing an unbalanced and unbiased outcome. In addition and as mentioned above, the snowballing technique does allow for the most suitably qualified individuals to respond to the questionnaire, thereby generating more accurate data.
iv. The use of the responses to the study area section of the questionnaire and Google Earth images, as sites could not be visited. The questionnaire and Google Earth assisted in corroborating whether the anticipated outcomes of the EIA and conditions of the EA were present on the ground.
v. Utilising the KwaZulu-Natal Systematic Conservation Plan to determine if EIAs could contribute towards strategic plans.
vi. Not assessing the validity of Ezemvelo or other commenting authorities' responses, as it was assumed that all responses submitted to the authorising department were valid. Instead this research focuses on whether the current reality meets the approved outcome of EIA applications (by considering CD indicators and the EAs), in terms of safeguarding biodiversity.

Based on the abovementioned points, it is believed that the conclusions and recommendations drawn from the analysis are valid and sound.

4.4 Conclusion

It is concluded that the selected study area and applications considered for this study consisted of a range of biodiversity features, at varying degrees of conservation significance, which represented a variety of scenarios that exist within the KwaZulu-Natal provincial landscape. As a result, this study has assessed a representative sample of EIA applications, which justifies the outcomes of the analysis. In addition, the methodologies applied to this study use both quantitative and qualitative research methods, which combine both science and social science methodologies to address the key questions of this research.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Introduction

This chapter is divided into three main sections which analyses and discusses the results of the primary and secondary data obtained, and includes the integration of several points highlighted within Chapter Three (Literature Review). Section 6.2 is primarily based on four (of six) sections of the questionnaire and depicts the understandings and perceptions of both biodiversity and EIAs of key groups of people that work either directly or indirectly within the EIA process. Section 6.3 illustrates the potential for EIAs to contribute towards conserving biodiversity by analysing both secondary data (eight EIAs and EAs) and primary data (the responses to the last two sections of the questionnaire, which focuses on the eight EIAs). Lastly, Section 6.4 presents the findings on how EIAs affect biodiversity conservation and whether EIAs can contribute towards strategic plans, through spatial analysis.

5.2 Understandings and Perceptions of Biodiversity and EIAs

5.2.1 Biodiversity

5.2.1.1 Results

Figure 5.1 illustrates the perception of the state of biodiversity (utilising KwaZulu-Natal's biomes as a surrogate for biodiversity) by 33 respondents which include government officials, private consultants and NGOs. While 30% of the respondents believe that the Savanna biome is considered to be in good condition (with the highest 'good state' rating of all the biomes), 28% of the respondents were uncertain (the highest uncertainty rating of all biomes) and overall, 36% (the majority of the respondents for that biome) believed that the Savanna biome was in fair condition (see Appendix 9 for definitions of 'good', 'fair' and 'poor'). The Forest biome was listed as fair by 49% of the respondents. The Estuarine biome is considered to be in poor condition by 67% of the respondents, with the River and Wetland biomes following closely behind as indicated by 61% of the respondents in both cases. The Grassland biome was also considered to be in poor condition by 55% of the respondents, as well as the coastal belt by 46% of the respondents. Overall, none of the biomes were considered in good condition by a majority of any magnitude, the Forest and Savanna biomes were the only two biomes that were considered in a fair state by a majority of 49% and 36% respectively. The remaining five biomes were all considered to be in a poor state with a majority difference ranging from 10-37% (that is, the gap between the majority and the next highest status ranking for that biome).

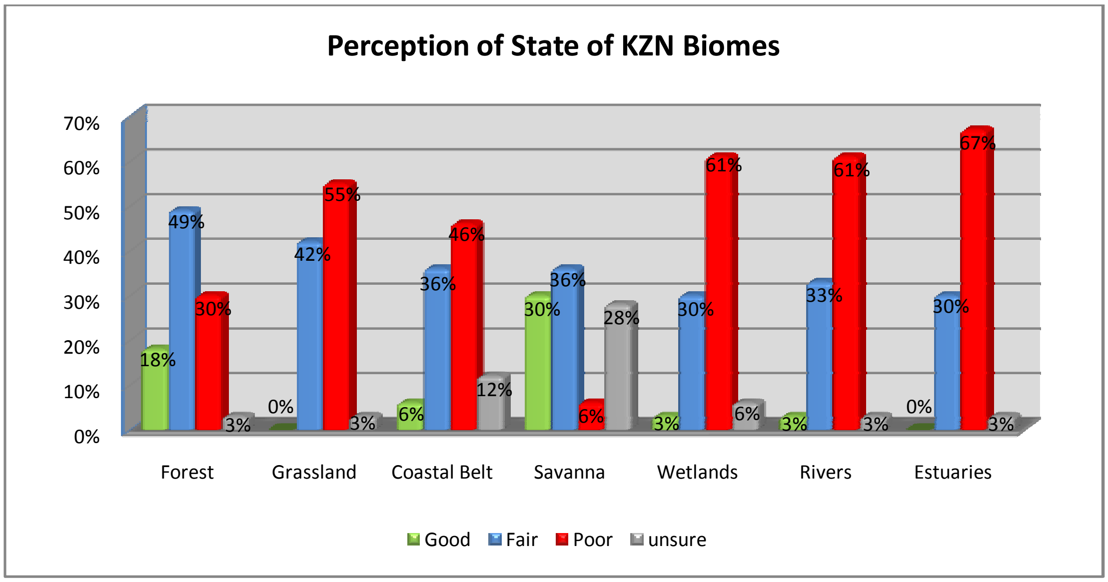

Figure 5.1: Perception of State of KwaZulu-Natal's Biomes (n=33)

PCA was used to determine if any similarities or differences existed amongst the responses of the respondents, in terms of their perceptions of the state of KwaZulu-Natal's Biomes, which may occur as a result of their respective work mandates or educational background. Figure 5.2 illustrates 63.1% of the variation amongst the responses received. While those responses that were the same, such as two municipal responses and a consultant; and two NGOs, have been overlaid upon each other, the figure below does indicate a large degree of variation in views between the two responses obtained from the developers; the municipal responses are divergent from the majority of the provincial conservation organisation and provincial environmental department's responses; and both the consultants and NGOs have a wide range of variation, which intermix with the developers, municipalities, provincial conservation organisation and provincial environmental department.

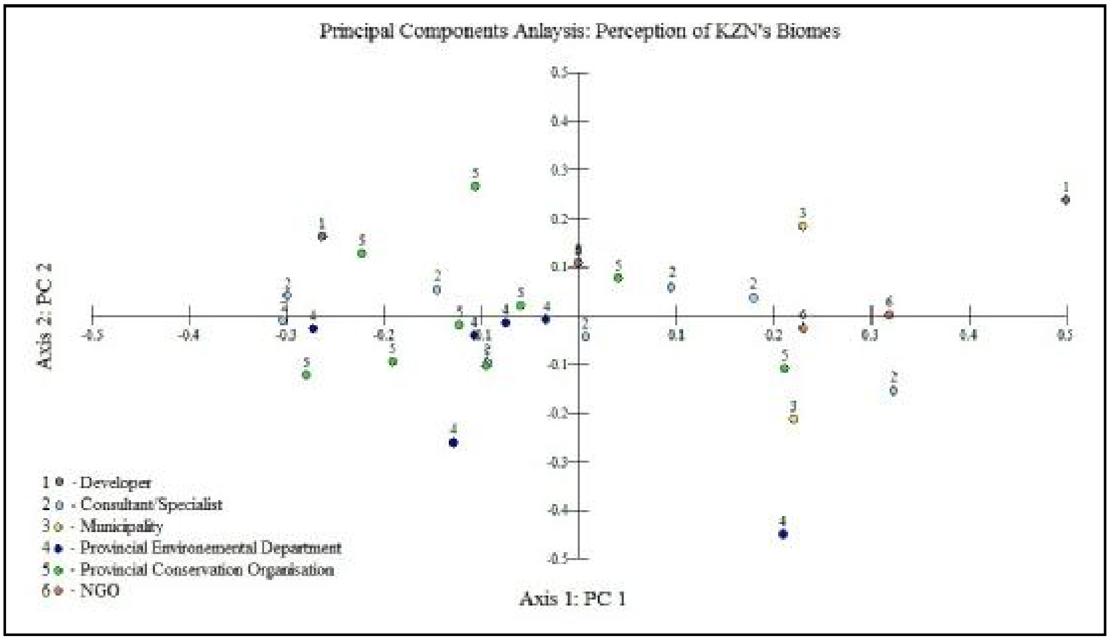

Figure 5.2: PCA: Perception of State of KwaZulu-Natal's Biomes

In terms of the perception of importance of particular ecosystem services, figure 5.3 illustrates that the majority, 85% of the 33 respondents, consider water regulation to be an important ecosystem service, along with habitat or refugia for species by 70% of the respondents. Pollination, nutrient cycling and disturbance regulation were considered important by 64% of the respondents, while 61% of the respondents perceived genetic resource and erosion control to be significant. Fifty-two percent of the respondents considered waste treatment and climate regulation as important and food production was perceived important by a majority of 42%. In terms of medium or average importance, recreational value was perceived as such by 60% of the respondents as well as cultural value by a 48% majority; and raw materials by a 42% majority. While food production received the highest low value rating by 24% of the respondents, overall, none of the listed ecosystems services were considered to be of low value by any majority of respondents.

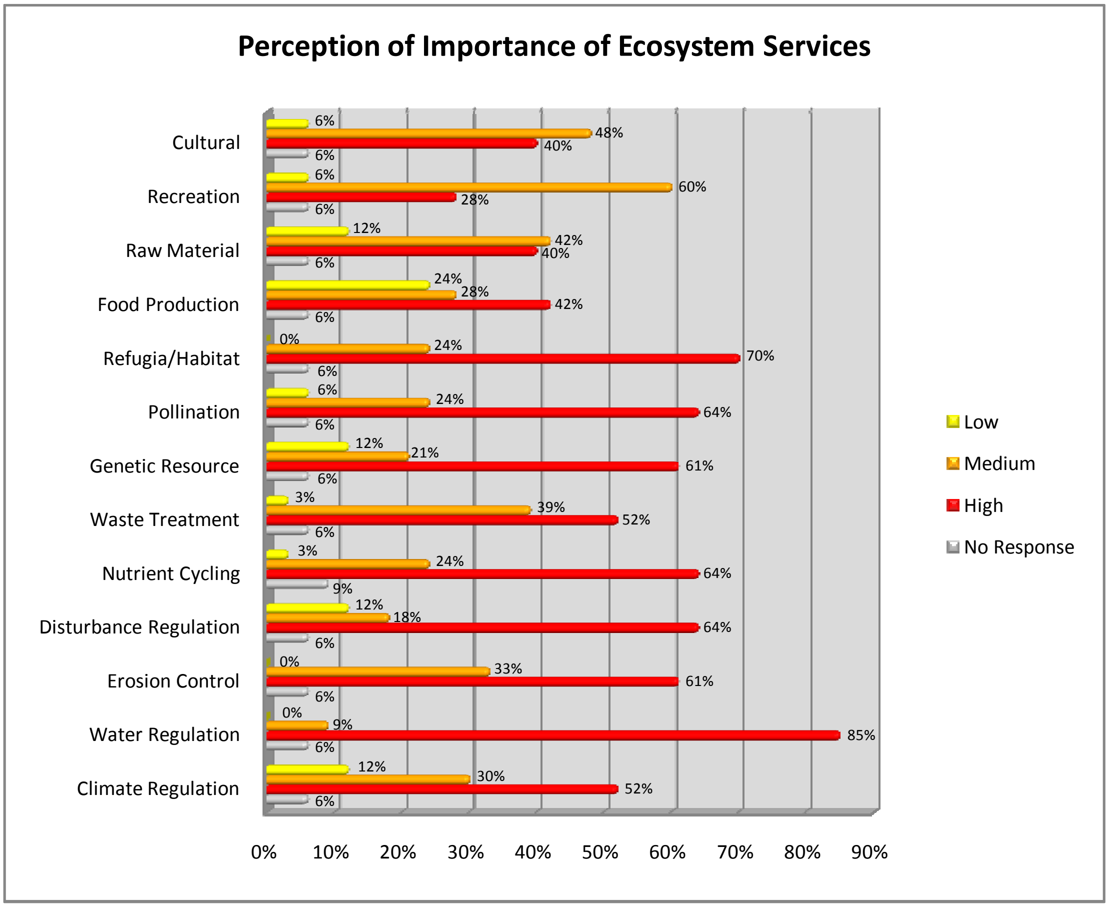

Figure 5.3: Perception of Importance of Ecosystem Services (n=33)

Figure 5.4 below illustrates 61.8% of the variation amongst the responses received in terms of the respondent's perceptions of the importance of ecosystem services. While two municipal responses were the same (and therefore the points overlaid upon each other), the figure below indicates a large degree of variation in views between the two responses obtained from the municipality, however they are intermixed amongst the consultants, NGOs, provincial conservation organisation and provincial environmental department which have a wide range of variation. The responses amongst the developers were also significantly divergent, with only one respondent intermixing with the majority.

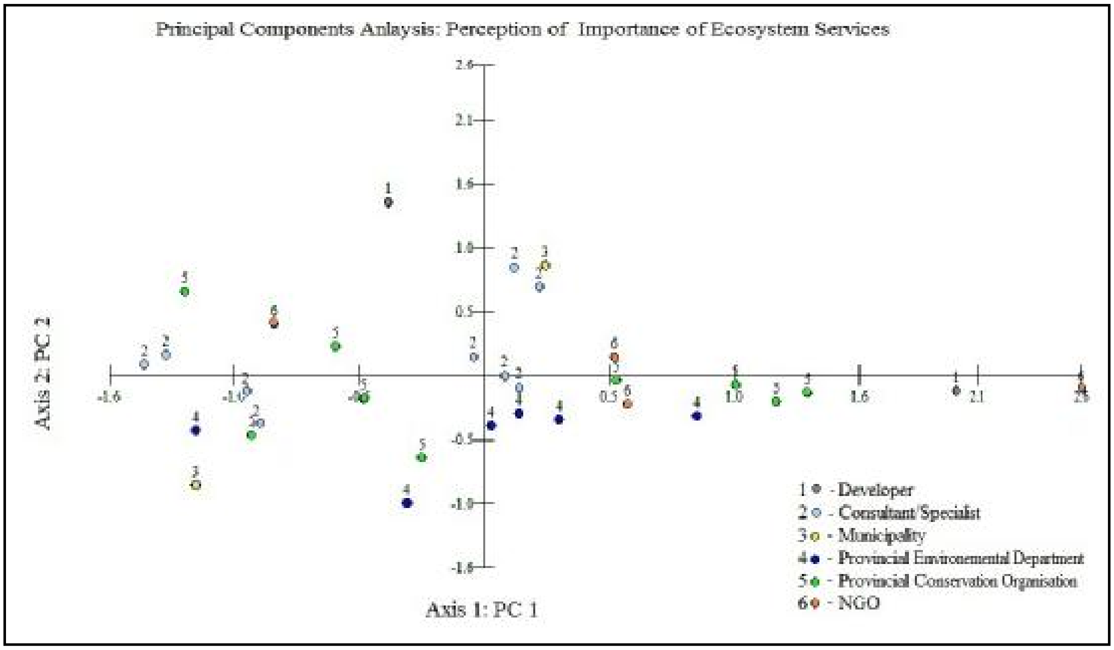

Figure 5.4: PCA: Perception of Importance of Ecosystem Services

5.2.1.2 Discussion

According to Ezemvelo's KwaZulu-Natal Vegetation Type classification (Ezemvelo, 2009c), each vegetation type has a threat status. Table 5.1 below was generated in order to determine the biome status within which each of the vegetation types occur, so as to allow for a comparison with the results of the respondents. The table below indicates the number of vegetation types (including the percentage) within a particular threat status, for a specific biome.

Table 5.1 Biome Assessment (adapted from Ezemvelo, 2009c).

Biome	**Vegetation Type Status**				**Biome Status**	**Majority Respondents Assessment**
	Least Threatened	**Vulnerable**	**Endangered**	**Critically Endangered**		
Forest	16 (94%)	0	0	1 (6%)	Fair	Fair (49%)
Grassland	13 (52%)	7 (28%)	2 (8%)	3 (12%)	Fair/Poor	Poor (55%)
Coastal Belt	2 (20%)	1 (10%)	3 (30%)	4 (40%)	Poor	Poor (46%)
Savanna	9 (50%)	4 (22%)	2 (11%)	3 (17%)	Fair/Poor	Fair (36%)
Wetlands (>2ha)	3 (50%)	2 (33%)	1 (17%)	0	Fair/Poor	Poor (61%)

It is evident from Table 5.1 that the respondents were generally accurate with their assessment of the status of the various biomes within KwaZulu-Natal, as a biome can only be considered in good condition if none of the vegetation types within it are threatened. While the majority of the vegetation types within the Forest biome are least threatened, 1 of the 17 vegetation types is critically endangered (that is the highest threat status that can be assigned), hence this biome is considered to be in fair condition. The grassland, savanna and wetland biomes are all considered to be in fair to poor condition given that approximately 50% are least threatened and the remainder fall within the higher threat status ratings. The coastal belt is considered to be in a poor state, as this biome has a high percentage of critically endangered vegetation types.

In terms of rivers and estuaries, according to the National Freshwater Ecosystem Priority Areas study, 57% of river ecosystems and 82% of estuarine ecosystems are threatened, which ranges from vulnerable to endangered to critically endangered (South African National Biodiversity, 2011). As a result, it is considered that river ecosystems are in a fair to poor condition, while estuarine ecosystems are in a poor condition. Hence, a majority of the respondents (67%) were accurate with their assessment of the status of the estuarine ecosystem (that is, being in poor condition), but slightly under estimated (by 61% of the respondents) the status of the river ecosystem (as this ecosystem is in fair to poor condition, rather than poor).

In addition, variation amongst the responses received from the questionnaire, indicates that the clustering of the majority of provincial environmental department and the provincial conservation authority could be a result of their similar or overlapping mandates. The NGOs and consultants are both concerned with environmental and social issues, hence their wider range of variation, while the municipality is largely mandated with social issues and therefore fall on the opposite side of the majority of the provincial environmental department and the provincial conservation authority. However, with only two, significantly divergent, responses representing the developers, it is not feasible to determine on which side of the side of the scale this group would cluster, it is therefore estimated that there would be a wide variation amongst their responses. This suggests that while there is an overall adequate understanding on the state of KwaZulu-Natal's biomes, the mandates which govern the various groups affects the degree of magnitude of their response.

In terms of the importance of ecosystem services, the majority of the respondents ranked those services which benefit either humans or biodiversity highest, while recreational and cultural services were perceived moderately important. Given that no majority indicated any ecosystem service to be of low value, the importance and value of ecosystem services appears to be widely accepted. These perceptions confirm the findings of Costanza (1997), who highlighted that ecosystem services make an important contribution to human welfare. In addition, the perceptions of ecosystem services correlate with the findings of Butchart *et al.* (2010: 1165), who identified that the majority of the indicators of pressures on biodiversity (which are on the increase) include "aggregate human consumption of the planet's ecological assets". In other words, there is a greater demand on the services ecosystems provide, which explains the high value placed upon these services.

In terms of the variation amongst the responses received, the responses amongst the developers are significantly divergent, as well as those amongst the municipalities. However the municipalities were clustered among the majority of provincial environmental department, the provincial conservation authority, NGOs and consultants, all of which had a wide range of variation. Based upon the above responses, it is evident that while the degree of magnitude of the response received is varied, the state of biodiversity and the value and importance of ecosystem services are widely accepted amongst the respondents. In addition, these responses are in line with international and national thinking, as described by Butchart *et al.* (2010) who highlighted significant declines in ecosystems with no decrease in the rate of decline.

5.2.2 EIAs

5.2.2.1 Results

The highest percentages of disagreement or strong disagreement of the 12 key weaknesses of EIAs in terms of assessing biodiversity, as identified by SAIEA (Brownlie *et al.*, 2006), were towards the late input of biodiversity information into the EIA process, by 40% of the 33 respondents. Thirty three of the percent of the respondents felt that there was a lack of biodiversity information available and that biodiversity is perceived as irrelevant or can be safeguarded elsewhere. In addition, 28% felt that the relevance of biodiversity information is not made explicit, as illustrated in figure 6.5. In other words, these respondents believed that the four abovementioned weaknesses were negligible. However, overall, figure 5.5 illustrates that the majority of the respondents agreed or strongly agreed that all 12 key weaknesses contribute towards the poor assessment of biodiversity within the EIA process.

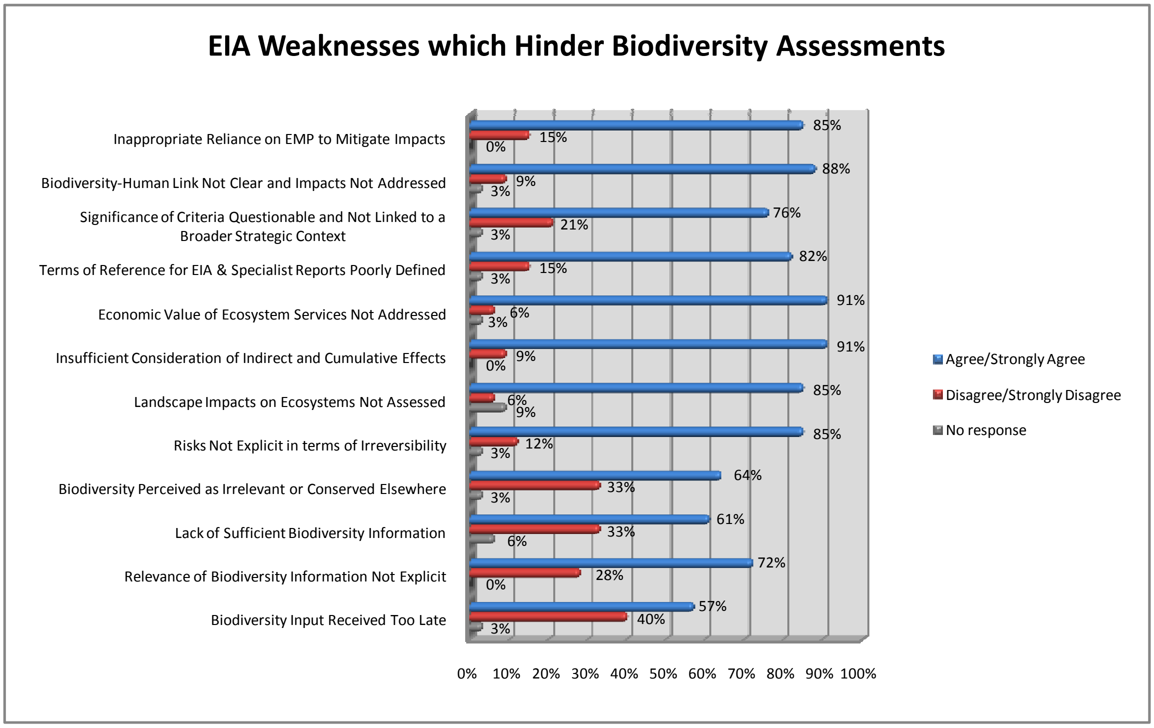

Figure 5.5: EIA Weaknesses which Hinder Biodiversity Assessments (n=33)

PCA was used to determine if any similarities or differences existed amongst the respondents, in terms of their perceptions of the weaknesses of the EIA to assess biodiversity, which may occur as a result of their respective work mandates or educational background. Figure 5.6 below illustrates 63% of the variation amongst the responses received in terms of the respondent's perceptions. The majority of the NGOs and provincial conservation authority have a similar degree of variation within their responses (Group A), while the municipalities (two of which have similar responses and therefore their points are overlaid upon each other), along with some of the consultants and the provincial environmental department, are significantly divergent from them (Group B). However, the developers, consultants and the provincial environmental department have a wide range of variation, which ranges from that of Group A to that of Group B (Overlap).

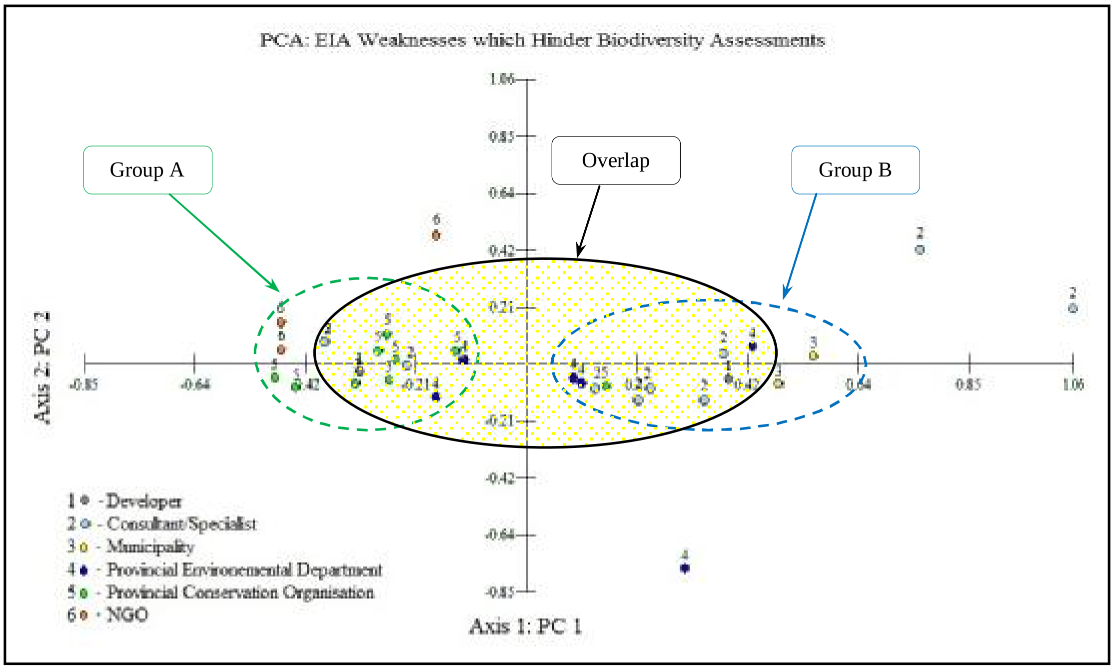

Figure 5.6: PCA: EIA Weaknesses which Hinder Biodiversity Assessments

In terms of the decision-making process, seven key weaknesses which impede decision-making to the extent that decisions do not seem to support sustainable development were identified by SAIEA (Brownlie *et al.*, 2006). The highest percentages of disagreement or strong disagreement towards these weaknesses, were that little to no compliance monitoring occurred, by 30% of the respondents; the quality of authorisations were poor, by 27%; and that the need to realise short-term socio-economic benefits were more important than biodiversity issues, by 22%. That is, these respondents believed that the three abovementioned weaknesses were negligible. However, overall, figure 5.7 below illustrates that the majority of the respondents agreed or strongly agreed that all seven key weaknesses contribute towards poor decision-making.

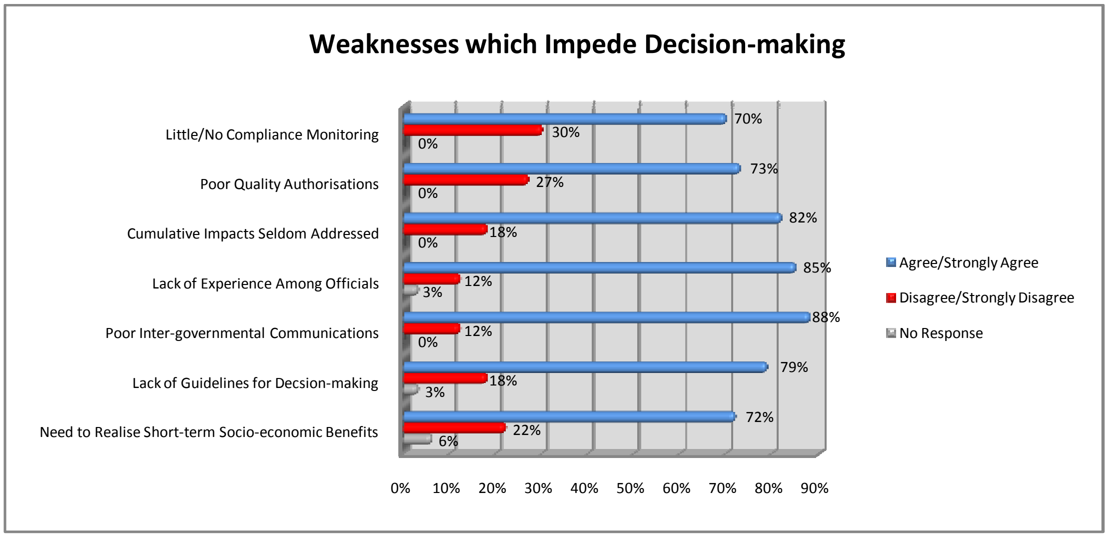

Figure 5.7: Weaknesses which Impede Decision-making (n=33)

Figure 5.8 below illustrates 66.4% of the variation amongst the responses received in terms of the respondent’s perceptions of the weaknesses which impede decision-making. While the majority of the NGOs and provincial conservation authority have a similar degree of variation within their responses (Group A), the provincial environmental department responses (Group B) are significantly divergent from them. However, the consultants, developers and the municipalities (two of which have similar responses and therefore their points are overlaid upon each other) have a wide range of variation which ranges from that of Group A to that of Group B (Overlap).

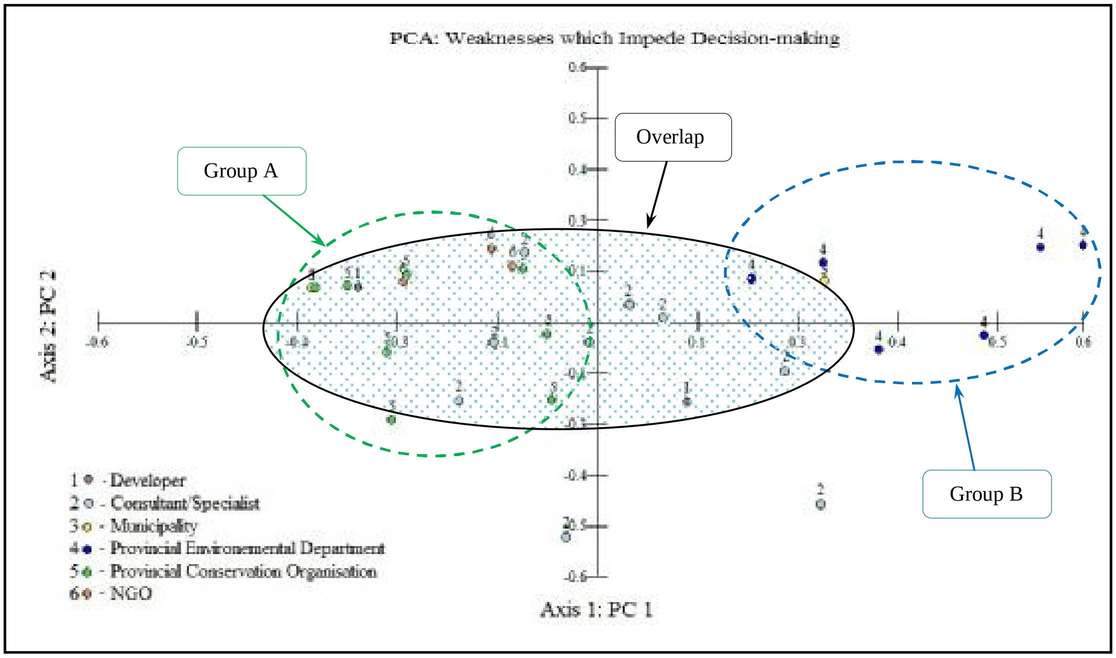

Figure 5.8: PCA: Weaknesses which Impede Decision-making

5.2.2.2 Discussion

Respondents were asked to consider weakness, in terms of biodiversity, in both EIAs and the decision-making process. Respondents noted that EIAs assisted in creating awareness around conservation targets, biodiversity and areas of high conservation significance; aimed to control inappropriate development; mitigate negative biodiversity impacts and ensure long-term management. However, all respondents agreed that the weakness identified by the SAIEA (Brownlie *et al.*, 2006), for considering biodiversity within EIAs and the decision-making process, were contributing factors. Some respondents highlighted that in addition to the weakness listed, other weakness included inappropriate mitigatory measures; that the 'no-go option' is not considered seriously; political pressures influenced decision-making and that EIAs do not guarantee the protection of the biodiversity. These views were also in line with the list of weaknesses identified by SAIEA three years earlier, which included poor consideration of alternatives, lack of standard criteria for assessment, lack of administration capacity by government, lack of access or understanding of biophysical information, etcetera (SAIEA, 2003: 214). This trend, therefore suggests that over the last eight years the weaknesses of the EIA and decision-making processes have not been adequately addressed.

In addition, the variation amongst the responses received, suggests that the clustering of the NGO and provincial conservation authority responses could be a result of their similar responsibilities as commenting stakeholders, while the consultants produce the applications being criticised and the provincial environmental department administrates the process. However, the overlap between the two groups indicates the varying degree to which the consultants, developers and provincial environmental department diverge from the commenting stakeholders.

When respondents were asked to elaborate on the weakness identified, several stated that there is a lack in the understanding of the link between biodiversity and human well being; there are no guidelines to quantify social gains against biodiversity loss (that is resource economics); information on cumulative impacts is not accessible and there are no guidelines to assist with the drafting of an assessments terms of reference, therefore consultants cannot address these issues. Additionally, it was also highlighted by some individuals that authorities should consider cumulative impacts, not consultants; more compliance monitoring should take place; the constitution (particularly in terms of future generations) needs to be taken more seriously and that workshops should be arranged to inform consultants about various strategic plans. Further issues identified by respondents included the need for more inter-governmental communication and interaction, which would restrict 'silo-thinking' and promote sustainability, as well as the need for quality control in terms of EA issued. In addition to the above, respondents also identified situations for when biodiversity should not have to be considered in the EIA, these included environmental rehabilitation projects and transformed sites.

Once again, the variation amongst the responses received suggests that the clustering of the NGO and provincial conservation authority responses could be a result of their similar responsibilities as commenting stakeholders, while only the provincial environmental department responses are significantly divergent from the commenting stakeholders, potentially as a result of their duties to solely administer the decision-making process. The consultants, developers and municipalities, however, have a range of variation that extends to both ends of the scale.

While the degree of magnitude of the response received is varied, the above responses confirm the weakness identified by the SAIEA (Brownlie *et al.*, 2006 and SAIEA, 2003). It is further noted, that the findings of Gontier *et al.*(2005), indicated that that EIAs are not as effective as they should be (due to their vague and descriptive nature) and that the methods for calculating and identifying impacts of biodiversity fragmentation are not well developed, are also confirmed by the responses received. It is therefore evident that practical steps need to be undertaken to address the weaknesses identified in both the EIA process and the decision-making process, such as strengthening EIA practices and procedures and asserting the substantive purpose of EIAs (Jay, 2006), particularly if biodiversity is to be safeguarded and sustainability achieved.

5.2.3 Potential Value of CD Indicators to the EIA Process

5.2.3.1 Results

As indicated in figure 5.9, while 36% and less of the 33 respondents considered all 15 CD Indicators to be of medium significance, a majority ranging from 49% to 79% considered all 15 indicators to be significantly valuable to the EIA process. Five of the indicators, namely eco-sensitive land management; activities to stabilise or improve the viability of conservation targets, regular monitoring, off-site connectivity and land alteration, were not considered to be of low value by any percentage of the respondents.

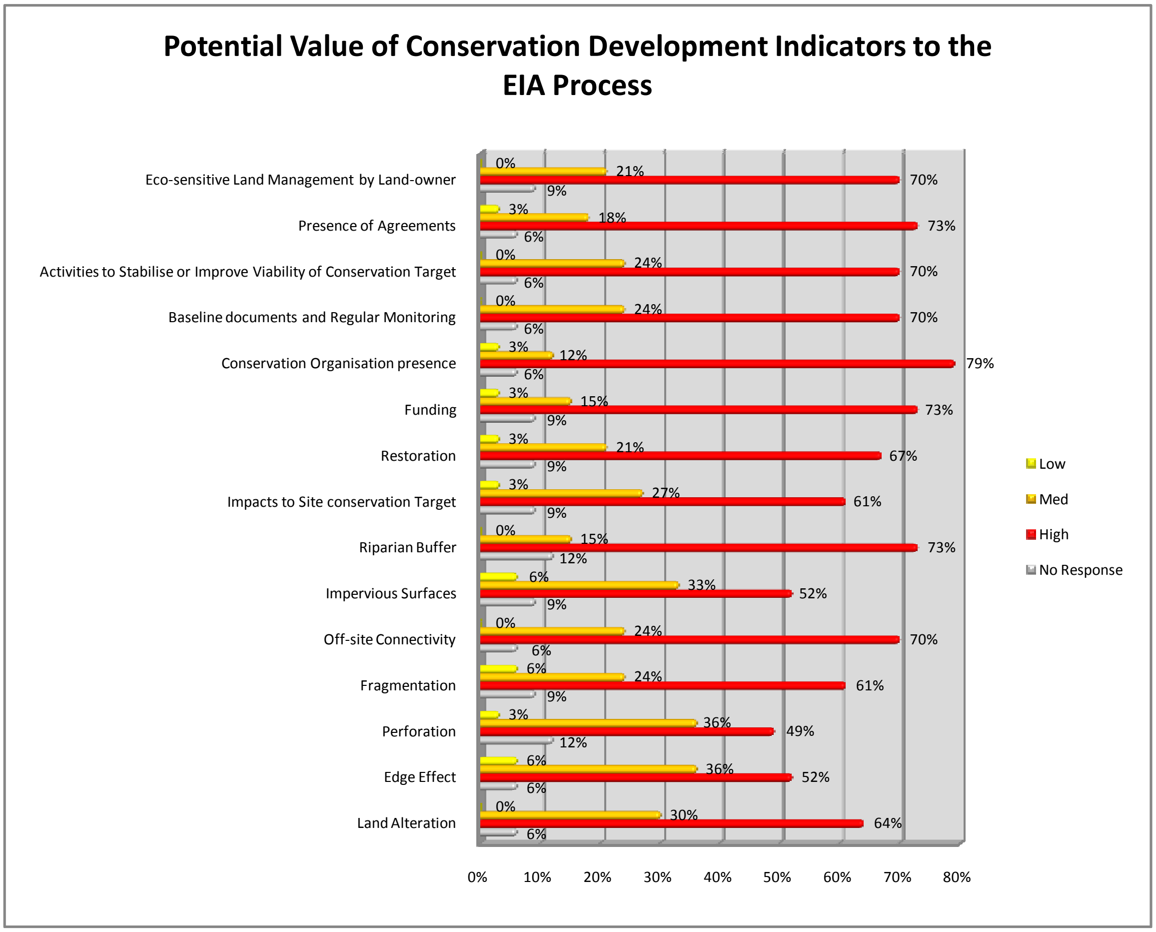

Figure 5.9: Potential Value of Conservation Indicators to the EIA Process (n=33)

Figure 5.10 below illustrates 68.9% of the variation amongst the responses received in terms of the respondent’s perceptions of the value of conservation indicators to the EIA process. While the consultants, developers and provincial environmental department have a wide range of variance in terms of their perceptions, the NGO, municipality (two of which have similar responses and therefore their points are overlaid upon each other) and provincial conservation authority responses have a variation which lies within the consultants, developers and provincial environmental departments range of variance.

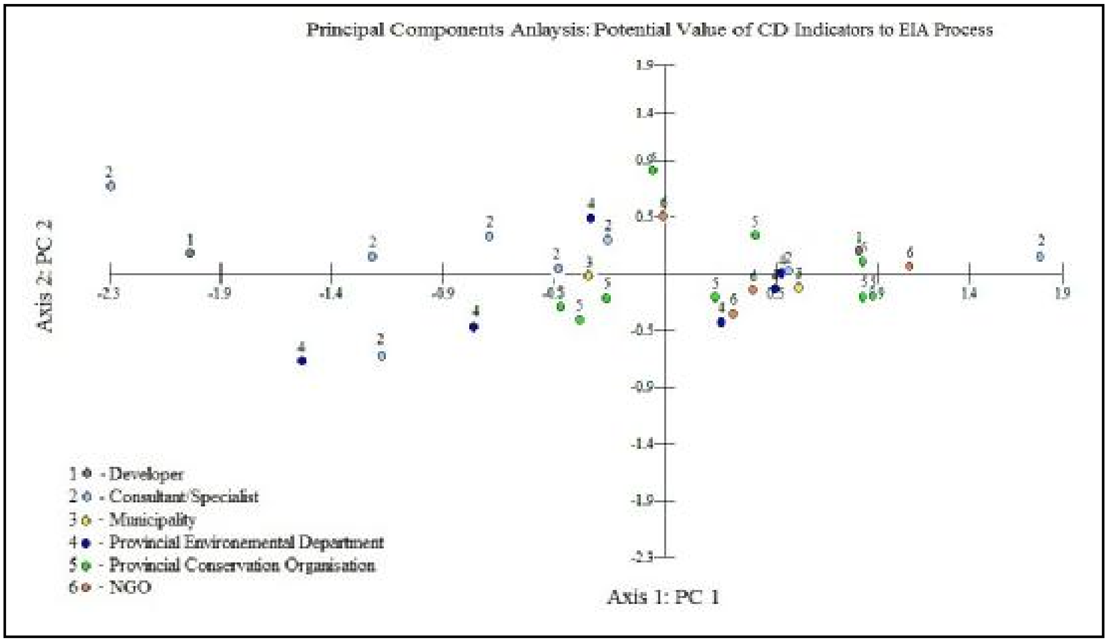

Figure 5.10: PCA: Potential Value of Conservation Indicators to the EIA Process

5.2.3.2 Discussion

Respondents were asked to consider the use of CD Indicators (which can be used to measure conservation success) in the EIA process. The majority of the respondents considered all 15 indicators to be significantly valuable to the EIA process. Some respondents suggested additional criteria, such as the likelihood of the development to attract more development and the percent of ecosystem and red data species preserved at a regional scale. The responses obtained highlighted that the positive aspects of CD Indicators, such as its use as a cost-effective land protection strategy or to create multi-objective projects with both profit and conservation goals (Milder, 2008), would be considered acceptable and useful. Further, these criteria could also assist in improving the compliance monitoring phase of the EIA process (which was identified as an area of weakness), as CD Indicators are quantifiable.

In addition, it is very apparent that natural variation exists amongst the responses received, as no pattern was revealed within the multivariate analysis. Therefore the responses to CD indicators value to the EIA process can be considered significant, at different scales.

5.3 Potential for EIAs to Contribute Towards Conserving Biodiversity

5.3.1 Results

Of the 33 respondents, only a fraction were familiar with the details of the EIAs considered within this study (indicated in Table 5.2) to assess the inadvertent contribution being made to conservation. Seven of eight EIAs received responses from a minimum of two different response groups, while the eighth EIA (Hillcrest Retirement Village) received only one response from the Provincial Environmental Department. The DTP-KSIA had the highest number and diversity of respondents, in that each of the five respondents represented five of the six response groups.

Table 5.2 Respondents that Commented on EIAs within Study Area

Study Site	**Respondents**		
	No. of Respondents	**Groups***	**% of Total**
uMgeni			
Shawlands Farm	3	4,5,5	9%
Fernhill Estate	2	2,4	6%
Brookdale Estate	2	4,5	6%
Hilton Estate	2	4,5	6%
eThekwini			
Hillcrest Retirement Village	1	4	3%
Marianhill Cold Storage Complex	2	4,5	6%
Broadlands Estate	2	1,4	6%
DTP-KSIA	6	1,2,4,5,6	18%

***Groups:** **1**=Developer **2**=Consultant/Specialist **3**=Municipality **4**=Provincial Environmental Department **5**=Provincial Conservation Organisation **6**=NGO

While the respondents to the Shawlands Farm site (figure 5.11) had different opinions on the level of land alteration that occurred, the majority agreed that there was a low negative impact to impervious surfaces, a moderate negative impact on edge effects; perforation; fragmentation and off-site connectivity, and that riparian areas were significantly protected with adequate buffers. A majority of the respondents also believed that the cultivation on Shawlands Farm did not allow for the protection of site specific or provincial conservation targets, nor that restoration of key ecological attributes was undertaken. In addition, the majority of the respondents noted that adequate funding was available; the conservation organisation were present; brief monitoring was undertaken and that the landowner had displayed ecologically sensitive land management, however no effort was made to stabilise or improve the viability of the conservation targets, nor were any agreements in place ensure ecological based land management.

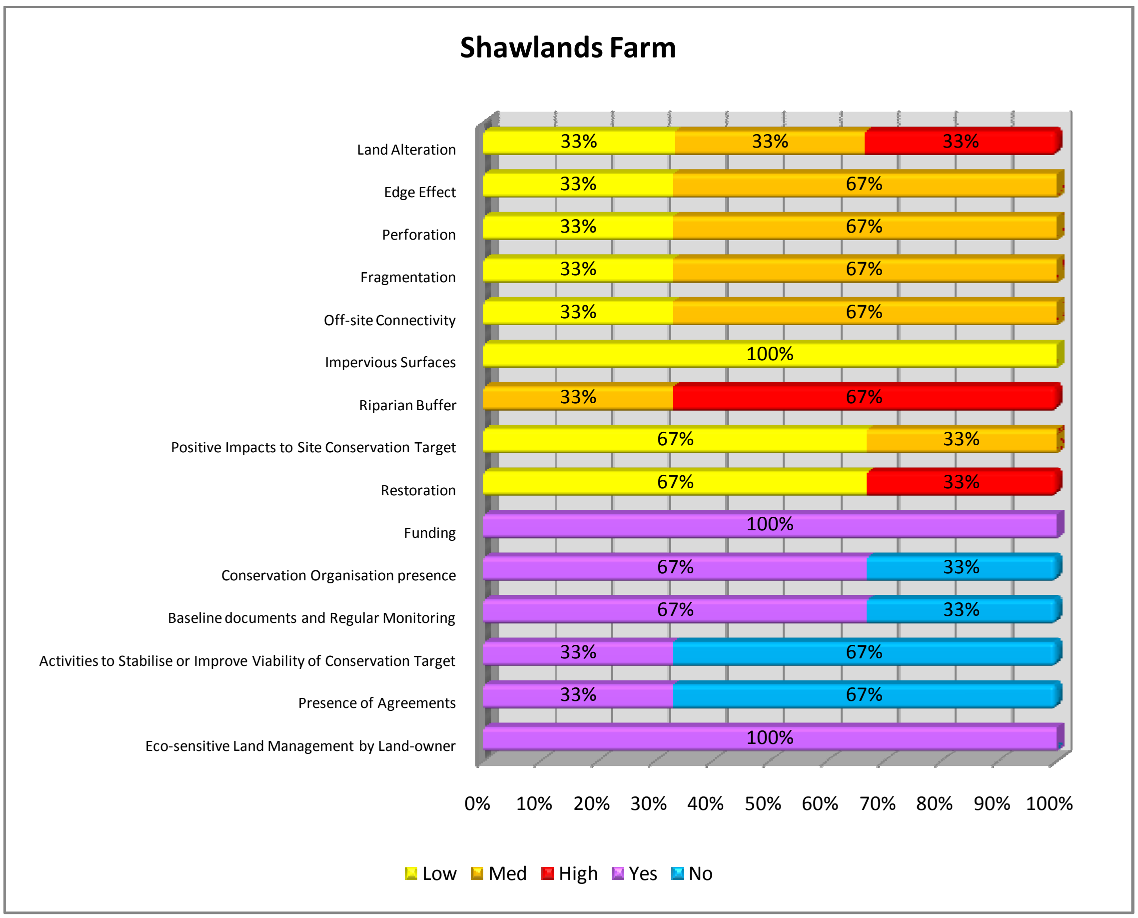

Figure 5.11 CD Indicators: Shawlands Farm (n=3)

The respondents to Fernhill Estate agreed that the site had low potential for restoration of key ecological attributes and that fragmentation would have a moderate impact, while land alteration; edge effect; perforation; off-site connectivity; impervious surfaces and site conservation targets had low to moderate impacts. While one respondent perceived that the riparian areas were significantly protected with adequate buffers, the second respondent did not comment in this regard. In terms of land management, that is the last six indicators illustrated in figure 5.12, all respondents agreed that resources were available to achieve effective land management presently and into the future.

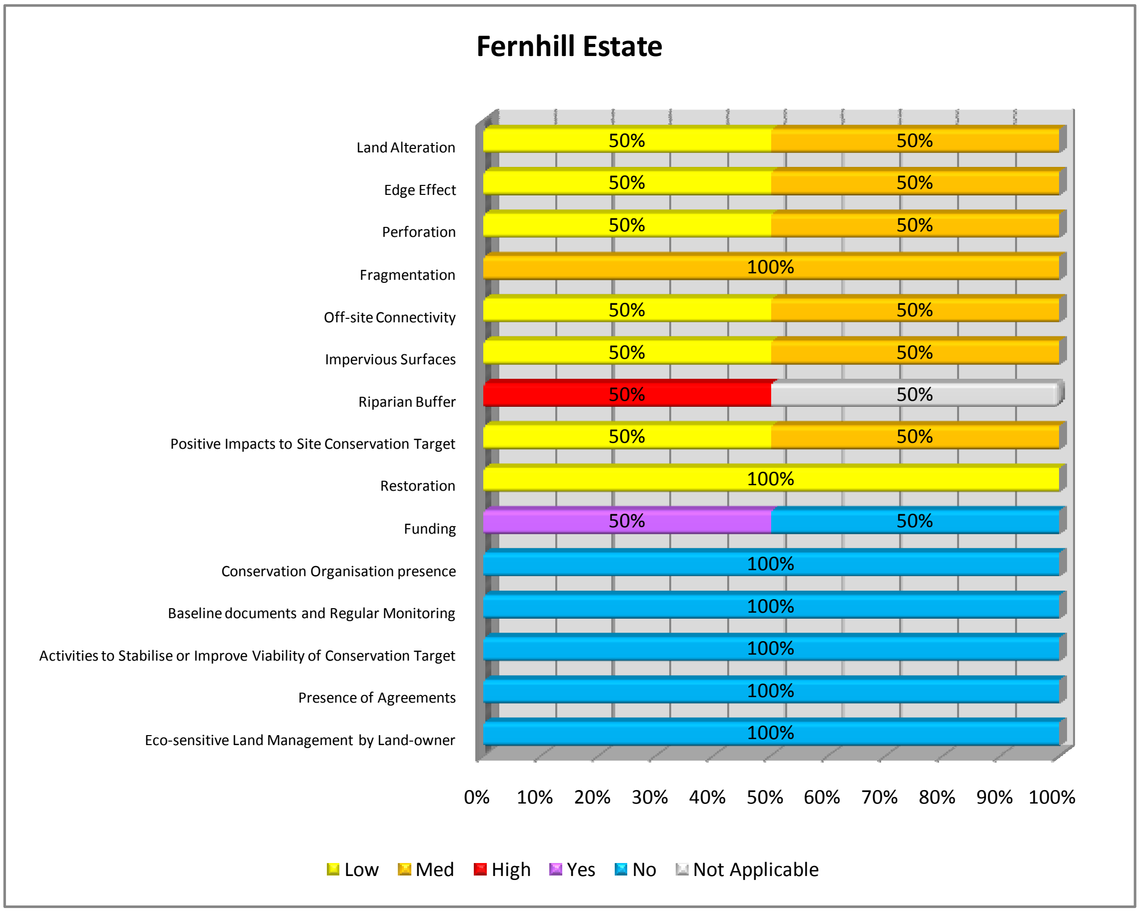

Figure 5.12 CD Indicators: Fernhill Estate (n=2)

Respondents to Brookdale Estate indicated that negative impacts as a result of land alteration; edge effects; perforation; fragmentation; off-site connectivity; impervious surfaces, as well as meeting site conservation targets and the ability to restore key ecological attributes (that is restoration), range from low to moderate to high. However both respondents agreed that riparian areas were significantly protected with adequate buffers. In addition, while respondents agreed that sufficient funds were available to ensure effective management, they were divided on the remaining five indicators of effective land management, as illustrated in figure 5.13.

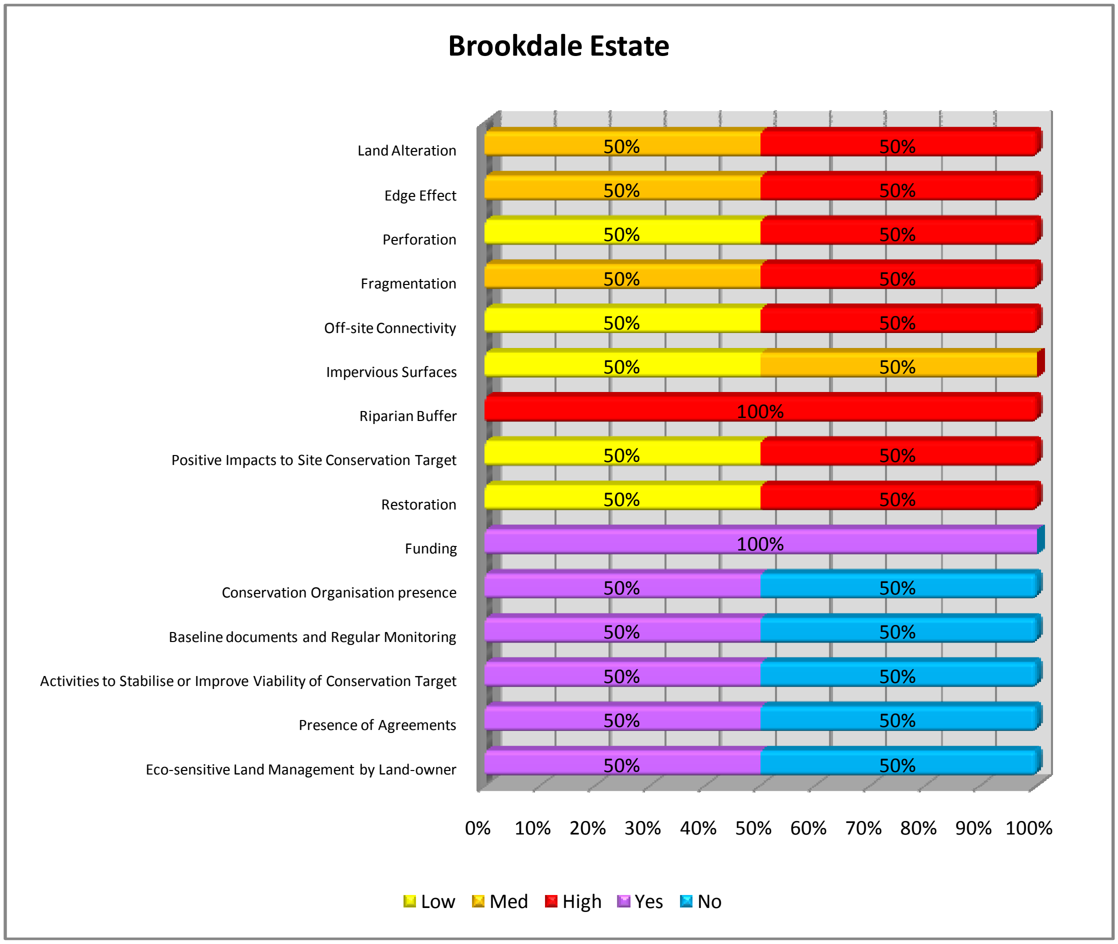

Figure 5.13 CD Indicators: Brookdale Estate (n=2)

While the respondents of Hilton Estate agreed that edge effects; fragmentation and change in impervious surfaces had moderate negative impacts upon the site, perforation; off-site connectivity and impacts to site conservation targets ranged from low to moderate. Land alteration was considered a moderate to high impact by the respondents, while riparian areas were moderately to significantly protected by adequate buffers. In addition, respondents agreed that sufficient funds were available to allow for effective land management and activities to stabilise or improve site conservation targets were present. However, respondents were divided on the remaining four indicators of effective land management, as illustrated in figure 5.14.

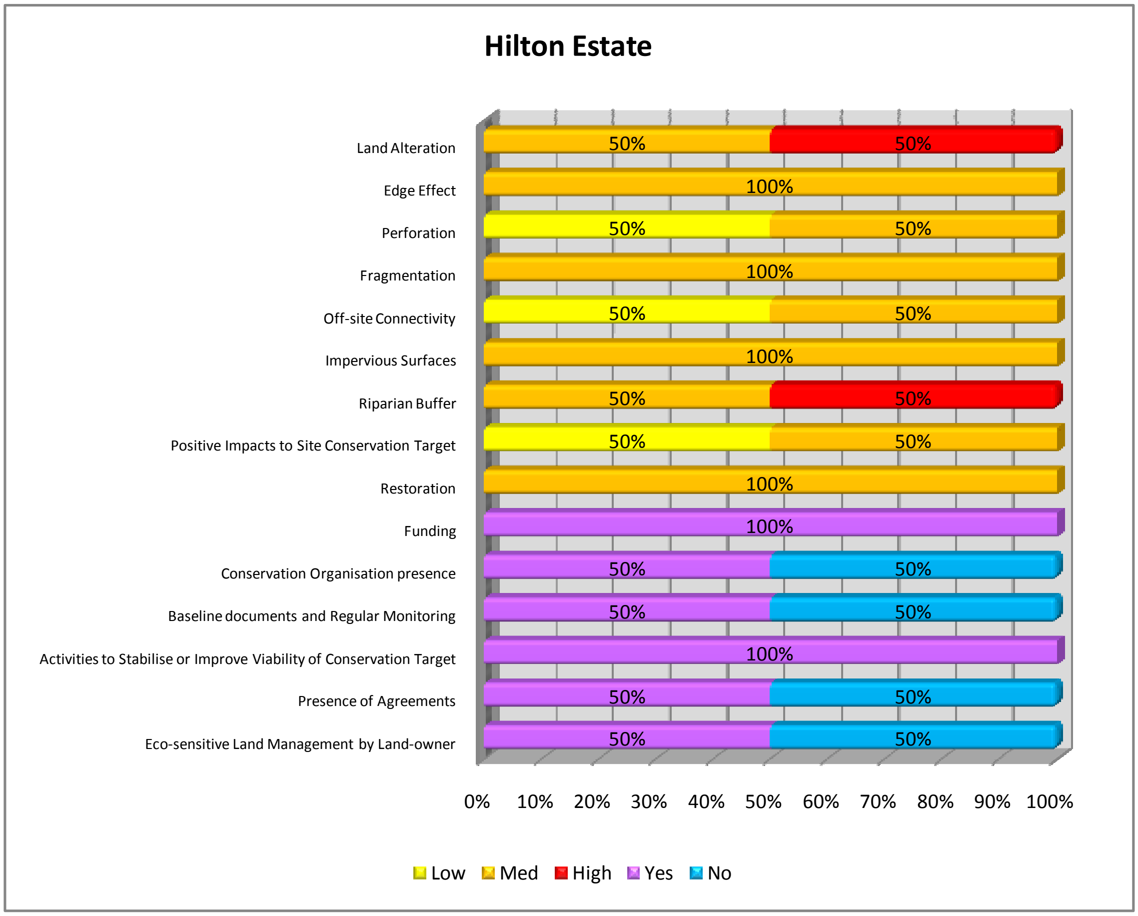

Figure 5.14 CD Indicators: Hilton Estate (n=2)

The Hillcrest Retirement Village site was considered by only one respondent, who indicated that there was complete land alteration and a significant increase in impervious surfaces, moderate edge effects, perforation and fragmentation, and low impacts upon off-site connectivity; minimal riparian buffers; minimal protection for conservation targets and the potential for restoration. In addition, while funding was available for effective land management, the possible presence of the conservation organisation and the potential for monitoring existed; no activities could stabilise or improve the viability of the conservation target, nor were agreements presents that would ensure eco-sensitive land management.

While respondents for the Marianhill Storage Complex agreed that land alteration would have a moderate negative impact and off-site connectivity would be moderately affected (figure 5.15), respondents' perceived edge effects and increase in impervious surfaces as low to moderate impacts. Riparian areas protected by adequate buffers, as well as the ability to restore key ecological attributes (that is restoration) were deemed to range from moderate to significantly positive by respondents, however respondents were divided on the impacts that would result from perforation; fragmentation and impacts to conservation targets. In addition, while respondents identified that funding was available for effective land management, the possible presence of the conservation organisation and the potential for monitoring existed, respondents were divided and undecided on the remaining three indicators of effective land management (figure 5.15).

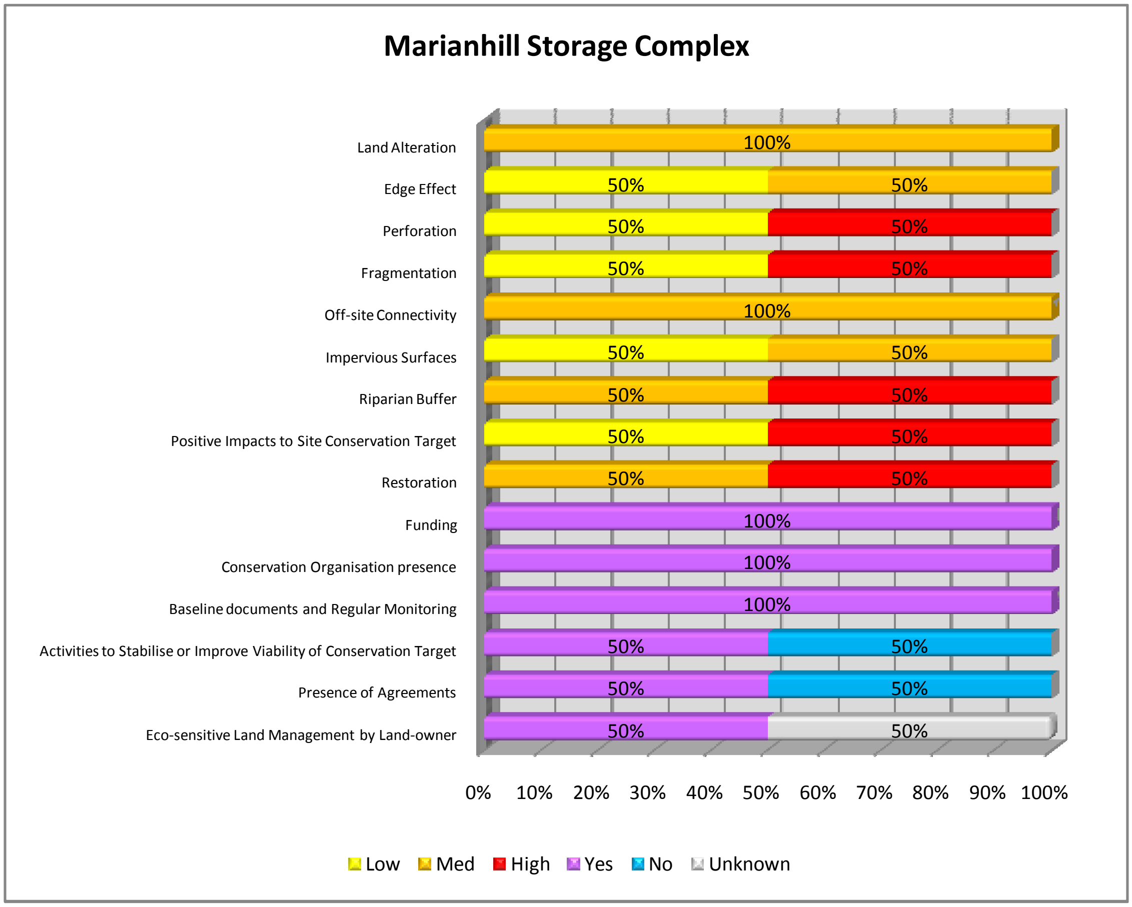

Figure 5.15 CD Indicators: Marianhill Storage Complex (n=2)

The respondents of Broadlands Estate (figure 5.16) agreed that edge effects, perforation and fragmentation impacts were low, as well as that riparian areas were significantly protected by adequate buffers. The success of restoration was considered to be moderate to high, while views on the degree of land alteration, impacts upon off-site connectivity, amount of impervious surfaces and impacts upon site conservation targets were divergent. In addition, while respondents identified that funding was available for effective land management, the possible presence of the conservation organisation, the potential for monitoring existed and eco-sensitive land management was evident, respondents were divergent on whether the development stabilised or improved the viability of conservation targets or if agreements were in place that would ensure ecological based management.

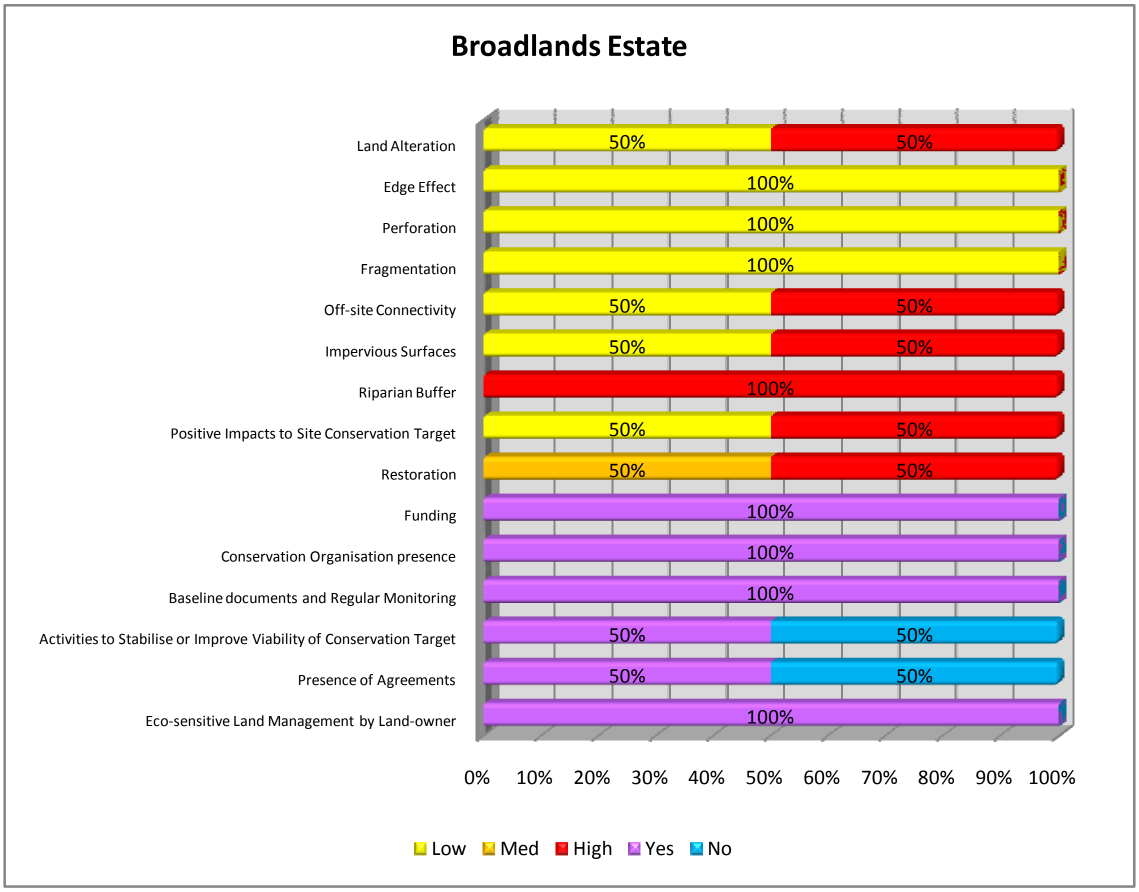

Figure 5.16 CD Indicators: Broadlands Estate (n=2)

A majority of the respondents to DTP-KSIA (figure 5.17) indicated that while there was significant land alteration, high impacts as a result of edge effects, a moderate increase in the amount of impervious surfaces, riparian areas were significantly protected by adequate buffers, there was a moderate success to restoring key ecological of the site and site conservation targets were moderately protected. However, respondents were evenly split in terms of whether the negative impacts of perforation and fragmentation were moderate or high. In addition, in terms of effective land management, all respondents agreed that baseline documents and regular monitoring were present, while a majority agreed that sufficient funding was available, the conservation organisation was present, as well as that agreements to ensure effective ecologically based management were in place and eco-sensitive land management was evident.

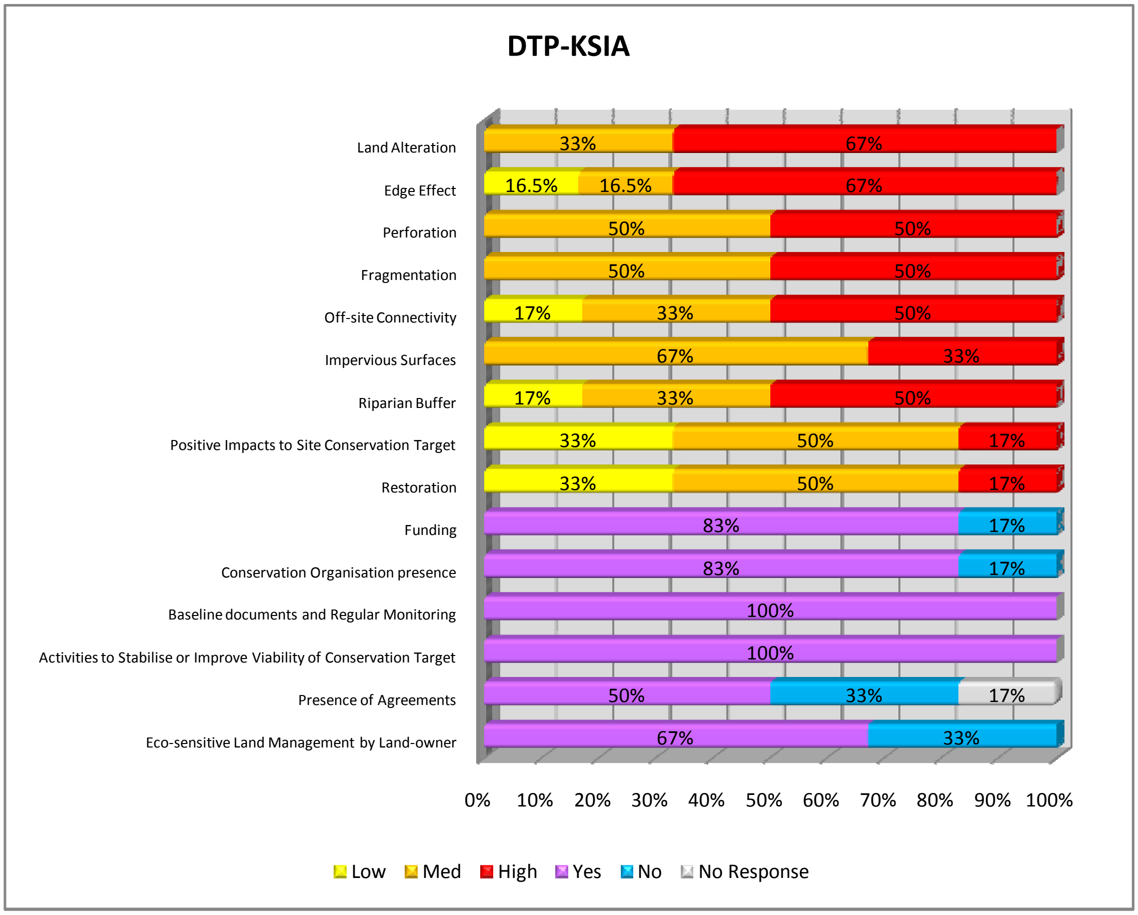

Figure 5.17 CD Indicators: DTP-KSIA (n=6)

The results in figures 5.11-5.17 indicate the respondent's perception of how eight EIAs ranked against CD indicators, to determine whether EIAs would be effective in safeguarding biodiversity. However due to the insufficient information contained within the EIA applications, actual figures could not be assigned to the CD indicators to determine how accurate the perceptions of the respondents were. Therefore, two broad categories were identified to capture the intent of the indicators, namely 'ecosystem protected' (for the first nine indicators) and 'long-term biodiversity management' (for the last six indicators) and using the information contained within the EIA application and EA broad ratings were determined. Table 5.3 illustrates the ratings based on the information contained within the EIA applications and those of the respondents.

Table 5.3: Perception of Eight EIAs Contribution Towards Biodiversity Conservation

Study Sites	**Conservation Indicator Categories**			
	Ecosystem Protected		Long-term Biodiversity Management	
	Application Based Rating	Respondents Perception Rating	Application Based Rating	Respondents Perception Rating
uMgeni				
Shawlands	**N/A**	±	**N/A**	±
Fernhill	**N/A**	±	ü	û
Brookdale	**N/A**	±	ü	±
Hilton	ü	±	ü	±
eThekwini				
Hillcrest	**N/A**	±	**N/A**	±
Marianhill	±	±	ü	±
Broadlands	ü	±	ü	±
DTP-KSIA	±	±	ü	ü
Contribution Symbol	ü= Yes	û= No	± = Partial Contribution	**N/A =**Not Applicable

In addition, Table 5.4 below illustrates the key outcomes of analysis, to assist in determining whether EIAs could effectively conserve biodiversity. Of the eight EIAs assessed, 62.5% were predicted to have biodiversity sensitivities (as determined by the KwaZulu-Natal SCP) which were accommodated within the EA, however 75% safe-guarded biodiversity (that is an additional 12.5% or one EIA). While 25% have not yet complied with the EA, as respondents stated that these developments have not yet commenced, respondents highlighted 62.5% of the EIAs have not transgressed any conditions within the respective EAs. In addition, one development or 12.5% of the EIAs, has contravened the conditions of its EA, and while procedures and measures have been initiated to rectify the transgression, the outcome was unavailable at the time of concluding this study.

Table 5.4: Effectiveness of EIAs to Conserve Biodiversity

Effectiveness of EIAs to Conserve Biodiversity			
Potential Indicator	**Yes**	**No**	**N/A**
% of EIA authorisations which safe-guarded biodiversity	**75%** (6 of 8)	-	**25%** (2 of 8)
% of EIA authorisations which safe-guarded biodiversity in areas known to be sensitive	**62.5%** (5 of 8)	-	**37.5%** (3 of 8)
% of developments that have complied with EIA authorisation	**62.5%** (5 of 8)	**12.5%** (1 of 8)	**25%** (2 of 8)
% of those developments that are non-compliant which have had intervention to rectify unlawful activity	**100%** (1)	-	-
Outcome of intervention on non-compliant development	**Positive**	**Negative**	**Unknown**
			û

5.3.2 Discussion

Overall respondents considered the eight EIAs to partially contribute towards biodiversity conservation. In the case of Fernhill Estate, respondents were not under the impression that long-term management would be present, however the EA included a condition which enforced long-term biodiversity management. The DTP-KSIA was the only EIA were the majority of the respondents believed that long-term biodiversity management would occur. The provincial environmental department authorised a portion of the proposed area for Shawlands Farm, as the remaining area required further detailed investigation due to the high biodiversity and environmental sensitivity of the site, however unlawful activities were undertaken at a later stage. In the case of Hillcrest Retirement village, due to transformed state of the site, no biodiversity features were present that required protection.

Overall, the information extracted from the EIA applications, indicated that four sites did not require the protection ecosystems, two sites protected ecosystems and two sites partially protected ecosystems, as well as, all but two sites warranted long-term biodiversity management. Hence, 75% of the EIAs safe-guarded biodiversity and the one site upon which unlawful activities were undertaken, were in the process of being rectified. Therefore, based on the above, that is both the respondents' responses and information extracted from the EIA, it is evident that EIAs do contribute towards conserving biodiversity. This is similar to the outcomes from the Western Cape, where BotSoc where able to avoid biodiversity loss through the EIA process and secure conservation benefits, by ensuring that landscape biodiversity planning was considered in the EIA process (de Villers *et al*., 2008).

5.4 EIAs Contribution Towards Biodiversity Conservation and Spatial Planning

5.4.1 Results

To determine the extent to which EIAs inadvertently contribute towards biodiversity conservation and its potential value to strategic plans, the information contained within the EIA applications and EAs for the eight study sites were utilised (as detailed in Chapter Four). Table 5.5 illustrates that, in the case of uMgeni, only the portion of land that did not negatively affect biodiversity on Shawlands Farm was approved and no positive contribution was made to biodiversity conservation. However the information within the Shawlands Farm EIA application confirmed the conservation value of area, as predicted by the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004). The approval of Fernhill Estate allowed for the protection of species and long-term biodiversity management of the conservation servitude set aside for the species identified. In addition, the Fernhill Estate EIA contributed towards clarifying the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004) as the prediction was in valid in this case, and improved the accuracy of data in the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004) by including species that were previously unknown in that area. Brookdale Estate did not protect any ecosystems or species, as none were present on the site. However the Brookdale Estate was located adjacent to a PA and thus the EA stipulated long-term biodiversity management for a conservation servitude that buffered the PA (that is to protect the integrity of the PA). As a result, the information extracted from the Brookdale Estate EIA application clarified the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004), as none of the biodiversity features predicted to occur were present and hence improved data accuracy for the area. The approval of the Hilton Estate provided for the protection of both ecosystems and species, and endorsed long-term biodiversity management. In addition, the Hilton Estate EIA application clarified the prediction of the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004) which inaccurately indicated that the area was transformed, as well as added new records of species of conservation significance to the area.

Table 5.5: uMegeni: EIAs Contribution Towards Biodiversity Conservation and Strategic Plans

uMgeni Study Sites	**Outcomes of EIA Process**				
	Ecosystem Protected	Species Protected	Long-term Biodiversity Management	Affirms Conservation Plan	Improves Data Accuracy
Shawlands	**N/A**	**N/A**	**N/A**	ü	ü
Fernhill	**N/A**	ü	ü	ü	ü
Brookdale	**N/A**	**N/A**	ü	ü	ü
Hilton	ü	ü	ü	ü	ü
Contribution Symbol	ü= Yes	û= No	? = Unknown	± = Partial Contribution	**N/A** =Not Applicable

In the case of eThekwini Municipality (Table 5.6), the approval of the Hillcrest Retirement Village did not require the protection of ecosystems or species, nor the need for long-term biodiversity management, as the entire site was transformed. However, the information obtained from the Hillcrest Retirement Village EIA application clarified the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2007), which inaccurately predicted that approximately 50% of the site was of high conservation value. The authorisation of the Marianhill Cold Storage Complex allowed for the partial protection of ecosystems and species, as some patches of North Coast Grassland was lost and the potential for species of conservation significance existed (although not confirmed). In addition, the Marianhill Cold Storage Complex confirmed some features predicted by the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2007), as well as added new records of species of conservation significance to the area. The Broadlands Estate approval allowed for ecosystem protection and long-term biodiversity management, as the transformed nature of the site did not accommodate any species of conservation significance. As a result, the information extracted from the Broadlands Estate EIA application clarified the prediction of the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004), which inaccurately predicted the area as being of high conservation value, and therefore improved the accuracy of the data for the area. The DTP-KSIA approval allowed for the protection of ecosystems and species and stipulated long-term biodiversity management. In addition, confirming and clarifying parts of the KwaZulu-Natal Systematic Conservation Plan (Ezemvelo, 2004), several new records of species of conservation significance were added to the area.

Table 5.6: eThekwini: EIAs Contribution Towards Biodiversity Conservation and Strategic Plans

eThekwini Study Sites	**Outcomes of EIA Process**				
	Ecosystem Protected	Species Protected	Long-term Biodiversity Management	Affirms Conservation Plan	Improves Data Accuracy
Hillcrest	**N/A**	**N/A**	**N/A**	ü	ü
Marianhill	±	?/±	ü	ü	ü
Broadlands	ü	**N/A**	ü	ü	ü
DTP-KSIA	±	±	ü	ü	ü
Contribution Symbol	ü= Yes	û= No	? = Unknown	± = Partial Contribution	**N/A** =Not Applicable

5.4.2 Discussion

The above results illustrate that EIAs do have a significant ability to conserve biodiversity, as well as manage and maintain biodiversity features on a long-term basis. Of the eight EIAs assessed, four sites protected ecosystems (either partially or fully), four sites protected species (either partially or fully) and six sites provided for long-term biodiversity management. However, some respondents highlighted that regardless of ability of the EIA process to protect biodiversity, the protection cannot be guaranteed. For example, in the case of Shawlands Farm, one respondent highlighted that as a result of the high biodiversity sensitivities identified, the portion of the development (that is cultivation of land) that was not approved, was to be further assessed and would also include the remainder of the property in the assessment. However, while a detailed impact assessment (through a second EIA process) was being undertaken, revised EIA regulations were gazetted. As a result of the new EIA regulations and the uncertainties of their interpretation by some individuals, portions of the Shawlands Farm were cultivated without authorisation (as stated by one of the respondents). The result of this unlawful activity has lead to the loss of significant biodiversity features, regardless of the awareness created by the initial EIA process.

Another example provided from two of the respondents of this study, is that of Fernhill Estate and Hilton Estate. While both these estates were meant to conserve ecosystems and species, as well as maintain long-term biodiversity management, none of the estates have been constructed and therefore none of the measures to protect of either the ecosystem or species has been undertaken. While the EAs for the EIA applications holds the applicants accountable for the conditions contained therein, the conditions are only enforceable once the activity commences.

In terms of EIAs contributing towards strategic plans, due to the scale of the eight EIAs, no visual change could be made to the KwaZulu-Natal SCP (Ezemvelo, 2010), as the provincial plan covers several thousand hectares. However, these eight sites have increased the accuracy of information for approximately 2200 hectares of vegetation and 233 different species by either confirmation of an existing record or a new record. If the data (both condition of existing environment and species data) from all EIA applications that affect biodiversity were collected to update the transformation layer (that is the GIS layer depicting transformed landscapes) and improve species records within the province, the systematic conservation plan will most likely have a different and more accurate output every time it is updated. In addition, if those developments which have long-term biodiversity management plans were confirmed as active and monitored, these areas too could be designated on the systematic conservation plan as providing some level of contribution towards the provinces conservation goals and targets. These findings support those of Knight *et al.* (2006: 412) who highlight the need for feedback loops from the implementation stages back into the planning stages, which supports and facilitates "action research, social learning, and adaptive management".

5.5 Conclusion

It is evident that the individuals who work with EIAs have a fairly acceptable level of awareness around the state of biodiversity within the KwaZulu-Natal province, and as such, their responses to the use of conservation indicators within the EIA process can be acknowledged and accepted. This is further supported as a result of the inadvertent contribution EIAs make towards biodiversity conservation, despite the weakness identified within the EIA process, in both the assessment and decision-making realms (which every attempt must be made to overcome). In other words, it is imperative that any transformation or contribution towards biodiversity conservation is known and calculated, given the need to ensure that the most accurate data is used to form the basis of SCP. It is only through the best available information, can SCP ensure that the appropriate areas are ‘flagged’ to meet conservation goals and targets effectively.

CHAPTER SIX:

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

To conclude, this chapter contextualises the outcomes of this study, in consideration of the premise of this research, by summarising the key findings and results in relation to the research aims and objectives. This chapter also provides a list of key recommendations, identified through this study, which could contribute towards meeting provincial conservation targets, as well as inform advocacy for bridging the information-implementation gap in EIAs.

6.2 Conclusion

The aim of this research was to determine whether EIAs inadvertently contribute towards or hinders the potential for KwaZulu-Natal to achieve its conservation targets, due to the lack of feedback mechanisms to integrate EIA decisions into spatial frameworks, as the impacts of decisions made at a landscape level are unknown. In order to achieve the aim, this study fulfilled three objectives which are described below:

Objective One: To assess a subset of EIAs (located within a coastal and inland municipality and approved between 2005 and 2008) to evaluate their contribution to conserving biodiversity in KwaZulu-Natal.

Due to the limited information within the subset of EIA applications selected, broad categories were utilised to determine whether EIAs could effectively conserve biodiversity. Of the eight EIAs assessed within the study area, greater than 62% safe-guarded biodiversity at various levels (on a site specific scale) while the remainder did not require the implementation of biodiversity protection measures. While one case did result in significant biodiversity loss due to unlawful activities, interventions had commenced to rectify the situation and on-going monitoring is required. It is therefore concluded that EIAs inadvertently contribute towards KwaZulu-Natal conservation targets. However, substandard EIA reports, poor decision-making or lack of monitoring has the potential to significantly negatively affect KwaZulu-Natal's ability to meet its conservation targets.

Objective Two: To identify the potential value of EIAs in conserving KwaZulu-Natal's biodiversity through spatial analysis.

Due to the scale of the eight EIAs, no visual change could be made to the KwaZulu-Natal Systematic Conservation Plan, as the provincial plan covers several thousand hectares. However, the information contained within the eight EIAs improved data for approximately 2200 hectares of vegetation and 233 different species by either confirmation of an existing record or a new record. It is therefore concluded that while EIAs cannot inform strategic spatial plans on a cases by case basis, a strategic approach to collating data contained within an EIA over a period of time can improve the quality of data during periodic updates of the spatial plan. In addition, if those developments which have long-term biodiversity management plans were confirmed as active and regularly monitored, these areas too could be designated on a spatial plan as providing some level of contribution towards the provinces conservation goals and targets.

Objective Three: To determine whether EIAs can bridge the information-implementation gap at strategic planning levels.

Based on the information gathered to determine objective two and based on the outcome of the analysis, it is concluded that EIAs have the ability to bridge the information-implementation gap at strategic planning levels, but on a periodic basis and not as each individual EIA is undertaken. In other words, data contained within EIAs would need to be collated and included into the updating process of strategic plans.

The overall conclusion of this study suggests that the null hypothesis has been determined, as at the onset of this study it was assumed that the outcome of many EIAs negatively impact KwaZulu-Natal's ability to achieve its conservation targets. However, the null hypothesis has further endorsed the need to bridge the information–implementation gap, as well as resulted in the identification of several critical and practical recommendations to improve future decision-making and planning as a way forward.

6.2 Recommendations

Based on the outcomes of the analysis, five key recommendations have been identified, as a result of evaluating the contribution EIAs make towards KwaZulu-Natal's conservation targets. These recommendations would assist in improving future decision-making and planning:

- Workshops: Information sharing between departments, consultants and the public;

- Guidelines for Terms of References for Impact Assessments: Clearly guides information collection and presentation, to better inform decision-making processes;

- Compliance monitoring by or with appropriate authorities: Monitoring should be undertaken by both the authorising environmental department and the provincial conservation organisation (as the authority mandated to conserve biodiversity) for those EIAs that set aside areas specifically for biodiversity protection;

- Use of conservation indicator for EIAs: Allows for the accurate determination of the inadvertent contribution EIAs make towards conservation, so as to improve data knowledge and hence future planning;

- Feedback loops to allow for EIAs to inform strategic plans: A strategic approach to collating data contained within an EIA, to improve the quality of data for spatial and strategic plans. A simplistic, potential model for a feedback loop is illustrated in figure 6.1, which bridges the information–implementation gap by improving decision-making and planning, as a result of improving data sets with data that would not ordinarily be captured.

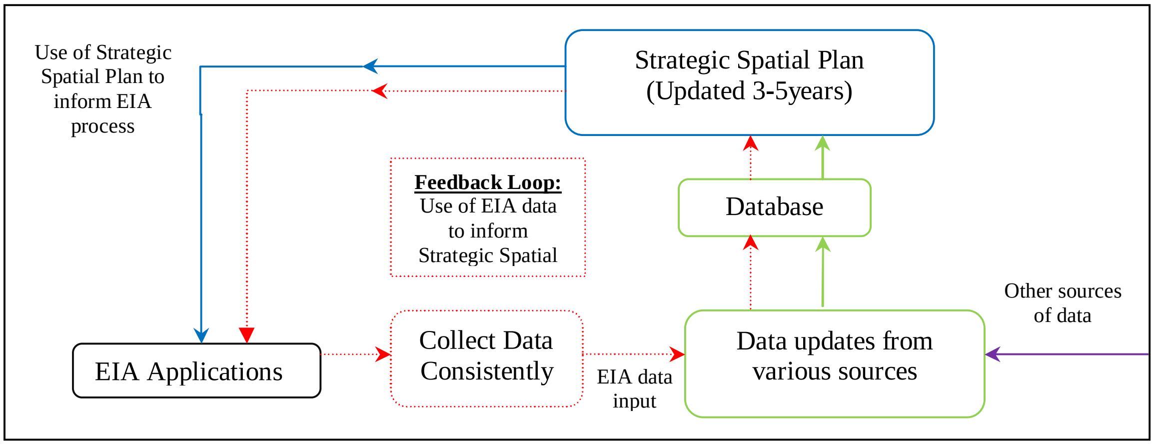

Figure 6.1: Potential EIA Feedback Loop Model

The red dotted line illustrates the feedback loop for data from the EIA process, which is fed into the database that the strategic spatial plan (example the systematic conservation plan) draws data for periodic updates. The updated plan is then utilised during the investigation stage of the EIA process. This model is in-line with the Knight *et al.*'s (2006) Operational Model for Conservation Planning (figure 3.13) and expands on the feedback loop identified therein, with regards to input into strategic spatial plans.

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APPENDICES

Appendix 1:

Shawlands Farm

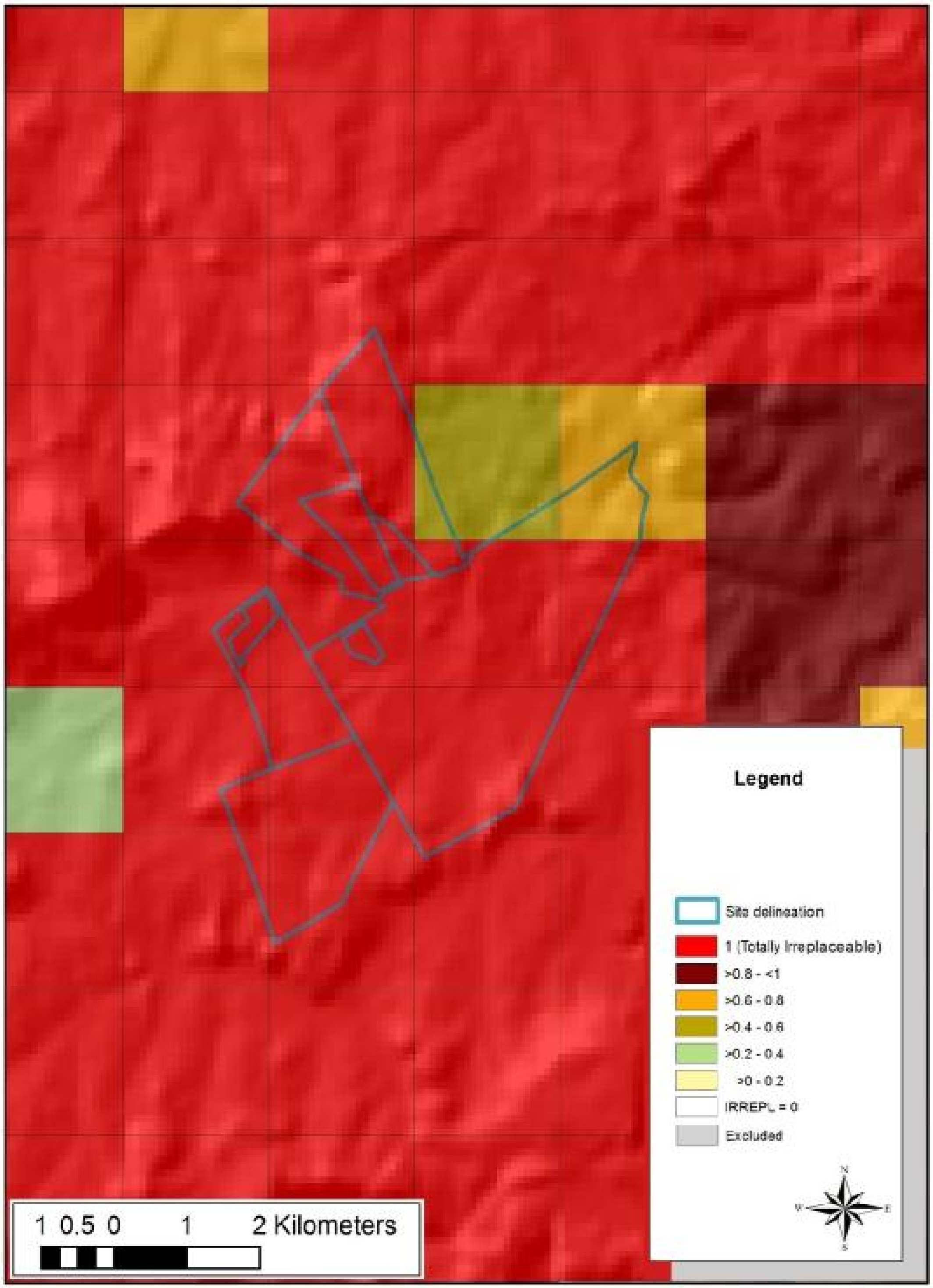
Appendix 1a: Shawlands Farm superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)

Appendix 1b: Shawlands Farm - Initial Proposed Layout

Appendix 1c: Shawlands Farm - Revised Layout

Appendix 1a:

Shawlands Farm superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)



Appendix 1b:

Shawlands Farm Initial Proposed Layout:

The initial 50 hectare area applied for on Shawlands Farm.

Appendix 1c:

Shawlands Farm Revised Layout:

The approved 30 hectare area on Shawlands Farm.

Appendix 2:

Fernhill Estate:

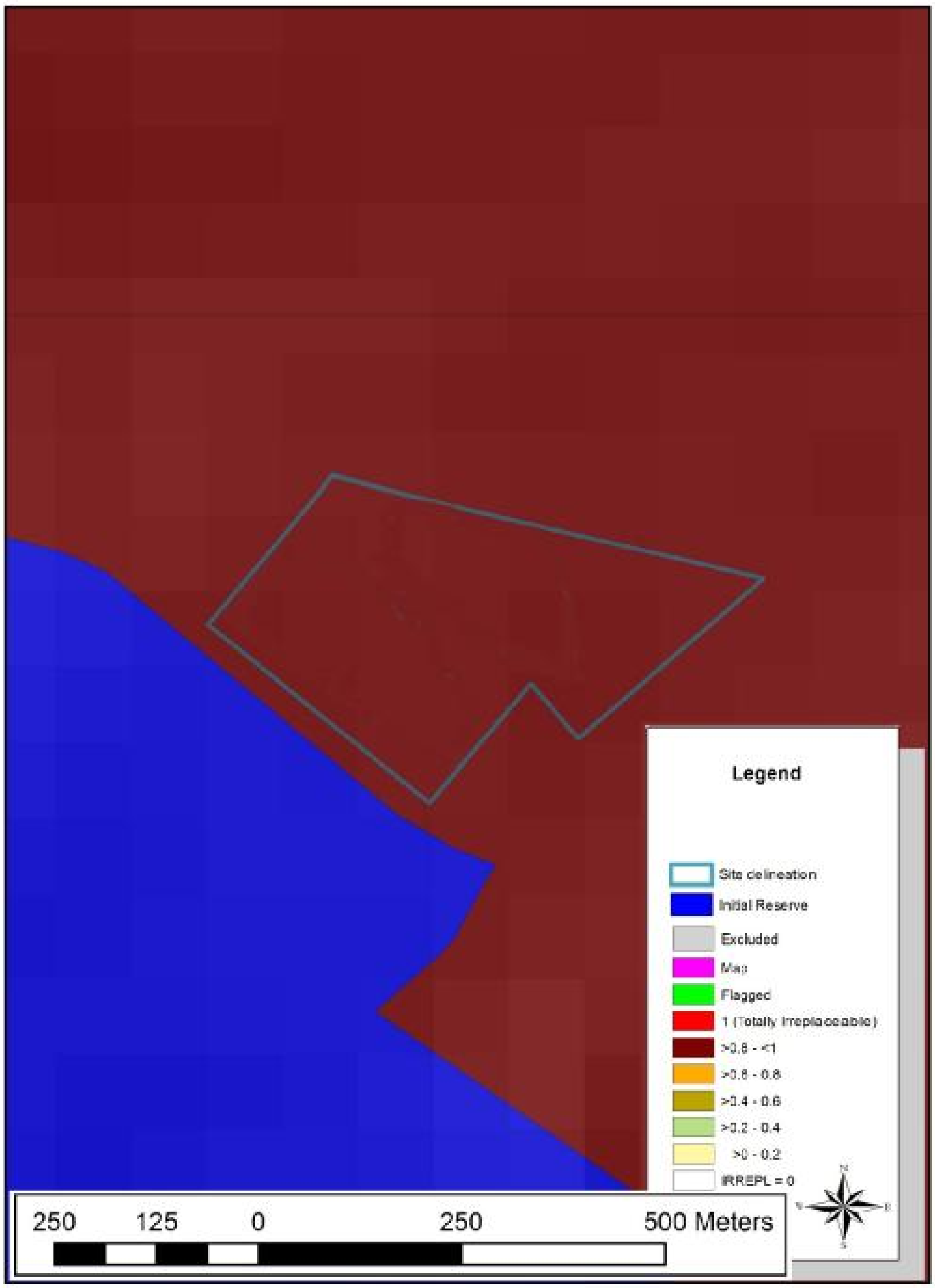
Appendix 2a: Fernhill Estate superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)

Appendix 2b: Fernhill Estate - Initial Proposed Layout

Appendix 2c: Fernhill Estate - Revised Layout

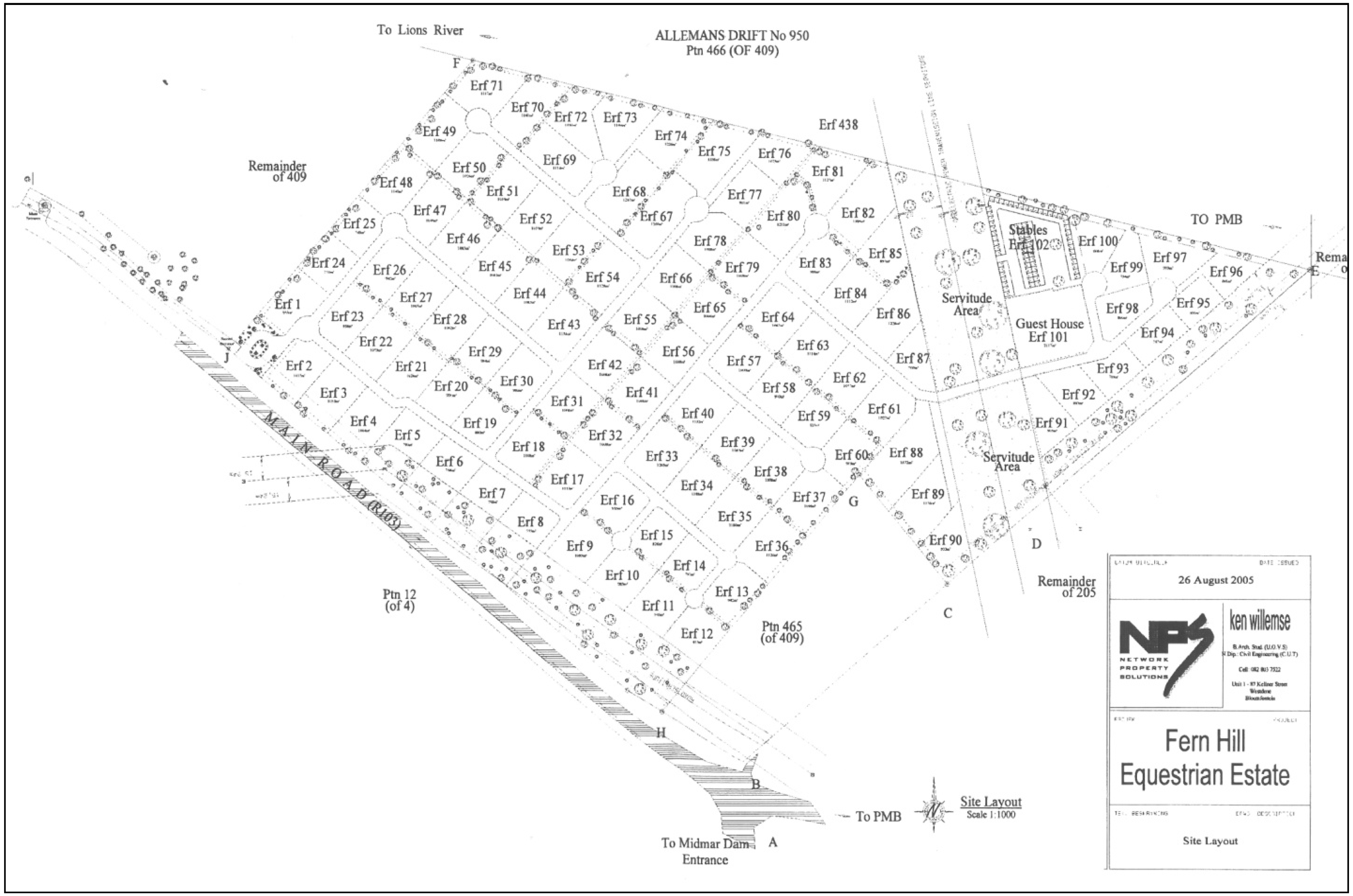
Appendix 2a:

Fernhill Estate superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)



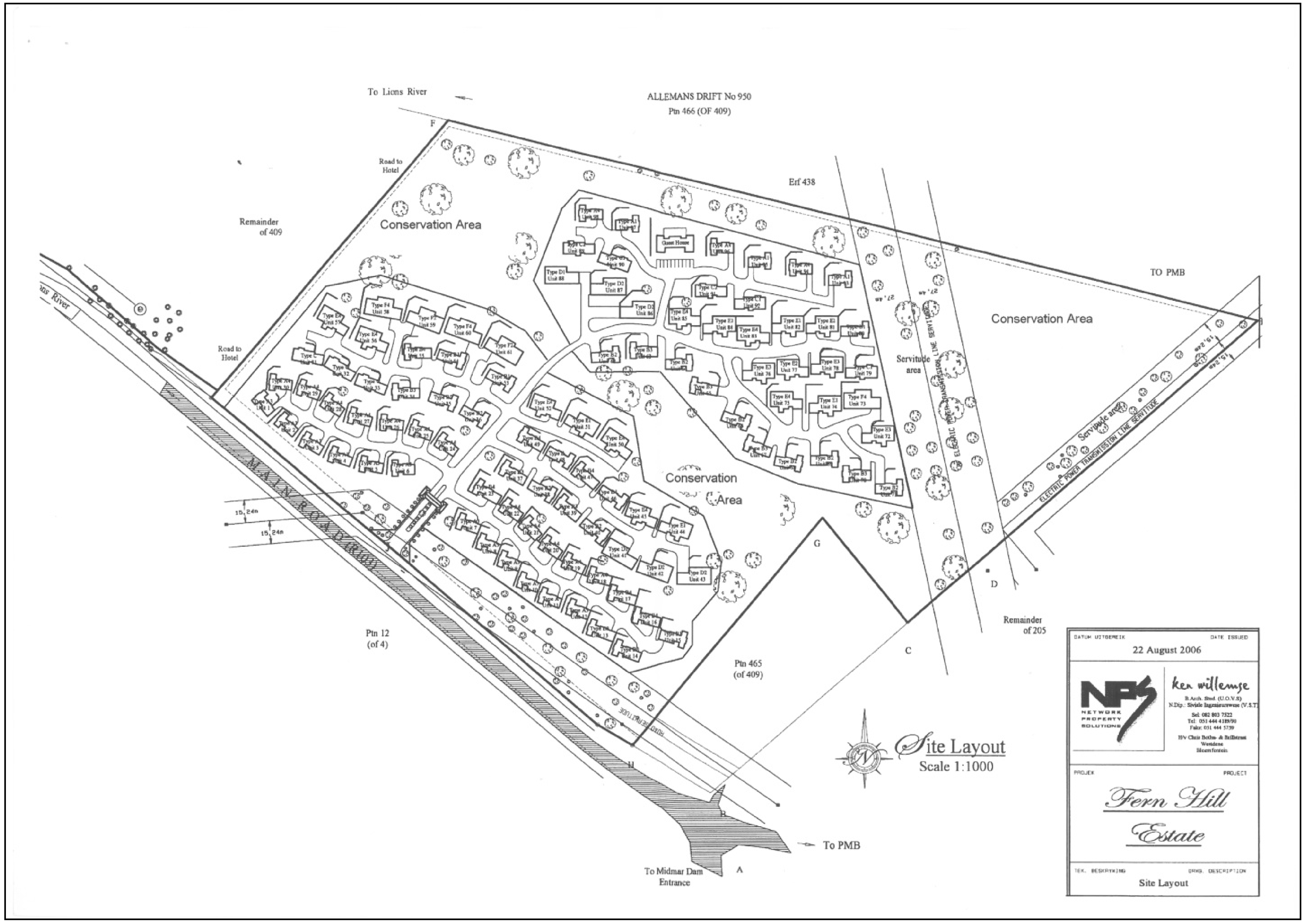
Appendix 2b:

Fernhill Estate Initial Proposed Layout



Appendix 2c:

Fernhill Estate Revised Layout

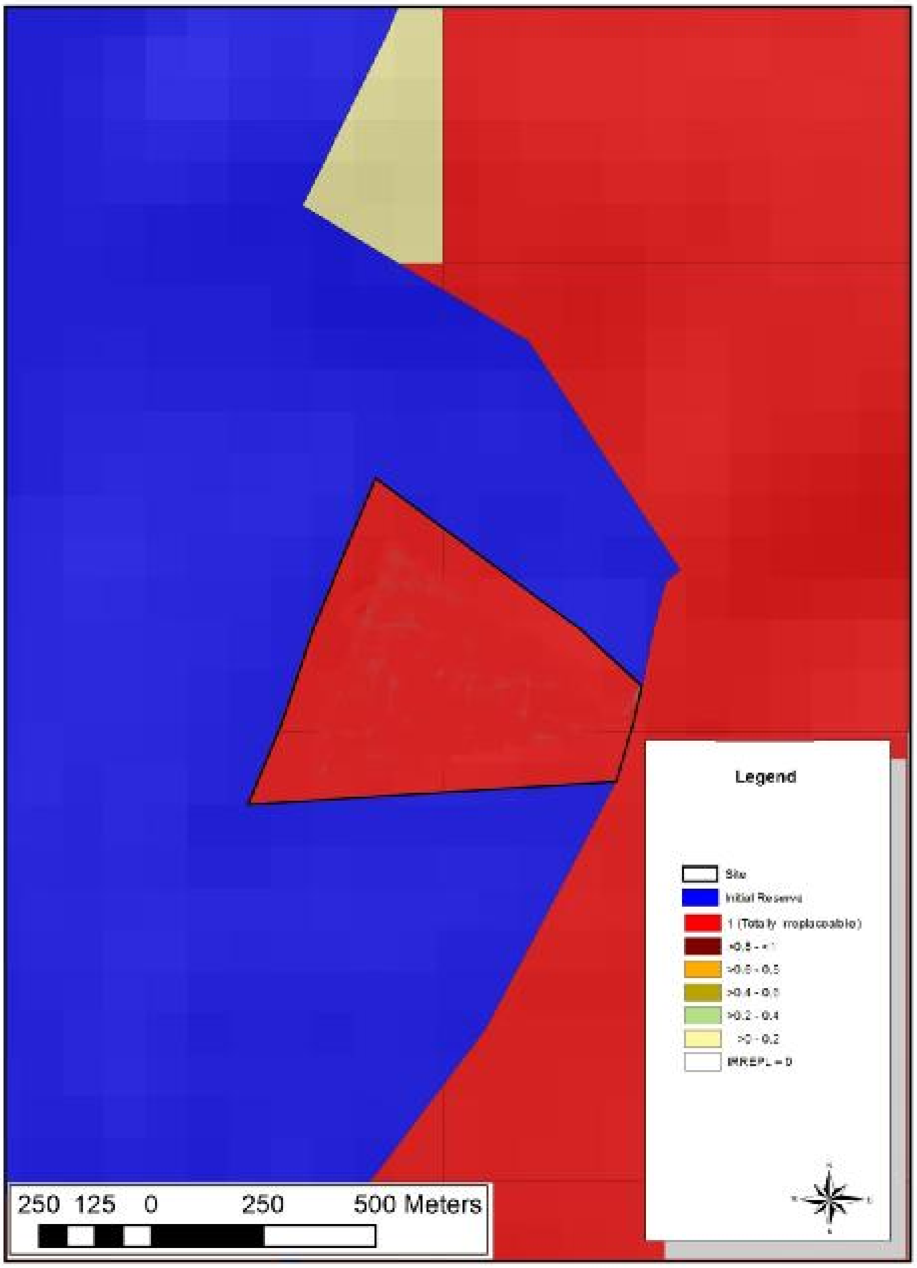


Appendix 3:

Brookdales Farm:

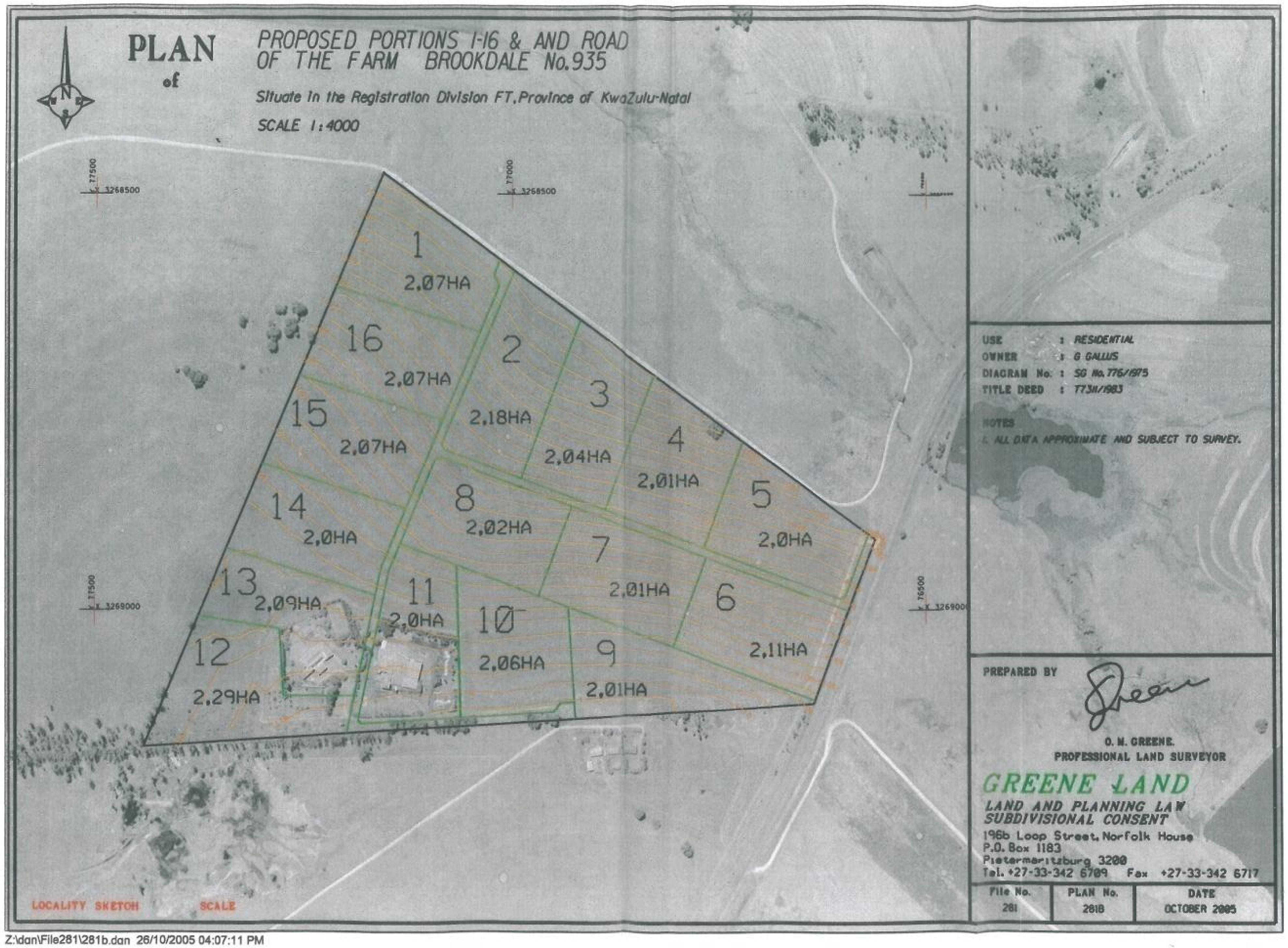
Appendix 3a:

Brookdales Farm superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)



Appendix 3b:

Brookdales Farm Revised Proposed Layout



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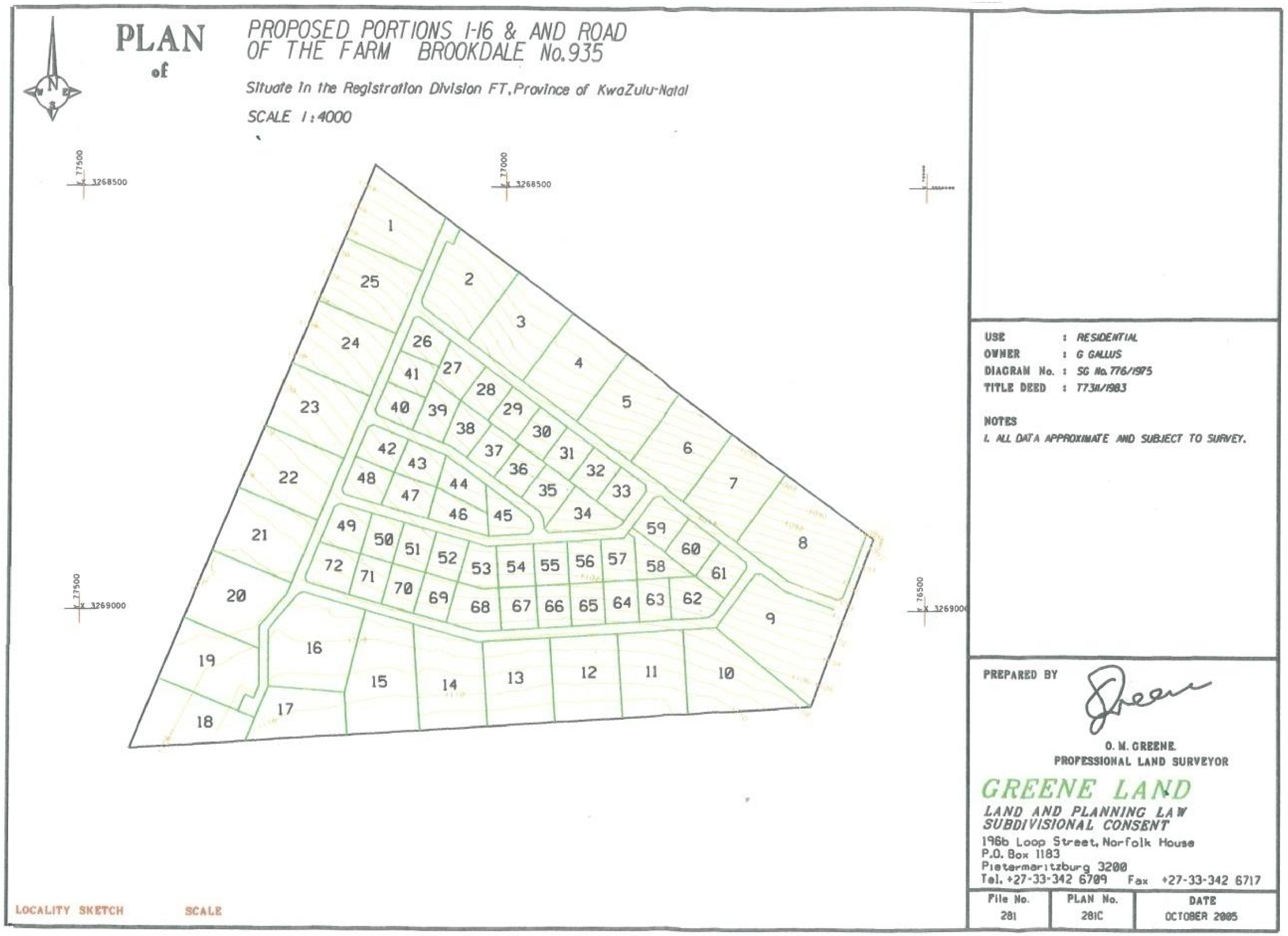
Appendix 3c:

Brookdales Farm Second Amended Proposed Layout

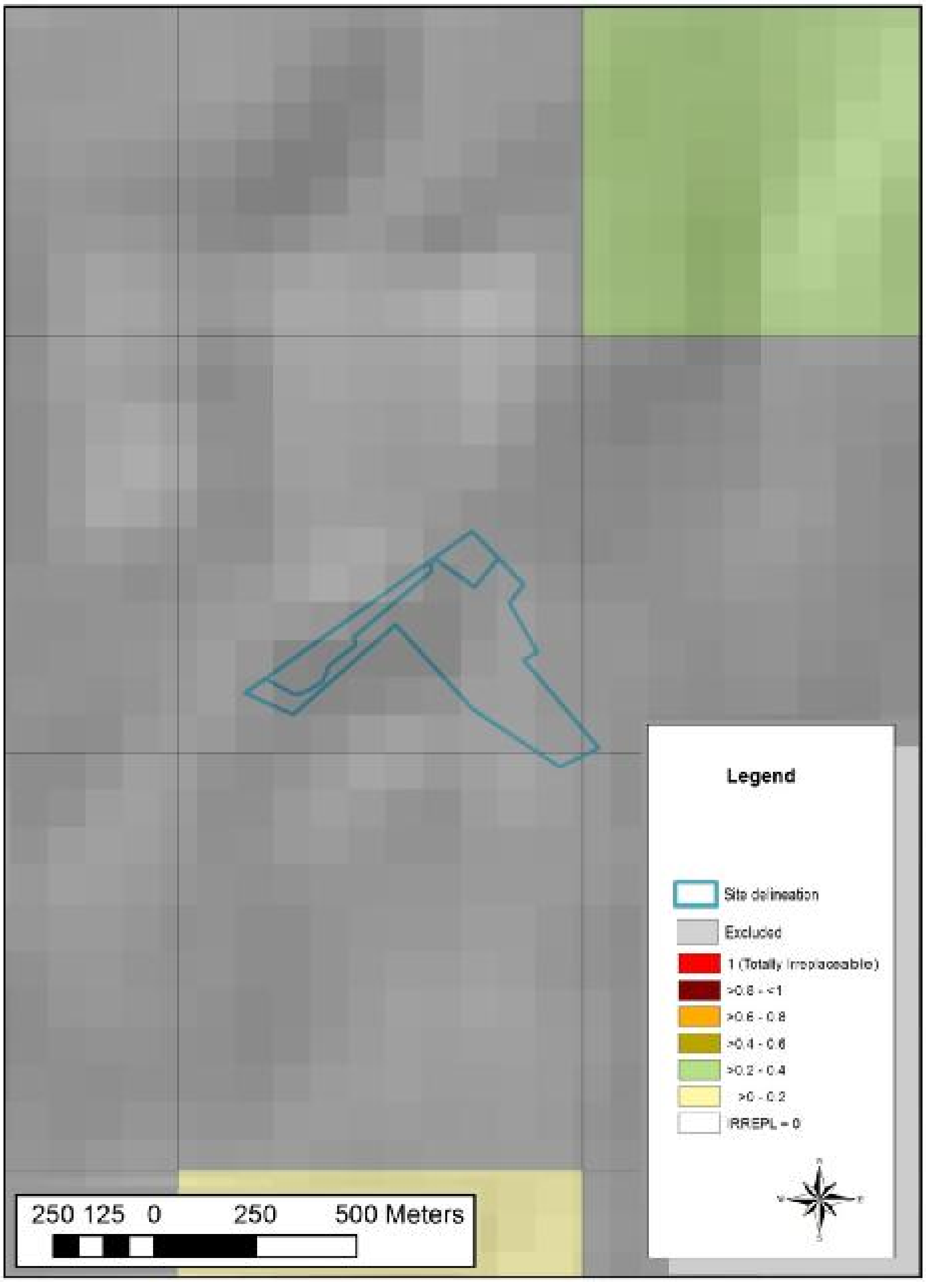


Appendix 4:

Hilton Estate:

Appendix 4a:

Hilton Estate superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)



Appendix 4b:

Hilton Estate Initial Proposed Layout

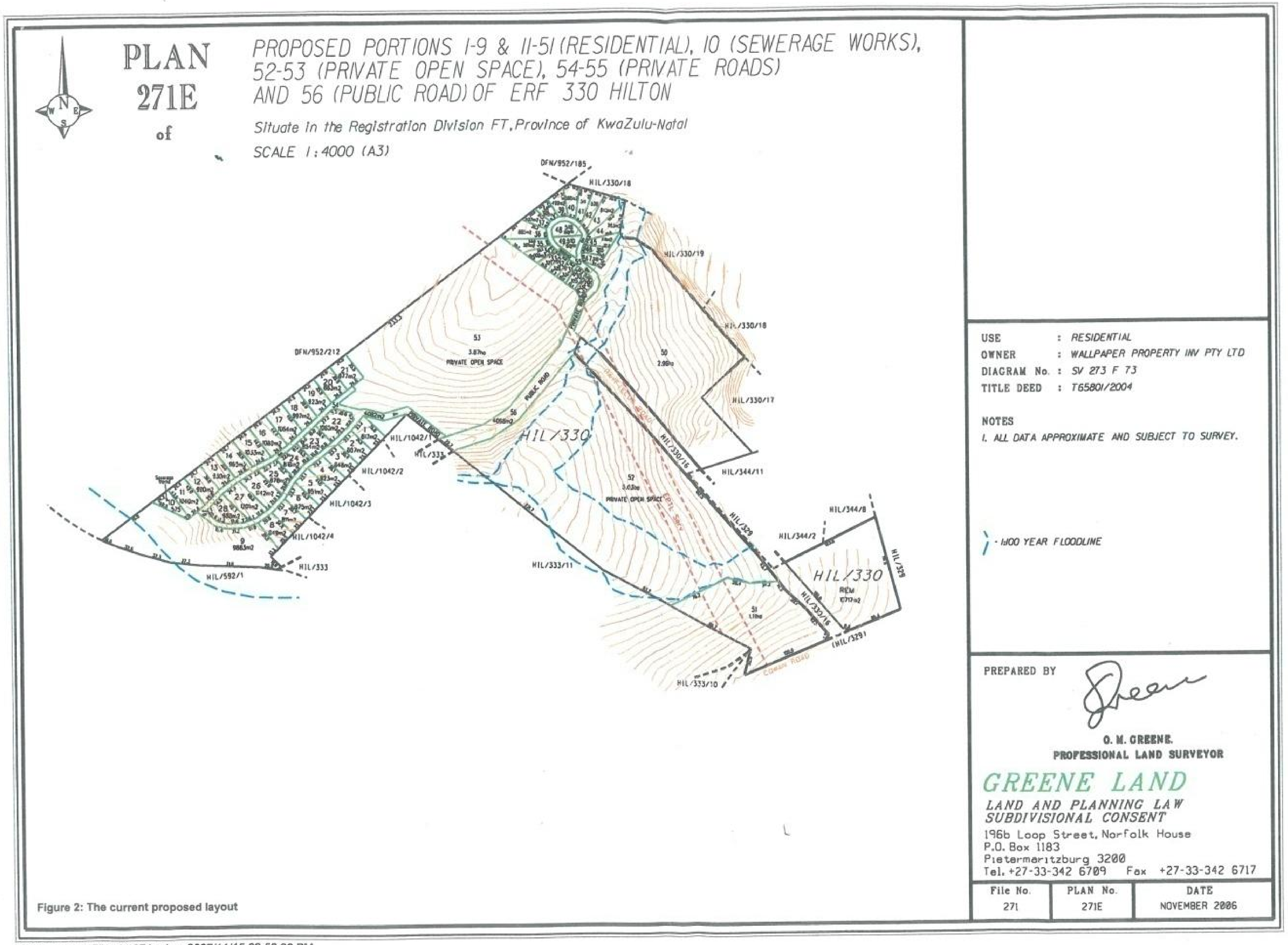


Figure 2: The current proposed layout

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Appendix 4c:

Hilton Estate Amend Layout

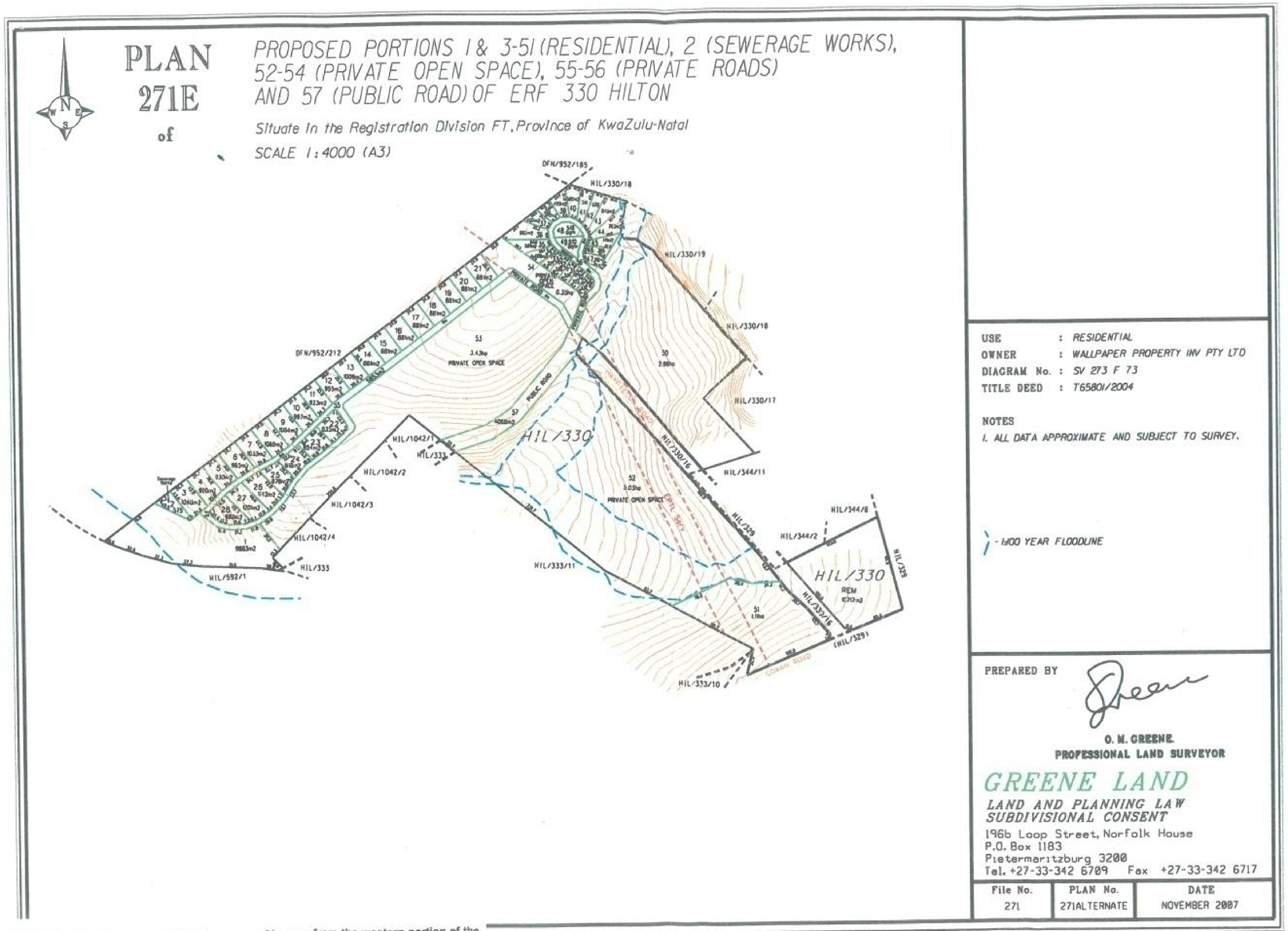


Figure 4: The alternative of re-locating a row of houses from the western portion of the residential sub-division to the northern boundary adjoining the Mondi Property

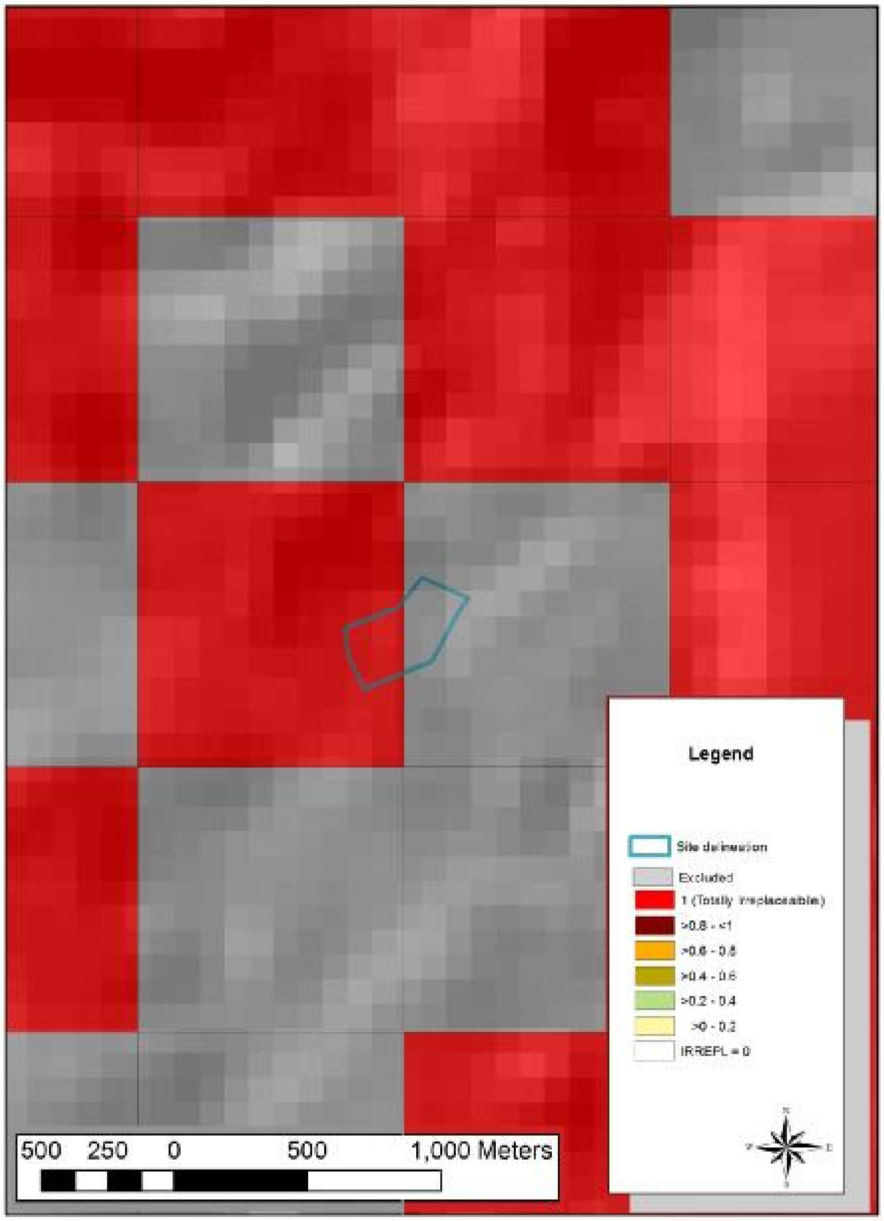
Appendix 5:

Hillcrest Retirement Village:

Appendix 5a:	Hillcrest Retirement Village superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)
Appendix 5b:	Hillcrest Retirement Village - Initial Proposed Layout

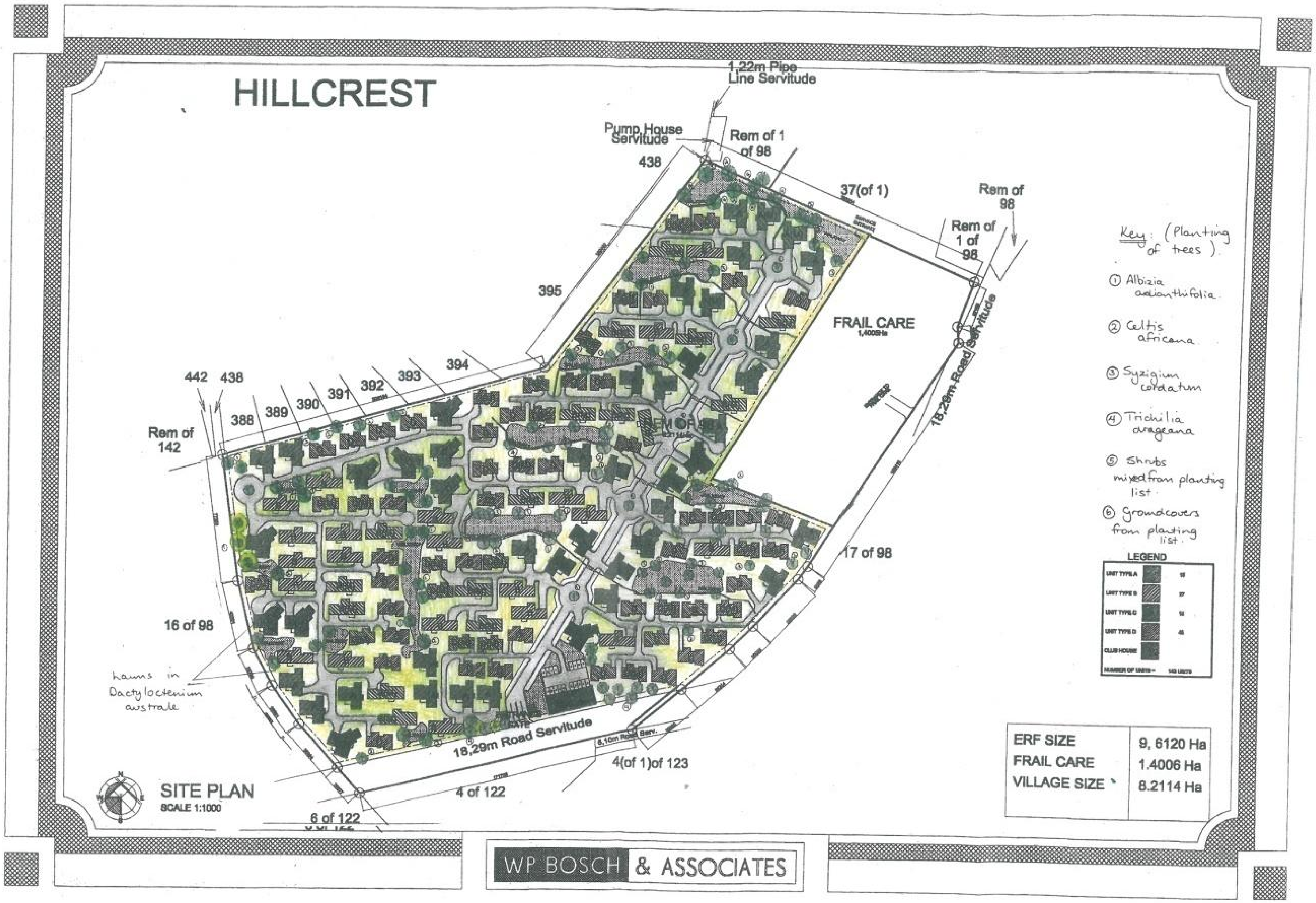
Appendix 5a:

Hillcrest Retirement Village superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)



Appendix 5b:

Hillcrest Retirement Village Initial Proposed Layout



Appendix 6:

Marianhill Storage Complex:

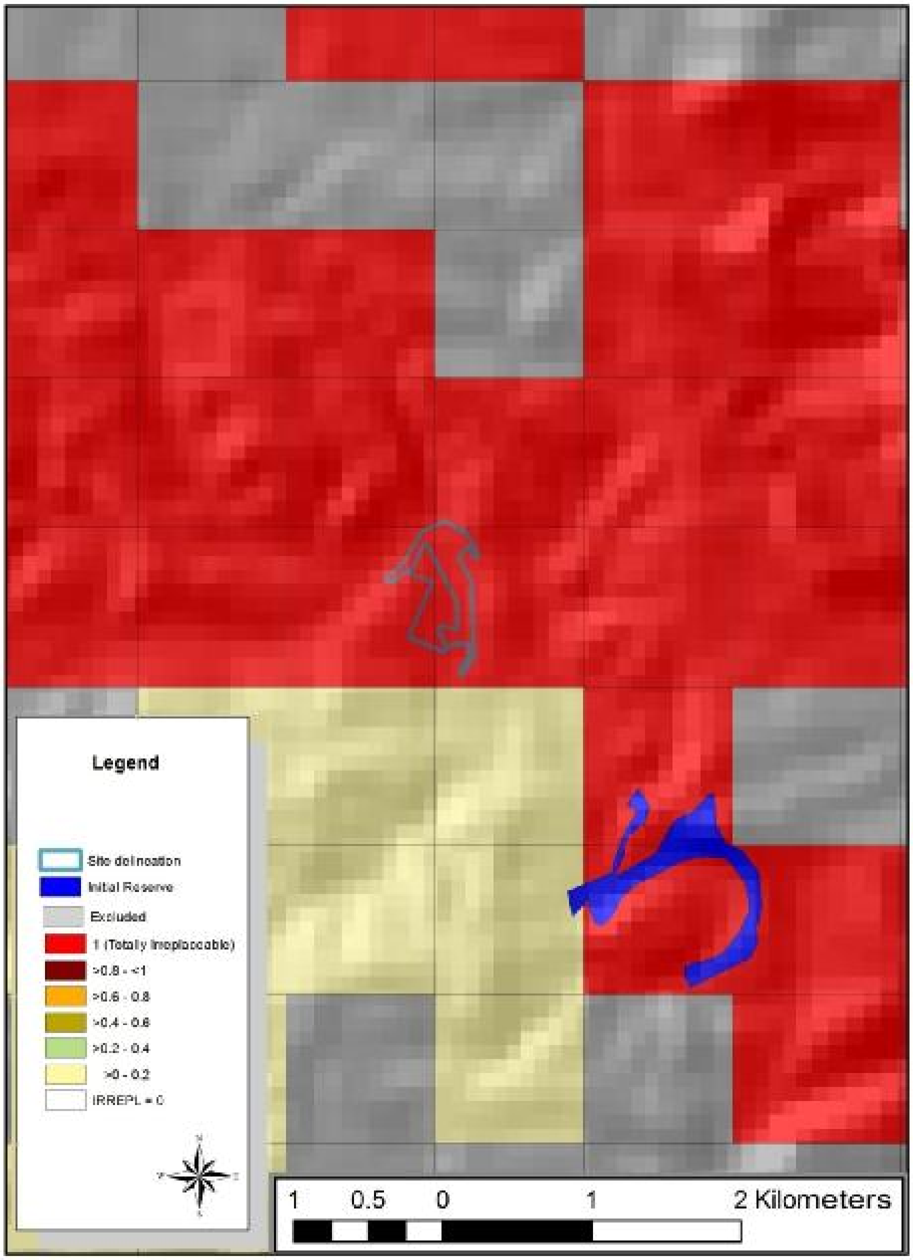
Appendix 6a: Marianhill Storage Complex superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)

Appendix 6b: Marianhill Storage Complex - Initial Proposed Layout

Appendix 6c: Marianhill Storage Complex - Revised Layout

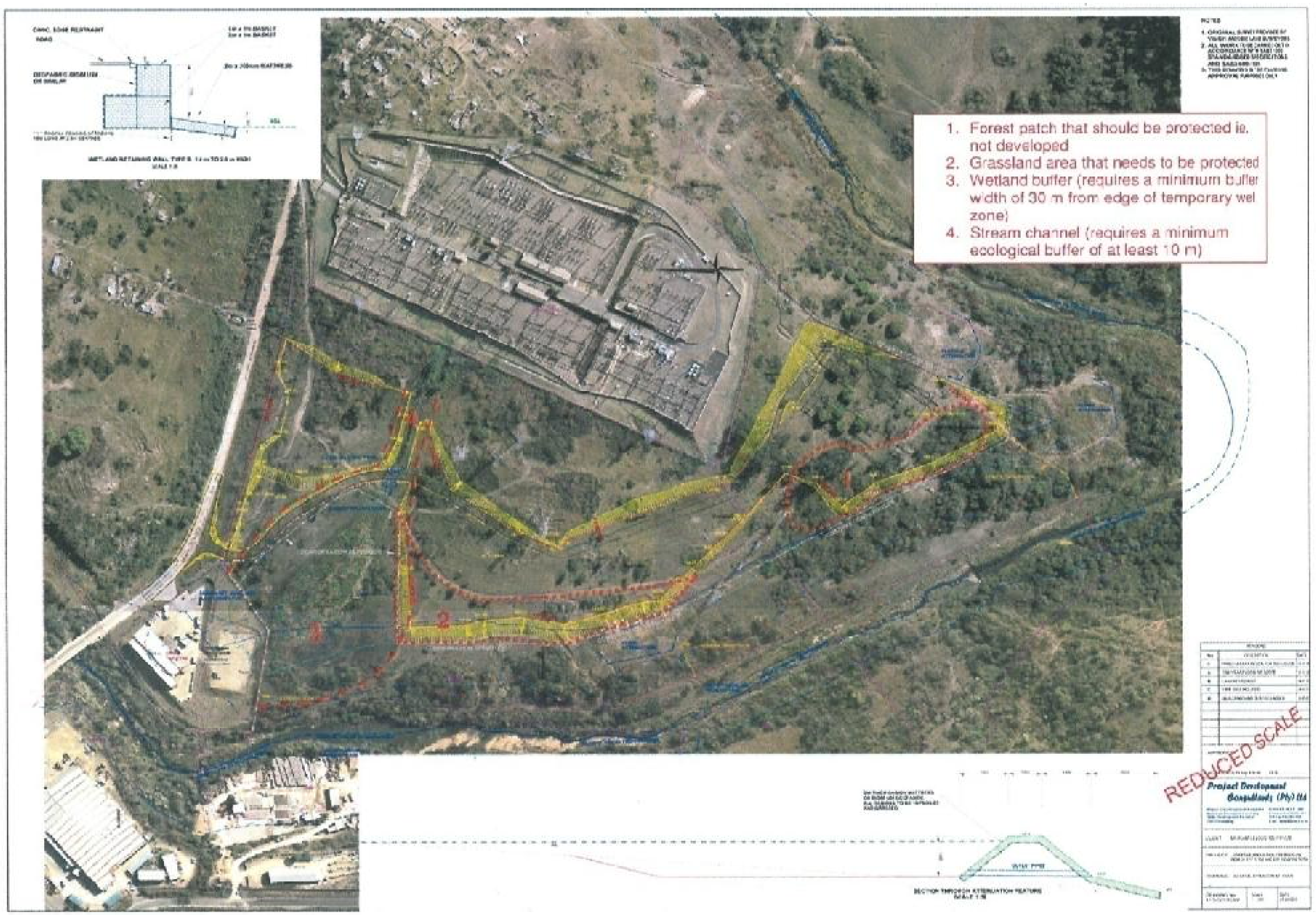
Appendix 6a:

Marianhill Storage Complex superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)



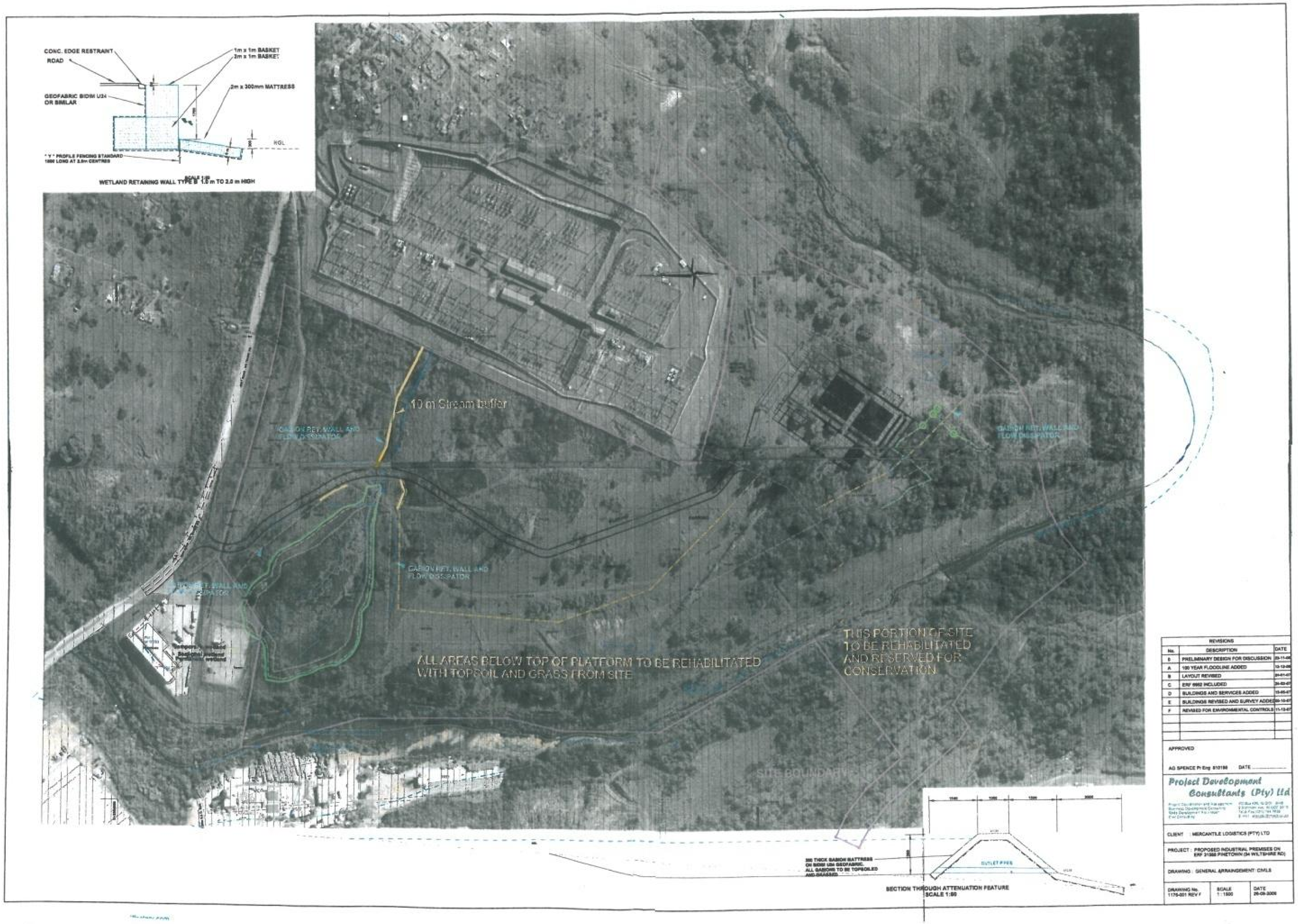
Appendix 6b:

Marianhill Storage Complex Initial Proposed Layout



Appendix 6c:

Marianhill Storage Complex Revised Layout



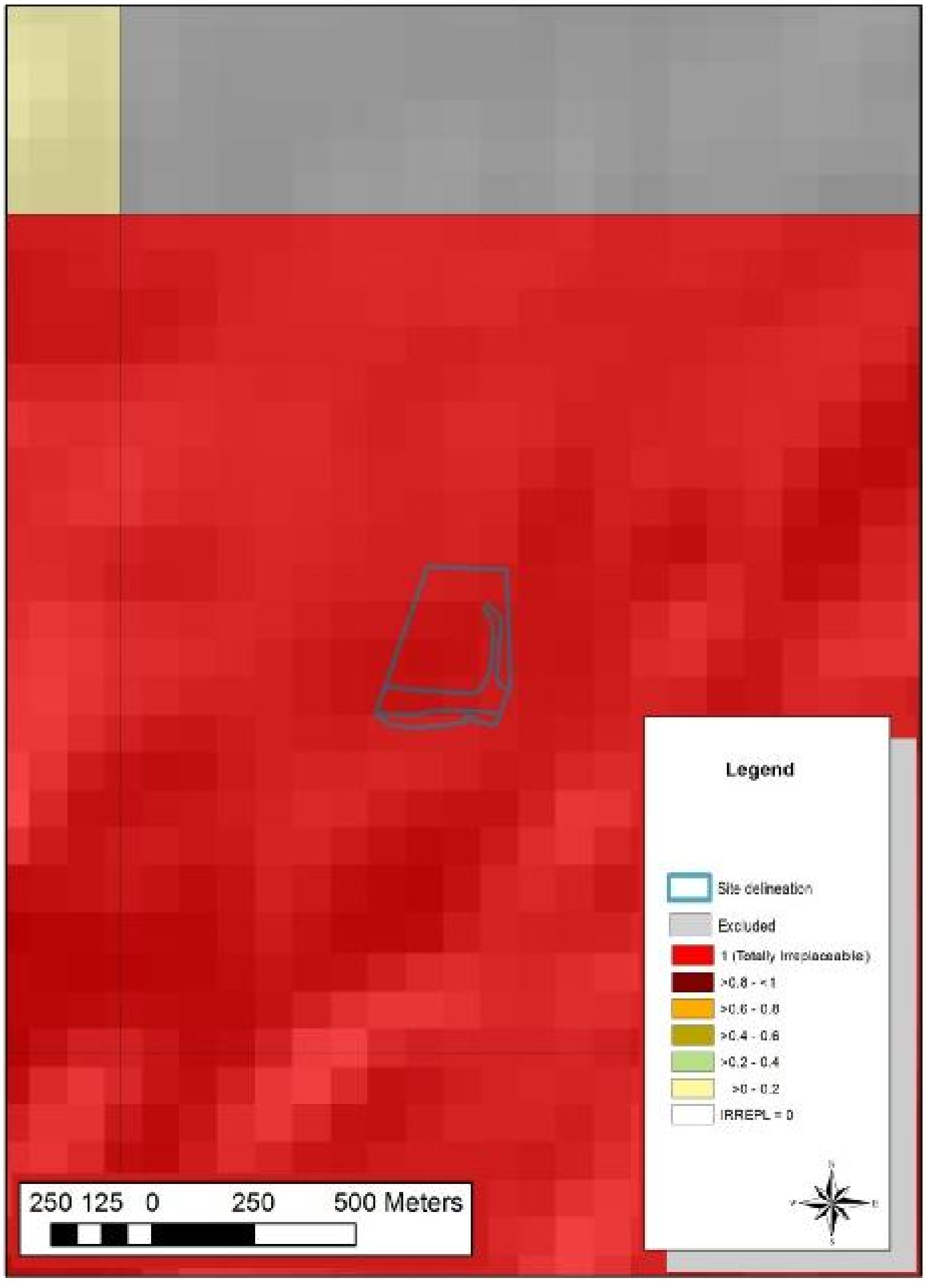
Appendix 7:

Broadlands Estate:

Appendix 7a:	Broadlands Estate superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)
Appendix 7b:	Broadlands Estate - Initial Proposed Layout
Appendix 7c:	Broadlands Estate - Amended Layout

Appendix 7a:

Broadlands Estate superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2007 (Ezemvelo, 2007)

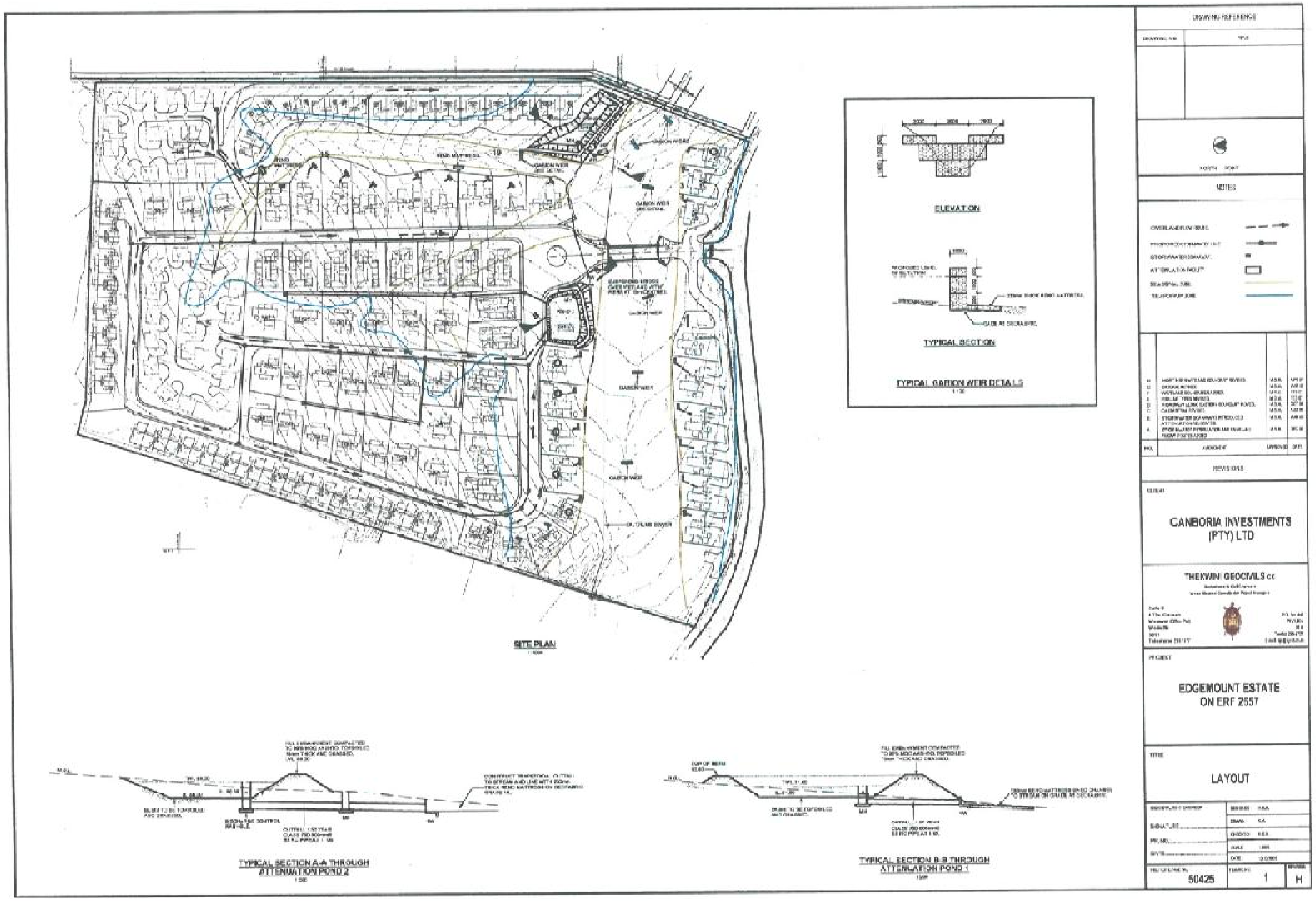


Appendix 7b:

Marianhill Storage Complex Initial Proposed Layout

Appendix 7c:

Marianhill Storage Complex Amended Layout



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Appendix 8:

King Shaka International Airport – Dube Trade Port (KSIA-DTP):

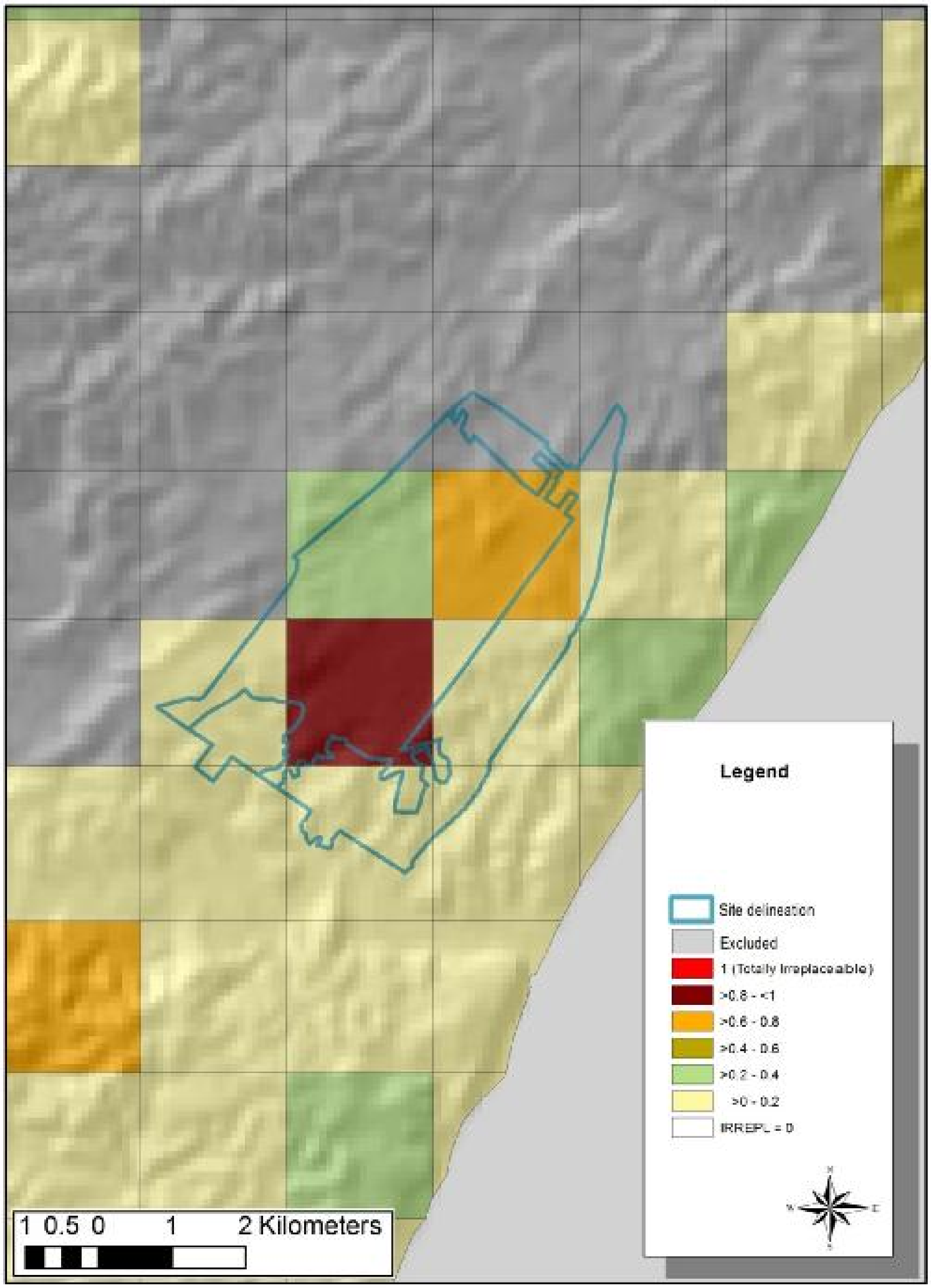
Appendix 8a: KSIA-DTP superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)

Appendix 8b: KSIA-DTP - Initial Proposed Layout

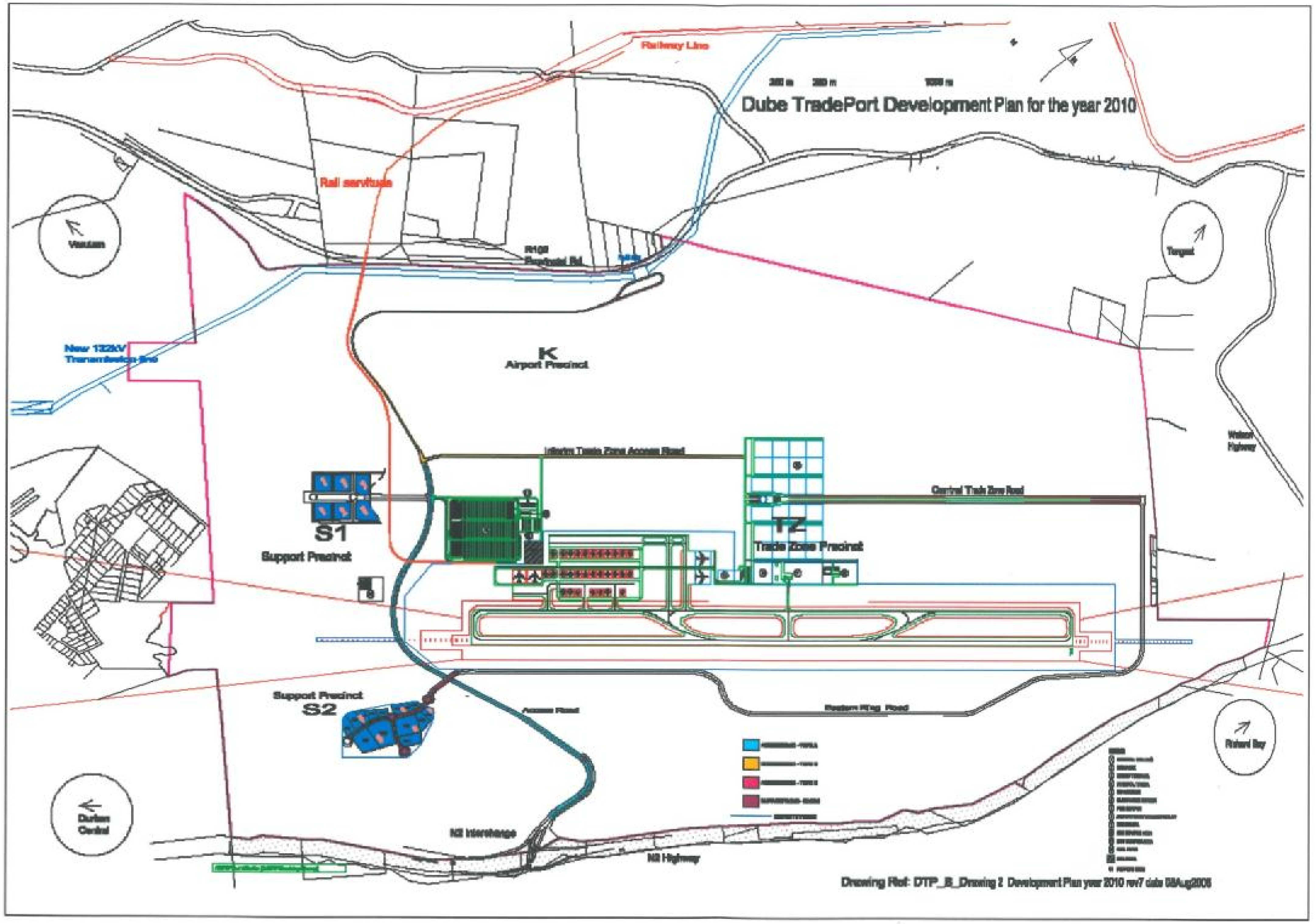
Appendix 8c: KSIA-DTP - Revised Layout

Appendix 8a:

KSIA-DTP superimposed upon the KwaZulu-Natal Terrestrial Systematic Conservation Plan 2004 (Ezemvelo, 2004)

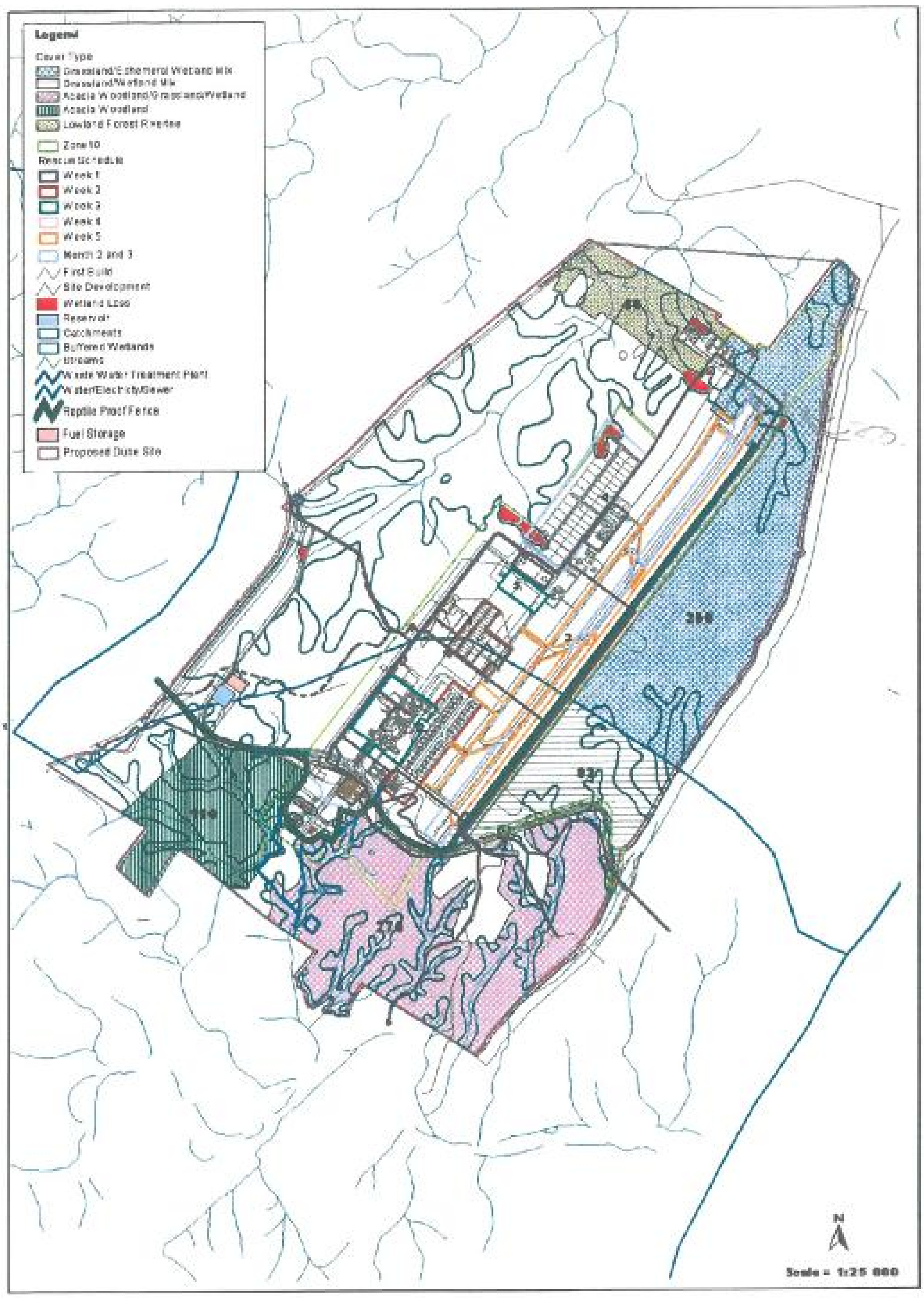


KSIA-DTP Initial Proposed Layout



Appendix 8b:

KSIA-DTP Initial Revised Layout



Appendix 9:

The Questionnaire

SCHOOL OF LIFE AND ENVIRONMENTAL SCIENCES

University of KwaZulu-Natal
(Howard Collage Campus)

Topic:

An evaluation of the consequences of Environmental Impact Assessments (EIAs) on KwaZulu-Natal's (KZN's) biodiversity targets: Are EIAs contributing towards or hindering the potential for KZN to achieve its conservation targets?

Researcher: Ms Dinesree Thambu

All responses will be treated with the strictest confidence

Section 1: Introduction

1. Please indicate the name of the department/company/organization that you work for. (Optional)

____

____

2. What environmental function does your department/company/organisation provide (please indicate the scale at which they function, local/ provincial/ national)? Please provide as much detail as possible.

____

____

____

3. What position do you hold within this company/organization and how does your position influence the EIA or the assessment thereof? (Optional)

____

____

____

Section 2: Biodiversity and Ecosystem Services

4. Using the table below, please rate (in your opinion) the current state of biodiversity in the province of KZN? Please note that your rating must consider that the following biomes also provide habitat to faunal species, that is, your rating should be a combined vegetation and animal species rating.

Good – least threatened Fair – vulnerable Poor – most threatened

KZN Biome	**Good**	**Fair**	**Poor**	**I Don't Know**
Forest				
Grassland				
Indian Ocean Coastal Belt				
Savanna				
Wetlands				
Rivers				
Estuaries				

5. Please rank the importance of the following ecosystem services, which are provided by the natural environment?

Scale: 0 (No Value) - 10 (Significantly Important)

Ecosystem Service	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Climate Regulation											
Water Regulation (includes flood control) and Supply											
Erosion Control											
Disturbance Regulation (e.g. storm protection)											
Nutrient Cycling											
Waste Treatment											
Genetic Resources											
Pollination											
Refugia / Habitat											
Food Production											
Raw Materials											
Recreation											
Cultural (including spiritual, sense of place and wellbeing)											

Section 3: Environmental Impact Assessments (EIAs)

6. EIAs and Biodiversity Information:

6.1. In your opinion, how do EIAs provide for the protection of biodiversity and conserving the natural environment?

____

____

____

6.2. Below is a list of weaknesses, largely identified by the South African Institute for Environmental Assessment (Brownlie *et al*, 2006, ii), which hinder the assessment of biodiversity in the EIA process. Please indicate the degree to which you either agree or disagree.

Area of weakness	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
Biodiversity input received too late in EIA process to influence proposal.				
Relevance of biodiversity information provided in EIA is not made explicit.				
Lack of sufficient biodiversity information (result of either lack of data or effort).				
Biodiversity is perceived to be irrelevant or could be conserved elsewhere				
Implications of information gaps, risks or uncertainty is not made explicit in terms of irreversibility of impact, loss of resource, etc.				
Biodiversity information is site specific and does not address landscape-scale effects on ecosystems and process.				
Insufficient consideration of indirect and cumulative effects.				
Economic value of ecosystem goods and services is seldom addressed.				

Area of weakness	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
The Terms of Reference for many EIA reports and specialist studies are frequently poorly defined.				
Criteria used to determine the significance of impacts is questionable, as they are not linked to a broader strategic context (e.g. policies, frameworks, conservation plans, etc.)				
Linkages between biodiversity, ecosystem services and human wellbeing (particularly dependence on resources) are seldom clearly described and hence the effects on these linkages (and dependent communities) are not addressed.				
There is an inappropriate reliance on environmental management plans and programmes for effective mitigation (so-called 'proper management will fix all ills' approach).				

6.3. Are there any points you would like to elaborate on or explain?

____

____

____

7. EIAs and Decision-making:

7.1. Are there any reasons (valid or otherwise) to disregard considering biodiversity when reviewing an EIA and granting an authorization?

____

____

____

7.2. Below is a list of weaknesses, identified by the South African Institute for Environmental Assessment (Brownlie *et al*, 2006, ii), which impede decision making to the extent that the decision does not seem to support sustainable development, although sufficient information has been provided within the EIA report. Please indicate the degree to which you either agree or disagree.

Area of weakness	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
The need to realise short-term socio-economic benefits.				
General lack of clear guidelines or criteria on which to base decisions, resulting in inconsistencies in decision-making (e.g. how to apply sustainability principles such as the Precautionary Principle).				
Inadequate consultation and co-operation between authorities.				
Lack of experience within government departments to thoroughly review environmental and specialist reports.				
Cumulative effects are seldom addressed at project-level EIAs, hence developments approved on a piecemeal basis, without the broader picture being considered.				
Authorisations are vague. Many of the associated conditions of approval are impossible to implement or audit and are vulnerable to legal challenge.				
Compliance monitoring is seldom, if ever, followed up by authorities.				

7.3. Are there any points above which you would like to elaborate on or explain?

____

____

____

Section 3: Comparison to Existing Concept of Conservation Development

8. The following is a list of indicators that determines a project's impact (both positive and negative) on the surrounding terrestrial and aquatic ecosystems. These indicators have been recently developed to assess Conservation Development Projects, a concept which has been created in the United States through a process of ecologically based planning and design (Milder, 2008: 73-75).

   Please rank the importance of these criteria in terms of what you think their value would be to the EIA process.

Scale: 0 (No Value) - 10 (Critical)

Indicator	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Land Alteration: quantifies the net change in developed/altered land as a result of the development.											
2. Edge Effect: quantifies the net change in the portion of the site affected by the proximity of the development.											
3. Spatial Configuration and Connectivity:											
a Perforation: quantifies the net change in perforated habitat, as a result of the development, and is measured as a percentage of the total site.											
b. Fragmentation: measures fragmentation minor barriers (e.g. driveways, roads) and major barriers (e.g. swaths of developed land).											
c. Off-site Connectivity: assesses the degree to which the development maintained or compromised spatial connections on the site and on adjacent natural areas.											
4. Impervious Surfaces: quantifies the net change in the percentage of each site covered by impervious surfaces.											
5. Riparian Buffers: quantifies the distribution of widths of the vegetated buffer zone around wetlands, streams and rivers.											
6. Impacts to Site Conservation Targets: evaluates the degree to which the development protects site-specific/provincial conservation targets											

7. Restoration: assesses the developments success at restoring key ecological attributes of the site's/province's conservation targets.											
8. Land Management - to measure effectiveness of current and future land management:											
a. Presence of adequate funding for on-going management activities											
b. Presence of organisation with conservation expertise responsible for stewardship											
c. Presence of baseline documentation and regular monitoring of the site's biodiversity											
d. Presence of activities to stabilise or improve the viability of conservation targets											
e. Presence of agreements (e.g. MoU, MoA, Stewardship Agreements) requiring ecologically based management of private land											
f. Evidence of ecologically sensitive land management by private land owners.											

8.1. Please list any additional criteria that you think should be included into the above list, as well as its importance ranking.

____

____

____

Section 4: The Study Area

9. Please indicate which of the approved developments listed below you are familiar with.

A	EIA 12/12/20/686: King Shaka International Airport, La Mercy, eThekwini	
B	EIA/7160: Broadlands Housing Development, Mt Edgecombe, eThekwini	
C	DM/0018/06: Cold Storage Complex, Wiltshire Place, Marianhill, eThekwini	
D	DM/0069/08: Retirement Village, Assagay Farm, eThekwini	
E	EIA/6694: Residential Development, Brookdale Farm, Midmar, Umgungundlovu	
F	EIA/6933: Hilton Residential Development, Hilton, Umgungundlovu	
G	EIA/6381: Fernhill Estate, Lion's River, Umgungundlovu	
H	EIA/6514: Cultivation of Virgin Land, Shawlands Farm, Nottingham Rd, Umgungundlovu	

When answering the remaining questions in this section, please list the corresponding letter of that project to your response, to ensure that the question is answered for all projects ticked.

10. Are there monitoring procedures or policies in place to ensure that acceptable standards are maintained and the conditions of authorization complied with? Please elaborate.

____

____

____

11. Has the development been audited? Please elaborate.

____

____

____

12. What criteria are used to evaluate the effectiveness of the development, in terms of its contribution towards maintaining or improving ecosystem functioning?

____

____

____

13. Have the conditions of the authorisaton been sufficient in protecting key biodiversity?

____

____

____

14. Were the impacts on the ground the same as that predicted?

15. Have any setbacks or problems occurred (e.g. non-compliance) and if so, how have they been resolved?

16. Using the table below, please suggest how you think the development/s ranks against the Conservation Development indicators.

Scale: The underlined values indicate greater conservation success

Please assign values under those letters that represent the projects ticked previously.

Indicator	**Rank**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
1. Land Alteration: quantifies the net change in developed/altered land as a result of the development. 0 – 100%								
2. Edge Effect: quantifies the net change in the portion of the site affected by the proximity of the development. 0 – 100%								
3. Spatial Configuration and Connectivity:								
a. Perforation: quantifies the net change in perforated habitat, as a result of the development, and is measured as a percentage of the total site. 0 – 100%								
b. Fragmentation: measures fragmentation minor barriers (e.g. driveways, roads) and major barriers (e.g. swaths of developed land). 0 – 100%								
c. Off-site Connectivity: assesses the degree to which the development maintained or compromised spatial connections on the site and on adjacent natural areas. 0 – 100%								

4. Impervious Surfaces: quantifies the net change in the percentage of each site covered by impervious surfaces. 0 – 100%								
5. Riparian Buffers: quantifies the distribution of widths of the vegetated buffer zone around wetlands, streams and rivers. 0 – 100%								
6. Impacts to Site Conservation Targets: evaluates the degree to which the development protects site-specific/provincial conservation targets. 0 – 100%								
7. Restoration: assesses the developments success at restoring key ecological attributes of the site's/province's conservation targets. 0 – 100%								

8. Land Management - to measure effectiveness of current and future land management:	**Yes**								**No**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
a. Presence of adequate funding for on-going management activities.																
b. Presence of organisation with conservation expertise responsible for stewardship																
c. Presence of baseline documentation and regular monitoring of the site's biodiversity																
d. Presence of activities to stabilise or improve the viability of conservation targets																
e. Presence of agreements (e.g. MoU, MoA, Stewardship Agreements) requiring ecologically based management of private land																
f. Evidence of ecologically sensitive land management by private land owners.																

16.1 Are there any points above that you would like to elaborate on/explain further?

____

____

____

17. How would you want the property to look in 5, 10, 25 or 50 years from now?

5 years: ____

10 years: ____

25 years: ____

50 years: ____

17.1 Do you think this would be possible under the current (economic, social and political) climate? If not, what would be required?

____

____

____

Section 5: General Comments

18. Please list any additional comments you would like to make? (Optional)

____

____

____

References:

Milder, JC. 2008. 'Conserving Biodiversity and Ecosystem Function through Limited Development: an Empirical Evaluation', *Conservation Biology,* 22(1): 70-79.

Brownlie, S., Walmsley, B. & Tarr, P. 2006. Final Draft: Guidance Document on Biodiversity, Impact Assessment and Decision Making in Southern Africa. Report compiled for IAIA's Capacity Building in Biodiversity and Impact Assessment Project. Compiled by the Southern African Institute for Environmental Assessment and deVilliers Brownlie Associates. Unpublished.

Thank you for your contribution and co-operation.

Please forward all responses or queries to:
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Alternatively, you can contact me on (tel) 033 – 845 1425.