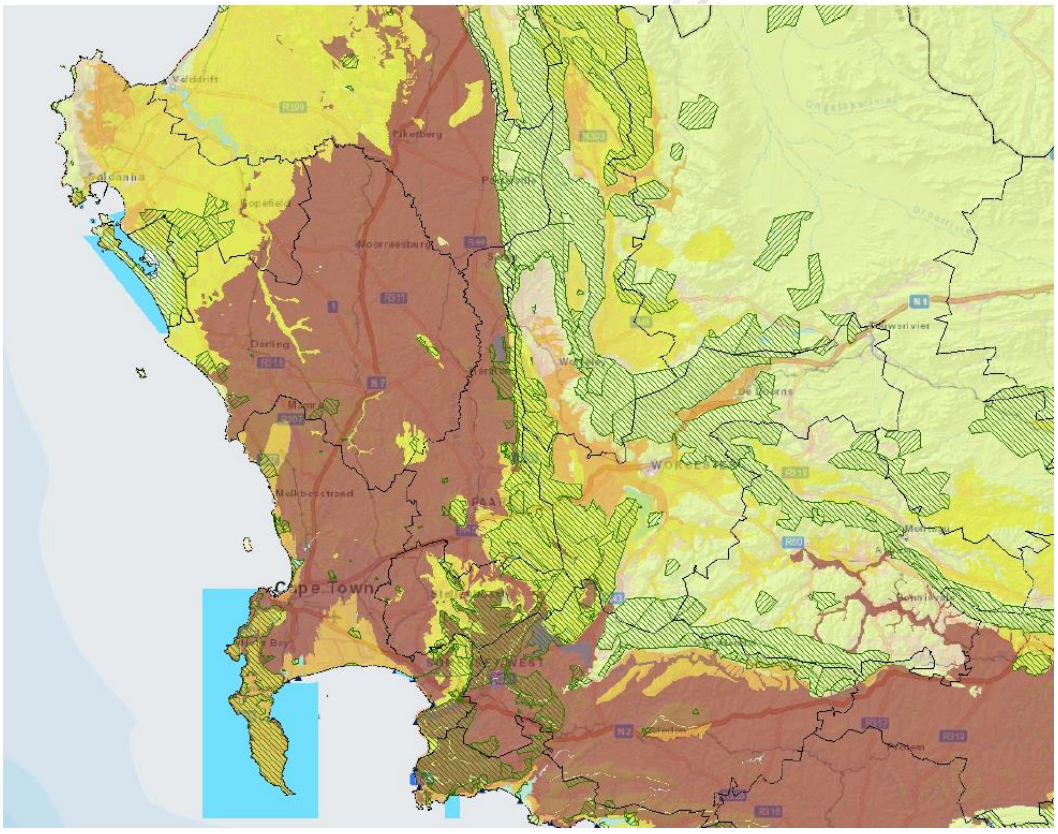
Assessing the Effectiveness of Environmental Impact Assessment as a Safeguard to Biodiversity in the Cape Floristic Region of South Africa

Dissertation
in partial fulfilment of the requirements for a
Masters of Philosophy in Environment, Society and Sustainability
Department of Environmental and Geographical Science
University of Cape Town
August 2017

By Griffin Nortje
NRTGRI001



Supervisor:

Dr Richard Hill

Department of Environmental and Geographical Science, University of Cape Town

PLAGIARISM DECLARATION

1. I know that plagiarism is wrong. Plagiarism is using another's work and to pretend that it is one's own.

2. I have used a recognised convention for citation and referencing. Each significant contribution to, and quotation in, this thesis from the work, or works of other people has been attributed and has been cited and referenced.

3. This dissertation is my own work.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

ABSTRACT

Environmental Impact Assessment (EIA) is subject to challenges that undermine this process as an effective safeguard to biodiversity. Internationally, effective EIA is hindered by the following issues: a low priority assigned to the consideration of biodiversity and a limited capacity to carry out assessments; a lack of formalised procedures and inconsistent methodologies to address biodiversity within the EIA framework; and a lack of formal requirements for post-project monitoring of biodiversity aspects.

Traditionally effectiveness studies in this regard have focused on evaluating the procedural aspects of EIA, and have focused less on the substantive outcomes of the post-authorisation phase of a proposed project. While South Africa has a considerable body of literature pertaining to the procedural aspects of EIA, there remain two substantial gaps in the literature. Firstly, there is an evident absence of effectiveness studies in South Africa that focus primarily on biodiversity-specific procedure. Secondly, almost no research has been conducted in South Africa which investigates the outcomes of mitigation measures, mandatory monitoring, reporting and compliance with biodiversity aspects of EIA. This research therefore aims to fill these gaps by investigating the quality of information generated in five EIAs in the Western Cape. It also examines the implementation success of mitigation measures aimed at managing unavoidable impacts in the post-authorisation phase of these projects.

This research has adopted a case study methodological approach. Five EIAs were selected from a sample of 9. In no order of significance, the variables considered most important in the sampling protocol were: the presence of a biodiversity-related specialist report; availability of environmental assessment documentation; overall cases to represent at least two different local jurisdictions; and the uniqueness of adopted biodiversity-related mitigation measures. The primary method used to evaluate the quality of biodiversity-related information is a Key Performance Indicator analysis, whereby the performance of cases is measured against legal and best-practice reporting principles. The substantive outcomes of EIA have been investigated by means of site inspections and interviews with key stakeholders.

This research has found that the five cases performed well with complying with best-practice EIA procedure, indicating a 53% full compliance, 29% partial compliance and 18% of best-practice principles were not complied with at all. This research has shown that direct impacts on biodiversity (such as the physical removal of indigenous vegetation) are adequately identified, and indirect impacts (typically those impacting off-site and on ecological processes) are poorly identified in EIA. Therefore, the information required to avoid impacts on biodiversity is available, but this research has found that this information is underutilized in this regard. Notably, avoidance of impacts was undermined by inadequate site and layout alternatives and poor decision making in terms of the regular authorisation of irreversible impacts on biodiversity. Conversely, only 18% of mitigation measures were fully complied with, 36% were partially complied with, and 45% of mitigation measures were not complied with. These results indicate a poor performance of EIA in the implementation stage of a project lifecycle. This research has concluded that this is most likely due to a poor conversion of recommended mitigation measures into conditions of authorisation and a limited capacity of the competent authority to perform compliance monitoring.

Table of Contents

List of Tables and Figures

Tables:

Figures:

1. INTRODUCTION AND PROJECT MOTIVATION

1.1 OVERVIEW AND RESEARCH RATIONALE

A large proportion of critical biodiversity areas and threatened ecosystems within the Cape Floristic Region (CFR) of the Western Cape of South Africa are found on privately owned land and are therefore seldom appointed a formal conservation status. Increasing land transformation and the associated degradation of natural systems, primarily in the form of urban and agricultural development, pose a serious threat to biodiversity, ecological processes and the maintenance of ecosystem goods and services in these areas. While these threats impact directly on biodiversity in the CFR, the complex and diverse nature of biodiversity in this region also requires the consideration of indirect impacts such as the disturbance of natural fire regimes and reduced connectivity between remnant vegetation patches as a result of fragmentation. In order to ensure the persistence of biodiversity, Pence (2008) stated that approximately 30 percent of the landscape outside of protected areas needs to be managed in accordance with conservation objectives. This therefore places biodiversity directly in the realm of land-use planning and the regulation of development. There are essentially two avenues by which biodiversity priorities can be incorporated into decisions regarding changes in land-use:

1. The strategic planning route, via spatial techniques such as Spatial Development Frameworks (SDF), Environmental Management Frameworks (EMF) or Strategic Environmental Assessment (SEA); and

2. The reactive, regulatory approach, primarily through the prescribed environmental impact assessment (EIA) process, but also by means of other land-use controls such as water licensing or zoning scheme regulations.

EIA can be described as a policy and legislative instrument in that it provides a management framework for the consideration of all changes incurred on the environment (ecological and socio-economic) as a result of a project proposal. Strategic planning components can be incorporated into EIA to aid decision-making and to inform context, which are more commonly conducted independently of project proposals. However, due to the complex nature of biodiversity and its interaction with the broader landscape, the consideration of the strategic implications of a proposal on biodiversity specifically has become a mandatory requirement in the EIA process in South Africa. Therefore, while the focus of this research will be specifically on EIA as a management framework, as opposed to SEA, it will not disregard the influence that strategic or spatial planning has on sound biodiversity management.

Biodiversity mainstreaming through the regulatory EIA route is subject to challenges that undermine this process as a biodiversity safeguard. In the international arena, effective EIA is hindered by the following issues: a low priority assigned to the consideration of biodiversity and a limited capacity to carry out assessments (Treweek, 2001); a lack of formalised procedures and inconsistent methodologies to address biodiversity in EIA (Geneletti, 2002); and a lack of formal requirements for post-project monitoring of biodiversity aspects (Treweek, 1996). What is evident from this literature is that much of the research efforts investigating EIA as a safeguard for biodiversity have focused on the procedural aspects as opposed to substantive aspects. This remains true in the South African context where much of the research

has been aimed at investigating report quality and procedural effectiveness of environmental assessment (Retief, 2007; Sandham and Pretorius 2008; Hulett and Diab (2002) state that environmental assessment in general demonstrates limited practical concern for the auditing and monitoring of post-authorisation impacts when compared to the effort that goes into the EIA stages preceding a decision. In terms of biodiversity conservation in South Africa, there remains two substantial literary gaps; firstly, very little research has been conducted which exclusively evaluates biodiversity-specific procedure, and secondly there is a similar absence relating to the substantive effectiveness of post-authorisation biodiversity outcomes in South African EIA in general. More specifically, little to no research has been conducted in South Africa which investigates the outcomes of mandatory monitoring, reporting and compliance with respect to biodiversity aspects of EIA, and how this relates to attaining biodiversity targets. EIA places emphasis on the implementation of the mitigation hierarchy in order to achieve biodiversity targets, and yet the practice typically lacks an adaptive management component which investigates the appropriateness and effectiveness of such management solutions. Nevertheless, this industry has experienced rapid development of legislation over the past 20 years, including the development of the framework National Environmental Management Act, Act 107 of 1998, as well as three successive publications of regulations specifically addressing EIA procedure. Furthermore, provincial best-practice policy documents have been developed concurrently with emerging legislation, which give clear guidance on practically all aspects of EIA relating to biodiversity.

The need for evaluating the performance of EIA as a safeguard to biodiversity in the CFR is of utmost importance for conservation in South Africa for a variety of reasons; firstly EIA often represents the only mechanism for protecting biodiversity, and secondly, those threats that have impacted on many endangered vegetation types of this region may continue to undermine biodiversity in the absence of effective management.

1.2 RESEARCH QUESTIONS AND OBJECTIVES

The objectives and questions of this research are stated below. Further background and rationale is provided in Chapter 2 (literature review) and Chapter 3 (research methodology).

The main research question is as follows:
How effective is EIA at mitigating and managing the impacts on biodiversity associated with development proposals in the Cape Floristic Region (CFR), as exemplified in five EIAs?

The research objectives are as follows:

Research objective 1: procedural effectiveness

The first objective of this research is to assess and evaluate how well EIA, and associated conditions of authorisation, address biodiversity considerations in decisions impacting on changes in land use.

The following are the questions this research aims to address in terms of this objective:

1.1 To what extent do biodiversity specialists and Environmental Assessment Practitioners (EAPs), or consultants, comply with legal and best-practice requirements for incorporating biodiversity into EIA?

1.2 To what extent are the full range of impacts on biodiversity as a result of a development identified in the Environmental Impact Report (EIR), and how well are these mitigated in the construction and operational phases by means of the Environmental Management Programme (EMPr)?
1.3 How practical, appropriate and enforceable are biodiversity-specific mitigation measures?

Research objective 2: substantive effectiveness

The second objective of this research is to assess and evaluate how well impacts and mitigation measures are managed in the selected authorised developments.

The following are the questions this research aims to address in terms of this objective:

2.1 How capacitated are government institutions to perform compliance monitoring of biodiversity-specific conditions of authorisation?
2.2 To what extent do authorised developments comply with biodiversity-specific mitigation measures?
2.3 Are the biodiversity-specific mitigation measures working?

1.3 ASSUMPTIONS AND LIMITATIONS

Caution must be applied when extrapolating the findings of this research. While Eisenhardt (1989) concludes that four to ten cases are appropriate for any case study, the findings of this research should not be considered standard practice. As this research has adopted a judgement-based sampling protocol for case selection, the intention is to contribute to the generation of generalizable theory, by means of multiple methods and triangulation, rather than through statistical generalizations.

The generalisability of findings may be influenced by overlaps of consultants and specialists. This is therefore stated here as a potential limitation to the study. Four consultants were involved in this research. Specifically, the Search & Rescue and Housing Estate EIRs were conducted by the same consultant. Two specialist were involved in this research. Specifically, one specialist conducted the botanical reports for the Golf Course & Housing Estate and Commercial Development cases. Another specialist conducted the botanical reports for the Industrial Development, Search & Rescue and Housing Estate cases.

As the cases for this research are all contained within the Western Cape, and that decisions made by the competent authority are made at the level of provincial government, the theory generated in this research should be interpreted thus, and not for South Africa.

Various components of this research necessitated personal interpretations and value judgements by the researcher. This includes evaluating the quality of information (done through a key performance indicator process) produced in the impact assessment process as well as during compliance inspections. Great care has been taken by the researcher to ensure these judgments and interpretations were made objectively. Due to the confidentiality of cases and their associated documentation adopted by this research, the integrity of these judgements cannot be verified by the reader. However, these judgements are substantiated in-text and in Appendix 2.

2. LITERATURE REVIEW

Chapter 2 outlines the state of biodiversity specifically in the Cape Floristic Region, as well as the management tools in place which regulate changes in land-use and impacts on biodiversity. It begins with a report on the current status of this region's biodiversity in section 2.1, and also defines biodiversity terminology which is used throughout this dissertation. This section also highlights the key ecological drivers of ecosystem functionality and threats to biodiversity in this region. Ecological functionality drivers and threats to biodiversity represent key components to be addressed in EIA, and these aspects are discussed in more detail in section 2.2. Section 2.3 then introduces EIA as a management framework in South Africa, as well as the best-practice reporting requirements for biodiversity in EIA.

2.1 INTERPRETING BIODIVERSITY IN THE CAPE FLORISTIC REGION

Situated at the southern tip of Africa, the Cape Floristic Region (CFR) has long been recognized for its immense biological diversity and endemism. The CFR covers an area of 87892km^2 and is home to over 9000 plant species of which 70% occur nowhere else in the world (Goldblatt and Manning, 2000). The CFR is also known as the Cape Floral Kingdom and is the smallest, and for its size, the most biologically rich of the world's six floral kingdoms (Cowling et al., 1992). This area has been listed as an Endemic Bird Area (Stattersfield et al., 1998), a Center of Plant Diversity (IUCN, 1994; WWF, 1994), a Global Ecoregion (Olson and Dinerstein, 1998) and contains many statutorily protected areas and Heritage Sites (Cowling, 2003). The exceptional levels of endemism (Goldblatt and Manning, 2002) together with the immense threats to biodiversity (Rouget et al., 2003) have resulted in the classification of the CFR as a biodiversity hotspot (Mittermeier et al., 1998; Myers et al., 2002).

The Cape Metropolitan Area (CMA) is the largest metropolitan within the CFR and its administrative boundaries span an area of approximately 2460km^2 (Holmes et al., 2012). The CMA can be divided into two major geophysical areas, namely the Cape Peninsula mountain chain and the Cape Flats. The steep, rugged and inaccessible nature of the mountain chain has largely protected it from urbanisation and as a result, this area still supports some 2585 plant species in a mere 471km^2 (Maze et al., 2002). The Cape Flats represent the lowland area of sandy isthmus between False and Table Bays and, conversely, has been subject to extensive urbanisation. This has resulted in the transformation of approximately 70% of land in this area (Maze et al., 2002). As a result, natural habitats in the Lowland areas are restricted to numerous isolated remnants that can be found in parks, nature reserves, undeveloped spaces, infrastructure servitudes, corridors and road and freeway verges. Nevertheless, this area represents a unique concentration of rare and endemic species contained in an urban setting and supports some 1466 plant species in 1874km^2 with 76 local endemics and 131 Red Data Book plants (Maze et al., 2002). Outside of the CMA and further north along the west coast towards Malmesbury, the landscape changes to the undulating hills that are characteristic of the Malmesbury Shale geology.

2.1.1 Biodiversity Pattern and Process in the Cape Floristic Region

Understanding biodiversity pattern and process and threats to conservation are of upmost importance when evaluating the effectiveness of environmental assessment in safeguarding

biodiversity. Slootweg et al. (2010) emphasise the following three steps when assessing the probability of predicted impacts having a detrimental effect on biodiversity: 1) define drivers of change and their temporal and spatial range of influence as a result of a proposed activity; 2) to identify the ecosystems within this range; and 3) provide definitions of the level of diversity affected (genetic, species, ecosystem) in each identified ecosystem type. These inputs should be interpreted in relation to the following aspects of biodiversity:

- *Biodiversity pattern (or composition):* biodiversity pattern refers to how biological units are organised in time and space and can be described as static elements of biodiversity that can be geospatially mapped (Pressey et al., 2007). Biodiversity pattern is the most commonly known and used aspect of biodiversity and includes: genetic variability within species or between populations of species; diversity of species expressed in a variety of different diversity indices; and diversity in types of ecosystems (Slootweg et al., 2010). Although biodiversity pattern applies to all levels of diversity, in environmental assessment it usually relates to the ecosystem level of diversity as well as in cases where critical species are studied at the population and habitat levels (Slootweg et al., 2010).
- *Biodiversity process:* biodiversity process refers to the physical, biological or human processes that are of key importance for the creation and/or maintenance of biodiversity (Slootweg et al., 2010). Biodiversity process is usually interpreted at the ecosystem level and may refer to the birth, death and movement of individual organisms, local extinctions and recolonizations of populations, disturbance such as fire and herbivory, predation, patch dynamics, seasonal migrations, and adjustments of the distributions of species to changing climates and speciation (Pressey et al., 2007). If a human intervention affects biodiversity process, it should be assumed that such a driver of change will lead to changes in biodiversity and therefore influence ecosystem services provided by this biodiversity.

Conservation planning has traditionally focused on lower levels of biodiversity, namely species and/or populations (Rouget et al., 2003). However, due primarily to the complexity of biodiversity and the amount of resources required to manage biodiversity at such a fine scale, surrogates (habitat types/ species assemblages) have been used more recently in an attempt to reduce complexity and increase the efficiency of biodiversity conservation (Noss et al., 1997). The conservation of biodiversity in South Africa uses this approach by focusing conservation efforts on ecosystems and vegetation types.

The vegetation types in the CFR of relevance to this research can be grouped into three major ecosystem types, namely: 1) midland and mountain fynbos ecosystems, 2) lowland fynbos ecosystems and 3) Renosterveld ecosystems. Midland and mountain fynbos displays the highest levels biodiversity (Maze, et al. 2002) and the most vegetation types (see Table 1). The large diversity of this ecosystem has been partly attributed to the topographically complex landscapes and sharp altitudinal gradients of these areas. Furthermore, Schnitzler et al. (2011) identified soil type shifts as the most important cause of speciation among the most abundant plant families in this region. The relatively uniform edaphic (soil characteristics) conditions and comparatively fewer vegetation types of the lowland fynbos and Renosterveld ecosystems appears to be evidence of this phenomenon. Understanding the similarities and differences in the drivers of ecosystem functionality, threats, key issues and vulnerabilities is of upmost

importance for effective management and conservation of biodiversity and will therefore be discussed below.

2.1.1.1 Key Ecological Drivers of Ecosystem Functionality

A major ecological factor for maintaining healthy ecosystem process in the CFR is the presence of fire and periodic burning of natural vegetation. Post-fire recruitment is caused by fire-stimulated flowering, fire-stimulated germination by heat or smoke as well as from serotiny (the fire-stimulated release of seeds) (Manders et al., 1992). Furthermore, the unnatural succession of fynbos into forest ecosystems has been noted in the absence of fire at various sites in the CFR. For example, significant areas of Orange Kloof in the CMA have been entirely converted from fynbos to forest after 50 years of fire suppression, as well as at Swartboskloof Valley after only 28 years of no fire (Masson and Moll, 1987; Manders et al., 1992). Healthy Fynbos and Renosterveld ecosystems are therefore naturally maintained in the presence of fire for two primary reasons: 1) that non-fire adapted species attempting to colonise natural fynbos/renosterveld territory are unlikely to outlive fire events at the natural frequencies, and 2) fynbos species have a recruitment competitive advantage over non-fire adapted species in post-fire environments. The three ecosystem types shown Table 1 all require fire for their persistence over unnatural invaders but the frequency and intensity (fire regime) differs for each of the ecosystems. For instance, while the ideal fire frequency in the wetter areas of Renosterveld ecosystems may be between 10-15 years, lowland fynbos ecosystems may require a fire frequency of 30 years (De Villiers et al., 20016). Despite the fragmented and patchy landscape of the Lowland Fynbos ecosystem, Cowling and Bond (1991) found that these small remnants can retain biodiversity processes provided they are subject to the correct fire regime. Fulfilling a similar role to fire, the presence of grazers and browsers also play an important role in maintaining natural biodiversity pattern and process by preventing the dominance of either grasses or understory shrubs respectively.

Table 1: Relevant ecosystems, associated vegetation types, urban cover (%), cultivated cover (%), degree of natural vegetation containing aliens (%) and total land transformation (%) in the Cape Floristic Region (Rouget et al., 2003)

Ecosystem Type	Vegetation Type	Urban Cover (%)	Cultivated Cover (%)	Natural Vegetation Containing Aliens (%)	Total Transformed (%)
Midland & Mountain Fynbos		18.24	4.55	77.2	26.31
	Peninsula Sandstone Fynbos Alluvial Fynbos Granite Fynbos Grassy Fynbos Sandstone Fynbos				
Lowland Fynbos		60.66	10.92	28.42	76.1
	Sand Fynbos Limestone Fynbos				
Renosterveld		0.72	88.15	11.14	89.2
	Swartland Shale Renosterveld Swartland Granite Renosterveld				

Of equal importance to managing and conserving healthy ecosystems are the edaphic conditions – in particular soil characteristics such as nutrient status, depth and water availability (De

Villiers et al., 2005). While Schnitzler et al. (2010) have shown that edaphic conditions drive diversity through speciation, the implication is that soil conditions largely determine species composition of communities and the occurrence of rare species. This remains true not only for the type of vegetation, but also more broadly in determining what type of ecosystem exists on any given soil environment. While Renosterveld usually occurs on relatively nutrient enriched soils derived from shales and granite, fynbos vegetation dominates some of the most nutrient poor soil environments in the world, with particularly low levels of nitrogen and phosphorous (Witkowski and Mitchell, 1987; Stock et al., 1995). Although fynbos dominates low nutrient environments, Midland and Mountain and Lowland Fynbos ecosystems are limited not primarily by nutrients but by water, and can replace Renosterveld on clay soils where rainfall exceeds 600mm per annum (De Villiers, et al. 2016). Additionally, Midland and Mountain and Lowland Fynbos ecosystem types have further specialised by adapting to different low nutrient soil environments (De Villiers et al., 2016).

A variety of other factors are important for the persistence of natural ecosystems. For instance, granite fynbos and other fynbos vegetation types with specific lithologies in the Midland and Mountain Fynbos ecosystem often depend on dense stands of pioneer plant species in the early stages of development. These pioneer plants shape favourable nutrient and light environments and may be present for 4-8 years before being replaced by fynbos. Similarly, the periodic dominance of renosterbos *Elytropappus rhinocerotis*as an over-story species naturally occurs to reset understory plant-plant interactions (De Villiers et al., 2016). In the Lowland Fynbos ecosystem, population patch size and connectivity with other surrounding limestone environments is important for maintaining healthy biodiversity.

2.1.1.2 Key Issues, Vulnerabilities and Threats

Rouget et al. (2003) highlight the following two reasons why an understanding of biodiversity threats must form an essential component of conservation planning and management: 1) conservation planning must operate within the constraints and limitations of current and future land-use changes, and 2) the spatial component of current and predicted land transformation have implications for setting objectives and targets and for implementing conservation strategies. Generally speaking, urban transformation, cultivation and invasive alien species represent the three most serious threats to biodiversity in the CFR (Wilcove et al., 1998). Currently urban development and agriculture alone account for 26% and 35% of land cover in the CMA respectively (Holmes, et al. 2012). Details of the urban cover, cultivated land, the degree of alien invasion of natural habitats and total land transformation for each of the ecosystem types are provided in Table 1 (sourced from Rouget et al., 2003).

The impacts of urban transformation are particularly severe in the Lowland Fynbos ecosystems - so much so that an area more than the total of all remaining natural habitats needs to be protected in order to meet conservation targets (Pressey et al., 2003). Urban development and informal urban sprawl therefore represents the greatest threat to biodiversity in the lowlands of the CMA. However, the wetlands, sink depressions and moister soil facies of this area are also used extensively for agriculture (De Villiers et al., 2005). To an extent, the opposite is true for the Renosterveld ecosystem; while the distance from the city center has saved the Renosterveld ecosystem from heavy urbanisation seen in the lowlands, fertile soils have resulted in intensive agricultural practices. Agriculture in the Swartland Coast Renosterveld has resulted in the transformation of almost 90% of natural habitats, leaving the remnants of this ecosystem

heavily fragmented (Rouget et al., 2003). Remarkably, the plant species composition of the fragmented Renosterveld remnants in this area appears relatively unaffected, suggesting that these remnants play an important role in species-level conservation and in maintaining Renosterveld biodiversity process (Cowling and Bond, 1991). In contrast to the Lowland Fynbos and Renosterveld ecosystems, 73% of Midland and Mountain Fynbos ecosystems fall within statutorily protected areas, namely the Table Mountain National Park, which is the beneficiary of international, city and national funding resources (Pierce et al., 2002). However, the exceptional views of the lower mountain slopes of this ecosystem provides prime real-estate and significant areas of these environments outside of protected areas have been developed.

In addition to urban transformation and cultivation, invasive alien species pose an enormous threat to biodiversity in the CFR. Invasive alien species erode natural capital, compromise ecosystem stability and threaten economic productivity of natural ecosystems (Mgidi et al., 2007). Without natural enemies to control them, invasive aliens out-compete indigenous vegetation for space, nutrients and light (De Villiers et al., 2005). In general, fynbos is more susceptible to aliens (particularly after physical disturbance and unseasonal and too-frequent fires), although Renosterveld is susceptible to invasive annual alien grasses that replace and outcompete indigenous bulbs. The enhanced biomass as a result of dense alien stands increase the intensity and temperature of fires which, in turn, changes the physical structure and composition of soil and destroys indigenous seed banks (De Villiers et al., 2016). Specifically, Limestone Fynbos in the lowlands is especially susceptible to invasion by rooikrans *Acacia Cyclops* on deeper sands and valleys between rocky outcrops. Additionally, Sand Fynbos of the lowlands is also vulnerable to the invasion of Port Jackson *Acacia saligna*, *Eucalyptus gomphocephala* and *Leptospermum laevigatum*as well as annual grasses (De Villiers et al., 2016). Midland and mountain fynbos is by far the most heavily affected in this regard and 77.2% of natural vegetation in this ecosystem contains invasive alien species, although mostly in low densities (Rouget et al., 2003). This ecosystem is predominantly susceptible to invasion by Pines and Hakea as well as *Eucalyptus* on hilly environments. However, long-leafed wattle *Acacia longifolia* tends to invade Sandstone Fynbos habitats while bramble *Rubus* invades Shale, Ferricrete, Conglomerate and Silcrete Fynbos areas. Black wattle *Acacia mearnsii* also invades heavily in riparian areas in the midland and mountain ecosystem (De Villiers et al., 2016).

Other threats to these ecosystems include altered fire regimes, monocultures of indigenous vegetation and crops, over-harvesting of indigenous plant species, groundwater abstraction, quarrying for stone and gravel, soil erosion by physical disturbance and the introduction of invasive alien fauna such as the Argentine ant *Linepithmahumile,* which can out-compete and displace important natural pollinators (De Villiers et al., 2005).

2.1.2 Ecosystem Goods and Services

The concept of ecosystem goods and services has received significant attention since the Millennium Ecosystem Assessment (MA) (2003). Ecosystems have since become well recognized as vital for maintaining and supporting human well-being, particularly through the provision of goods and services (Reid et al., 2005). The concept of ecosystem goods and services is important for the purposes of this research, as impacts associated with developments may undermine the goods and services of the ecosystem as a whole. Individuals involved in EIA therefore have an environmental, social and economic responsibility to consider the potential impacts on ecosystem goods and services as a result of a proposed activity. This subsection will

therefore briefly highlight the main types of ecosystem goods, a South African example of how the implementation of this concept has been beneficial as well as the current regulatory and policy state of ecosystem goods and services in South Africa.

The MA (2003) has identified four primary categories of ecosystem goods and services, including: i) provisioning services, such as water and food; ii) regulating services such as disease and flood control; iii) cultural services such as recreational, spiritual and cultural benefits; and iv) supporting services such as nutrient cycling. Although not identified by the MA, other categories have been recognized in the scientific literature such as 'carrying services' (providing a backdrop or substrate for human activities) or 'preserving services' which includes guarding against uncertainty through the maintenance of diversity (Van Beukering and Slootweg, 2010). Detailed studies including the economic valuation of these services are available for the Southern African region (SafMA report) and for the Cape Floristic Region (Turpie et al., 2003).

An example of the recognition of ecosystem goods and services in South Africa is elaborated on below in order to highlight the benefit of applying this concept in environmental assessment. In the South African city of uMhlathuze, biodiversity issues have led to various conflicts due to the poor socioeconomic climate of the area. In the classic 'development' versus 'conservation' debate, the local municipality is mostly in favour of development. In order to avoid delays associated with EIAs in biodiversity hotspots such as the uMhlathuze catchment area, the local authority opted to undertake a SEA. Rather than identifying strict no-go areas for development, the SEA emphasized the ecosystem services provided to the Municipality free of charge. These included water supply, water regulation, flood and drought management and nutrient cycling. The valuation process estimated the total value of ecosystem services provided by all catchments to be R1.7 billion. This approach was well received by the local politicians and resulted in the identification of the following: i) sensitive ecosystems which should be avoided; ii) supporting areas to link important ecosystems; iii) acceptable areas for development; iv) and measures for the effective management of these areas to ensure for the survival of key biodiversity assets (Van Beukering and Slootweg, 2010).

Van Beukering and Slootweg (2010) state that ecosystem goods and services are most appropriately mainstreamed through strategic planning processes, such as SEAs. An appropriate tool in the South African context might therefore be bioregional plans. However, very few bioregional plans have been produced in South Africa, and therefore have very little influence on decisions made regarding environmental authorisation for EIAs. Furthermore, NEMA and the associated EIA regulations (RSA: DEA, 2014) provide little to no compelling requirements for the consideration of ecosystem goods and services in EIA. The available policy in the Western Cape represents the most influential source of guidance on incorporating ecosystem goods and services in EIA. Most notably, the DEA&DP's official guideline for involving biodiversity specialists in the Western Cape recommends the consideration of ecosystem goods and services at all stages of report production. The consideration of ecosystem goods and services is incredibly important as a means to translate the environment into societal benefits.

2.2 BIODIVEVERSITY MAINSTREAMING AND TOOLS FOR CONSERVATION

This section will cover the various laws, policies and planning tools that streamline the conservation of biodiversity in the Western Cape. This section begins by introducing the

international platform (section 2.2.1) upon which South Africa's conservation legislation and policy is based. South Africa's legal and policy framework relating specifically to the conservation of biodiversity is then elaborated on in section 2.2.2, and includes, inter alia, details on South Africa's National Biodiversity Assessment and National Biodiversity Strategic and Action Plan. This section also discusses South Africa's tools for biodiversity planning, and includes details on informative (systematic biodiversity planning) and prescriptive (land use planning) planning components. Legislation and policy relating to EIA is intentionally omitted in this section and included in section 2.3

2.2.1 International Agreements and the Origins of Biodiversity Conservation in South Africa

The South African National Biodiversity Institute website (SANBI, 2014) describes biodiversity mainstreaming as:

"the process of incorporating biodiversity considerations directly into the policies and planning of business or industry and organs of state. Mainstreaming biodiversity ensures that addressing development needs and protecting the environment is not an either-or situation, but rather that development is supported by the sustainable use of natural resources".

The root of contemporary biodiversity mainstreaming in South Africa can be traced to the ratification of the Convention on Biological Diversity (CBD). South Africa signed as a party to the CBD in 1992 and has as such agreed to implement policies to protect and monitor the components of biodiversity at three defined levels, with a particular emphasis on those which offer the greatest potential for sustainable use and those requiring urgent conservation measures. The three levels of biodiversity determined by the CBD (1992) that require protection and monitoring are:

1. *Ecosystems and habitats* containing high diversity, large numbers of endemic or threated species, or wilderness; required by migratory species; of social economic, cultural or scientific importance; or, which are representative, unique, or associated with key evolutionary or other biological processes;
2. *Species and communities* which are: threatened; wild relatives of domestic or cultivated species; of medicinal, agricultural or other economic value; or social, scientific, or cultural importance; or importance for research into the conservation and sustainable use of biological diversity, such as indicator species; and
3. *Described genomes and genes* of social, scientific, or economic importance.

The CBD (1992) is founded on three primary objectives, which can easily be linked with the social, ecological and economic pillars of sustainable development. Firstly, the 'ecological' objective outlined by the CBD is the conservation of biological diversity which serves to maintain future options for human development and more importantly in maintaining Earth's life-support systems. Secondly, the biodiversity objective relating to the economic pillar of sustainable development is the sustainable use of components of biodiversity. This objective aims to recognize livelihood opportunities that arise from biodiversity without jeopardising the same opportunities for future generations. Lastly, the objective provided by the CBD relating to social sustainability is the fair and equitable sharing of benefits that arise from the use of genetic resources.

Similar to the three pillars of sustainable development, the three biodiversity objectives of the CBD are intimately linked and cannot be considered independently. For example, the fair and equitable use of biodiversity contributes to the conservation of biodiversity, and the sustainable use of biodiversity contributes to intergenerational equity, and so forth. Because the concept of sustainable development and the objectives of the CBD stress the interconnectedness of social, economic and ecological components, they have become vulnerable to distortion by special interest groups. For example, Slootweg et al. (2010) have noted that decision-makers in different administrative jurisdictions around the world often misinterpret this representation of connectedness in order to create trade-offs between the biodiversity objectives. The authors go on to state that the problem lies in a poor consideration of the time factor and in the distribution of power and benefits. Making trade-offs between biodiversity objectives is essentially transferring the costs to future generations or to remote stakeholders elsewhere. The trade-offs for developing countries such as South Africa often impact negatively on biodiversity as a result of the proportionally larger value placed on economic development. In an effort to overcome this, the ecosystem approach was endorsed by the CBD in 2000 (Decision V/6) which explicitly states that humans and their cultural diversity are an integral component of many ecosystems. The ecosystems approach is essentially a strategy for the integrated management of land, water and living resources in order to promote conservation and the sustainable use of natural resources in an equitable way (CBD, 2000). The application of the ecosystem approach can prevent the abovementioned trade-offs and associated costs through its aim of achieving a balance between the three objectives of the convention. This approach has meaningful implications for South Africa and has been recognized by the World Summit on Sustainable Development as an important instrument for enhancing sustainable development and poverty alleviation (CBD, 2004). The 'landscape approach' adopted by South Africa followings the same theory and will be discussed later in the sections dealing with the policy context.

The mechanisms for achieving the objectives of the CBD in South Africa can be closely related to the Articles provided by the CBD. In order to guide signatories on their selection of mechanisms for the conservation of biodiversity, specific provisions are provided in these Articles (CBD, 1992). The articles provided by the CBD which are of relevance to this study are:

(1) *Article 6 - General Measures for Conservation and Sustainable Use:* states that South Africa, as a signatory, shall in accordance with its particular conditions and capabilities, develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity. The national plans referred to in this article are the National Biodiversity Strategy and Action Plans (NBSAP) that each party is expected to submit to the convention. NBSAPs can be valuable tools to conservationists as they contain large amounts of information on biodiversity status and policies implemented.
(2) *Article 7- Identification and Monitoring:* states that all signatories of the convention shall identify components of biological diversity important for conservation and sustainable use, as well as processes and categories of activities which have or are likely to have significant adverse effects on the conservation and sustainable use of biodiversity. Furthermore, signatories are required to monitor, through sampling or other techniques, key components of biological diversity as well as to maintain biological diversity in response to the monitoring programme.
(3) *Article 14 –Impact Assessment and Minimizing Adverse Impacts:* states that all signatories shall introduce appropriate environmental impact assessment of its proposed projects that

are likely to have a significant adverse effect on biological diversity with a view to avoiding or minimizing such affects and to allow for public participation in this process.

As a signatory to this convention, South Africa has agreed to fulfil the provisions of the three articles mentioned above. These provisions have shaped the current operation of biodiversity planning, policy and legislative developments aimed at the conservation of biodiversity.

2.2.2 South African Biodiversity Conservation Legislation and Policy

Although the CBD is a non-binding agreement, its tenets can be found throughout South African legislation. The Constitution of the Republic of South Africa is the overarching legislative tool, which sets out basic environmental rights and defines the roles and responsibilities of government spheres in environmental conservation. In order to give legislative effect to the environmental right, the National Environmental Management Act (107 of 1998) (NEMA) provides the framework for environmental conservation by defining principles and procedures for environmental management, assessment and governance. The key policy tools relating to biodiversity conservation are legislated in two specific environmental management acts (SEMAs) which operate within the NEMA framework, namely the National Environmental Management: Biodiversity Act (14 of 2009) (NEMBA) and the National Environmental Management: Protected Areas Act (57 of 2003) (NEMPAA). The provisions of these acts and the requirement for South Africa to fulfil the Articles of the CBD has resulted in the publication of five key policy tools: the National Biodiversity Assessment, the NBSAP, the National Biodiversity Framework, Bioregional Plans and the National Protected Areas Expansion Strategy. The development of most of the abovementioned policies is to a large extent the responsibility of SANBI, which has the primary role of providing technical expertise on biodiversity matters in South Africa, including the coordination of biodiversity research, monitoring and reporting. SANBI also provides knowledge and information, gives planning and policy advice and pilots best-practice management models. Although the abovementioned policy tools are mostly of a proactive planning nature, they are of relevance to this study as they are used extensively to inform regulators, consultants and specialists in reactive project level assessments and will therefore be discussed in detail below.

The National Biodiversity Assessment (NBA) (Driver et al., 2011) was completed in 2011 after the first edition in 2004. The NBA represents one of the most significant contributions to biodiversity mainstreaming in South Africa to date. The purpose of the NBA is to fulfil Article 7 of CBD relating to the identification of components of biodiversity important for conservation and sustainable use. The NBA assessed the state of South Africa's biodiversity and emphasized a spatial representation of biodiversity information for both ecosystems and species (Driver et al., 2011). The outcomes of the NBA are used extensively in all avenues of biodiversity mainstreaming and form the basis for conservation in South Africa. The NBA therefore effectively represents the beginning of spatial biodiversity planning in South Africa.

The NBA is central to SANBI's mandate to monitor and report regularly on biodiversity information. It includes two headline indicators that are assessed across all environments, namely ecosystem threat status and ecosystem protection level (Driver et al., 2011). Threat status is traditionally compiled at the species level in the form of national or global Red Lists that draw attention to specific species threatened with extinction. Assessing threat status and protection levels at the ecosystem scale allows for a landscape approach to managing and

conserving biodiversity. Assessing ecosystem threat status begins with determining the ecological condition of all remaining vegetation; the NBA uses a condition status of good, fair or poor. The proportion of each ecosystem type that remained in good condition was then assessed against a series of thresholds. Firstly, the biodiversity target (BT) threshold, which is defined by Driver et al. (2011: p. 39) as "the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long term in order to maintain viable representative samples of all ecosystem type and the majority of species associated with those ecosystems". These targets are calculated based on species richness and values range from between 16% and 36% of the original extent of each ecosystem type (Driver et al., 2011). Any ecosystem type with a total area less than the BT is classified as critically endangered (CR) and the persistence of biodiversity pattern within such an ecosystem will be significantly at risk. Secondly, anything between BT and (BT+15%) is classified as endangered (EN). Finally, anything between (BT+15%) and the ecological function threshold (generally 60%) is classified as vulnerable (VU) and the persistence of biodiversity process will be significantly at risk for any ecosystem below this threshold. Anything above the ecological function threshold is classified as least threatened (LT). This information is displayed graphically below in Figure 1 (sourced from Driver et al., 2011).

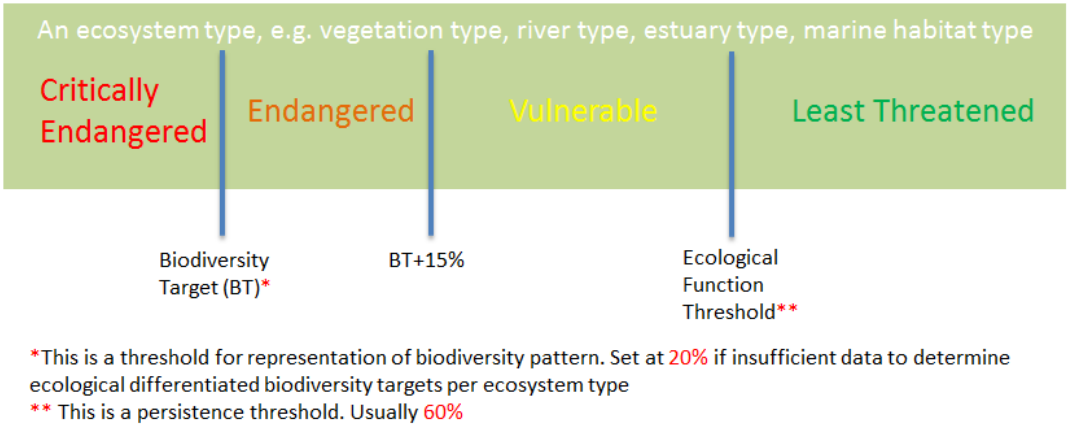


Figure 1: A graphical representation of biodiversity thresholds (sourced from Driver et al., 2011))

A "threatened ecosystem" is a term used to encompass CR, EN and VU ecosystems, which are defined by NEMBA (s52 (2)) as:

- Critically Endangered: are those ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- Endangered: refers to those ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; and
- Vulnerable: are those ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered or endangered.

The NBA used this method for determining the ecosystem threat level for all identified ecosystems in South Africa. In terms of section 52 of NEMBA, a formal list of all threatened

ecosystems has been published (GN 1002 in GG 34809 of 9 December 2011). Furthermore, a list of all threatened and protected species has also been published (GNR151 and GNR 152 in GG 29657 of 23 February 2007) in terms of section 56 of NEMBA.

The National Biodiversity Strategy and Action Plan (NBSAP) (2005) should be considered a sister document to the NBA. The contribution of threat status by the NBA is certainly important for conservation, but alone gives limited direction for conservation action. For example, while critically endangered and endangered ecosystems will always form part of priority areas for preventing further loss or degradation of habitat, there are many least threatened ecosystems that play a vital role in maintaining biodiversity process and connectivity between areas of biological importance. The role of NBSAP is therefore to fulfil Article 6 of the CBD relating to the development of a national plan for the conservation and sustainable use of biodiversity. This is done by setting an overall goal which is guided by a series of strategic objectives and priority actions to meet long term (15 year) targets (NBSAP, 2005).

The National Biodiversity Framework (NBF) is essentially a statutory plan of the NBA and NBSAP, as required in terms of section 38 of NEMBA. The NBF draws on key elements of the NBA and NBSAP and focuses attention on the immediate priorities, both spatial and thematic, over a five year period. Furthermore, a vitally important role of the NBF is allocating and coordinating the efforts of all government bodies and institutions responsible for the conservation of biodiversity. The NBF differs from the NBA and NBSAP in that there is an emphasis on coordinating biodiversity conservation and development, and statutorily informs the location and type of development and the consumption of natural resources associated in the development process. The NBF is important for the purposes of this research as it places an obligation on the relevant authorities to consider the alignment of any decisions impacting biodiversity with the NBF, such as environmental authorisation for development applications. As the NBF is informed by the NBA and NBSAP, decision-making is required to consider threatened ecosystems and species and its alignment with biodiversity spatial planning.

Bioregional Plans are policy documents created for specific bioregions as determined by the national or provincial environmental minister. The details and contents for these plans are provided for by NEMBA. Bioregions are geographical areas that contain several nested ecosystems and are characterised by articular landforms, vegetation cover, human cultures and history. As such, measures for the effective management of biodiversity in these areas are generally relatively standardised for any given bioregion. As bioregional plans are governed by the NBF, any decisions impacting on biodiversity must be aligned with its contents. Therefore, there is enormous potential for bioregional plans to act as a safeguard to biodiversity. However, the uptake of this policy tool has been limited; to date, the Nelson Mandela Bay Municipality have the only draft bioregional plan in South Africa.

The National Protected Areas Expansion Strategy (NPAES) is a policy tool aimed at conserving biodiversity through increasing the area of land statutorily protected against future development. Nationally, only 6.5% of land is conserved in protected areas (DEA, 2010), which falls dramatically short of the latest target adopted by the CBD 10 in Nagoya (the 2010 Aichi Target) of 17%. Furthermore, the current conservation estate is not representative of national biodiversity pattern. For example, in the CFR, the Cape Lowlands represents one of the most threatened regions in South Africa and should constitute a priority for protected areas

expansion, yet no funding from national or provincial government has been allocated towards expanding protected areas in this region (Holmes, 2012).

Holmes (2012) identifies two primary causes for the failure of the NPAES in the City of Cape Town (CCT) and in municipalities in general. Firstly, the emphasis on the economic viability of actions associated with the NPAES results in the selection of cheap, rural and remote land which is subject to relatively low development pressures and often does not represent land important for meeting targets of biodiversity pattern. Secondly, the failure to implement such policies in heavily degraded areas such as the Cape Lowlands is exacerbated by a poor recognition given to the potential role of local government in the NBF; as priority actions for biodiversity conservation are the mandate of national and provincial government only, local government has limited influence on implementing conservation in their areas of jurisdiction, which most often experience the highest rates of development.

The NPAES has implications for this research as protected area expansion targets can be achieved reactively through biodiversity stewardship agreements. There are a range of agreements available in South Africa for promoting biodiversity stewardship (see Table 2), varying in protection status and government input. NEMPAA provides the legislation for the two highest levels of biodiversity stewardship, which are Nature Reserves and Protected Environments. In addition to providing the highest level of legal protection against land-use changes, these forms of biodiversity stewardship are also associated with the most government support, typically in the form of financial, technical and managerial assistance (SANBI, 2014). Biodiversity Management Agreements and Biodiversity Agreements have no binding restrictions on the use of land and are associated with less protection. As these types of biodiversity stewardship agreements are not legislated through NEMPAA, they are not subject to the same regulations and standards of Nature Reserves and Protected Environments. The details and restrictions associated with Biodiversity Management Agreements and Biodiversity Agreements are dependent on the co-operation of the landowner and are usually determined on a case-by-case basis. Due to the non-binding nature of Biodiversity Agreements and Biodiversity Management Agreements, these stewardship agreements do not contribute to South Africa's national conservation estate.

While all biodiversity stewardship agreements are encouraged voluntarily by national conservation agencies, such agreements may also be conditional on the authorisation of development applications (see section 2.3.2 for the authorisation process). As such, the authority tasked with managing national parks, South African National Parks (SANParks), is required to comment on such development applications to provide insight into the implications such a project has on the goals and objectives of the NPAES.

Table 2: A summary of the mechanisms for biodiversity stewardship in South Africa (sourced from SANBI, 2014).

Type of Agreement	Legal Mechanism	Typical Contract Length	Binding on the Property	Binding on the Landowner
Nature Reserve	National Environmental Management: Protected Areas Act 57 of 2003	30-99 years or in perpetuity	Protected area declaration and title deed restriction	Contract agreement
Protected Environment	National Environmental Management: Protected Areas Act 57 of 2003	Minimum of 30 years	Protected area declaration and title deed note	Contract agreement
Biodiversity Management Agreement	National Environmental Management: Biodiversity Act 10 of 2004	5-10 years	Not binding	Agreement governed by the Biodiversity Act
Biodiversity Agreement	Contract Law	5-10 years	Not binding	Contract agreement
Biodiversity Partnership Areas	Informal Agreement		Not binding	Not binding

2.2.3 Systematic Biodiversity Planning

Driver et al., (2011: p180) define systematic biodiversity planning as, "A scientific method for identifying geographical areas of biodiversity importance. It involves: mapping biodiversity features; mapping a range of information related to these biodiversity features and their ecological condition; setting quantitative targets for biodiversity features; analysing the information using software linked to GIS; and developing maps that show spatial biodiversity priorities".

Possibly the most useful output of systematic biodiversity planning to conservationists are fine-scale spatial representations of biodiversity priority areas. Biodiversity priority areas include CR and EN ecosystems, as well critical biodiversity areas (CBA) and ecological support areas (ESA) (Driver et al., 2011). CBAs are areas important for biodiversity conservation and must be safeguarded in their natural state in order to meet the biodiversity goals of representivity (pattern) and persistence (process) (Ralston et al., 2009). CBAs include three types of areas: 1) areas requiring safeguarding in order to meet national biodiversity targets; 2) areas required to ensure the continued existence and function of species and ecosystems, including the delivery of ecosystem services; and 3) special habitats or locations where species of special concern occur. ESAs are additional supporting zones aimed at maintaining biodiversity process and preventing loss of CBAs (Maree and Vromans, 2010).

Systematic biodiversity planning was undertaken as a part of the NBA, and since then most provinces have developed, or are in the process of developing, CBA and ESA maps. However, the responsibility for producing fine-scale systematic biodiversity plans generally lies with local government. The City of Cape Town have implemented fine-scale systematic biodiversity planning, the primary product of which is the Biodiversity Network (BioNet). As the production of BioNet has been closely aligned with national legislation and policy, the incorporation of this plan into the SDF has been relatively successful, especially outside the urban edge (Holmes, 2012). Fine-scale systematic biodiversity planning in South Africa has also received international support; for example, the Cape Action Plan for People and the Environment (C.A.P.E) (Pence, 2008) is a partnership project between the provincial conservation agency,

CapeNature, the Global Environment Facility and SANBI. C.A.P.E has produced fine-scale systematic biodiversity plans for nine municipalities in the CFR. As noted by Holmes (2012), fine-scale systematic biodiversity plans can be subject to conflicts with land use designations made by municipal SDFs. This author goes on to state that these conflicts will only be resolves through the impact assessment process.

A well-known criticism of the impact assessment process is that it is mostly carried out reactively at the project level and fails to account for the broader context in which the application occurs (Ralston et al., 2009). Given the ability of CBA and fine-scale maps to identify off-site and/or cumulative impacts of a proposed development, these instruments can therefore dramatically assist EIA with fulfilling its central, if neglected, role as a safeguard to threatened biodiversity (IAIA, 2005). It has been noted by a variety of authors (De Villiers, 2003; Brownlie et al., 2005; De Villiers and Hill, 2008) that even the use of broad-scale systematic biodiversity planning can introduce significant improvements to the quality of impact assessment and can help stem biodiversity loss in off-reserve contexts. The use of fine-scale systematic biodiversity plans such as CBAs can improve the effectiveness of EIA as a biodiversity safeguard in a number of ways. This includes presenting a readily available red-flag system, providing a strategic overview of a project's biodiversity context, and in supporting ecosystem-scale assessment and evaluation of potential impacts in project-level environmental assessments (Ralston et al., 2009). Furthermore, the use of CBA maps is advocated by the Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape (De Villiers et al., 2005) in a proactive approach by supporting biodiversity-conscious planning and design at the earliest stage of project development.

2.2.4 Land Use Planning

Land use planning is the mandate of local government, however provincial and national government are occasionally called on for support in this process. Land use planning in South Africa includes forward-looking, informative aspects such as spatial planning as well as prescriptive tools pertaining to land use management. Both the informative and prescriptive aspects of land use planning play a significant role in biodiversity conservation and are therefore discussed below.

Although prescriptive land use management tools such as zoning schemes and title deed restrictions have obvious implications for changes in land use and biodiversity conservation, they are of little relevance to this study. As the consideration of applications to rezone or remove title deed restrictions depends on the same factors that are dealt with in the EIA process, these two processes are almost always dealt with concurrently. Furthermore, the approval of a rezoning or removal of title deed application is generally dependent on receiving environmental authorisation in terms of section 24 of NEMA. This is because successful applications for rezoning or the removal of title deed restrictions do not exempt the landowner from receiving environmental authorisation for the intended activity. This setup is therefore highly beneficial to the conservation of biodiversity as it requires landowners to provide an environmental motive for their applications to rezone or remove title deed restrictions.

Spatial planning and the policy tools that arise from this practice have significant potential to influence biodiversity conservation at the municipal level and to inform decision-makers in project level assessments. The policy tool with the most potential to implement projects at the

municipal level is the integrated development plan (IDP), which is essentially a five year municipal business plan. However, Holmes (2012) notes that none of the focus areas in the City of Cape Town IDP includes management or conservation of the natural environment as a key element. The implications of this are profound and the result is no allocated budget for biodiversity conservation in the City of Cape Town. Furthermore, the local conservation sector in this area, the Biodiversity Management Branch (BMB), is heavily under-resourced and its ability to utilize spatial planning to influence biodiversity conservation in the City of Cape Town is undermined by a lack of financial support and recognition in the IDP. Notwithstanding, the conservation sector has managed to influence the IDP through associating conservation with municipal goals, such as directly linking natural resource management and job creation with the IDPs strategic focus area of 'an opportunity city' (Holmes, 2012).

Another way for the conservation sector to influence spatial planning is through a policy tool embedded within the IDP, the Spatial Development Framework (SDF). The SDF is essentially a spatial plan that represents areas best suited to urban development as well as areas that should be protected against development (City of Cape Town, 2013). In this way, it provides guidance to decision-makers regarding the appropriateness of development proposals as well as to private investors regarding the most viable investment options. The BMB has had relative success with integrating conservation concerns into the SDF through fine-scale systematic biodiversity planning.

2.3 ENVIRONMENTAL IMPACT ASSESSMENT

Since the elaboration of the concept of sustainable development in the Brundtland Report (WCED, 1987), there was a growing realization in the world of the need for an integrating framework to deal with social, economic and environmental factors in project level assessments. The legal home for such a framework in South Africa is contained within Chapter 5 of NEMA, which states the primary objective of integrated environmental management (IEM) as (NEMA s23(b)):

"To identify, predict and evaluate the actual and potential impact on the environment, socioeconomic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management"..

While IEM encompasses a range of different tools for achieving the abovementioned objective, the tool of most relevance to this research is that which applies to reactive project-level development applications. NEMA has defined Environmental Impact Assessment (EIA) as the prescribed tool for assessing and evaluating the potential impacts associated with development applications. The process of assessment involves impact identification (typically through the provision of scientifically credible data) as well as the process of impact evaluation, which is predominantly driven by social variables such as values, preferences and ethics (Hill, 2005). As biodiversity conservation is a process dependent on assessment and evaluation, understanding these components is vitally important when investigating the effectiveness of EIA as a biodiversity safeguard. Therefore, in the context of biodiversity, this section will discuss the theoretical basis upon which best-practice EIA operates as well as the procedural framework for EIA in South Africa.

2.3.1 EIA's Purpose and Effectiveness

Since the first formal establishment of EIA by the US National Environmental Policy Act (NEPA), the speed at which EIA spread internationally resulted in limitations in procedural provisions for, and effectiveness of, EIA in different jurisdictions (Cashmore, 2004). This is partly due to the inconsistency in EIA methodologies and lack of reporting on the effectiveness of methodologies and outcomes, which greatly hampers the accumulation of knowledge and growth of best-practice EIA (Slootweg et al., 2010). Another reason is that the objectives of EIA practice are often poorly defined and vary greatly in different jurisdictions.

While specific objectives are rarely identified, it is more common that EIA is conducted through a multi-objective philosophy (Brown and Hill, 1995). Traditionally, a major objective of EIA is viewed as the provision of environmental advice to decision-makers (Hill, 2005; Jay et al., 2006). Another universal objective of particular relevance to this research relates to the use of EIA to mitigate environmental effects of projects (Jay et al., 2006). While these two objectives are common in the practice of EIA throughout different countries and administrative jurisdictions, many other objectives have also been incorporated that are not necessarily as widely practiced. Examples of such objectives include those relating to changing the nature of decision-making and those relating to EIAs ability to interact with the design process.

Since its global uptake, there has been no shortage of studies into how effective EIA has been in meeting the procedural requirements as determined by different administrative jurisdictions and regulatory bodies. The process of investigating the degree to which EIA achieves its procedural requirements is known as the 'procedural effectiveness' of EIA (Jay et al., 2006). The evaluation of EIA procedure in South Africa has received considerable attention and has been marked by three successive publications of EIA regulations since the promulgation of NEMA in 1998. However, increasing attention is being placed on evaluating EIA according to more substantive outcomes, such as whether EIA is resulting in the kind of outcomes that are typically sought (Cashmore et al., 2008). In the realm of EIA effectiveness, developing theory on the substantive effectiveness of EIA is the process of evaluating the outcomes, or the degree to which objectives are attained.

Evaluating the substantive effectiveness of EIA is essentially aimed at determining how much of a difference EIA is actually making (Jay et al., 2006). However, it is difficult to define, in a measurable way, the various aspects of environmental quality that might be improved as a result of EIA. This issue is confounded by the elusive concept of sustainable development, which is increasingly being adopted as the primary goal of EIA, but remains poorly defined (Jay et al., 2006). Conceptually there has been a shift in sustainable development theory. Conventional theory, as represented by the 'venn diagram' model, suggest that sustainable development practices should strive to achieve a balance between social, economic and ecological aspects (Slootweg et al., 2010). A more contemporary notion of sustainable development is represented by a 'nested egg' model, whereby environmental aspects fully encompass social and economic components. This model is based on the principle that all economic activities should be aimed towards social progress and that this must be achieved within environmental limits.

Sustainable development is ensured in South Africa primarily by NEMA. Section 2 of NEMA sets out the principles by which environmental management must be practiced, and many of these are specifically aligned with the notion of sustainable development. For example, section 2(3) of

NEMA states that, "development must be socially, environmentally and economically sustainable" (NEMA 107 of 1998). While NEMA principles set out the broad framework by which environmental management must be practiced, sustainability assurance in South African EIA is primarily achieved through the generation of scientifically credible data. South African EIA typically strives to achieve its objectives by providing clear, well organised information on the environmental effects, consequences and risks of development proposals. The generation of information in EIA is controlled by specific procedures, which in the case of South Africa is legally regulated by NEMA. Furthermore, EIA procedure in South Africa is guided by a suite of best-practice policy documents, which too have the primary objective of achieving sustainable development. Lafferty and Hovden (2003) identify environmental policy integration into non-environmental policy sectors (such as development regulation) as a defining feature of sustainable development. Therefore, complying with EIA procedure and best-practice policy is of utmost importance for achieving EIAs primary purpose of ensuring sustainable development.

2.3.2 EIA Procedure and Best-Practice in South Africa

In South Africa, it is NEMA that sets out the framework for IEM in general, while the EIA regulations (RSA: DEA, 2014) set out the specific procedural requirements relating to EIA. These regulations contain the following important procedural provisions: timeframes; general requirements; standards for authorisation applications; provisions for auditing compliance with environmental authorisations/environmental management programmes; as well as the provisions for public participation in EIA. An important aspect of EIA in South Africa is that applications must be compiled independently by an Environmental Assessment Practitioner (EAP) (RSA: DEA, 2014; reg. 14). The EAP should have no vested interests in decisions regarding project authorisation and are ethically bound to represent the best interests of the environment (that is, the biophysical and socio-economic environment). The procedural requirements for incorporating biodiversity into EIA will be discussed below in terms of assessing impacts, planning for management as well as how this relates to decision-making and public involvement.

2.3.2.1 Environmental Impact Assessment

The first step in the lifecycle of a development application process is determining the need for, and the scale of, an EIA. This process is internationally recognized as the screening stage and should take place concurrently with project conception (Brownlie et al., 2006). While NEMA's duty of care provision (s28) requires all persons to legally inquire into any potentially environmentally harmful actions, the screening process in South Africa is streamlined by the production of lists of activities that are known to have a significant detrimental effect on the environment. Three lists of activities are regulated which categorise impacts in terms of their scale and significance, which in turn inform the level of assessment to be undertaken. South African legislation distinguishes between relatively low-impact activities (listing notice 1 and 3) requiring the proponent to undertake the less intensive Basic Assessment Report (BAR) and relatively high-impact activities (listing notice 2) which require the full Scoping and Environmental Impact Report (S&EIR). The requirements of the full S&EIR will be emphasised in this research as it is assumed that these will adequately encompass all procedures relating to biodiversity in EIA. Significantly, certain geographically distinct activities contained in listing notice 3 will always trigger if they occur within CBAs or ESAs as identified by recognized conservation plans and bioregional plans. Furthermore, listing notice 3 also contains activities

that are known to be harmful in critically endangered and endangered vegetation as determined by the NBA. These provisions therefore represent an important regulatory mechanism which incentivises impact avoidance through planning and design. This provides a good example of how procedural provisions can contribute to the conservation of biodiversity.

The term 'fatal flaw' is often used by best-practice literature and should be identified in the screening stage to evaluate whether or not an identified impact would have a 'no-go' implication for the project (Brownlie, 2005). In terms of biodiversity, fatal flaws are usually associated with impacts that result in the irreplaceable and/or irreversible loss of biodiversity (DEADP, 2011). A pre-application biodiversity-specific screening process is advocated by the Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape (De Villiers et al., 2005),which involves the use of spatial biodiversity plans to identify site-specific opportunities and constraints at the conception of the proposal. The benefit of this approach is two-fold; firstly it contributes significantly to avoiding impacts through planning and design and secondly it improves the efficiency of EIA by identifying obstacles prior to the application that would otherwise result in delays and additional costs to the project proponent (De Villiers et al., 2016).

Once the EAP has determined the level of assessment to be undertaken in the screening process, a pre-feasibility study is to be undertaken which is internationally recognized as the scoping stage. Slootweg et al. (2010) emphasise the importance of biodiversity scoping because it is at this stage where the necessary quality and quantity of biodiversity input is determined. Therefore, it is at the outset of the scoping stage that the EAP must consider the appointment of a biodiversity specialist. The triggers for involving a biodiversity specialist are, inter alia: legal triggers (removing or trading of threatened vegetation); lack of information; potential threats to important biodiversity pattern, process and/or ecosystem services or any other situation where the receiving environment is subject to potential threats as a result of the activity (Brownlie et al., 2006).

The role of the biodiversity specialist at the scoping stage should be reflective and advisory by providing insight into key biodiversity issues and aspects of the development that will require further investigation. At this stage, the specialist must also provide insights into indirect impacts (the physical footprint of non-project activities, for example off-site impacts or the disturbance of ecological processes such pollination or fire) and cumulative impacts (the contribution the proposal makes towards overall impacts occurring in the project landscape) as a result of the proposal (Hardner et al., 2015). Biodiversity scoping should not be a quantitative undertaking by the specialist, but rather a process to identify biodiversity aspects which will require further detailed (often quantitative) investigation in the impact assessment process (Brownlie et al., 2006).

The EAP should use the information generated in the scoping exercise to draw up the terms of reference to be addressed in the impact assessment report. Terms of reference are essentially a set of questions that must ensure that uncertainties, risks, gaps in information and the implications for decision-making are adequately addressed (Brownlie, 2005). In England and the Netherlands, it was found that a lack of formalised procedures and an inconsistency in methodologies greatly undermined the input of adequate biodiversity data necessary for making informed decisions on development proposals (Thompson et al., 1997; Geneletti, 2002). Furthermore, two international studies evaluating the treatment of biodiversity in EIA found a very poor representation of ecological process (Pritchard, 2005) and ecosystem services

(Gontier et al., 2006). This is in part due to inadequate terms of reference which state the need to address these issues in the early stages of the project lifecycle. While the terms of reference for a proposal should always be case-specific, De Villiers et al. (2016) have drawn up some generic terms of reference which proposals in the CFR should draw on as a minimum requirement. This approach helps to avoid the inadequate provision of biodiversity data and to ensure the effective investigation of impacts on biodiversity pattern, process, and ecosystem goods and services.

Significantly, the objectives of the CBD (conservation, sustainable use and equitable sharing of biodiversity) seldom translate explicitly into the terms of reference in EIA. This is because it is assumed that the CBD objectives are adequately addressed in the concept of ecosystem goods and services. Slootweg et al. (2010) identify this to be an international fatal flaw in EIA; because of the limited attention given to ecosystem goods and services, a means for translating biodiversity into social values (social and economic) in EIA is effectively non-existent. The concept of ecosystem goods and services is poorly incorporated into the South African EIA regulations (RSA: DEA, 2014), despite being recommended by various best-practice literature and guideline documents for this region (Brownlie et al., 2005; Brownlie et al., 2006; CBD, 2006; De Villiers et al., 2016). However, it should be noted that while the concept of ecosystem goods and services are not present in the EIA regulations, many NEMA principles (Act 107 of 1998: Chapter 1) do in fact cover certain aspects. It is argued here that these principles should be converted into explicit EIA regulations in order to improve the consideration of ecosystem goods and services in EIA. The value of biodiversity in EIA, in the absence of an adequate consideration of ecosystem goods and services, will most often be underrepresented.

Arguably one of the most important requirements of the scoping stage in South Africa is the mandatory provision of alternatives. Hill (2009) notes that the determination of alternatives is closely linked to the stated need (also a legal and best-practice requirement of the scoping stage); a broad stated need will allow for the identification of a wide range of alternatives .Many references to alternatives in EIA legislation often refer to 'reasonable' alternative options. While EIA regulations in South Africa practically define alternatives in terms of project location, layout, technology and type of activity, Schmidt (1993) argues that any alternative that meets the desired need of the proposal should be interpreted as an acceptable alternative. Importantly, the definition of alternatives in the EIA regulations states that it must include the alternative of 'no-go'. The benefits of a mandatory requirement for including a no-go alternative to development are twofold. Firstly, it provides a means for evaluating other alternatives against the no-go alternative, or baseline environment, which may be subject to threats unrelated to the development (Hardner et al., 2015). Secondly, the no-go alternative also provides a means for identifying existing opportunities and constraints to the impacts on extant biodiversity (DEAT, 2004). The requirement to produce alternatives therefore plays an important role in contributing to the avoidance of impacts through planning and design. However, it has been noted by DEAT (2004) that feasible alternatives may be deliberately omitted, and that the failure to consider a full range of feasible alternatives at the outset is often indicative of a symptomatically biased approach towards EIA that inherently defends a given project proposal.

The final submission when applying for environmental authorisation represents the integration of aspects of the scoping report and the impact assessment, known as the S&EIR. The process of assessing impacts is largely an objective and scientific/technical exercise whereby data is

actively gathered by the specialist relating to the nature and intensity (severity and magnitude) of the impacts on biodiversity (Brownlie, 2005). The official criteria used for the assessment of impacts are (Brownlie, 2005):

- Extent – refers to the spatial area of influence and the site-specific, regional, national and international extent of the impact should be differentiated by the specialist;
- Duration – the lifetime of an impact must be defined in terms of whether the impact is short term (construction phase), medium term (operational phase), long-term (beyond operation) and whether the impact is transitory or permanent;
- Intensity/Magnitude – relates to the size of the impact or its severity, which should be categorised as low (negligible impact on biodiversity), medium (pattern, process and ecosystem services affected but recoverable) and high (significant effect on biodiversity resulting in irreplaceable loss);
- Probability – refers to the likelihood of the impact occurring and should be classified as improbable, probable, highly probable and definite;
- Significance – this should be used as a rating for specialists/EAPs to synthesise the aforementioned criteria for assessing impacts, and should include classifications of low (negligible effect on decision-making), medium (must influence decision-making), high (major influence on decision-making) and very high (should be central consideration in decision-making) significance.

Once impacts have been identified and assessed, they must then be evaluated. Impact evaluation involves the consideration of scientific biodiversity data (generated in the assessment process) with the social context and value system of affected individuals. Guiding documents for biodiversity specialists therefore recommend that during evaluation, impacts need to be interpreted within the context of international conventions, and national, provincial and local laws, policies, plans and strategies. This suite of documents represent a reflection of the values of the broader society (Brownlie, 2005). Public participation is also therefore key to evaluation as this is the primary avenue (apart from indirectly through policy) whereby parties interested in or potentially affected by the development can express their values relating to specific impacts identified in the assessment process. One way to integrate values into decisions on technical assessments is through a multi-criteria decision analysis which involves a set of actions (alternatives and associated mitigation), criteria (identified impacts) and at least one decision-maker (Greco, 2005). This process involves a sensitivity analysis whereby the various impacts of different alternatives are weighted depending on the values associated with them.

The final submission of the S&EIR process includes a set of draft documents for post-authorisation management that must be submitted prior to the decision regarding project authorisation. The framework document for this process is the Environmental Management Programme (EMPr), which must contain details of, or result in the development of additional documents relating to: planning and design; pre-construction and construction activities; post-construction rehabilitation and management measures for project operation and mitigation of residual impacts. Importantly, the EMPr also provides for the details pertaining to monitoring and reporting of environmental performance in the post-authorisation stage of the development.

2.3.2.2 Biodiversity Mitigation

Most developments that require an EIA will have residual impacts on biodiversity. Arguably the primary role of EIA in safeguarding biodiversity is therefore to mitigate and to manage these impacts. Slootweg (2010) states that the purpose of mitigation in EIA is to look for ways to achieve the project objectives while avoiding negative impacts, or reducing them to acceptable levels. The mitigation hierarchy is a globally accepted framework for managing risks and potential impacts related to biodiversity and ecosystem services. The cross-sector biodiversity initiative (CSBI, 2015: p 8) defines the mitigation hierarchy as:

"the sequence of actions to anticipate and avoid impacts on biodiversity and ecosystem services; and where avoidance is not possible, minimize, and, when impacts occur, rehabilitate or restore; and where significant residual impacts remain, offset."

The mitigation hierarchy may be applied to any planning and implementation of developments and should not be considered a standard or goal, but rather a means for achieving biodiversity goals such as no net loss (NNL) or a net positive impact (NPI) (CSBI, 2015). NNL can be defined as the point at which a project's impacts on biodiversity are balanced by the application of the mitigation hierarchy so that no loss remains. When the gains are greater than the losses, there is a NPI (CSBI, 2015).

Given that mitigation actions are present in a hierarchy, avoidance is considered the most favourable action whereas offsets are considered least favourable. The three types of avoidance can be achieved through site selection, project design and scheduling (CSBI, 2015). As EIA may not have an influence on site selection and a limited influence on scheduling, the primary contribution EIA makes to avoiding impacts is through planning and design in the screening and scoping stages, particularly in the development of alternatives (see discussion on impact assessment earlier in this section). Discussions pertaining to mitigation here will therefore focus on minimization, restoration/rehabilitation and offsets. In accordance with the hierarchy, it must be assumed that all efforts to avoid impacts have been made before any other mitigation is pursued. A brief definition of the remaining mitigation measures is provided below (CSBI, 2015):

- Minimization refers to measures taken to reduce the duration, intensity, significance and/or extent of impacts (including direct, indirect and cumulative) which cannot be avoided. This includes physical controls (adapting existing design), operational controls (managing and regulating the actions of people) and abatement controls (steps to reduce levels of pollutants).
- Restoration refers to measures taken to repair degraded or damaged biodiversity features; restoration must be interpreted as an additional conservation action and should not contribute to the loss/gain of biodiversity associated with a project.
- Offsets are measurable conservation actions applied to areas not impacted by the project that compensate for adverse impacts of a project.

Residual impacts associated with project proposals are increasingly being recognized as unavoidable, and the benefit that offsets can make to achieving net biodiversity gain is becoming increasingly more popular. The concept of biodiversity offsets is premised on a 'no harm' principle (Slootweg et al., 2010) and objectives range from no net loss to net gain of biodiversity (Ten Kate et al., 2004). While the scope of offsets in the international debate

encompasses conservation-orientated actions as well as a wide range of market-based approaches (Slootweg, et al., 2010), the Western Cape has three offset distinctions (Department of Environmental Affairs and Development Planning, 2011), which are: 1) securing habitat for conservation in-situ or ex-situ; 2) provision of financial guarantee up-front to stand surety for future securing of habitat; or 3) the provision of monetary compensation to be used for biodiversity conservation. Although DEADP are currently developing a Business and Biodiversity Offsets Programme (BBOP) 'accounting' approach to offsets, the primary approach for determining biodiversity offsets in the Western Cape is a ratio-based adjustment approach. This calculates the amount of offset land required depending on a variety of factors such as whether the project proposal occurs within the urban edge (which decreases the ratio-based adjustment) or on the threat status of affected vegetation (in which case the ratio-based adjustment increased with greater threat) (DEADP, 2011). Importantly, residual impacts of very-high significance (impacts on CBAs or critically endangered vegetation) should represent a fatal flaw in a project proposal and a biodiversity offset should theoretically be incapable of compensating for such irreplaceable and/or irreversible loss (DEADP, 2011).

2.3.2.3 Decision-making and Public Participation

Decision-making and public participation are key inputs that are regulated at various stages in the EIA lifecycle. Because the environment cannot speak for itself, these inputs are fundamentally important in promoting the conservation of biodiversity by aligning decisions with national policy and societal values – particularly the values of those affected by the proposed activity. 'Governance' is a widely-debated term which emerged from the general acceptance that decisions impacting on both the environment and society must be made in a dispersed, decentralised manner. Governance is therefore a complex and multi-dimensional concept which incorporates three key democratically determined components: 1) a guiding philosophy of agreed operating principles (largely through constitutional provisions); 2) a preferred process that guides the way people interact with each other and administrative authorities (such as the EIA and/or biodiversity conservation regulations); and 3) a desired set of outcomes which are contained within a country's hierarchy of conventions, protocols, policies and strategies (such as the CBD, the NBA or the NBSAP) (Brownlie, 2005).

In order for any administrative authority to implement best-practice governance, or 'good governance', Brownlie (2005) advocates five common principles by which governance should operate: 1) transparency in decisions; 2) participation in the quality, relevance and effectiveness of policies, legislation and practice; 3) accountability in decisions; 4) effectiveness relating to the efficient use of resources and the achievement of targets, goals and/or objectives; 5) coherence and consistency of decisions to ensure that all participants understand administrative actions. While the South African government is expected to operate in accordance with internationally accepted principles of 'good governance', NEMA provides legal reassurance of these principles by ensuring co-operative governance (Chapter 3), fair decision-making and conflict management (Chapter 4) as well as other administrative requirements such as the process for appealing decisions (s43). Additionally, this is further reiterated on a constitutional level by the Promotion of Administrative Justice Act (PAJA) (Act 3 of 2000), which ensures that all administrative actions must be lawful, procedurally fair and reasonable.

There are three decision inputs and two public participation inputs (Figure 2) into the South African EIA lifecycle. Public participation in South Africa is managed by the EAP. An individual

may register as an interested and affected party (I&AP) and may submit comments, complaints and other issues relating to the development. This process must be conducted for a minimum of 30 days for any public participation process in EIA (reg 3(8)). The first public participation input into EIA occurs at the draft scoping report stage. This is arguably the most important stage of public participation in EIA, as it allows those affected by the development to identify issues to be investigated in the impact assessment. The second public participation process occurs in the finalisation of the draft EIR. At this stage, public participation is key as the values of the public are a pivotal consideration in impact evaluation. As the scoping report must be produced within 44 days, which must contain a minimum of 30 days of public participation, the scoping report must essentially be drafted within the first two weeks of acceptance of the application for authorisation. This represents one of the many instances where time constraints hamper the effective implementation of EIA. Another time constraint, that is known to hamper the effectiveness of biodiversity inputs into EIA, is that specialist studies are usually only conducted during a single season, which, particularly for vegetation, limits the opportunity to identify the amount and value of biodiversity. In these situations biodiversity will usually be underrepresented. For this reason, Brownlie (2005) notes that clearly stating confidence, uncertainties and limitations in predictions must always be made when assessing and evaluating impacts on biodiversity.

The first decision (Figure 2, decision 1) regarding the consideration of an application for environmental authorisation is vitally important in EIA for two reasons. Firstly, this decision point contributes to the efficiency of EIA by providing an opportunity at the earliest stage for the competent authority to bypass the necessity for undertaking an EIA where a proposal is foreseen to result in negligible impacts on the environment and society. The United States also implement this by means of the publication of a Finding of No Significant Impact (FONSI) report (CEQ, 2005). Secondly, it is at this stage where the competent authority is required to consider the need and desirability of the proposal (regulation 18). In the guidelines for need and desirability in EIA (GNR 891 of GG 38108), ecosystem protection and strategic planning are mandatory considerations when evaluating the need and desirability of a proposal. This therefore gives the competent authority autonomy in rejecting an application at the earliest stage of EIA when the impact on ecosystem protection will be too significant or where the project is in direct conflict with strategic planning objectives. Depending on the impact information provided to the competent authority, the authority may also reject a proposal after acceptance of the scoping report or the full EIR.

The final decision (Figure 2, decision 3) is one where the proposal may be rejected or authorised after the consideration of, and public participation in, the final EIR. If the proposal is approved by the competent authority, an Environmental Authorisation (EA) document will be signed by the competent authority and sent to the applicant. The EA represents a document that details the legal requirements of the applicant, which in terms of biodiversity and mitigation, are often present in conditions of authorisation (CoA). The monitoring of compliance with environmental authorisations – in instances where conditions of authorisation apply to biodiversity – offers a promising opportunity for investigating whether environmental assessment does, in fact, act as an adequate and effective biodiversity safeguard.

2.3.2.4 Compliance Monitoring and EIA Follow-up

Conditions of authorisation represent the 'teeth' of the environmental regulatory regime and compliance is therefore the crux to 'sustainability assurance' (Glazewski, 2000). However, the degree of compliance with such conditions is widely questioned (Brownlie and Wynberg, 2001), and the ability of the State to review compliance is constrained. In terms of the EIA regulations, conditions of authorisation must be given effect through the implementation of the EMPr, which is often contingent upon the appointment of an Environmental Control Officer (ECO) to manage the stipulations of this programme. The EIA regulations state that the purpose of an EMPr is to ensure compliance with conditions of authorisation, but also to impose a binding obligation on the developer for the submission (since the promulgation of the 2014 EIA regulations) of an audit report. The latter must include details regarding the level of performance and compliance of a project with the conditions of authorisation as well as the extent to which the provisions of the EMPr sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the activity. This provision therefore represents a significant quality assurance control mechanism regarding the substantive outcomes of the conditions of authorisation.

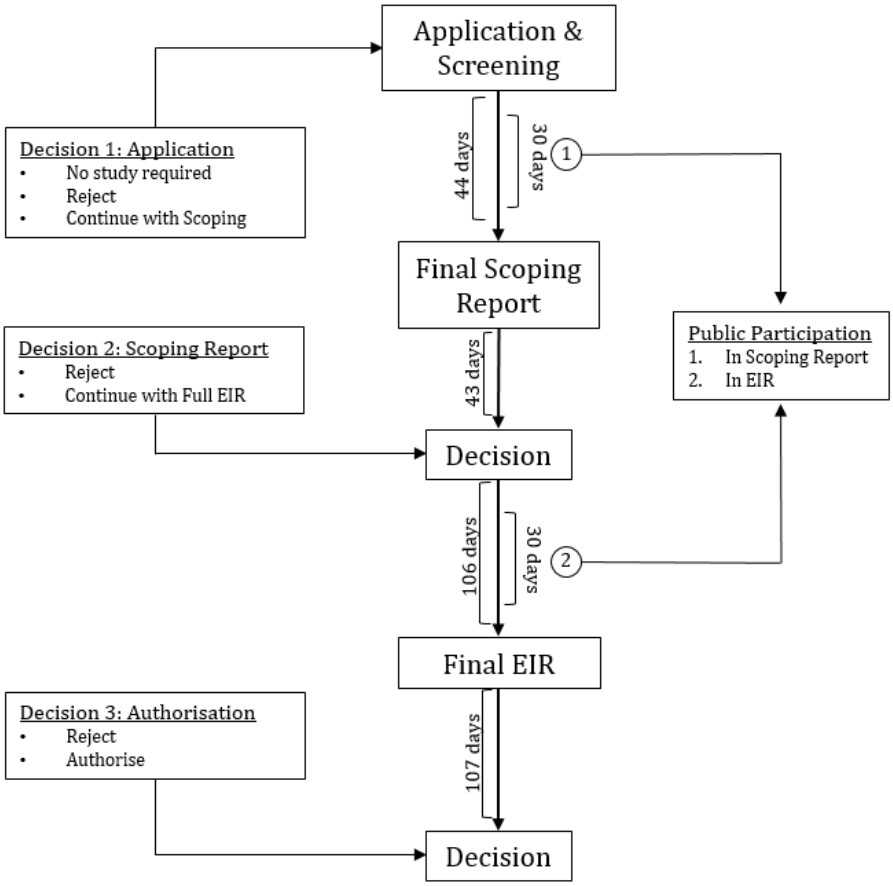


Figure 2: Decision-making, public participation and timeframes in S&EIR in South Africa

In South Africa, a variety of compliance monitoring obligations are imposed on development applicants throughout the lifecycle of the EIA process. While monitoring must be considered at

various stages, the details including the method, time periods, mechanisms and program for reporting monitoring must be contained in the Environmental Management Programme (EMPr). Morrison-Saunders et al. (2007) suggest that compliance monitoring should form as a sub-set of a more inclusive set of activities these authors describe as 'EIA follow-up'.

Morrison-Saunders and Arts (2004: p 1) define EIA follow-up as "the monitoring and evaluation of the impacts of a project or plan (that have been subject to EIA) for the management of, and communication about, the environmental performance of that project or plan". These authors state that the purpose of EIA follow-up is, inter alia, to provide feedback on EIA outcomes such as whether impacts were mitigated and managed in accordance with approval conditions set by decision-makers. While this purpose fits closely with that of the 'compliance monitoring' role of follow-up, it would also be highly relevant to a more focussed assessment of the outcomes in relation to biodiversity-related conditions of authorisation. Including monitoring, EIA follow-up comprises of the four key elements listed below (Arts et al., 2001):

- Monitoring – or the collection of activity and environmental data both before (baseline monitoring) and after activity implementation (compliance and impact monitoring);
- Evaluation – or the appraisal of a development in terms of how it conforms with standards, predictions and/or expectations as well as the environmental performance of the activity; evaluation explicitly involves value judgements;
- Management – or making decisions and taking appropriate action in response to issues arising from monitoring and evaluation activities; and
- Communication – informing stakeholders about the results of the EIA follow-up, in order to provide feedback on project/plan implementation as well as feedback on the EIA process.

Marshall et al. (2005) have highlighted the need for EIA follow-up, which hinges broadly on the following factors:

- It is essential for determining the outcome of an EIA: by incorporating feedback into the EIA process, follow-up enables learning to occur and prevents EIA being just a pro forma exercise;
- Follow-up links the pre- and post-decision stages of EIA, thereby bridging the gap (and resolving the uncertainty) that can arise between project plans, stated intentions and substantive outcomes for the environment in general and biodiversity in particular; and
- Follow-up provides information on the substantive as opposed to predicted impacts, allowing decision-makers and implementers to adopt preventative, mitigation or remedial measures that address real as opposed to anticipated effects.

The benefit of EIA follow-up is that it has a wide range of applications in terms of scale. Follow-up can be limited to monitoring and evaluating individual projects (probably the norm in South Africa) or it can be directed at examining entire systems for EIA or even strategic environmental assessment (SEA) (Marshall et al., 2005). In terms of applying follow-up to systems, DEADP has investigated applying this theory on a sectoral basis (e.g. wastewater treatment or property development) and have referred to this as a compliance review strategy.

While the value of compliance monitoring in environmental law enforcement is certainly significant, Hulett and Diab (2002) state that environmental assessment in general

demonstrates limited practical concern for the auditing and monitoring of post-authorisation impacts when compared to the effort that goes into the EIA stages preceding a decision. Additionally, Wessels et al. (2015) argue that the current application of compliance monitoring in post-authorisation phases of the development lifecycle add very limited learning opportunities to the EIA process due to a general absence of feedback mechanisms which allow for positive change. This arguably represents one of the most significant short-comings of integrated environmental management and biodiversity conservation in South Africa.

A senior official in the Chief Directorate: Environmental Impact Management in the former Department of Environmental Affairs and Tourism stated that "compliance monitoring and the auditing of the effectiveness of environmental management are poorly developed and we do not really have scientific evidence of the effectiveness of EIA post decision-making" (McCourt, 2009). More specifically, an assessment of the integration of biodiversity in impact assessment and decision-making in South Africa found that there is no clear understanding from either the authorities or key stakeholders on the existence of effective checks on the implementation after decision-making, although most participants in the study were of the opinion that the status quo in this regard is inadequate (Brownlie et al., 2006).

In the Western Cape, the majority of the monitoring responsibilities fall with DEADP. This department has set a capacity target for compliance inspections in this regard, stating the objective of conducting an average of 200 compliance inspections in any given financial year (DEADP, 2011). However, the actual number of compliance inspections may be more or less than this figure due to a fluctuating percentage of cases as a result of the varying number of authorisations. The primary limiting factor for conducting compliance inspections of post-authorisations developments can be attributed to staff constraints. In DEADP's 2010/2011 annual report, the vacancy rate (percentage of posts that were not filled as per the funded post establishment) for the compliance and enforcement sector responsible for compliance monitoring was 25.9%. Interestingly, the sector responsible for biodiversity management had the highest vacancy rate, reflecting that 42.9% of funded posts were not filled. The inadequate capacity in this regard undoubtedly impacted on the ability of the department's compliance section to undertake post-authorisation monitoring, a conclusion that was shared by a comprehensive study into national EIA administrative capacity (DEAT, 2008).

Inadequate EIA follow-up is not unique to South Africa or the Western Cape. The first attempt to standardize follow-up guidelines in the international EIA arena occurred in 2005 (Marshall et al., 2005). Sadler (2004) stated that EIA follow-up is poorly developed in many systems and effectiveness and performance reviews are carried out superficially or not at all. While the status quo of post-authorisation monitoring in South Africa undoubtedly provides for a useful source of information, the purpose of such monitoring differs from the compliance review proposed by this research. For example, monitoring in support of potential law enforcement actions would not necessarily yield the type of learning opportunity, or support for adaptive management, that is described in the EIA follow-up literature (e.g. Marshall et al., 2005). Through the lens of biodiversity conservation, this research seeks to address this apparent short-coming by developing an adaptive management framework which links pre-authorisation information generated by EAPs and biodiversity specialists with post-authorisation implementation success.

2.3.3 Roles and Responsibilities

This section will briefly outline the roles and responsibilities of the key individuals involved in EIA during the application and during operation. The key individuals involved are the following: the applicant; the environmental assessment practitioner; specialists; the competent authority; and the commenting authority.

The applicant: also known as the proponent, this is the individual intending to submit an application for environmental authorisation, and is exclusively known as the applicant once this application has been lodged. The applicant is therefore responsible for appointing an environmental assessment practitioner to compile the application for environmental authorisation. If environmental authorisation is granted, the applicant will enter into a legal agreement which compels the applicant to uphold certain conditions of authorisation, as determined by the competent authority.

The environmental assessment practitioner (EAP): the EAP is responsible for compiling the application for environmental authorisation. This involves determining the scope of the investigation required (basic or full assessment), as well as what aspects of the environment require further detailed investigation by means of a specialist report. The EAP will holistically interpret and compile all the information in order to submit this as a full S&EIR, which is the application for environmental authorisation. The EAP will generally be employed by an environmental consulting firm, which often take on the responsibility of impact monitoring in the construction and operational phases of the development. The EAP must be independent and impartial to the outcome of the application.

Specialists: a specialist is a person that is generally recognized within the scientific community as having the capability of undertaking, in conformance with generally recognized scientific principles, specialist studies or preparing specialists reports. The specialists investigated in this research are biodiversity specialists, who are typically terrestrial ecologists or botanists.

The competent authority: the competent authority is the organ of state charged with evaluating the environmental impact of an activity and, where appropriate, granting or refusing environmental authorisation in respect of that activity. The competent authority is also responsible for compliance and enforcement, which is typically undertaken by a team of environmental management inspectors.

Commenting authority: the commenting authority for the purposes of this research is CapeNature. The commenting authority is responsible for lodging official comments on technical aspects of applications for environmental authorisation, such as those aspects relating to the impacts on biodiversity. The commenting authority will provide recommendations to the competent authority regarding additional work and whether information provided in the application is acceptable. The commenting authority will also attend compliance inspections in instances where these inspections require technical expertise, such as monitoring the success of alien removal plans.

3. RESEARCH APPROACH

This Chapter will discuss the methodological framework followed by this research to answer the questions and achieve the objectives stated in Chapter 1. Included in this Chapter is the broad methodological framework adopted by this research (section 3.1), the process by which cases have been selected (section 3.2) and the specific research methods used to answer the research questions (section 3.3).

3.1 RESEARCH METHODOLOGY

The methodology followed in this research was based upon a critical realist philosophy of science. Critical realism rejects the 'successionist' view of cause and effect on the basis that it over-emphasises the role of prediction in explanation. Cashmore et al. (2008) note that explanation (as opposed to observation) should not involve the identification of patterns of recurring events, because the underlying cause that results in something happening has nothing to do with the number of times it happens. Explanation is the identification of underlying mechanisms that cause events, which are typically not observable. Furthermore, explanation should strive to explain how casual mechanisms work and understand the conditions under which they are activated. In this way, this research has focused on the explanation of EIA as a safeguard to biodiversity in light of Verstehen (understanding of human behaviour), rather than statistical generalisations.

The evaluation of EIA as a safeguard to biodiversity hinges broadly upon two components. Firstly the procedural inputs into EIA are important, which determine the quality and quantity of biodiversity information necessary to inform decisions regarding impacts on, and mitigation of, biodiversity. Secondly, the substantive outcomes of EIA, which inform the appropriateness of decisions and how effectively biodiversity is managed post-authorisation. Evaluating the procedural component of EIA requires understanding of legal and best-practice requirements, roles and responsibilities and the management systems that are established to implement and enforce these requirements. It has been previously noted that extant literature evaluating EIA in South Africa is typically focussed on the procedural aspects of EIA. Therefore, where possible, research findings on biodiversity-specific procedural inputs into EIA are compared with existing literature. Conversely, the substantive outcomes of biodiversity in EIA have received very little attention in extant literature which makes comparative interpretations more difficult. Investigating the substantive outcomes of EIA relating to the management of biodiversity requires a specific knowledge of legal requirements as well as a general knowledge of biodiversity, ecology and habitat health.

This research will investigate real-life and complex phenomena of which other theories are unlikely to be particularly relevant. Gillham (2000) notes that an emergent design approach is particularly suitable to such types of research, which is characterised by inductive theorizing, i.e. making sense of what one finds after it has been found. Given that specific research into biodiversity in EIA in South Africa is a relatively novel field, a case study methodology (see Yin, 2003) is therefore considered the most suitable research strategy for performance evaluation and building theory (Owen and Rogers 1999; Gillham, 2000; Wessels et al., 2015). More specifically, this research has adopted a multiple case study research approach by investigating

a variety of development applications in order to achieve the objectives stated in chapter 1. Notably, Yin (2003) emphasises the topic of "decisions" as a major focus of case studies; given that EIA and development applications all depend on evaluative decisions, the case study analysis approach seems particularly fitting for such research. Although the process of evaluation has already been discussed in the context of EIA (see section 2.3.2), research evaluation should include the following: 1) establishing criteria of worth; 2) constructing standards; 3) measuring performance and comparing with standards; and 4) synthesizing and integrating evidence into a judgement of value (Owen and Rogers, 1999). Although evaluation is used at various stages of data capture in this research, it should not be considered a methodology or a method, but rather a process to be followed in judgements of performance in order to substantiate the generation of theory.

The following case study methodological research steps are sourced from a combination of the recommendations made by Eisenhardt (1989) and Yin (2003): 1) determining research questions; 2) selecting cases; 3) crafting instruments and protocols; 4) entering the field; 5) analysing data; 6) shaping hypotheses; 7) enfolding literature; 8) reaching closure. While step 1 has already been elaborated on in chapter 1 of this research, steps 2 and 3 will be discussed in detail in separate sections of this chapter. The remaining discussion of this section will briefly outline how the remaining steps were achieved.

In step (4), entering the field, it was deemed necessary to analyse the procedural aspects of this research prior to engaging with any substantive investigations. The 'field' of this research is considered to be the practical realm of EIA and therefore contains the following research processes: 1) collecting EIA documentation through the access to information sector of DEA&DP and by directly contacting consultants; 2) site inspections; and 3) interviews with key role players in the EIA industry.

In step (5), analysing data, the analysis of the collected data focused on emergent themes related to effective EIA rather than case-specific findings. The findings have been incorporated into a discussion-based interpretation in chapter 4.

In step (6), shaping hypotheses, where possible, research evidence was gathered from the cases specifically as well as from general interpretations of the EIA industry through interviews in order to look for recurrent, replicated findings. This process of the research emphasises triangulation of results and aims to confirm, reinforce and where possible extend the research findings and discussions contained in Chapter 4.

In step (7), enfolding literature, appropriate comparisons of the findings from this research are made with extant literature and are contained in chapter 4 of this research. However, it should be noted that due to the novelty of this research, the contribution this research step makes towards the generation of theory is limited. Notwithstanding, comparisons are certainly beneficial for two reasons: firstly, it will provide support for similar findings elsewhere, and secondly it will provide new insights and indicate potential issues where findings are dissimilar or absent.

In step (8), research closure, this research step is relevant to research which is designed to include an unlimited number of cases and is therefore not particularly relevant to this research. However, the replicability of this research may certainly be beneficial for growth in the EIA industry and for biodiversity conservation.

3.2 CASE SELECTION

The literature on case study research emphasizes three key themes when selecting cases: sample population, criteria for selection and the number of cases (Eisenhardt, 1989). The primary consideration in case selection for this research was the degree to which biodiversity influenced project proposals in the CFR. The sample population therefore essentially represents all development applications in the CFR that triggered a listed activity and required an EIA. Defining the sample population is important as it identifies the types of entities that will be considered and helps guide research away from undesirable variations in cases that are unlikely to contribute to the generation of theory (Eisenhardt, 1989). The assumption here is that cases where biodiversity significantly influenced the assessment process are more likely to contain information valuable to this research. Therefore, a judgement-based sampling protocol was developed to actively select cases thought to possess a high capacity to contribution to the development of theory.

Due to the confidentiality many developers have towards their own assessments, the contribution of public advisors (see section 3.2.2.3 for definitions of public advisors) in this process was necessary to identify contemporary cases that fit the sampling protocol. In no order of significance, the variables considered most important in the sampling protocol are: the presence of a biodiversity-related specialist report; availability of environmental assessment documentation (the access to information through DEA&DP can be time-consuming and often provides documentation only available in hard copy); overall cases to represent at least two different local jurisdictions; and the uniqueness of adopted biodiversity-related mitigation measures. Furthermore, convenience, access, geographical proximity and the willingness of developers to participate in the research were factors considered in the sampling protocol.

Nine cases were considered in the sampling protocol, of which five were selected for study. Although it is possible to generate meaningful theory from a single case, Eisenhardt (1989) recommends between four and ten cases in case study analysis. The number of cases selected for this research therefore fits within this range. In order to maximize the theoretical output of case study research, Eisenhardt (1989) notes that cases should be selected in order to extend emergent theory and to represent polar types (differing content). In this way, the number of cases selected significantly depended on ensuring that an appropriate range of mitigation measures were contained in the representative sample. Table 3 below provides a summary of the cases selected for study in this research, including their date of authorisation, primary mitigation measures and the local government within which the development is situated. Note that as all the cases selected for this research are contained within the Western Cape, DEA&DP and CapeNature are recognised as the competent authority and commenting authority respectively.

Table 3: Summary of the selected cases and their background information

Case	Date Authorised	Primary Mitigation Measures	Local Government
Golf Course & Housing Estate	**24-Jun-05**	Rehabilitation Biodiversity Offset Restoration In-situ conservation area Search and Rescue	Swartland Local Municipality
Industrial Development	**16-Jan-13**	Biodiversity Offset	City of Cape Town
Search and Rescue	**16-Nov-16**	Search and Rescue	City of Cape Town
Housing Estate	**26-Feb-13**	Rehabilitation In-situ conservation area	City of Cape Town
Commercial Development	**04-Apr-06**	Rehabilitation Biodiversity Offset Restoration In-situ conservation area	City of Cape Town

3.3RESEARCH INSTRUMENTS AND PROTOCOLS

This research has been split into two distinct objectives. Firstly, the procedural effectiveness of the cases has been analysed, which determines the quality of biodiversity information generated in the cases. Secondly, the substantive effectiveness of biodiversity in EIA has been addressed which determines the appropriateness of decisions and also investigates the implementation of EIA outcomes. It must be noted that while the EMPr is primarily used as an implementation tool and is intimately linked with the substantive component, it is included in the procedural component of this research. This is because development authorisation is theoretically contingent upon the production of an EMPr of acceptable quality. This section will detail the research instruments (methods) used to evaluate the procedural and substantive effectiveness of the selected EIAs.

3.3.1 Methods Used to Determine the Procedural Effectiveness of EIA

Most analytical methods in qualitative research involve the examination and interpretation of data in order to elicit meaning, gain understanding and develop empirical knowledge (Corbin and Strauss, 2008). This approach was followed in analysing the procedural effectiveness of biodiversity-related EIA primarily by means of a document analysis. Document analysis is defined by Bowen (2009; p 1) as "the systematic procedure for reviewing or evaluating documents", and may include letters, policy statements, regulations, guidelines and public documents (Gillham, 2000). A detailed document analysis of each case was undertaken to identify indicators that could reveal information on the following themes: the landscape-level objectives relating to biodiversity management; the impacts associated with the development; biodiversity-related mitigation measures; and the mechanisms for biodiversity management. Table 4 summarises the documents involved in acquiring this information. This document analysis process was repeated for each case in order to extract specific findings which contributed to generalizable theory building.

The abovementioned document analysis represents a case assessment process as it focusses on the identification of key themes relating to biodiversity in the selected cases. In order to reach legitimate conclusions regarding the quality of biodiversity inputs into the selected cases, the documentation must be subject to detailed evaluation whereby inputs are compared against standards. Key performance indicators are used by this research to evaluate such performance.

Table 4: The contribution of specific environmental impact assessment documents to obtaining information on key themes relating to procedural effectiveness

Analysed Documents	Landscape Management Objectives	Development Impacts	Biodiversity Mitigation Measures	Appropriateness of Conditions of Authorisation	Management Mechanisms
Environmental Impact Report		x	x	x	
Biodiversity Specialist Assessment	x	x	x		
Environmental Management Plan			x		x
Environmental Authorisation			x	x	x

3.3.1.1 Key performance areas and indicators

Key performance indicators (KPI) are processes used by researchers and many commercial organisations to evaluate and optimize performance and are defined by Parmenter (2007: p 7) as, "a set of measures focusing on those aspects of organisational performance that are the most critical for the current and future success of the organisation". For this research, the "organisation" represents the biodiversity information submitted to the competent authority for environmental authorisation. In this way, KPIs can be adopted to measure the performance of the most critical aspects of EIA necessary for meeting biodiversity goals and objectives. The similarity in procedure between KPIs and the process of evaluation makes this tool particularly useful when reaching conclusions on performance.

Owen and Rogers (1999) state that the first step in evaluation is to establish criteria of worth. In light of this, KPIs represent criteria that are in the form of questions. Such criteria could theoretically be established using the detailed requirements for biodiversity inputs as stipulated by the EIA regulations. However, this approach would result in data that would more closely resemble legal compliance as opposed to indications of procedural performance that best represent the consideration of biodiversity. A review of literature, both national and international best-practice principles was therefore central to this phase of the research, against which the cases could be evaluated. Table 5 shows the most commonly proposed principles in the best-practice literature.

Good Practice for Biodiversity Inclusive Impact Assessment and Management Planning (Hardner et al., 2015) represents a source of international best-practice and is the culmination of two PhDs and has been produced by the Multilateral Financial Institution's Biodiversity Working Group. While this report focuses on impact assessment, it also provides principles for environmental management more broadly and therefore adopts a holistic approach to best-practice in order to reach the international community. This document is also endorsed by various financing institutions from the Americas as well as European countries. The documents Brownlie et al. (2006) and Brownlie et al. (2005) represent guidelines on Biodiversity, Impact Assessment and Decision-Making in Southern Africa, and on Involving Biodiversity Specialists in EIA in the Western Cape, respectively. These two sources, along with the EIA regulations, therefore alone represent enough legitimacy to evaluate the procedural inputs into EIA against

nationally recognized best-practice literature. The CBD also published a guidance document on best-practice impact assessment (CBD, 2006) and is therefore relevant to all countries party to this convention.

The principles contained in table 5 were subsequently converted into key questions (KPIs) which were asked for each individual case in order to evaluate procedural performance. In order for full realisation of best-practice EIA, the standard assumption regarding the answer to these questions is "full compliance". Two other categories were used in the judgement process, namely "partial compliance", and "noncompliance". Full compliance, partial compliance and non-compliance are represented by the numbers 2, 1 and 0 respectively. This stage of the evaluation fits closely with Owen and Rogers (1999)'s steps of constructing standards, measuring performance and comparing standards, and integrating evidence into a judgement of value. In terms of the latter, the overall compliance with best-practice EIA principles has been plotted in the form of a bar graph in order to provide a more sophisticated visual interpretation of EIA procedure in the selected cases.

Table 5: Origins of extracted most commonly proposed principles in the best-practice and legal literature

	Principle	Hardner et al., 2015	Brownlie et al., 2006	CBD, 2006	Brownlie et., al 2005	Marshall et., al 2015	EIA Regs
1.1	Involve a biodiversity specialist at project conception	X	X	X	X		
1.2	Draw up a good terms of reference to ensure that answers to questions about impacts on biodiversity, ecosystem services and the link to human well-being will be answered in the impact study and relevant specialist reports		X	X	X		
1.3	Define time and space boundaries of the study to ensure that impacts within and between ecosystems are adequately addressed and to allow both long and short term impacts on biodiversity and ecosystem services to be considered		X	X	X		X
1.4	Comply with relevant laws and policies relating to biodiversity inputs into EIA		X	X	X		X
1.5	Identify and assess direct, indirect and cumulative impacts on biodiversity as a result of the proposed project	X	X	X	X		X
1.6	Assign a rating of significance to each potential impact on biodiversity	X	X	X	X		X
1.7	Provide a spatial analysis (mapping or GIS) of the project, including the physical footprint as well as layers depicting the spatial extent of other impacts such as those related to air and water quality	X		X	X		X
1.8	Apply biodiversity-inclusive 'positive planning' by using specialist information on biodiversity pattern (species and community) and process (ecosystem)	X	X	X	X		
1.9	Include an analysis of project alternatives including the "no project" option	X	X	X	X		X
1.10	Apply mitigation hierarchy to identified impacts: in order of good practice preference, impacts should be avoided, minimized, rectified or compensated	X	X	X	X		X
1.11	Use all available relevant information, including scientific, local, traditional and indigenous knowledge	X	X	X	X		
1.12	Involve regulators and other key stakeholders in determining the level of treatment of cumulative impacts	X					X
1.13	Ensure the fair and equitable sharing of the benefits arising from the use of biodiversity (incl. the removal thereof)		X	X			
1.14	Promote intergenerational equity and equitable sharing of benefits arising from access to biodiversity		X	X	X		
2.1	Ensure community involvement in follow-up design and implementation					X	
2.2	Ensure follow-up is objective-led and goal orientated		X	X		X	X
2.3	Regulators must determine which aspects of the project require follow-up procedures		X	X		X	
2.4	Ensure that follow-up is legally ensured		X	X		X	X
2.5	Ensure the provision of the following components of the EMPr:						
2.5.1	Environmental awareness training programme		X			X	X
2.5.2	Schedule of incentives and penalties		X			X	
2.5.3	Procedures to be followed for corrective actions, complaints and environmental incidents		X			X	
2.5.4	Resettlement plan (search and rescue – where applicable)		X			X	
2.5.5	Compensation plan (eg. offset plan – where applicable)		X			X	
2.5.6	For monitoring purposes: what is to be monitored, where monitoring should take place, who is responsible for monitoring, ,monitoring frequency		X	X	X	X	X
2.5.7	EMPr compliance auditing programme		X	X	X	X	X
2.5.8	EMPr review and update programme		X	X		X	X
2.6	Inform stakeholders of follow-up outcomes		X			X	

Table 5 distinguishes between two distinct sets of principles. 1.1-1.14 represent principles relating specifically to pre-authorisation biodiversity information generated by EAPs and specialists contained in the EIR and specialist reports. Principles 2.1-2.6 are related to post-authorisation management and represent those that specifically address the production of the EMPr. These principles have subsequently been converted into questions (in some instances more than one question per principle), which are contained in Tables 7 and 12 for principles pre-authorisation (KPIs 1.1-1.14) and post authorisation (KPIs 2.1-2.6) respectively. Tables 7 and 12 are discussed independently of one another in sections 4.1 and 4.3 respectively.

3.3.2 Methods used to determine the substantive effectiveness of EIA

For the purpose of this research, the substantive component relates to all outcomes of EIA applications. This therefore includes: the decision-making process; the enforceability and consistency of mitigation measures and the degree to which these are complied with; and the appropriateness of conditions of authorisation. In terms of the latter, this information was obtained through the document analysis process mentioned above and should be considered a source of information that contributes to the evaluation of the substantive effectiveness of EIA. The appropriateness of conditions of authorisation relates specifically to the similarity of mitigation measures recommended by the specialist and those that are included in the conditions of authorisation.

3.3.2.1 Geographical Information Systems

SANBI established a website in 2005 (www.bgis.sanbi.org) with the sole intention of collating spatial biodiversity data into one location. Such spatial information provides a good representation of the strategic biodiversity context within which decisions are made. The information offered by this website covers almost the entire country and includes, but is not limited to, data sets on CBAs, ESAs, threat levels, and protection statuses.

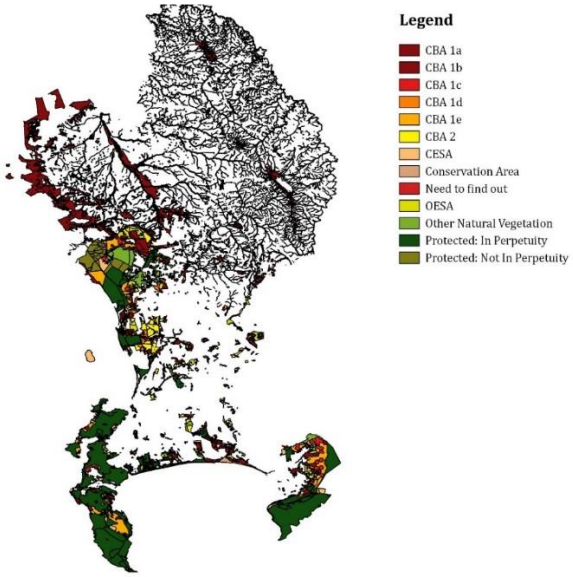


Figure 3: CBA and ESA information for the City of Cape Town and Swartland local municipalities (sourced from bgis.sanbi.org)

The primary data sets used for this research were the City of Cape Town's Biodiversity Network (BioNet), the Swartland CBA network and national datasets on protection status and threat levels. As this information is accessible to all individuals, organisations and government bodies, it provides a means for representing the appropriateness of decisions made in terms of spatial biodiversity goals and objectives. This is emphasized by the fact that EIA advocates the consideration of site alternatives as the most valuable contribution to avoiding biodiversity impacts.

Quantum Geographic Information Systems (QGIS) is a free mapping tool that was used to overlay the property boundaries and physical footprints of each of the cases investigated. This provided the research with a variety of meaningful outcomes, namely: it allowed for correspondence of affected vegetation types and their threat levels as stated by the specialist reports; it allowed a spatial biodiversity context within which decisions regarding the physical footprints were authorised; and it provided a means for comparing decisions made by the competent authority with the management objectives of the CBAs. The latter was made possible by the publication of the BioNet technical report (Holmes et al., 2012), which has specific management objectives pertaining to different CBA classifications. It should be noted that although CBAs are identified as a trigger mechanism in the EIA regulations, the maps and data used in this research are not regulated as they are not incorporated into official bioregional plans. However, given that CBAs typically comprise of critically endangered and endangered vegetation types as well as ESAs, CBAs are of upmost importance for meeting national biodiversity goals and objectives and should therefore be avoided entirely in accordance with best-practice EIA.

3.3.2.2 Site Inspections

Of the five cases selected for this research, it was determined that three would be subject to site inspections. These are the Search & Rescue, the Golf Course & Housing Estate, and the Commercial Development. The reason for this relates to the nature of the development and mitigation measures attached to them; as the Industrial Development relied entirely on an offset option, the absence of in-situ conservation measures would have resulted in a meaningless site inspection. As no mitigation measures have been implemented at the Housing Estate site due to a recent authorisation and delays in development, a site inspection here is deemed unnecessary. The Industrial Development and Housing Estate cases therefore contributed to determining the procedural effectiveness of EIA only.

The Golf Course & Housing Estate and Commercial Development cases involved detailed site inspections of specific in-situ mitigation measures, whereas the Search and Rescue case involved an inspection of the receptor site only in order to provide an evidence platform for interpretations of the success of Search and Rescue in general. Inspection forms for the former two cases were compiled which included formal mitigation measures extracted from the conditions of authorisation. Specific mitigation measures were evaluated on site by using the same judgement process as detailed in the section pertaining to KPAs (see section 3.2.1). In order to improve the understanding of the implementation success of specific mitigation measures, detailed comments are provided in Appendix B.

The inspection at the Search and Rescue receptor site took place over two days of distinct methodological activities. The first day involved obtaining a quantitative representation of

species survival in order to determine the success of the operation. This involved conducting transects through the receptor site and noting the presence of species and comparing them to those originally found at the donor site. Information on donor species was obtained from the specialist report; unfortunately, the number of species involved in the search and rescue was not included in the specialist report or the methods statement and determining rates of survival was therefore not possible. The quantitative understanding of the success of the search and rescue therefore relied on comparisons of alpha diversity. The second day of inspection involved meeting with various scientific advisors at the receptor site in order to obtain a qualitative understanding of the success of the search and rescue. Individuals involved in this inspection included 3 public scientific advisors who are familiar with this particular case and a PhD student investigating rehabilitation specifically in the Western Cape. The views and opinions of the individuals involved in this inspection have been included in the data obtained from the interviews and has been subject to the same analysis.

3.3.2.3 Interviews

The interview process followed a semi-structured format and was guided by open-ended questions relating to pre-determined themes. The information obtained from the document analysis and procedural investigations, described in section 3.2.1 of this dissertation, were pertinent to interview design. The design process helped organise the interviews to cover the following themes: 1. Decision-making; 2. Biodiversity reporting; 3. Biodiversity mitigation; and 4. Biodiversity management. This approach allowed the interviewer to guide the discussion and use questions to focus on issues that of major importance to the conservation of biodiversity and to allow for specific insights into evident short-comings as identified in the document analysis. Questions varied depending on the progression of the interview, however specific questions were developed to gain professional insights into the general operation of the above-mentioned themes. Additionally, questions relating specifically to the findings of case analysis were asked and interpretations of how these findings compared to general practice was sought from the interviewees.

The interview process followed an "elite interview" protocol (see Gillham, 2000) in that individuals known to be in positions of authority and/or those with a prominent presence in the literature were actively sought out to participate. The reason for this is that due to the paucity of literature, the majority of knowledge regarding biodiversity in EIA in the Western Cape was anticipated to come from individuals with practical experience in industry as a whole. The objective of the interview process was to encompass representatives from the three principle categories of environmental assessment stakeholders, namely: decision-makers (DM) (n=1), which are the competent authorities whom make decisions on proposal authorisation; public advisors (PA) (n=5), which are members from public institutions who comment on EIAs from a professional capacity and include members from SANBI, CapeNature and the Biodiversity Management Branch; and private consultants (C) (n=2), which includes EAPs and policy developers. An emphasis was placed on interviewing public advisors as their experience with the EIA industry was predicted to be more beneficial to this research. The identity and place of employment of the subjects are kept anonymous as this was intended to improve the willingness of individuals to share information. Where interview data is used in this dissertation, the abovementioned abbreviations, followed by a unique reference number, is used to indicate the subject's role in the EIA industry.

The broad analytical framework of Miles and Huberman (1994) was adopted at this stage of the research to structure the analysis of qualitative data obtained from the interviews. Below are the three cyclical elements as described by these authors, including specific descriptions of how they have influenced this research:

(1) Data reduction: this involved the transformation of raw qualitative data through the application of descriptive or inferential coding. As recommended by Gillham (2000), interviews were recorded and transcribed at a later stage. The raw data was then coded by organising answers and statements into conceptual categories.

(2) Data display: this involves the conversion of data into tables, charts, networks and other graphical formats. This process was avoided in the analysis of interview data because the findings of the interviews have been used for in-text triangulation and substantiation of the findings of other methods used.

(3) Data synthesis: this involves the continuous process of extracting meaning from the data. This was primarily achieved through correlation of answers and statements made by interviewees, as well as through triangulation of these results with the results of other methods.

4. RESULTS

This chapter is organised into the following sections: 4.1 Biodiversity Impact Identification and Evaluation; 4.2 Biodiversity Mitigation Measures; and 4.3 Biodiversity Management during Implementation.

Section 4.1 analyses the quality of information generated by the EAPs and specialists during the stages preceding the environmental authorisation, as per the identified Key Performance Indicators (KPI). Section 4.2 shows the application and details of the biodiversity mitigation measures for the case studies organised according to the mitigation hierarchy. Section 4.3 shows the results relating to the management of biodiversity in the selected cases during and after project implementation.

The sections identified above all contain two sets of data. The first set of data draws on my own analysis of case documentation. This includes an evaluation of EIA documents, as well as summarized tables of relevant findings, such as the details of mitigation measures. Secondly, the interview data obtained in this research has been organised according to the sections of this chapter. In instances where the same point has been made by more than one interviewee, this data has been coded and organised into key themes and topics and is included in tabular form in the relevant sections of this chapter. Certain individual comments made by interviewees contributed interpretatively to this research and have been reserved for the discussion in Chapter 5.

A brief description of the cases is given here in order to improve the interpretation of the results.

Industrial Development (ID): This case was authorised in 2013. The case involved the development of a large industry on municipal-owned land and is connected with a Special Economic Zone (SEZ) revitalization programme aimed at alleviating poverty and unemployment in the area. The primary impact identified in the botanical report is the removal of endangered and critically endangered vegetation types a result of the layout of the development. Due to the aforementioned SEZ, the mitigation for this impact was determined prior to the application, which is a pro-active land bank biodiversity offset. This offset required a financial contribution by the developer and is managed by the local authority. This case was not subject to a site inspection as no in-situ mitigation measures were recommended.

Commercial Development (CD): This case was authorised in 2006 and involves various types of developments on a large property including film studios, office blocks and housing units. The impacts identified in the specialist reports were the removal of threatened vegetation types (two critically endangered and one endangered) as well as development within a wetland. The mitigation for this case included avoidance, minimization, rehabilitation and offset measures to account for the residual impacts associated with this development.

Housing Estate (HE): This case was authorised in 2013 and includes the development of various individual housing units dispersed over a large properly. The primary impact of this development was the removal of threatened vegetation types (two critically endangered and two vulnerable) in the physical footprint. The mitigation for this case included avoidance, minimization, rehabilitation and offset measures to account for the residual impacts associated

with this development. This case was not subject to a site inspection as development has been delayed due to financial constraints. This case therefore contributed to the procedural component of this research only.

Golf Course & Housing Estate (GC&HE): This case was authorised in 2005 and included the upgrading of a 9-hole golf course to an 18-hole golf course, as well as adding housing units to the estate. The primary impact of this development was the removal of critically endangered vegetation in the physical footprint of the upgraded golf course and housing units. The mitigation for this case included avoidance, minimization, rehabilitation and offset measures to account for the residual impacts associated with this development.

4.1 BIODIVERSITY IMPACT IDENTIFICATION AND EVALUATION

The results of this section show the quality of information generated by EAPs and specialists during the stages preceding environmental authorisation. The quality of this information has been determined by means of the KPI process described in section 3.3.1.1 of this dissertation. Each case has been rated against individual KPIs with a score of either 2 (full compliance), 1 (partial compliance) or 0 (non-compliance). The outcomes of this process inform the procedural effectiveness of the cases investigated.

Table 6 details the results of the KPI process. The KPIs are displayed as questions, which are directly related to the legal and best-practice principles identified in Table 5. For instance, KPIs 1.5.1-1.5.4 in Table 6 all relate to principle 1.5 of Table 5, which is to 'Identify and assess direct, indirect and cumulative impacts on biodiversity as a result of the proposed project'. The interview data for this section are contained in Table 7. The data analysis process identified four emergent interview topics relating to impact identification and evaluation. These are: terms of reference; biodiversity process; cumulative impacts and; ecosystem goods and services. The interview data in Table 7 has been structured according to these interview topics. The following text will therefore highlight individual results of the KPI as well as interview data where appropriate.

Biodiversity specialists were appointed during the screening stage for all the cases investigated in this research (Table 6: KPI 1.1). Although it has not been determined whether pre-application biodiversity screening was undertaken, specialists were certainly involved at the outset of the formal application process. This allowed for biodiversity opportunities and constraints to be incorporated into project design at the earliest stage of proposal formulation.

Table 6 shows that three of the cases investigated in this research performed well with matching their terms of reference with those of best-practice (Table 6: KPI 1.2). The specialist reports for two of these cases (the Industrial Development and Housing Estate cases) went as far as to include a term of reference specifically stating their intention to comply with the best-practice guidelines referred to in section 3.2.1 of this dissertation. Of the two cases that only partially complied in this regard, both omitted terms of reference directed at investigating the impacts on biodiversity processes associated with the proposed development. Notably, none of the cases included terms of reference aimed at investigating the impacts of the proposed development on ecosystem goods and services.

These findings substantiate the opinions of four of the interviewees, who concluded that terms of reference vary, are poorly defined and fail to address the full range of impacts experienced in

developments (Table 7: Opinion 1). Interestingly, the decision-maker investigated in this research was of the opinion that terms of reference should always be adequate as they as subject to quality control mechanisms such as public participation and EIA review (Table 7: Opinion 2). Three interviewees noted that EAPs should be responsible for determining terms of reference, not specialists (Table 7: Opinion 3). Furthermore, many interviewees were of the opinion that terms of reference for EIAs in the Western Cape should be aligned with the minimum reporting requirements stipulated by the Fynbos Forum Guidelines, but should not be standardized as this will remove the emphasis to investigate site specific issues (Table 7: Opinion 4). Two interviewees were of the opinion that EAPs and specialists fail to provide understandable information to decision-makers (Table 7: Opinion 5).

Table 6: Outcomes of KPIs relating specifically to the quality of biodiversity information generated in the specialist reports and environmental impact reports

(Key: CD= Commercial Development; GCHE= Golf Course & Housing Estate; ID = Industrial Development; HE= Housing Estate; SR= Search and Rescue. Adherence to the KPI was scored as: 2= full compliance; 1= partial compliance, 0= non-compliance.)

KPI	**Question:** note that all questions begin with "To what extent…"	CD	GCHE	ID	HE	SR
1.1	*… was a biodiversity specialist involved in establishing whether an EIA was required for the project (screening)?*	2	2	2	2	2
1.2	*… do the biodiversity assessment terms of reference match those of best-practice as described by the Fynbos Forum Guidelines for Impact Assessment?*	1	1	2	2	1
1.3	*… have time and space boundaries been set to allow for adequate consideration of the full range of temporal (long and short-term) and spatial (in-situ and ex-situ) biodiversity impacts as a result of the development?*	2	0	1	2	2
1.4	*… does the specialist report or EIA provide a statement as to whether the proposed project complies with national, provincial and local legislation, policy and plans as they apply to biodiversity?*	0	0	2	2	1
1.5.1	*… have both direct and indirect impacts as a result of the development been assessed?*	2	2	2	2	2
1.5.2	*… does the specialist report or EIA include a statement as to which impacts are irreversible, or result in an irreplaceable loss of biodiversity or ecosystem services?*	2	1	2	2	1
1.5.3	*… does the specialist report or EIA provide a statement of need for higher order assessment to address cumulative impacts on biodiversity?*	1	0	1	2	1
1.5.4	*… does the specialist report or EIA provide a statement of assumptions and confidence levels in the assessment predictions?*	1	1	1	0	2
1.6	*… has a significance rating been applied to each potential impact on biodiversity?*	2	2	2	2	2
1.7	*… has a spatial analysis of the physical footprint and the biodiversity area of influence of the project been provided?*	2	2	2	2	2
1.8.1	*… did the proponent apply a 'positive planning' approach to incorporate biodiversity issues into planning and design?*	1	2	1	2	0
1.8.2	*… does the specialist report or EIA provide a concise description of the importance of the affected area to biodiversity in terms of pattern, process and ecosystems goods and services?*	1	1	1	1	1
1.8.3	*… does the specialist report or EIA provide a description of the ecosystem goods and services of the area?*	0	0	0	0	0
1.9	*… have alternatives (including no-go) been analysed in terms of their associated impacts?*	2	2	1	2	1
1.10.1	*… does the specialist report or EIA provide a summary of the mitigation measures in accordance with the mitigation hierarchy?*	2	2	1	2	1
1.10.2	*… are impact ratings assigned to quantify inherent (without mitigation) and residual impacts (with mitigation)?*	2	2	2	2	2
1.10.3	*… has the assessment promoted no net loss of biodiversity through planning and mitigation?*	2	2	1	1	1
1.11	*… were efforts made to include local, indigenous or traditional knowledge regarding biodiversity impacts?*	1	1	1	1	1
1.12	*… has the level of treatment of cumulative impacts been determined and negotiated?*	1	0	2	2	2
1.13.1	*… have efforts been made to promote equitable sharing of benefits arising from the impacts on biodiversity?*	1	1	2	2	0
1.13.2	*… does the specialist report or EIA provide a statement on the main beneficiaries and losers where there are clear dependencies on ecosystems goods and services?*	0	0	0	0	0
1.14	*… have efforts been made to promote intergenerational equity and equitable sharing of benefits arising from the impacts on biodiversity?*	0	1	2	2	0

Of the five cases investigated in this research, three complied fully with their responsibility to define spatial and temporal boundaries (Table 6: KPI 1.3). These three cases made statements in their 'limitations and assumptions' section regarding the influence of the factor 'time' in impact identification similar to the following (extracted from the Commercial Development's specialist report):

"Any botanical assessments of a large site, unless conducted bimonthly over at least a full year, may result in an underestimate of the flora, and consequently of the conservation value of the site. This is due to the seasonal appearance of certain species (annuals, bulbs), and may also be a result of certain perennial species being very cryptic or unidentifiable unless flowering."

The two remaining cases which only complied partially in this regard omitted any statement regarding the influence of the factor 'time' in impact identification. Whether this limitation was stated or not, the strict timelines associated with the EIA process precluded seasonal assessments of flora in all of the cases investigated by this research. This result substantiates the opinions of two interviewees that EIA does not allow for seasonal assessments of flora, which results in undervalued estimations of local flora (Table 7: Opinion 6).

Table 7: Statements of interviewees grouped into substantive opinions relating to impact identification and evaluation which are organised into topics

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion number	Substantive Opinions	Contributing Subjects
Terms of Reference	1	Terms of reference vary, are poorly defined and don't fully incorporate the scope of biodiversity impacts experienced in developments	C1, C2, PA2, PA1,
	2	Terms of reference should always be adequate as they are subject to quality control mechanisms, namely public participation and EIA review	DM1
	3	EAPs should determine the terms of reference, not specialists	C1, PA2, PA4
	4	Terms of Reference should follow a generalised minimum requirement (such as recommended by the Fynbos Forum Guideline for EIA in the Western Cape) but should not be standardised as this will remove the emphasis to investigate site-specific issues	C1, C2, PA1, PA3, PA4
	5	Specialists and EAPs struggle to produce information that is understandable to decision-makers	C2, PA3
	6	EIA in general does not allow for seasonal assessment of flora, so biodiversity will always be undervalued	C1, PA2
Cumulative Impacts	7	The current regulatory framework is not designed to properly address cumulative impacts and as a result are not dealt with adequately in EIA	C2, DM1, PA1, PA2, PA3, PA4
	8	There is not enough scientific understanding of how cumulative impacts work and the non-negociatiables for meeting connectivity objectives	C2, DM1, PA2, PA4,
Biodiversity Process	9	Ecological drivers of biodiversity process (fire, pollination, evolutionary processes) aren't adequately dealt with in specialist reports	C1, C2, DM1, PA1, PA4
	10	Connectivity in the broader landscape, as well as within specific sites, is vitally important for biodiversity persistence but is often ignored in development applications	C1, PA4
Ecosystem Goods and Services	11	Many specialists and EAPs don't know how to deal with ecosystem goods and services or how intrinsic biodiversity translates into social values	C1, C2, DM1, PA1, PA2, PA3, PA4
	12	Ecosystem goods and services are often dealt with implicitly simply by advocating conservation of natural habitats but are rarely addressed explicitly in EIA documentation	C1, C2, PA3, PA4
	13	Ecosystem goods and services are poorly dealt with because of the lack of communication between biodiversity, economic and social specialists in the EIA process	C1, C2
	14	Ecosystem goods and services are more likely to be addressed for heavily exploited provisioning services (e.g. wetland attenuation in diminishing aquifers)	PA1, PA3
	15	Ecosystem goods and services are inadequately dealt with in EIA because the EAPs aren't asking the relevant questions in the terms of reference	C1, C2, DM1

Only two of the cases (Industrial Development and Housing Estate cases) fully complied with their responsibility to align their EIAs with national, provincial and local legislation, policy and plans as they apply to biodiversity (Table 6: KPI 1.4). The cases which performed poorly in this regard either made no such statements, or only referenced their intention to comply with the NEMA EIA regulations.

The cases investigated in this research performed well in terms of stating the direct and indirect impacts on biodiversity pattern which could occur as a result of the proposed development (Table 6: KPI 1.5.1). The approach by specialists in dealing with the direct impacts on biodiversity pattern was characterised by technical and quantitative scientific methods. Such an approach yielded valuable information on how an assessment of biodiversity pattern could constrain or limit development layout at a site.

In terms of an assessment of the intensity of impacts, which is usually described in terms of their irreversible or irreplaceable character, the cases performed less well, with two cases omitting such statements (Table 6: KPI 1.5.2). Importantly, all the cases investigated in this research resulted in irreversible impacts on biodiversity as stated in the specialist reports.

The approach to assessing and evaluating cumulative impacts was similar to that of indirect impacts in that it was limited to qualitative predictions. Importantly, no cases included cumulative impacts in the impact evaluation process. However, the cases performed relatively well in terms of stating the need for a higher order assessment to address the cumulative impacts of the proposed activity (Table 6: KPI 1.5.3). It was the opinion of the interviewees that site specific EIAs should not be responsible for dealing with cumulative impacts (Table 7: Opinion 7), and that there is very little understanding of how cumulative impacts relate, for example, to minimum requirements for meeting connectivity objectives (Table 7: Opinion 8).

Interestingly, all of the cases performed relatively poorly in terms of stating their confidence in the assessment predictions (Table 6: KPI 1.5.4). Notwithstanding this finding, the cases fully complied with the requirement to describe the nature of the identified impacts. For instance, all the cases provided significance ratings to their identified impacts (Table 6: KPI 1.6).

For all the cases investigated in this research, spatial boundaries were adequately defined in relation to direct impacts (i.e. loss of natural vegetation within the development area) and all the specialist reports included a spatial analysis of the physical footprint of the proposed activity (Table 6: KPI 1.7). Additionally, all the specialist reports referenced spatial biodiversity information (typically the NBA, as per Mucina and Rutherford (2006), and the BioNet plan where applicable) and conducted field surveys to ground-proof any information relating to the ecosystems and species present. However, spatial boundaries were found to be poorly defined in relation to indirect impacts such as the alteration of natural fire frequency, and breakdown in pollinator or seed disperser interactions (ecological processes).

Despite the early involvement of specialists in all the cases, three of the cases performed poorly in terms of adopting a positive planning approach to incorporating biodiversity issues into project design (Table 6: KPI 1.8.1). This resulted in irreversible impacts on biodiversity that may have otherwise been avoided through adequate planning.

Indirect impacts and those impacting on ecological process were dealt with in a more qualitative and ad hoc manner. The quality of reporting was therefore highly variable with

respect to identifying potential impacts on biodiversity processes (Table 6: KPI 1.8.2). For instance, four of the cases' specialist reports stated that the natural fire regime would be impacted negatively as a result of the development, but only the Housing Estate case included fire as a criterion in the evaluation of impacts. Fire was given additional attention in this EIA by providing an alternative layout for one cluster development to allow for regular burning of natural vegetation in accordance with the required fire regime. These findings substantiate the opinions of the interviewees that impacts on biodiversity processes as a whole are dealt with poorly in EIA (Table 7: Opinions 9 and 10). Importantly, none of the cases investigated in this research assessed or evaluated the impacts of the development on ecosystem goods and services (Table 6: KPI 1.8.3).

Three of the cases investigated in this research identified a range of layout alternatives for the proposed developments (Table 6: KPI 1.9) while two cases assessed only the applicant's preferred alternative and the standard 'no go' alternative requirement. Interestingly, four of the interviewees noted that while layout alternatives do influence small changes in planning and design, in general, alternatives in the Western Cape contribute poorly to the overall avoidance of impacts (Table 8 : Opinion 1).

The results of the KPI process contained in Table 6 reveal some important insights into the general application of the mitigation hierarchy prior to receiving environmental authorisation. Firstly, three of the cases performed well in terms of promoting their mitigation measures hierarchically (Table 6: KPI 1.10.1). In the two cases that performed poorly in this regard, more effort could have been made to avoid impacts rather than minimizing and offsetting. Secondly, all the cases investigated in this research had impact ratings to quantify inherent (without mitigation) and residual impacts (with mitigation) (Table 6: KPI 1.10.2).

None of the cases mentioned any intention or records pertaining to the use of traditional knowledge (Table 7: KPI 1.11). However, all cases have been scored as partially compliant as local knowledge has been used by the appointment of specialists who have specific knowledge of local fauna and flora, as well as indirectly through the application of local policy.

The cases performed reasonably well in terms of promoting the fair and equitable sharing of contemporary benefits arising from the use of biological resources (Table 7: KPI 1.13.1). For instance, the Golf Course & Housing Estate case investigated in this research motivated their proposal by ensuring the rehabilitation and ongoing conservation of naturally vegetated public space. Additionally, the Housing Estate motivated their application by ensuring the establishment of an educational center which is to be funded by the levies obtained from future home owners.

No information was made available in any of the cases regarding the main beneficiaries and losers where there are dependencies on ecological goods and services (Table 6: KPI 1.13.2). None of the cases investigated in this research mentioned any statement regarding the potential for impacts to be transferred to future generations (Table 7: KPI 1.14). All of the interviewees stated that the primary reason behind these findings is that many specialists and EAPs do not know how to deal with ecosystem goods and services or how biodiversity translates into social values (Table 7: Opinion 11). Interestingly, four interviewees stated their confidence in the fact that ecosystem goods and services can be dealt with in EIA simply by ensuring the conservation of natural habitats (Table 7: Opinion 12). Poor communication between biodiversity, economic

and social specialists also undermines the identification of ecosystem goods and services in EIA, as noted by two interviewees (Table 7: Opinion 13). Furthermore, the interview process revealed that ecosystem goods and services are more likely to be addressed for heavily exploited provisioning services (such as wetland attenuation) (Table 7: Opinion 14). It was the opinion of three interviewees that ecosystem goods and services are inadequately dealt with in EIA because EAPs are not asking the relevant questions in their terms of reference (Table 7: Opinion 15). .

Figure 4 shows a percentage summary of the performance of all the cases for KPIs 1.1-1.14, which represents the overall procedural effectiveness of the cases investigated by this research. This analysis shows that 53% of KPIs were fully complied with, 29% were partially complied with, and 18% were not addressed at all in the documentation of the EIA case studies examined.

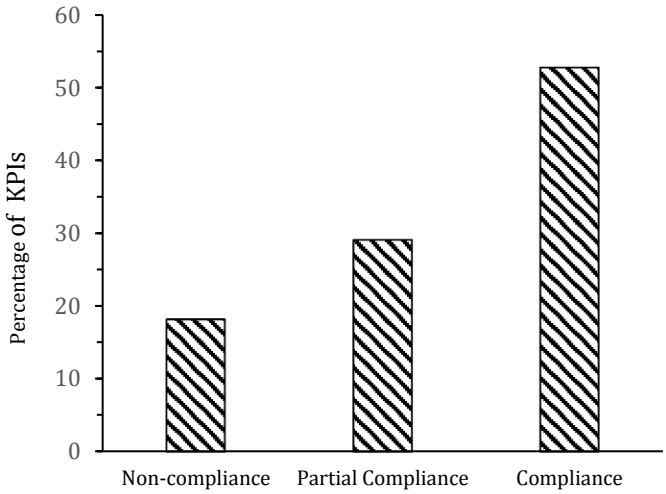


Figure 4: Bar graph showing the overall quality of biodiversity-related information generated in the EIA stages preceding environmental authorisation

4.2 BIODIVERSITY MITIGATION MEASURES

The results of this section show the application and details of the biodiversity mitigation measures throughout the case studies. Such measures are best understood in terms of a mitigation hierarchy and this section is organised accordingly. This section therefore includes the following subsections: 4.2.1 Avoidance of Impacts; 4.2.2 Minimization of Impacts; 4.2.3 Rehabilitation and Restoration; and 4.2.4 Offsets.

4.2.1 Avoidance of Impacts

The avoidance of impacts in South African EIA is primarily achieved by adopting a positive planning approach to proposal formulation. Positive planning can be achieved in the following ways, which have been addressed by various KPIs contained in Table 6: firstly, by involving a biodiversity specialist at the earliest stage of proposal formulation (see Table 6: KPI 1.1); secondly by incorporating identified biodiversity aspects into proposal formulation (see Table 6: KPI 1.8.1); and finally by developing a range of alternatives which avoid impacts in project layout design (see Table 6: KPI 1.9).

Table 8 shows the interview opinions relating to the avoidance of impacts in EIA. Interestingly, four of the interviewees noted that while layout alternatives do influence small changes in planning and design, in general, alternatives in the Western Cape contribute poorly to the overall avoidance of impacts (Table 8 : Opinion 1)

Table 8: Statements of interviewees grouped into substantive opinions relating to the avoidance of impacts in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion number	Substantive Opinions	Contributing Subjects
Avoidance	1	Alternatives in EIA contribute poorly to overall avoidance of impacts, and only marginally influence site-specific changes in planning and design	DM1, C1, PA2, PA3
	2	Local government's spatial planning tools (SDFs, EMFs) contribute poorly to avoidance of impacts as development priorities always trump conservation priorities, regardless of vegetation threat status	C1, PA1, DM1,
	3	Developing spatial biodiversity plans (such as bioregional plans) are a priority for promoting avoidance through site selection and layout alternatives	C1, C2, DM1, PA1, PA2, PA3, PA4
	4	The only mechanisms that really work towards avoidance of impacts are those that significantly influence the decision-making process	PA3, C2

Table 9 shows data relating to the vegetation type, CBA classification and associated management objective for each case investigated in this research. Notably, this table indicates that all cases investigated in this research impacted on critically endangered vegetation, which by definition should represent CBAs. Furthermore, the authorisation of these developments is in direct conflict with spatial biodiversity planning management objectives. These results show that even in instances where planning for avoidance has taken place (such as through design changes and alternatives), irreversible impacts on biodiversity have still occurred.

Table 9: Affected vegetation for each case investigated in this research and their associated CBA classifications and management objectives

Case	Affected Ecosystem and Threat Level	CBA Classification	Management Objective
Golf Course & Housing Estate	Swartland Granite Renosterveld (CR)	No CBA Data	100% irreplaceable (C.A.P.E)
		Priority Habitat (SANBI)	No development in northern and central area of site (high conservation value)
Industrial Development	Cape Flats Dune Strandveld (EN)	Other Natural Vegetation	Sustainable management within general rural land-use principles
	Atlantis Sand Fynbos (CR)	As above	As above
Search and Rescue	Laurensford Alluvium Fynbos (CR)	CBA1B	Irreplaceable High & Medium condition sites. Obtain appropriate legal conservation status. Maintain natural ecosystems, restore degraded land to natural and manage for no further degradation
Housing Estate	Boland Granite Fynbos (VU)	CBA1C	Obtain appropriate legal conservation status. Maintain natural ecosystems, restore degraded land to natural and manage for no further degradation
	Cape Winelands Shale Fynbos (VU)	As above	As above
	Swartland Shale Renosterveld (CR)	CBA1E	As above
	Swartland Granite Renosterveld (CR)	As above	As above
Commercial Development	Cape Flats Sand Fynbos (CR)	CBA1B	As above
	Swartland Shale Renosterveld (CR)	As above	As above
	Cape Flats Dune Strandveld (EN)	OESA	Maintain as open and where appropriate restore degraded land to natural or near natural for improved ecological functioning

These results contained in Table 9 substantiate the opinions of four interviewees that spatial planning tools contribute poorly to the avoidance of impacts (Table 8: Opinion 2). All interviewees were of the opinion that developing official spatial biodiversity plans (such as bioregional plans) are a priority for promoting impact avoidance in EIA (Table 8: Opinion 3). Furthermore, two interviewees stated that the only mechanisms that really promote the avoidance of impacts in EIA are those that significantly influence the decision-making process (Table 8: Opinion 4).

Table 10 shows the collection of CoAs aimed at avoiding impacts on biodiversity for all the cases investigated in this research. As discussed in section 4.1.2 of this dissertation, biodiversity reporting in EIA often produces spatial information identifying sensitive biodiversity areas. When these areas are actively avoided in development layout planning, ensuring the avoidance of impacts on these areas in the operational phase is usually achieved by designating these areas for conservation. This type of biodiversity mitigation was recommended for three of the cases investigated in this research (Table 10: Conditions 1, 8, 10). However, only the Golf Course & Housing Estate case had stewardship incorporation requirements in their CoAs. Interestingly, rezoning is required for this conservation area and the specialist and EAP also stated that access to this conservation area by the public must be ensured (see Appendix B1: 19.2).

Table 10: Case specific information on biodiversity mitigation measures aimed at avoiding impacts on biodiversity

Mitigation Measure Category	**Case**	**Condition number**	**Associated Condition of Approval (CoA)** - including those conditions mentioned directly in the environmental authorisation and indirectly when mentioned in documents referenced in the environmental authorisation
Avoidance	**GCHE**	**1**	A conservation area must be established in the northern section of the development site and rezoned to open space III and incorporated into contractual nature reserve into CapeNature's stewardship programme before the construction of any developments of phase 3 commences
	GCHE	**2**	Buffer of 15m from N7 of no activity - 3m high berm to be naturally vegetated
	GCHE	**3**	Contained in operational EMP: "The layout of the erven has been revised accordingly and a minimum distance of 60m from the wetland was achieved".
	HE	**4**	EIR states that "All of the nature area and land designated as private open space will be owned by the Home Owners Association. It will therefore be protected against future development and will be managed in an integrated manner by a team of professionals experienced with environmental management and fire control".
	HE	**5**	Contained in EMP: "40m ecological buffer either side of ecological centerline"
	HE	**6**	Contained in EIR: "Units have been moved out of a 30m buffer around the seep"
	HE	**7**	Contained in EIR: "A 50m buffer around the outcrop must be catered for in which the Granite Renosterveld must be allowed to survive"
	CD	**8**	100m wide conservation area between area 1 and the Renosterveld area.
	CD	**9**	All remnant sensitive wetland areas and their associated dunes should be rezoned and managed as conservation areas
	CD	**10**	All conservation areas should be rezoned to Open Space 3 (Private Open Space)
	CD	**11**	Buffers of 10m must be maintained from conservation areas 1 & 2 identified in the botanical report
	CD	**12**	No footpaths are allowed in conservation area 2

Six CoAs in Table 10 relate specifically to ecological buffers surrounding sensitive areas in order to ensure the avoidance of impacts on these areas. However, in some cases the recommended buffers were found to be poorly defined by specialists and EAPs. For instance, the specialist for the Golf Course & Housing Estate case recommended a buffer of 30m from, "the center of the wetland", which is obviously difficult to define for an irregularly shaped wetland body (Table 10: Condition 3).

4.2.2 Minimization of Impacts

Table 11 shows the collection of mitigation measures aimed at minimizing impacts. Similarly, Table 12 shows the interview opinions relating to the practice of minimization mitigation measures.

Table 11: Case specific information on biodiversity mitigation measures aimed at minimizing impacts on biodiversity

Mitigation Measure Category	Case	Condition number	**Associated Condition of Approval (CoA)** - including those conditions mentioned directly in the environmental authorisation and indirectly when mentioned in documents referenced in the environmental authorisation
Minimization	**CD**	**1**	The retention pond and other wetland areas should be designed to attract birds such as by the production of heronries
	CD	**2**	Construction of speed bumps and a maximum speed of 45km/h (supported by signage) to minimize faunal mortality
	CD	**3**	Construction of under-road culverts to prevent wetland fragmentation
	CD	**4**	Widespread bridges/culverts should be used to access infilled areas, rather than roads so as to not obstruct water flow through wetland areas
	CD	**5**	Burning of natural vegetation every 10-15 years
	GCHE	**6**	Search and Rescue
	HE	**7**	Contained in EIR: "Funds for environmental management and fire control of private open space will be derived from levies paid by every home owner"
	S&R	**8**	"The project entails the translocation of a patch of critically endangered Lourensford Alluvium Fynbos of approximately 1200m2… to the Harmony Flats Nature Reserve, the receptor site, for transplanting"

A variety of mitigation measures were recommended by the Commercial Development specialists primarily aimed at minimizing the impacts associated with the development (Table 11: Conditions 1-5). For instance, the wetland specialist recognized the identified wetlands as important bird habitats and recommended, “these areas should be designed to attract birds such as the production of heronries”. Interestingly, this application to develop in a wetland was authorised, and minimization measures such as bridges to pass over the wetlands instead of infilled roads were recommended by the specialist and included as a CoA (Table 11: Condition 4).

Table 12: Statements of interviewees grouped into substantive opinions relating to the minimization of impacts in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion Number	Substantive Opinions	Contributing Subjects
Minimization	**1**	Search and rescue should not be considered a mitigation measure to reduce impact ratings, and should rather be done in addition to other mitigation measures as a best-practice exercise	C1, C2, PA2, PA1, PA4, PA3
	2	Search and rescue has a very low rate of success	C1, DM1, PA1, PA2, PA3

Search and rescue was recommended for two of the cases investigated in this research, namely the Golf Course & Housing Estate and Search & Rescue cases. The majority of data regarding search and rescue was obtained from the Search and Rescue case. This case has been named as such as no development was motivated in this application, and the entire focus of this EIA was on the search and rescue process. It became evident in the document analysis that, while an offset was considered for this case, it was either a search and rescue or an offset, not both.

The interview results show that many of the interviewees are of the opinion that search and rescue has a very low rate of success (Table 12: Opinion 1), and that it should not be considered a mitigation measure to reduce the significance of impacts (Table 12: Opinion 2).

4.2.3 Rehabilitation

Table 13 shows the various mitigation measures aimed at rehabilitating or restoring impacts in the cases investigated by this research. Table 14 shows the interview opinions relating to rehabilitation and restoration in EIA.

The majority of these mitigation measures involve alien clearing and the rehabilitation of natural vegetation. However, two of the cases involved rehabilitation that was not alien clearing and management, namely the Golf Course & Housing Estate and Commercial Development cases. For the Golf Course & Housing Estate, the specialist noted a high degree of erosion taking place along the majority of the watercourses inside the property, and it was recommended that rehabilitation of these areas be undertaken (Table 13: Condition 1). The rehabilitation mitigation measures recommended for the Commercial Development relate to improving the water quality of the wetlands present on the property and preventing future pollution of these areas (Table 13: Condition 8).

Table 13: Case specific information on biodiversity mitigation measures aimed rehabilitation and restoration

Mitigation Measure Category	**Case**	**Condition Number**	**Associated Condition of Approval (CoA)** - including those conditions mentioned directly in the environmental authorisation and indirectly when mentioned in documents referenced in the environmental authorisation
Rehabilitation	**GCHE**	**1**	Rehabilitation and control of the erosion along the watercourses and wetlands
	HE	**2**	Contained in EMP: "A comprehensive long-term Environmental Management Plan (EMP) is to be drawn up that will detail the removal of the trees, the gradual rehabilitation of the fynbos..."Once construction is complete, rehabilitation of un-built areas must be undertaken in order to restore the ecological value of the area"
	HE	**3**	Contained in ecological management plan: "It is imperative that an integrated, efficient, cost effective and structured alien clearing programme be established as soon as possible in order to maintain or improve biodiversity"
	CD	**4**	No invasive alien vegetation should be allowed in the conservation areas, and there should be ongoing annual alien invasive plant removal
	CD	**5**	Only the use of indigenous plants is allowed in residential properties bordering the conservation areas and specifically no kikuyu grass
	CD	**6**	Rehabilitation of all undeveloped land (specifically the ecological corridor), including alien clearing and indigenous landscaping
	CD	**7**	Rehabilitation of all remaining wetland areas including ongoing alien control (specifically *Typha capensis*)
	CD	**8**	Improving the water quality of the wetlands by preventing pollution
	GCHE	**9**	Removal of all woody aliens in the conservation area
	GCHE	**10**	Contained in OEMP: "Kikuyu will not be tolerated near the Renosterveld or wetland areas"

The approach to recommending rehabilitation and alien clearing mitigation measures by specialists and EAPs was highly variable and poorly defined. For instance, the specialist recommendation for the Commercial Development case states that, “no invasive alien vegetation should be allowed in the conservation areas, and there should be ongoing annual alien invasive plant removal”. This statement represents an ideal approach to alien invasive management, but is highly impractical and immeasurable. Given that the Commercial Development case resulted in the identification and designation of large conservation areas, this condition provides little direction or priority actions for implementing such a condition. Similar conditions have been noted for the Golf Course & Housing Estate (Table 13: Conditions 9 and 10), such as, “removal of all woody aliens in the conservation area”, and, “Kikuyu will not be tolerated near the Renosterveld or wetland areas”. For all the cases that included alien clearing as a mitigation measure, none of them produced an alien management plan prior to receiving environmental authorisation. Interestingly, the interview results show that many interviewees

were of the opinion that restoration and alien clearing should always be part of an approved management plan associated with the conditions of authorisation (Table 14: Opinion 2).

Table 14: Statements of interviewees grouped into substantive opinions relating to rehabilitation and restoration in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion number	Substantive Opinions	Contributing Subjects
Rehabilitation	**1**	Rehabilitation and alien clearing responsibilities in EIA offer a great opportunity to improve the conservation value of offset areas as well as areas allocated for conservation in-situ	C1, C2
	2	Rehabilitation and alien clearing must always be part of an approved management plan associated with conditions of authorisation	C1, DM1, PA1, PA2, PA3
	3	Restoration and rehabilitation often poorly implemented in the context of EIA due to poorly defined responsibilities and objectives which are measurable and time bound	C1, PA2
	4	Alien clearing often advocated as a positive impact of development; all landowners have a responsibility to manage alien vegetation, which often does not happen anyway	C1, C2, PA2

The interview process also revealed that restoration and EIA is poorly implemented in the Western Cape due to poorly defined responsibilities and objectives which are measurable and time bound (Table 14: Opinion 3). Furthermore, three interviewees disagreed with advocating alien clearing as a positive outcome in EIA, as managing alien vegetation should be a responsibility for any land owner (Table 14: Opinion 4).

4.2.4 Offsetting of Impacts

Table 15 show the various mitigation measures aimed at offsetting impacts associated with developments in the cases investigated in this research. Table 16 shows the interview opinions relating to biodiversity offsets.

Two types of offsets were recommended in the cases investigated by the research. Firstly, the Commercial Development, Industrial Development, and Golf Course & Housing Estate cases are required to secure ex-situ habitats for conservation (Table 15: Conditions 1-3). Secondly, a financial offset is recommended in the Housing Estate case, which is to be used for conservation purposes such as alien clearing, fire management and environmental skills training for local communities (Table 15: Condition 4).

Table 15: Case specific information on biodiversity mitigation measures aimed offsetting impacts

Mitigation Measure Category	Case	Condition Number	**Associated Condition of Approval (CoA)** - including those conditions mentioned directly in the environmental authorisation and indirectly when mentioned in documents referenced in the environmental authorisation
Offsets	**CD**	**1**	Ongoing financing of an Environmental Management Trust Fund should be established for the long term ecological management of all conservation areas.
	GCHE	**2**	Environmental Management Trust Fund must be established and R1.5m to be deposited before 80% of the phase 2 plots have been transferred and before development of houses may take place in phase 3
	ID	**3**	The off-site biodiversity offset must be secured within 1 (one) year of the date of the commencement of construction. The applicant must engage with CapeNature in this regard.
	HE	**4**	Contained in EIR: Possible Roll over effects of the continual monetary injection into the village may assist with a skills transfer education programme in terms of environmental management including alien vegetation and fire management

Table 16 shows that many interviewees were of the opinion that offsets should be a last resort in the mitigation hierarchy, and should result in formal protection and management in perpetuity (Table 16: Opinion 1). Interestingly, two subjects were of the opinion that the costing

process behind biodiversity offsets is ineffective (Table 16: Opinion 2), which is primarily due to an underestimated value of the management costs associated with biodiversity offsets. Due to the costs associated with securing the formal protection of biodiversity offsets and the management of these areas in perpetuity, many interviewees revealed that offsets are perceived to be unreasonably expensive (Table 16: Opinion 4).

Table 16: Statements of interviewees grouped into substantive opinions relating to the offsetting of impacts in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion Number	Substantive Opinions	Contributing Subjects
Offsets	1	Offsets should always be a last resort and should include funding for the formal protection and management in perpetuity of land of equal biodiversity value	C1, C2, PA3, PA4
	2	Costing of biodiversity offsets is ineffective	C1, PA3
	3	Offsets should be conducted proactively because EIA timeframes reduce the effectiveness of offset implementation	PA2, PA1
	4	Offsets requirements in EIA are often argued against by EAPs and developers because they are perceived to be unreasonably expensive	PA4, C2, PA2, PA3

4.3 BIODIVERSITY MANAGEMENT DURING IMPLEMENTATION

The section shows the results relating to the management of biodiversity in the selected cases during and after project implementation. This section has been divided into three subsections which are: 4.3.1 Environmental Management Programmes; 4.3.2 Compliance with Biodiversity Mitigation Measures; and 4.3.3 Decision-making and Conditions of Authorisation.

4.3.1 Environmental Management Programmes

Table 17 shows the results of the KPI process for the production of the EMPrs in the cases investigated by this research. Table 18 shows the interview opinions relating to EMPrs.

Table 17: Outcomes of KPIs relating specifically to the quality of Environmental Management Programmes (EMPr) in the selected cases:

CD= Commercial Development; GCHE= Golf Course & Housing Estate; ID = Industrial Development; HE= Housing Estate; SR= Search and Rescue. Adherence to the KPI was scored as: 2= full compliance; 1= partial compliance, 0= non-compliance. 0* = The EMPr for the Commercial Development case was not made publically accessible and have been rated 0*. 0* ratings have not contributed to the overall performance analysis in figure 5

KPI	**Question:** note that all questions begin with "To what extent…"	CD	GCHE	ID	HE	SR
2.1	*… have I&APs been involved in follow-up programme design?*	0*	0	0	0	0
2.2	*… is follow-up driven by objectives and goals specific to the impacts of the development?*	0*	1	1	0	1
2.3	*… have regulators clearly defined which aspects of the development require follow-up procedures?*	0*	0	2	2	2
2.4	*… is follow-up imposed as a mandatory requirement through the EMPr?*	0*	2	2	2	2
2.5	*… has the EMPr included the following:*	0*				
2.5.1	*An environmental awareness training programme?*	0*	2	2	2	2
2.5.2	*A compliance auditing programme?*	0*	2	2	2	2
2.5.3	*A review and update programme?*	0*	2	1	2	2
2.5.4	*Details on incentives and penalties?*	0*	1	1	1	1
2.5.5	*Procedures for following correcting actions, complaints and environmental incidents?*	0*	2	2	1	1
2.5.6	*A resettlement plan?*	0*	1		2	2
2.5.7	*A compensation plan?*	0*	0	0		
2.5.8	*The appropriate details of a monitoring programme?*	0*	2	2	2	2
2.6	*… are efforts made to inform I&APs of EIA follow-up outcomes?*	0*	0	0	0	0

All the cases performed well in complying with the best-practice requirements recommended by the recognized biodiversity guidelines for the Western Cape (Brownlie, 2005; Brownlie et al.,

2006), as depicted by KPIs 2.5.1-2.5.8 (see Table 17). These KPIs represent relatively generic requirements, such as auditing programmes, provisions for review and updating, and environmental awareness training. However, the majority of cases complied poorly with case specific requirements represented by KPIs 2.2 and 2.3 as shown in Table 17, which are vitally important components of EMPrs. These KPIs relate to defining site-specific issues that require monitoring, as well as time bound and measurable goals and objectives. KPIs 2.2 and 2.3 are therefore of utmost importance for the representation of biodiversity mitigation measures, and indeed four of the five cases performed poorly at converting specialist recommendations into EMPr criteria. These findings substantiate the opinions of three interviewees that EMPrs are often generic documents without specific objectives and outcomes that are measurable and time bound (Table 18: Opinion 1).

Table 18: Statements of interviewees grouped into substantive opinions relating to the production of environmental management programmes (EMPrs) in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion Number	Substantive Opinions	Contributing Subjects
EMPr	**1**	EMPrs are often generic documents without specific objectives and outcomes that are measurable and time bound	PA4, PA2, C2
	2	There is an over-reliance on EMPrs to ensure specialist recommendations are fulfilled	C2
	3	The competent authority is removing their responsibility for compliance monitoring by including specialist recommendations in the EMPr as opposed to conditions of authorisation	PA1

Figure 5 summarises the performance of all the cases for KPIs 2.1-2.6, which represents the procedural effectiveness of EMPr production. Figure 5 shows that 56% of KPIs were fully complied with, 20% were partially complied with, and 14% were not addressed at all in the cases' EIA documentation. These results are comparable to the procedural compliance shown in Table 5.

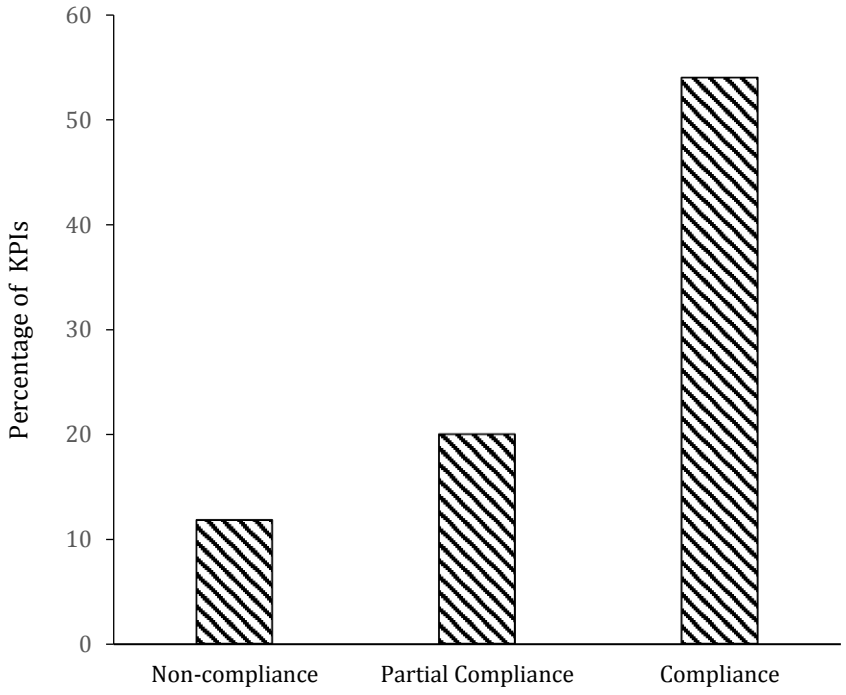


Figure 5: Bar graph showing the overall quality of EMPrs generated in the EIA stages preceding environmental authorisation

4.3.2 Compliance with Biodiversity Mitigation Measures

Table 19 shows the mitigation measures which were subject to site inspection in this research. The results of this section therefore provide information on the substantive effectiveness of biodiversity mitigation in EIA in the selected cases. Table 20 shows the opinions of the interviewees in relation to compliance monitoring in EIA.

Compliance with avoidance mitigation measures was low. The only mitigation measures fully complied with in this regard are the establishment of the conservation areas (Table 19: Condition 4) and the preclusion of footpaths (Table 19: Condition 8) at the Commercial Development site. All the mitigation measures relating to rezoning conservation areas and incorporating these into stewardship programmes (Table 19: Conditions 1, 5, and 6) were rated non-compliant. This is because none of these areas have been rezoned and no stewardship agreements have been initiated. The buffer areas which were subject to site inspection (Table 19: Conditions 2, 3, and 7) were all more narrow than required. Notably, the 25m buffer recommended for the Commercial Development case (Table 19: Condition 7) was so narrow that it in fact resulted in unauthorised construction within the wetland.

Compliance with minimization mitigation measures was also low, with none indicating full compliance. The minimization measures at the Commercial Development site (Table 19: conditions 9-11) promoted no ecological function. For instance, no efforts have been made to attract birds to the wetlands at the Commercial Development site, and infilled roads have been developed in the wetlands. The culverts present were simply concrete pipes which do not mitigate the habitat fragmentation between the divided wetland areas as a result of the infilled roads. Both the search and rescue operations investigated by this research have been conducted but have failed to perform any form of mitigation. The search and rescue performed for the Golf Course & Housing Estate case was essentially a process to augment indigenous landscaping within the estate. High rates of mortality of target plants were noted in this translocation due to overexposure to vehicle traffic and edge effects. Similarly, the translocation conducted for the Search and Rescue case also displayed high rates of mortality. This is due to insufficient planning and incorrect translocation methods. Details of these translocations will be elaborated on in Chapter 5.

Rehabilitation and restoration mitigation measures also displayed low levels of compliance. An exception to this was the mitigation measure aimed at restoring the water quality at the Commercial Development site. Regular water testing takes place on site, and litter is cleared weekly. Compliance with alien clearing mitigation measures however is very low. Both the Commercial Development and the Golf Course & Housing Estate were authorised approximately 11 years ago, and the first efforts made towards alien management were around the year 2015. The efforts made at the Golf Course & Housing Estate were ad hoc, and alien vegetation has persisted. Notably, woody aliens (Table 19: Condition 14) still persist throughout the conservation area, and Kikuyu grass (Table 19: Condition 15) is growing prolifically throughout the site, including within the wetland areas. No plan has been developed to guide alien clearing at the Golf Course & Housing Estate. The Commercial Development on the other hand has begun alien clearing in accordance with an approved management plan which has prioritized certain areas. However, large areas of the site still contain dense stands of aliens, particularly *Typha capensis* in the wetland areas.

Table 19: A summary of the mitigation measures included in the site inspections and their implementation rating

2= full compliance; 1= partial compliance, 0= non-compliance

Mitigation Category	Case	Condition Number	Mitigation Details	Compliance Rating
Avoidance	GHE	1	In-situ conservation area to be established, rezoned and incorporated into CapeNature's stewardship programme	1
	GHE	2	Buffer of 15m from N7 of no activity - 3m high berm to be naturally vegetated	1
	GHE	3	A minimum distance of 50m from the wetland	0
	CD	4	100m wide conservation area between area 1 and the Vergenoegd Renosterveld area.	2
	CD	5	All remnant sensitive wetland areas and their associated dunes should be rezoned and managed as conservation areas	0
	CD	6	All conservation areas should be rezoned to Open Space 3 (Private Open Space)	0
	CD	7	Buffers of 10m must be maintained from conservation areas 1 & 2 and 25m from all wetlands identified in the associated specialist reports	1
	CD	8	No footpaths are allowed in conservation area 2	2
Minimization	CD	9	Instillation of bird-attracting infrastructure in the retention pond	0
	CD	10	Construction of under-road culverts to prevent wetland fragmentation	1
	CD	11	Widespread brides/culverts should be used to access infilled areas, rather than roads so as to not obstruct water flow through wetland areas	0
	GHE	12	All indigenous vegetation in development footprint must be translocated to suitable areas	1
	SR	13	The translocation of a patch of critically endangered Lourensford Alluvium Fynbos to the Harmony Flats Nature Reserve	1
Rehabilitation & Restoration	GHE	14	Removal of all woody aliens in the conservation area	0
	GHE	15	Kikuyu will not be tolerated near the Renosterveld or wetland areas	0
	CD	16	No invasive alien vegetation should be allowed in the conservation areas, and there should be ongoing annual alien invasive plant removal	1
	CD	17	Rehabilitation of all undeveloped land including alien clearing and indigenous landscaping	1
	CD	18	Improving the water quality of the wetlands by preventing pollution	2
	CD	19	Rehabilitation of all remaining wetland areas including ongoing alien control (specifically *Typha capensis*)	0
Offsets	GHE	20	On-site and off-site compensation	0
	CD	21	On-site and off-site compensation	0
	ID	22	Off-site compensation	2

The Industrial Development case is the only case of the three with biodiversity offsets to comply with this mitigation measure. The Golf Course & Housing Estate and Commercial Developments have made no effort to secure land for ex-situ conservation. While management Trust Funds have been established for both these cases, no funds have been directed towards conservation.

The overall compliance with biodiversity mitigation measures is shown below in Figure 6. The results show a non-compliance of 46%, a partial compliance of 36%, and a full compliance of 18%. Two interviewees were of the opinion that compliance with biodiversity related

mitigation measures is undermined by poorly defined conditions of authorisation and EMPrs (Table 20: Condition 1). Compliance and enforcement by the competent authority and monitoring by CapeNature is said to be undermined by poor staffing/human capacity and limited resources (Table 20: Conditions 2 and 4).

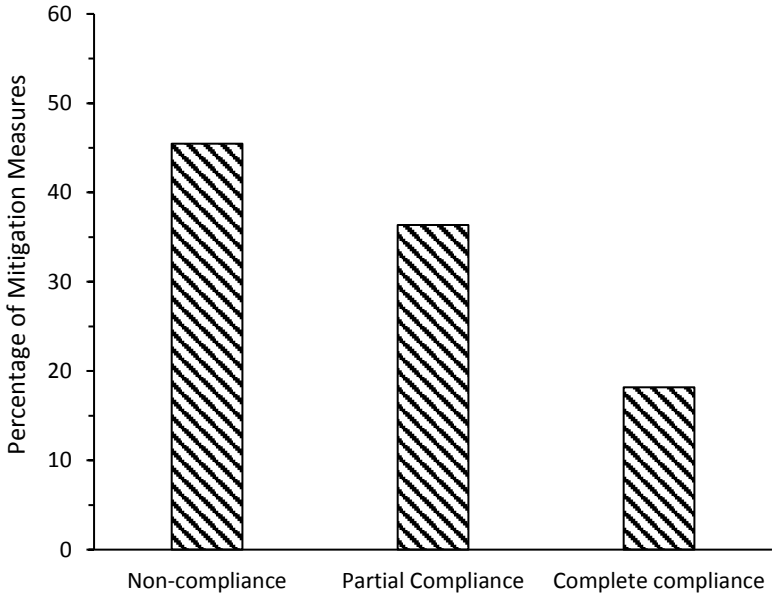


Figure 6: Bar graph showing the compliance with implementing mitigation measures in the cases investigated by this research

4.3.3 Decision-making and Conditions of Authorisation

The interview process revealed some valuable insights into the decision-making process around EIA applications, as well as the conditions of authorisation which get produced when an application receives environmental authorisation.

Firstly, interviewees were of the opinion that the decisions surrounding EIAs are often influenced by political pressures from other departments and authorities (Table 20: Opinion 1), and that social values are often favoured over biodiversity values in this process (Table 20: Opinion 2). Two interviewees were of the opinion that poor decisions made regarding EIA applications are often associated with larger EIA documents, which are more confusing (Table 20: Opinion 4). Furthermore, poor decisions are also thought to be the result of poor capacity and a high staff turnover in DEA&DP (Table 20: Opinion 5). Additionally, decision-making is thought to be inherently biased towards approval because the competent authority lacks the technical skills to challenge certain information provided in the EIA (Table 20: Opinion 6). More positively, one interviewee noted that EIA decision-making contributes to avoiding impacts on biodiversity as a result of a significant portion of rejected applications (Table 20: Opinion 3).

Table 20: Statements of interviewees grouped into substantive opinions relating to decision-making and conditions of authorisation in EIA

C=consultant, PA= public advisor, DM = decision-makers

Topic	Opinion number	Substantive Opinions	Contributing Subjects
Decision-making	1	The decision-making process in EIA is influenced by political pressures induced by other government departments and political authorities	PA4, C1, PA2, PA1
	2	Social aspects are often valued higher than biodiversity aspects in the decision-making process of EIA	C1, PA1, PA3
	3	EIA decision-making indirectly contributes to avoiding impacts through rejection of applications with too significant of an impact on the environment	PA3
	4	Poor decisions are often associated with longer documents and therefore generally more confusing EIA applications	C2, C1
	5	Poor decision-making is in part due to a lack of capacity and limited experience due to high staff turnover	C2, PA3, C1
	6	Decision-making is inherently bias towards approval because of selective documentation by EAPs and specialist findings that are unchallengeable due to technical incompetence of competent authorities	PA2, PA3
CoA	7	The feasibility of conditions of authorisation are often unrealistic	DM1
	8	Conditions of authorisation lack measurable objectives and performance standards	PA2, C1
	9	Conditions of authorisation differ from specialist recommendations because they can often be vague, indirect and difficult for the competent authority to understand	C1, C2, PA3
	10	Conditions of authorisation differ from specialist recommendations because EAPs selectively use certain recommendations	PA3
	11	Conditions of authorisation are increasingly becoming incorporated into EMPr because they are easier to amend than environmental authorisations	DM1
	12	Decision-makers need to get legal advice when drawing up conditions of authorisation	C2

The decision-maker interviewed in this research was of the opinion that the feasibility of conditions of authorisation is often unrealistic due to practical and financial limitations (Table 20: Opinion 7). Furthermore, three interviewees were of the opinion that the CoAs often differ from specialist recommendations because these can be vague, indirect and difficult for the competent authority to understand (Table 20: Opinion 9). Additionally, one public advisor noted that the CoAs often differ from specialist recommendations because EAPs selectively exclude specialist recommendations (Table 20: Opinion 10). Another factor which undermines CoAs is that they are said to be immeasurable and lack meaningful objectives and performance standards (Table 20: Opinion 8). The decision-maker interviewed in this research admitted that CoAs are often only included in the EMPr because they are easier to amend than environmental authorisation documents (Table 20: Opinion 11). A consultant interviewed by this research stated that decision-makers need legal advice when drawing up CoAs (Table 20: Opinion 12).

5. DISCUSSION

The contents of this chapter are organised into the same sections as that of the results, namely: 5.1 Biodiversity Impact Identification and Evaluation; 5.2 Biodiversity Mitigation; and 5.3 Biodiversity Management during Implementation. The KPA analysis is essentially a quality review of biodiversity-related information generated in the selected cases. Quality reviews are undertaken to explore the validity and procedural effectiveness of an EIA and to determine the degree to which EIA objectives have been accomplished (Sandham and Pretorius, 2008; Peterson, 2010). Individual comments made by interviewees are considered to be most insightful into the substantive effectiveness of EIA, which reveal the less obvious answers regarding the practicalities and implementation of EIA. The primary intention of this chapter is therefore to discuss the procedural and substantive effectiveness of EIA concurrently, which will allow for the identification of policy implementation gaps. Furthermore, these findings will be discussed in relation to relevant extant literature where possible in order to highlight trends in national and international practice of EIA.

5.1 BIODIVERSITY IMPACT IDENTIFICATION AND EVALUATION

The generation of scientific biodiversity information in EIA is considered most important by Slootweg et al. (2010) as it determines the effectiveness of case specific impact assessments at dealing with the relevant issues associated with developments. This in turn influences the proposed mitigation measures and the quality of decisions made by the competent authority. Figure 4 has shown that 53% of KPIs were fully complied with, 29% were partially complied with, and 18% were not addressed at all in the cases' EIA documentation. While these figures allow for a broad interpretation of overall procedural compliance of specialists and EAPs in meeting national and international best-practice reporting requirements, value-neutrality between KPIs should not be assumed. In other words, the overall quality scores do not tell us much in terms of the specific areas of weakness or strengths. Therefore, this section will discuss the quality of individual components of impact identification and evaluation in relation to the extant literature.

This section has been subdivided into four subsections, namely: 5.1.1 Terms of Reference; 5.1.2 Spatial and Temporal Boundaries; 5.1.3 Direct, Indirect and Cumulative Impacts; and 5.1.4 Ecosystem Goods and Services.

5.1.1 Terms of Reference

The generation of biodiversity information in EIA is guided by the terms of reference, which should be determined collaboratively by the EAP and the specialist (Brownlie et al., 2005). The results of this research have shown a high degree of variability in the terms of reference for the cases investigated in this research. However, it must be noted that many of the interviewees stated that variable terms of reference is not necessarily a bad thing; there should be no variation with the bare minimum terms of reference recommended by De Villiers et al. (2016), but variability in terms of reference which address site-specific issues should be encouraged. The reason for this is to prevent a generic tick-box approach to dealing with biodiversity issues experienced in EIA, which would result in the exclusion of site-specific impacts in the assessment and evaluation processes.

The document analysis has revealed unacceptable gaps in 'minimum requirement' terms of reference, most notably those aimed at addressing impacts on biodiversity processes and ecosystem goods and services. Assessing impacts on ecosystem goods and services and linking these impacts to human well-being is a minimum requirement recommended by various best-practice literature and guideline documents (Brownlie et al., 2005; CBD, 2006; Brownlie et al., 2006; De Villiers et al., 2016), yet no cases included terms of reference in this regard. Furthermore, Brownlie et al (2006) have noted that terms of reference are inappropriate when they focus only on site specific impacts rather than the broader landscape, or on a specific stretch of river while excluding downstream impacts. Both the Commercial Development and Golf Course & Housing Estate have constructed in wetlands and/or riparian environments, yet neither included terms of reference aimed at investigating the impacts these developments would have on downstream environments. The evident failure by the cases to include impacts on the broader landscape and those aimed at investigating impacts on ecosystem goods and services is considered a flaw by this research.

Brownlie et al. (2006) have noted that inadequate guidance from the environmental authority in formulating terms of reference leads to poor environmental reporting, inappropriate studies and indecision on the part of the authority. Interestingly, the decision-maker interviewed in this research was the only interviewee to comment on the mechanisms in place to control the quality of terms of reference, stating that, "terms of reference should always be adequate as they are subject to quality control mechanisms in the EIA process, namely public participation and EIA review" (DM1). However, it should not be assumed that members of the public registered as I&APs are capable of interpreting the quality of terms of reference, and this responsibility should rather lie with the competent authority or other public commenting authorities. Furthermore, this research has shown that EIA review is rarely initiated.

One public advisor stated, "I don't usually look at terms of reference too carefully, but rather at the quality of the actual information generated in the specialist report". This suggests that comments from parastatals predominantly occur at the second opportunity for public participation (see Figure 2) or not at all. Given that terms of reference are determined during screening, public participation as a quality control mechanism for terms of reference is unlikely to be particularly influential. As for EIA review, this mechanism for quality control is only undertaken when it is decided that either the EAP or the specialist failed to act independently (RSA: DEA, 2014). The decision-maker noted that this is a very subjective determination and as a result EIA review is rarely initiated. Given that EIA review is a crucial quality assurance mechanism, this is identified by this research as a significant flaw. The trigger for initiating EIA review should be expanded to include instances where the competent authority believe critical information is lacking. Furthermore, it is argued here that EIA review should be possible at the various stages of EIA. For instance, the quality of an EIA may be greatly improved if a review of the screening report could be undertaken. This will help improve the foundation of an EIA investigation to ensure that all environmental aspects are accounted for.

The evident failure by the competent authority and parastatals to assist in the formulation of terms of reference at the early stages of EIA may therefore be partly responsible for the inadequate terms of reference identified by this research. It is therefore recommended here that the competent authority and parastatals such as CapeNature should be more involved in formulating terms of reference during screening and scoping stages.

5.1.2 Spatial and Temporal Boundaries

The process of impact identification and the interpretation of these impacts in relation to the baseline environment is arguably the most important contribution by specialists for informing decision-making and the selection of appropriate mitigation measures. In order to ensure that the full range of impacts are identified, boundaries of time and space must be explicitly defined (Brownlie et al., 2005; CBD, 2006; Brownlie et al., 2006; De Villiers et al., 2016). The results of this research have shown a mixed approach by specialists and EAPs with respect to defining temporal boundaries. Although three of the five cases stated the influence of the factor 'time' on impact identification, these were mere statements of limitations and assumptions which made no positive contribution to the identification of impacts. The result is a high degree of uncertainty in terms of accurately determining the biodiversity value on site. This uncertainty evidently did not influence the evaluation of impacts in any of the cases investigated by this research. A high degree of uncertainty in impact prediction could have resulted in an increased significance ratings in the evaluation of impacts. This research has shown that biodiversity assessments in the CFR are conducted over insufficient time periods and during inappropriate seasons, which concurs with the findings of similar international research on the topic (Treweek, 1996; Thompson et al., 1997; Byron et al., 2000; Mandelik et al., 2005; Rajvanshi, 2005). For instance, Mandelik et al. (2005) found that only 21% of biodiversity surveys included in their assessment were conducted during spring, and 42% of surveys failed to specify the timeframes of their assessments.

One interviewee elaborated on time constraints in EIA, stating "there should be a clause in EIA to have to perform botanical assessments in different seasons, but a lot of specialists are happy to simply fulfil what the EAP requires" (PA1). This statement implies that the issue of seasonality is not being adequately addressed in the terms of reference. However, if certain EAPs and specialists required seasonal assessments when others did not, developers would presumably actively avoid these professionals due to the additional costs and project delays associated with seasonal assessments. Furthermore, the strict timelines associated with EIA in South Africa as illustrated by Figure 2 also precludes the incorporation of seasonal assessments. One possibility for overcoming this issue is the implementation of scheduling alternatives. "Alternatives" as defined by the EIA regulations include alternatives to the "operational aspects of the activity" (RSA: DEA, 2014: p9). This provision could therefore be utilized in the EIA system to allow for the operation of a particular alternative only provided certain areas be subject to a seasonal assessment. Another solution would be to require assessments of biodiversity before entering the formal application process. This will allow for biodiversity assessments to be conducted over different seasons, thereby providing a more accurate indication of the biodiversity value at a particular site.

This research has shown that spatial boundaries are adequately defined in relation to impacts on site, and poorly defined in relation to those which occur outside of the development site. These findings concur with those of Geneletti (2006), who notes that geographical study areas in EIA are often poorly defined. This author notes that a study area should be dictated by the expected spatial influence of the impacts. Poorly defined studies areas in this research may therefore be the result of poor terms of reference which fail to address potential impacts outside of the development area. These results show evidence of a poor application of an ecosystems approach to dealing with impacts in EIA. It is recommended that more effort should

be made towards defining study areas based on an ecological basis, rather than arbitrarily such as by property borders.

5.1.3 Direct, Indirect and Cumulative Impacts

The results of this research have shown that indirect impacts and those impacting on ecological process were dealt with ad hoc and qualitatively. This ad hoc approach could be the result of poorly defined terms of reference, or simply the lack of understanding by specialists and EAPs of how to report on impacts on ecological processes. One interviewee elaborated on this, stating "specialists and EAPs often ignore impacts on biodiversity that can't be seen, especially fire" (PA1), and many of the interviewees were of the opinion that impacts on biodiversity processes as a whole are dealt with poorly in EIA (Table 7: Opinion 9). It must be noted that the cases which stated intentions to investigate impacts on biodiversity process performed no better in this regard than those which did not. This suggests that clear terms of reference in this regard has a limited influence on the quality of reports in terms of dealing with potential impacts on biodiversity process. This is substantiated by the finding that none of the cases included fire as a criterion in the evaluation of impacts, despite identifying this as a likely impact of the proposal. Fire was typically the only aspect of biodiversity process addressed in any of the EIAs. For example, the Golf Course & Housing Estate and Commercial Development cases both have riparian environments adjacent to and within their development footprint, yet the impacts these developments could have off-site (such as fertilizer run-off and reduced flow), were not explicitly addressed in either the specialist report or the impact assessment.

The literature is urging specialists to shift reporting away from merely assessing impacts on species and habitats (Brownlie, 2005; De Villiers et al., 2016). The emphasis is rather on promoting an ecosystem approach, which includes the identification of impacts on biodiversity pattern (species and habitats) and process (e.g. fire, pollinator interactions, evolutionary potential) (Slootweg, 2005). Although using an ecosystem approach is the ideal way of assessing potential impacts on biodiversity, assessments have a tendency to focus on lower levels of biodiversity pattern, and often neglect impacts that are more difficult to see and measure – i.e. biodiversity processes such as fire or pollination (Treweek, 1999; Byron et al., 2000; Rouget et al., 2003; Brownlie et al., 2006). This research has drawn similar conclusions to these authors, showing that impacts on biodiversity pattern were rigorously investigated, while biodiversity process is relatively poorly addressed in the cases, and typically only included qualitative statements of interrupted fire regimes as a result of the development.

In addition to direct and indirect impacts, the identification of cumulative impacts is also required by South African EIA (RSA: DEA, 2014; s 3(j) (i)). Despite the fact that this represents a legal and best-practice requirement, only the Housing Estate case adequately stated the cumulative impacts as a result of the development (Table 7: 1.5.3). Importantly, no cases included cumulative impacts in the impact evaluation process. Many interviewees were of the opinion that this is because of the way the EIA framework is designed. One public advisor elaborated on this explaining, "there is no mechanism in place to process EIA information and physical footprints to allow for a delayed spatial impression of what's happening in the landscape" (PA3). In other words, there is no tool which allows for a spatial impression of future development (authorised developments which have not yet commenced). Interestingly, four cases noted that the proposed developments would result in reduced ecosystem connectivity. While ecosystem connectivity should not be considered synonymous with cumulative impacts,

this concept can act as a reasonable surrogate for informing on the spatial components (loss of natural vegetation) of cumulative impacts. As discussed in section 2.2.3 of this dissertation, CBA maps are comprised of a combination of threatened ecosystems and habitats essential for ensuring connectivity within the landscape. In this way, by promoting connectivity, CBA maps strive to reduce cumulative impacts with respect to the removal of natural vegetation. Figure 7 shows BioNet's CBA information in relationship to the Commercial Development's physical footprint. The authorised removal of the natural vegetation within the depicted physical footprint has clearly resulted in reduced connectivity between the CBA1b polygons. Despite the potential for these maps to inform on cumulative impacts, they are subject to the same barriers as other spatial planning, which will be discussed in section 5.2.1 of this chapter. One public advisor stated, "no amount of spatial planning will be able to deal with the issue of cumulative impacts because of the fine-scale decisions being made in EIA". As this information is publicly available, the absence of considering the strategic context of developments in the cases investigated in this research is considered a flaw in the decision-making process.

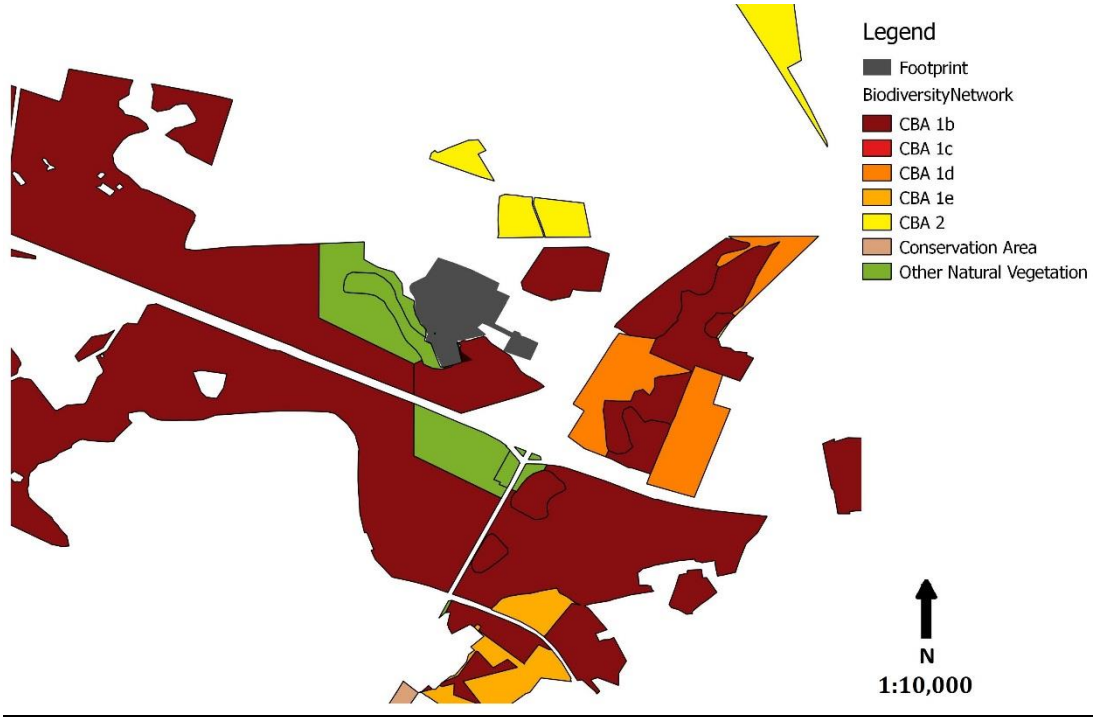


Figure 7: Image showing the BioNet spatial biodiversity data for the Commercial Development and the notable impact of the physical footprint on ecosystem connectivity (bgis.sanbi.org/)

Treweek (1996) stated, "there has been an almost universal failure for EIA to assess cumulative or long-term effects, despite the fact that these are often a highly significant cause of environmental degradation". Furthermore, GIS and spatial biodiversity planning have been identified as effective tools to address issues of cumulative impacts (Treweek, 1996; Ralston, 2009). This research has shown that cumulative impacts in the CFR aren't adequately dealt within EIA, despite an abundance of high quality spatial data for this region, which is similar to the findings of other studies in the Southern African region (Brownlie et al., 2006).

Sonntag et al. (1987) stated that cumulative impacts at a regional scale can only be controlled through central planning processes. However, central planning (SDFs, EMFs) in South Africa is undertaken primarily by local government and, as this research has shown, is subject to political

agendas which often results in trade-offs in which biodiversity is undervalued. This too prevents the incorporation of independent spatial biodiversity plans into legally recognized tools such as bioregional plans. In the United States of America, environmental assessment regulations (CEQ, 2005) require cumulative impacts to be grouped together in one analysis, such as an SEA. However, while three interviewees agreed that SEA would be the most effective tool to deal with cumulative impacts in South Africa (C1, PA4, PA3), this possibility is undermined by inadequate budget allocations by local governments in this regard.

Once direct, indirect and cumulative impacts have been identified, the specialist is required to characterise these in terms of their significance and intensity/magnitude (Brownlie, 2005). The results of this research have shown that the cases performed well in terms of allocating significance ratings to impacts, and poorly in terms of stating the irreversible or irreplaceable nature of their identified impacts. This research has also shown that all the cases resulted in the removal of critically endangered and/or endangered vegetation, which by definition are irreversible or irreplaceable impacts. Any irreversible impact on the environment should be considered a red-flag to development, and this is therefore argued to represent a significant flaw in the decision-making process. It is recommended that specialists and EAPs always state the intensity of the identified impacts in order to highlight the irreversible and/or irreplaceable nature of impacts to the competent authority.

5.1.4 Ecosystem Goods and Services

As previously mentioned in section 2.3.2 of this dissertation, the 'biosocial' objectives of the CBD (namely the sustainable use of biological resources and the equitable sharing of benefits arising from the use of biological resources) are poorly incorporated into South African regulations (see Table 5: Principles 1.11, 1.13 and 1.14). In order to ensure that the views and opinions of all affected individuals are adequately incorporated into EIA, the use of all local and indigenous knowledge is promoted by best-practice literature (Brownlie et al., 2005; CBD, 2006; Brownlie et al., 2006; De Villiers et al., 2016). The results of this research have shown that none of the cases mentioned any intentions or records pertaining to the use of local or traditional knowledge. The incorporation of knowledge from members of the public is primarily achieved in South African EIA by means of the public participation process. While public participation was not included in the scope of this research, one public advisor admitted, "members of the public are often ignored in public participation and EAPs generally respond inadequately to their raised issues with statements such as, 'comment noted'" (PA4).

As previously discussed in section 2.3.2, ecosystem goods and services represent a vitally important concept for highlighting the social values associated with conserving biodiversity (Rajvanshi, 2010). None of the cases investigated in this research mentioned ecosystem goods and services in either the specialist report or the EIA (Table 7: 1.8.3). All of the interviewees stated that the primary reason behind this finding is that, "many specialists and EAPs don't know how to deal with ecosystem goods and services or how biodiversity translates into social values" (Table 7: Opinion 11). While this may indeed be true, the benefit of explicitly defining ecosystem goods and services goes beyond conservation. Firstly, it helps identify habitats that have importance beyond those for meeting conservation targets, and secondly it elevates the value of biodiversity to decision-makers when considering the authorisation of applications (Van Beukering and Slootweg, 2010). The Commercial Development case provides a good example to substantiate the latter. This development's authorised physical footprint resulted in

the partial transformation of a wetland; it is argued here that had the true value of wetlands (e.g. providing water purification) been explicitly defined in the impact assessment and evaluation, decision-makers may have been less inclined to grant environmental authorisation. Various other reasons were given by interviewees regarding the poor incorporation of ecosystem goods and services, such as poor communication between biodiversity, economic and social specialists (Table 7: Opinion 13), and poor terms of reference in this regard (Table 7: Opinion 15). Notably, none of the cases research included aspects of ecosystem goods and services in their terms of reference.

The concept of ecosystem goods and services has received considerable attention since the appearance of the Millennium Ecosystem Assessment (2003). Environmental planners and economists have produced over 4000 valuation studies globally (Environmental Valuation Reference Inventory (EVRI), 2003). Importantly, an economic valuation of all ecosystem goods and services has also been developed for South Africa (CSIR, 2004). However, similar to the findings of Brownlie et al. (2006), the results of this research have shown that ecosystem goods and services are poorly addressed in EIA in the CFR. Given that the application of ecosystem goods and services into EIA practice has been shown to support decision-making and guide development into a more sustainable direction (Van Beukering and Slootweg, 2010), the evident absence of this concept in the CFR greatly undermines the objectives of EIA in this region. Van Beukering and Slootweg (2010) noted that ecosystem goods and services are more often included in SEAs as opposed to EIAs. For one particular SEA conducted in South Africa, the inclusion of an economic value associated with biodiversity influenced "typically biodiversity-adverse" politicians in the following ways: they were more open to negotiating no-go areas for sensitive ecosystems; their value of areas linking ecosystems (ESAs) was increased; and they were more interested in ensuring proper management of the affected habitats (Van Beukering and Slootweg, 2010: pp 296-297). The evident lack of incorporating the concept of ecosystem goods and services in EIA in the CFR is therefore considered a major short-fall to biodiversity-inclusive EIA. It is recommended that specialists and EAPs should pay more attention to identifying (and evaluating where possible) ecosystem goods and services.

This section has discussed the various strengths and weaknesses of impact identification and evaluation in the cases investigated by this research. It has shown that EIA has contributed positively to identifying direct impacts on biodiversity pattern, which is the result of rigorous scientific input by biodiversity specialists. However, this section has shown that indirect impacts and those impacting on biodiversity processes are poorly addressed in EIA. Furthermore, this section has discussed how the concept ecosystem goods and services is poorly addressed in EIA, which undermines the value of biodiversity and exacerbates the social injustices associated with large developments. Poorly defined terms of reference is a common finding throughout all the cases investigated by this research. Notably, where terms of reference were not included (such as those aimed at investigating impacts on biodiversity process and ecosystem goods and services), no information has been provided and no impacts were identified. Poor terms of reference may therefore be the primary reason behind inadequate impacting identification and evaluation. This research therefore stresses the importance of formulating terms of reference, which should be an iterative and collaborative process involving specialists, EAPs and the competent authority.

5.2 BIODIVERSITY MITIGATION MEASURES

Similar to section 5.1 of this dissertation, the data pertaining to biodiversity mitigation is comprised of procedural and substantive components. The document analysis was pertinent to extracting information on selected mitigation measures. However, evaluating the procedural effectiveness/appropriateness of mitigation measures posed a difficult task, as best-practice guidance on relating impacts to specific mitigation measures is largely absent in the literature. Therefore, the appropriateness of mitigation measures selected in the cases of this research is discussed qualitatively in text and interpreted in relation to the hierarchy of mitigation selection, i.e. where possible selecting avoidance over minimization, and minimization over rehabilitation, etc. Similar to section 5.1 of this dissertation, interviewees shared professional insights into the practical challenges with regard to mitigation implementation, and contributed to a significant portion of the substantive data in this regard. However, the generalisability of interview data pertaining to mitigation measures was not as evident when compared to data generated for impact identification and evaluation. The richness of this data was therefore more in the individual statements made by the interviewees, which are included in-text where relevant. The other set of data contributing the substantive components of EIA in this regard are sourced from the set of site inspections (see Appendix B), which informs on the implementation success and practicability of mitigation measures.

Similar to section 4.2 of this dissertation, the structure of this section will be organised in accordance with the mitigation hierarchy and will include the following subsections: 5.2.1 Avoidance of Impacts; 5.2.2 Minimization of Impacts; 5.2.3 Rehabilitation and Restoration; 5.2.4 Biodiversity Offsets.

5.2.1 Avoidance of Impacts

This section has been divided into two subsections in order to improve the context of the discussion. These two subsections are: 5.2.1.1 Positive Planning and Alternatives; and 5.2.1.2 Mitigation Measures Aimed at Avoiding Impacts In-situ.

5.2.1.1 Positive Planning and Alternatives

It has been previously mentioned that the avoidance of impacts in EIA in South Africa is primarily achieved by adopting a positive planning approach to proposal formulation. This research has shown that biodiversity specialists were appointed at the earliest stage of EIA. One interviewee elaborated on this stating that developers and EAPs employ specialists during screening, "not necessarily because they're concerned about biodiversity, but rather because they know that CapeNature will take issue with layout options that impact on areas of high biodiversity value" (PA3). Given that there is no legal requirement to appoint a specialist prior to the scoping stage, obtaining information on biodiversity-specific opportunities and constraints is presumably highly valuable to EAPs and developers for improving the efficiency of the application process and increasing the chances of receiving environmental authorisation. This interpretation concurs with the reasons given by De Villiers et al. (2016) for undertaking a pre-application biodiversity screening process. These findings suggest that EIA promotes a positive planning approach to development in the CFR by ensuring the early involvement of specialists to identify regulation 'red flags' (such as threatened vegetation) which informs proposal planning and design.

The Housing Estate case represents a good example of how positive planning resulted in the avoidance of impacts on threatened vegetation. During the screening stage of this application, the specialist identified a corridor of critically endangered vegetation that is present along the south-eastern border of the property; this area was proclaimed a 'no go' zone for development in the specialist report and was subsequently entirely avoided in all development layout options. The evident trend of adopting a positive planning approach by specialists and EAPs highlighted by these findings contrasts with international (Rajvanshi et al., 2010) and South African (Brownlie et al., 2006) studies on the topic.

In addition to the early identification of biodiversity red-flags, positive planning also involves the early identification and evaluation of conceptual alternatives (Brownlie, 2005). As previously discussed in section 2.3.1 of this dissertation, the legal requirement to produce alternatives represents a highly effective regulatory mechanism aimed towards promoting the avoidance of impacts in South African EIA. The results of this research have shown that three of the cases identified a range of layout alternatives and two cases assessed only the applicant's preferred alternative and the standard 'no go' alternative requirement. In the two cases which performed poorly in this regard, the purpose of alternatives is greatly undermined. Given that the 'no go' alternative is effectively a description of the baseline environment, a means for avoiding site-specific impacts through changes in planning and design in EIA is effectively missing in these two cases. A poor application of alternatives shown by this research therefore greatly undermines positive planning in EIA. However, in the three cases that performed well in this regard, the following trends are notable: 1) the final authorised alternative was always different to the preferred alternative motivated by the applicant; 2) the authorised alternative always had a smaller physical footprint than that of the applicant's preferred alternative; and 3) the impact on threatened vegetation was always less than that of the preferred alternative.

One public advisor explained that while the aforementioned trends are true for many EIAs in the Western Cape, the contribution that layout alternatives make towards the avoidance of impacts is undermined by a false negotiation process that takes place between applicants and the decision-makers which is difficult to capture in EIA reporting (PA3). For instance, many developers are so aware of how the EIA system works that they apply for a physical footprint in their preferred alternative which is larger than their actual desired footprint, knowing that anything less will be interpreted by decision-makers as a compromise. Furthermore, two interviewees also noted that developers frequently argue against alternative recommendations made by EAPs and decision-makers for technical or financial reasons (PA2; PA4). These findings concur with DEAT (2004) which noted that alternatives in South African EIA are often deliberately omitted or that alternatives proposed by stakeholders are rejected by developers without adequate justification.

Interestingly, four of the interviewees agreed that while layout alternatives do influence small changes in planning and design, in general, alternatives in the Western Cape contribute poorly to the overall avoidance of impacts (Table 8: Opinion 1). One reason behind this interpretation is the limited attention given to site alternatives that meet the same need of any given proposal. Another reason behind this interpretation is that despite the various other alternative layouts with no impacts, all final authorised alternatives impacted on critically endangered and/or endangered vegetation. The onus is therefore placed on the competent authority to ensure decisions are strategically justifiable and associated with the least impacts on biodiversity.

Given that decision-makers cannot take away property rights to develop, applications need to be carefully assessed in terms of their impacts on the landscape more broadly.

It is widely accepted that the primary purpose of alternatives in EIA is to determine various options for development which reach the same desired purpose and need (Steinemann, 2001; DEAT, 2004; Hill, 2009). As no site alternatives were included in the cases investigated by this research, this greatly undermines purpose of alternatives and the avoidance of impacts in EIA. One public advisor stated, "all applications should have site alternatives, but by the time a developer enters the formal EIA application process they already know exactly where they're going to develop, it's just a matter of deciding on layout options" (PA2). These findings concur with a study by Steinemann (2001) on 142 EIAs, which concluded that alternatives often enter central planning considerations too late to consider more strategic and functionally different types of alternatives.

One interviewee stated that site alternatives are absent in EIA in the Western Cape because, "they are only possible for government EIAs as they own multiple properties that can be used for the same proposal" (PA4). The Industrial Development case investigated in this research represents an application undertaken by local government on municipal property and therefore provides a good basis for such a discussion. This EIA is one of many included in a special economic zone (SEZ) revitalisation programme. The location was predetermined by municipal spatial planning which was based primarily on social factors such as high rates of unemployment in the area. Much of the vegetation in this area includes Cape Flats Dune Strandveld (EN) and Atlantis Sand Fynbos (CR) types, and by threat definition these should both represent critical biodiversity areas. This finding substantiates the opinions of three interviewees that social aspects are favoured over biodiversity aspects in the decision-making process (Table 20: Opinion 2). This evident trade-off is argued here to represent a flaw in the decision-making process. Furthermore, because the planning for this SEZ was undertaken prior to any EIA applications, and without the benefit of a SEA, there was no formal requirement for the determination of site alternatives for a development node such as this SEZ.

In the absence of site alternatives, sound spatial planning that is informed by biodiversity constraints represents a vitally important mechanism for avoiding impacts through proposal planning and design. However, it is evident that the SDF for the City of Cape Town has failed to incorporate national priority considerations for avoiding impacts on the critically endangered and endangered vegetation types present in the Industrial Development area. One interviewee elaborated on these findings, stating that, "planners often do consider biodiversity constraints, but they get dictated to by politicians whose primary focus is to look for jobs and employment opportunities" (PA2). These findings substantiate the opinions of three interviewees that spatial planning tools (such as SDFs and IDPs) contribute poorly to the overall avoidance of impacts, as social priorities always trump conservation priorities in this process (Table 8: Opinion 2). Furthermore, this also substantiates the opinions of 4 interviewees that decision-making in South Africa is influenced by political pressures (Table 20: Opinion 1). This finding concurs with that of Steinemann (2001) who concluded that alternatives in EIA can be subject to agency agendas. This is argued here to represent a significant flaw in the decision-making process, as decisions regarding impacts on critically endangered and endangered vegetation should be considered independently of municipal land use designations.

It was a common opinion of all interviewees that spatial biodiversity plans (such as CBA maps and bioregional plans) are essential for promoting the avoidance of impacts by informing the determination of site and layout alternatives. Given that site alternatives are for the most part absent in EIA in the selected cases, this information can be used by EAPs and specialists to inform layout options, as well as by the competent authority to inform the strategic implications of decisions. The high levels of compliance with providing spatial biodiversity information in EIA shown by this research is likely because EAPs and specialists have recently been required to include this as relevant information (DEA&DP: 0016/2014).

The results of this research have shown that critically endangered and endangered vegetation has been impacted on despite being identified in specialist reports. These findings substantiate the opinions of two interviewees that spatial planning only contributes to biodiversity conservation when it significantly influences the decision-making process (Table 8: Opinion 4). Converting spatial biodiversity plans into bioregional plans should therefore be considered a priority for biodiversity conservation at the level of local government. However, one interviewee explained this process is difficult because, "spatial biodiversity plans cannot be in conflict with SDFs, so sacrifices have to be made in areas of high biodiversity value which have been allocated for development" (PA1). This issue arises due to conflict between spheres of government, and is recognized as a significant barrier to the incorporation of biodiversity conservation policy in EIA (C1, DM1, PA1).

5.2.1.2 Mitigation Measures Aimed at Avoiding Impacts In-situ

This research has identified two types of mitigation measures aimed at avoiding impacts in-situ. Firstly, when areas of high biodiversity value are identified by specialists, these are generally avoided in project design and are required to be formally rezoned and managed as conservation areas. Secondly, buffer zones are recommended to ensure that an adequate distance is maintained between development and areas of high biodiversity value. These types of mitigation measures were recommended for the Golf Course & Housing Estate, the Housing Estate, and the Commercial Development.

Rajvanshi et al. (2010) note that the purpose of mitigation in EIA is to look for ways to achieve the project alternatives while avoiding negative impacts, or reducing them to acceptable levels. Furthermore, these authors also state that biodiversity mitigation also seeks to optimise the benefits to biodiversity. While in-situ conservation areas are certainly a mitigation measure aimed at avoiding impacts, in order to significantly optimise the benefits of these mitigation measures, EIA needs to ensure the formal conservation of these areas in the future. Many specialists and EAPs achieve this by including the requirement to rezone these areas to private open space, thereby precluding any future land uses that would impact on the conservation of these areas. In two of the cases subject to site inspections, only the Golf Course & Housing Estate partially complied with this requirement (see Appendix B1: Condition 1). Additionally, poorly defined conditions of authorisation were also found to undermine the designation of the conservation area at the Golf Course & Housing Estate. Specifically, the designation of the in-situ conservation area for this case was conditional upon reaching a particular phase of development. Upon site inspection, it became evident that this phase has not yet commenced, and there is therefore no legal obligation upon the developer to implement this mitigation measure approximately ten years after authorisation.

Where rezoning was required for the Golf Course & Housing Estate, the specialist and EAP also stated that access to the in-situ conservation area by the public must be ensured (see Appendix B1: 19.2). This is a valuable nuance as it contributes to the CBD objective relating to the fair and equitable sharing of benefits arising from the use of biological resources and no other case included this in their recommendations. However, upon site inspection, it became clear that access to this area is only possible by first entering the estate - a process which is subject to various security checks. Furthermore, no signage was present outside of the estate to indicate public access to this area. Theoretically, ensuring public access is a gain to biodiversity conservation – practically however, the benefit of such a recommendation is lost as a result of poor implementation.

Designated in-situ conservation areas make an additional contribution to biodiversity conservation when incorporated into CapeNature's stewardship programme. Of the three cases in this research that designated in-situ conservation areas, only the Golf Course & Housing Estate case had stewardship incorporation requirements in their conditions of authorisation, although approximately ten years after authorisation this has not yet been initiated. The interview process highlighted various limitations when rezoning in-situ land and incorporating these areas into stewardship programmes. Firstly, rezoning conditions of authorisation are contentious and have been legally set-aside in the past as it was defended on the grounds of appropriation of land use rights (PA2). Secondly, when such areas are incorporated into stewardship, CapeNature incur a variety of associated responsibilities (drawing up conservation management plans, monitoring and reporting, etc.) for which they do not have the resources (C1, PA1, PA2, PA4). These opinions are questionable, as the provincial offset guideline (DEA&DP, 2011) make it clear that financial provisions must be made for management plans and for associated management costs. Lastly, one public advisor explained that reactive stewardship is often less successful than proactive stewardship as those involved in reactive stewardship are often averse to the process and therefore lapse on their own responsibilities (PA4). For these reasons, many of the interviewees were of the opinion that CapeNature avoid reactive stewardship and the associated responsibilities (C1, PA1, PA2, PA4). This is highly unfortunate, as reactive stewardship through EIA has the capability of significantly improving the management of land outside of protected areas and nature reserves. Two interviewees suggested that reactive stewardship will be far more influential if CapeNature become exempt of any responsibilities to produce management plans and the monitoring and reporting of their implementation (C1, PA1).

In addition to the formal designation of sensitive areas identified in specialist reports, ecological buffers are also typically recommended to ensure impacts on these areas are entirely avoided. While buffer areas don't require specific management, they do preclude any form of disturbance. Six conditions of authorisation related specifically to ecological buffers surrounding sensitive areas identified in their specialist reports. However, in some cases the recommended buffers were found to be poorly defined by specialists and EAPs. For instance, the specialist for the Golf Course & Housing Estate case recommended a buffer of 30m from, "the center of the wetland". The reason for defining a buffer in relation to the center of a wetland as opposed to the edges has presumably got to do with the seasonal dynamics that wetlands are typically subject to, which makes defining spatial boundaries difficult. This makes the monitoring and reporting on such conditions difficult. Specifically, upon site inspection, the distance of one house to this wetland was less than 30m to the water's edge (see Appendix B.1:

25). Non-compliance with a 25m buffer was also noted at the Commercial Development site, where a road and a fence were within 5m of an identified sensitive wetland.

The results of this research have shown that three of the five cases have mitigation measures aimed at avoiding impacts, and two did not. In the two cases which did not, namely the Industrial Development and Search & Rescue cases, the absence of such mitigation measures is argued here to represent a significant flaw. Ekstrom et al. (2015) highlight the following advantages to selecting avoidance over other mitigation measures: most ecologically effective and associated with the lowest risk; increased chance of achieving no net loss of biodiversity and/or a net positive impact on biodiversity; financial costs associated with avoiding biodiversity are once-off, not ongoing (i.e. requiring management); there is a clear scientific basis; and the implementation is immediate and does not require long time frames to achieve outcomes that would be necessary for minimization, restoration and offsets. The two cases which did not identify avoidance mitigation measures are the same two cases which failed to identify a reasonable range of alternatives. It is argued here that alternatives should have been produced for these cases which identified layout options to allow for the avoidance of impacts, rather than immediately relying on minimization and offset measures.

This section has shown a mixed performance by the cases in terms of avoiding impacts on biodiversity. Three cases showed evidence of successfully reducing their impacts on biodiversity through avoidance measures. This evidence include the following: the early appointment of biodiversity specialists to identify sensitive 'no-go' areas for development; the formulation of a range of alternatives each with a varying degree of impacts on biodiversity; and the recommendation of mitigation measures to ensure for the avoidance of impacts, such as the formal designation of in-situ conservation areas and buffer zones. However, it must be noted that the avoidance of impacts on biodiversity in these cases is undermined by the poor implementation of mitigation measures in this regard. The two remaining cases contributed poorly to the avoidance of impacts, which is the result of inadequate layout alternatives and the absence of mitigation measures aimed at avoiding impacts in the construction and operational phases. This research has shown that the overall avoidance of impacts on biodiversity in EIA is undermined by the absence of site alternatives, poorly defined conditions of authorisation and poor decisions made by the competent authority.

5.2.2 Minimization of Impacts

The results of this research have shown a variety of different mitigation measures aimed at minimizing impacts. The majority of minimization mitigation measures were recommended for the Commercial Development case. In one such example, the wetland specialist identified the wetlands as important bird habitats and recommended, "these areas should be designed to attract birds such as the production of heronries". However, of the five minimization mitigation measures recommended for the Commercial Development, only the mitigation measures relating to road signs and speed humps to reduce faunal mortality have been successfully implemented (see Appendix B2). This is highly unfortunate, as minimization mitigation measures represent important means for meeting goals of biodiversity persistence (ensuring ecological processes). For instance, one road was authorised to bisect a sensitive wetland area and the specialist recommended that a wide-spread bridge/culverts be used for all sections of this road. This recommendation is to ensure for the persistence of biological interaction and connectivity between the divided wetland (Table 11: Condition 4). However, upon site

inspection, it was noted that this road comprised primarily of infilled areas, and one concrete pipe/culvert was noted which certainly did not seem to inspire any biological connectivity between the divided wetland (see Appendix B2: 6.4 and 7.3).

Two cases investigated in this research recommended a search and rescue, namely the Golf Course & Housing Estate and Search & Rescue case. However, six interviewees were of the opinion that search and rescue should not be considered a mitigation measure as it cannot contribute to achieving biodiversity goals and objectives, such as NNL or NPI (Table 12: Opinion 1). One interviewee elaborated on this, stating (PA3):

"Search and rescue is falsely punted by conservationists, EAPs and even politicians as a mitigation measure. Search and rescue should be done as standard practice on any site where we know there's going to be an irreversible impact on biodiversity. It should not be viewed as a solution to downgrade the significance of an impact".

The search and rescue undertaken for the Golf Course & Housing Estate conformed to the abovementioned statement in that it was recommended in addition to other mitigation measures aimed at reducing impact ratings, such as offsets and formal rezoning. Specifically, search and rescue was not included in the impact assessment and evaluation undertaken by the specialist for this case. Notwithstanding, the search and rescue undertaken by this case performed little to no ecological or conservation function. Plant species were selected randomly and placed in an open gravel track, which subjected them to environmental pressures associated with edge effects, such as desiccation resulting from wind and heat exposure and reduced connectivity (see Appendix B1: Condition 23).

This Search & Rescue case has been named as such as no development was motivated in this application, and the entire focus of this EIA was on the search and rescue process. This in itself represents a significant flaw, and by not motivating for a specific development it prevents the full consideration of layout alternatives which incorporate in-situ conservation, as well as a range of mitigation options to determine which is most appropriate. It became evident in the document analysis that an offset was considered for this case, but in this particular case it was either a search and rescue or an offset, not both. A few interviewees admitted they had never seen such an application (C1, PA2, PA4).

An important aspect of search and rescue is determining the donor site. For the Golf Course & Housing Estate case, vegetation contained within the authorised physical footprint was translocated to degraded, barren land in-situ. In this regard, search and rescue appears to be a mitigation measure aimed at minimizing the direct impact of removing vegetation. However, search and rescue in this sense should rather be interpreted as a form of restoration, which should supplement other indigenous landscaping efforts (PA3). The donor site for the Search and Rescue case translocation is a municipal reserve, which was agreed upon by the various stakeholders involved in this case (CapeNature, CoCT, DEA&DP). This reserve contains one of the last habitats of the identical vegetation type to that which was subject to the search and rescue process for this case. This too is argued here to represent a significant flaw, as replacing like for like theoretically represents a loss for the conservation of this critically endangered vegetation type.

Many of the interviewees advocated against search and rescue as a mitigation measure due to the apparent low rate of success of these operations in the Western Cape (Table 12: Opinion 2).

One reason for this may be the poor reception of fynbos vegetation to being uprooted; many fynbos plants have incredibly fine root systems in order to maximize their nutrient uptake in the nutrient-poor soils of the Western Cape (Lamont, 1982), and are therefore heavily disturbed once uprooted for translocation. However, it was noted that certain geophytic species can be amenable to translocations, as their underground storage systems act as a resource bank to tide them through the disturbance association with translocations (PA1). Notwithstanding, one public advisor stated that in the large translocation schemes s/he is currently overseeing, mortality rates of as high as 80% are being recorded, and in general search and rescue in the Western Cape experiences no less than 40% mortality (PA2).

Ekstrom et al. (2015) not that search and rescue could be considered a minimization measure if the action is expected to yield a measurable conservation benefit and all risks have been weighed and assessed. Furthermore, these authors note that search and rescue can result in new impacts, and do more harm than good if not carefully assessed and planned. Inadequate planning and the absence of a risk assessment for the search and rescue operations investigated by this research may therefore be another reason for the evident low rate of success. Notably, the document analysis revealed that no planning was undertaken for the search and rescue conducted at the Golf Course & Housing Estate, and a brief methods statement was submitted for the translocation for the Search and Rescue case. International guidelines relating to translocation planning have been produced (IUCN, 2013), which include, inter alia, the following requirements: planning the translocation (goals, objectives, actions, monitoring program design); feasibility and design (biological feasibility, social feasibility, regulatory compliance, resource availability); a risk assessment; and implementation (monitoring, continued management). None of these requirements were included for the translocations investigated in this research.

Particular aspects influencing the success of botanical translocations are the methods used and time of year at which the operation is conducted. The methods statement for the Search and Rescue adequately stated these details; specifically, this search and rescue was to be done by stockpiling and translocating topsoil from the receptor site during the month of November (late spring/early summer). However, this method differs to that suggested by the specialist report, which stated the translocation should be done in sods (translocating divided portions of in-tact soil and vegetation). The flaws of translocating stockpiled receptor soil are that it excludes the translocation of non-geophytic species, and is known to be less successful than sod translocation methods (PA1, PA4). Continuous watering of intact translocated sods allows for easy uptake of the root system. However, upon site inspection it was noted that watering was done for the stockpiled soil, which intensely compacted the soil and has evidently prevented geophyte regrowth. Furthermore, the translocation process took place in mid-summer (early February), and the high temperatures and windy conditions associated with this time of year is known to prevent search and rescue success (PA1). The result of the translocation for the Search and Rescue case is therefore a predominantly barren patch of clay soil, and an agreed upon failure by those present at the site inspection (among others, including interviewees PA1 and PA4). A few species were noted to be growing in the translocated area – however, as no species list was provided with the methods statement, it cannot be determined whether this is regrowth from receptor plants or seedlings from dispersal spill-over from the surrounding vegetation.

These findings have identified various reasons why search and rescue should not be considered a mitigation measure. Firstly, using search and rescue to mitigate impacts is theoretically ungrounded as it cannot contribute to objectives of NNL or NPI. Even if search and rescue is viewed as a minimization measure, this is still in conflict with the mitigation hierarchy as no mitigation measures aimed at avoiding these impacts were explored, which is argued here to represent a significant flaw in this case. However, search and rescue should not be discouraged as a method to augment restoration efforts for degraded areas in-situ. Secondly, the general failure of these operations that has become evident through the interview process and site inspection at the Search and Rescue donor site shows that this process is hampered by poor planning, implementation and decision-making (specifically the acceptance of an inadequate methods statement).

This research has shown various mitigation measures aimed at minimizing impacts. The minimization measures recommended by specialists are theoretically grounded as they have the potential to reduce the severity of the identified impacts. However, all the minimization measures are found to be undermined by poor implementation.

5.2.3. Rehabilitation

Restoration is defined by Brownlie (2005; p48) as, "the process of reinstating the pre-project pattern and process to allow the ecosystem to become self-regulating". Restoration is therefore more applicable to EIAs where impacts are temporary, such as those associated with mining activities. Rehabilitation, however, is a process more associated with the active conversion of a pre-project habitat to another which is more appropriate for meeting biodiversity goals and objectives (Brownlie, 2005). As the impacts of the cases in this research are all permanent, no mitigation measures relating to restoration were recommended, and the majority of rehabilitation recommendations exclusively involved alien clearing and management.

Two of the cases involved rehabilitation that was not alien clearing and management, namely the Golf Course & Housing Estate and Commercial Development cases. For the Golf Course & Housing Estate, the specialist noted a high degree of erosion taking place along the majority of the watercourses inside the property, and it was recommended that rehabilitation of these areas be undertaken. Although it is not possible to measure progress pre and post development, upon site inspection a high degree of erosion and run-off from the neighbouring farm was noted, and it appeared very little attention was given to ameliorating these effects (see Appendix B1: Condition 23). This has resulted in various negative implications for biodiversity conservation, including the loss of topsoil, siltation and the pollution of downstream aquatic systems. The lack of attention in this regard may be due to the failure to include this specialist recommendation directly as a condition of authorisation.

The rehabilitation mitigation measure recommended for the Commercial Development in this regard relates to improving the water quality of the wetlands present on the property (Table 13: Condition 8). This case fully complied with their responsibility in this regard, and after a discussion with the permanent conservation officer on site, it was revealed that the wetlands are cleared of litter, and indicators of water quality (pH and electrical conductivity) are measured, on a weekly basis. Notably, this recommendation was included as a condition of authorisation, which may therefore be responsible for the evident compliance.

Three of the interviewees were of the opinion that ensuring the proper management of in-situ conservation areas is as important as the formal designation of these areas itself (PA3, PA2, C1). Recognizing this, specialists and EAPs recommended rehabilitation and/or alien clearing for all the cases with in-situ conservation investigated in this research. However, the results of this research have shown that rehabilitation is undermined by poorly defined conditions of authorisation and poor management planning in this regard. One interviewee stated, "a plan for undertaking rehabilitation and alien clearing must be included in the conditions of authorisation" (C1). Two points of valuable information can be extracted for this statement. Firstly, an alien removal plan must be included in the EIA which stipulates time bound and measurable objectives. Secondly these plans must be produced prior to the environmental authorisation.

In the absence of a plan detailing measurable outcomes, the approach to alien clearing in the two cases inspected in this research was ad hoc. For instance, upon speaking with the manager of the Golf Course & Housing Estate, it was admitted that the majority of alien clearing has taken place along the perimeter of the development in order to improve the security of the estate, whereas the conservation and wetland areas were found to be heavily infested with alien vegetation (Appendix B.1: Condition 23). For all the cases that included alien clearing as a mitigation measure, none of them produced an alien management plan prior to receiving environmental authorisation. The result is very little urgency for undertaking alien removal for the cases investigated in this research. Notably, the Commercial Development only began alien removal in the year 2015, approximately 9 years after authorisation, and the Golf Course & Housing Estate have made little to no definitive commitment to ensuring the removal of alien vegetation. Furthermore, in the absence of an alien removal plan, the manager of the Golf Course & Housing Estate admitted uncertainties with how to adequately deal with the invasive aliens on their property. Specifically, a large portion of Port Jackson was cleared at this site twice in two years, but regrowth of this invasive alien has continued.

Managing and controlling the spread of Kikuyu grass for an application to develop a golf course should be at the forefront of environmental concerns, and certainly one condition stating that Kikuyu will not be allowed in certain areas does not adequately address this impact. Upon site inspection, it was clear that Kikuyu had invaded much of the conservation and wetland areas (see Appendix B1: Condition 23). Alien invasive management is a technical process that must be undertaken with methods specific to the species, and an estate manager should not be expected to have knowledge of this topic. This emphasises the need for a specialist to draw up these plans, or a third party with the appropriate technical competencies.

The interview process highlighted two important points regarding alien clearing and the motivation of alternatives by EAPs and developers. Firstly, one public advisor stated that, "EAPs and developers often motivate against the no-go alternative (proposal rejection) as the maintenance of the status quo is argued to result in increased presence of alien vegetation" (PA1). Additionally, another public advisor mentioned that EAPs and developers motivate for project approval as alien clearing is argued to contribute positively to the conservation of biodiversity on site. While this is certainly true, it should not be used as a motivation for project approval, as landowners are compelled by NEM:BA to manage alien vegetation on their property regardless of the outcome of an EIA application. Furthermore, given the low success rate of the alien clearing mitigation measures highlighted by this research, and for the Western Cape generally (PA2, PA4), this motivational argument by EAPs and developers becomes even

less justified. However, where EIA can contribute to the management of aliens when this is adequately addressed by specialists and EAPs through the production of an approved alien clearing plan, detailing time bound objectives and mechanisms for effective monitoring and reporting.

5.2.4 Biodiversity Offsets

Very little literary consistency was found in the definitions of biodiversity offsets. Rajvanshi et al. (2010) include a wide range of activities in their definition which are intended to achieve NNL or NPI. However, this approach seems to fit more closely with the mitigation hierarchy in general. For instance, Rajvanshi et al. (2010) include 'on-site' offsets in their definition, which are comparable to the in-situ conservation areas as discussed in section 5.2.1 of this dissertation. For the purpose of this research, offsets are considered to be final the consideration of the mitigation hierarchy (i.e. after measures to avoid, minimize or restore impacts have been considered). The results and discussion surrounding biodiversity offsets in this section will therefore be aligned to the South African offset distinction (DEADP, 2011) as discussed in section 2.3.2 of this dissertation, which correlates more closely with the following definition of biodiversity offsets as proposed by Ten Kate et al. (2004: p6):

"Biodiversity offsets are conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects to ensure 'no net loss' of biodiversity".

Table 15 shows the different offset mitigation measures recommended by the specialist reports investigated in this research. For the Commercial Development and Golf Course & Housing Estate cases, the recommendation to include an offset was highly appropriate, as both these developments has residual impacts that required mitigation after measures to avoid, minimize and rehabilitate were addressed. However, it must be noted that no mitigation measures aimed at avoiding, minimizing or rehabilitating impacts associated with the Industrial Development case were considered prior to the offset recommendation. This is therefore in direct conflict with the hierarchy of mitigation consideration and is argued here as a significant flaw in this case. Additionally, this development resulted in the removal of critically endangered and endangered vegetation, which was noted by the specialist report as an irreversible impact, and resulted in an irreplaceable loss of biodiversity. These too represent significant flaws for any application (Brownlie, 2005).

Two of the interviewees support offsets as a mitigation measure specifically because it allows for proactive conservation in areas of high biodiversity and ecological importance (PA1, PA2). The selection of the offset site is therefore integral to the quality of this mitigation measure. In all the cases with offset mitigation measures, the process of determining the offset site was a discussion between the specialist and public advisors in order to determine a site of equal biodiversity value. The area of the offset site is calculated using a ratio-based approach. For instance, where critically endangered vegetation has been impacted on as a result of a development outside the urban edge, an offset size of up to 30 times (ratio of 1:30) that of the size of the affected vegetation must be compensated for. This ratio is reduced to 1:2 for critically endangered vegetation within the urban edge, and is therefore applicable to the cases investigated in this research (DEA&DP, 2011). However, the Industrial Development case is one part of a land-bank scheme and ratio-based conversions for specific developments were not

made clear by the document analysis process. A land-bank scheme is one where all developments for a particular area contribute financially to a biodiversity offset elsewhere, which in this case was determined by the local government. However, two interviewees stated that the offset ratio for all developments for is 1:1 (PA1, PA4). This is therefore in direct conflict with best-practice offset requirements (DEA&DP, 2011), and has resulted in a loss of biodiversity. Similarly, for the Golf Course & Housing Estate and Commercial Development cases, no offset ratios were stated in either the specialist reports or the EIRs. Notably, the recommended sites all had the same vegetation type as that which was lost as a result of the development.

A major issue identified in the document analysis with respect to offset mitigation measures was the conversion of these specialist recommendations into conditions of authorisation. Notably, neither the Commercial Development nor Golf Course & Housing Estate had conditions of authorisation relating to their specialist offset recommendations. Both specialists regarded these offsets as essential for mitigating the residual impacts associated with the respective developments. This absence of legally enforceable conditions of authorisation removes the responsibility for developers to implement such mitigation measures. Upon site inspection and discussions with the site managers, neither the Commercial Development nor the Golf Course & Housing Estate have made any efforts towards securing these sites as biodiversity offsets (see Appendix B). The evident non-compliance with these specialist recommendations is presumably the result of the failure to include these recommendations as conditions of authorisation. It was noted by a few interviewees that offset recommendations are often argued against by EAPs and developers because they are perceived to be unreasonably expensive (Table 16: Opinion 4). Interestingly, one public advisor stated that, "offset financial liability is seldom more than 1% of the total development costs" (PA3).

The interview process highlighted two major factors determining the success of biodiversity offsets. Firstly in order for offsets to make a meaningful contribution to conservation, they need to be rezoned and incorporated into CapeNature's stewardship programme. One interviewee elaborated on this, stating, "if offset sites aren't formally protected, nothing is legally precluding development on this land in the future, and offsets in this scenario will simply just be rinsing money through the system" (PA3). Secondly, in order for offsets to make a meaningful contribution to conservation they need to ensure for the proper management of this land in perpetuity. This includes, inter alia, alien removal, fencing, security, the production of fire breaks and a host of other rehabilitation measures (PA3).

Two interviewees identified management as the major financial cost in effective offsets (PA1, PA3). One elaborated on this stating that, "of the offset cases I've been involved with, the associated management costs can often represent up to 90% of the overall financial contribution required for biodiversity offsets" (PA3). As the Industrial Development case only required the provision of finance to contribute to the land-bank, no management responsibilities are imposed on the developer. The management responsibilities therefore lie with the City of Cape Town, and by implication, the ratepayers of the Cape Town municipality. This is also argued as a significant flaw of this case. The decision-maker interviewed in this case stated, "maybe funds derived from offsets could be used to contribute to the existing management of areas, because offsets never require management costs" (DM1). The management of offset sites in perpetuity should be achieved by the establishment of a Trust Fund, which generates a monthly return which is to be allocated for management. However, two

interviewees were of the opinion that offset costing is flawed and ineffective (Table 16: Opinion 2). Both the Commercial Development and Golf Course & Housing Estate cases included a management trust funds in their conditions of authorisation for the "management of all conservation areas". However, given that these two cases were not required to secure ex-situ biodiversity offsets, these funds are therefore only required for in-situ management. As the funds for in-situ management are always derived from the developer in any case, one interviewee stated, "the only purpose of trust funds in this regard is to provide for oversight of conservation expenditure by compliance authorities" (PA4).

These results have shown that biodiversity offsets are widely accepted in the EIA community. On interviewee stated that, "offsets are vitally important for conservation, because you have to be proactive about securing land for conservation unconditionally" (PA1). Another stated, "reactive EIA isn't working in the Western Cape, it's a piecemeal process that yields very little for conservation" (PA2). However, through the document analysis process, it has become evident that the cases performed poorly in aligning the implementation of offset requirements with provincial guidelines (DEA&DP, 2011). Specifically, legally binding obligations on developers to adequately implement their offset requirements is hampered by poorly defined conditions of authorisation. Furthermore, these results have shown a poor consideration of the mitigation hierarchy, as offsets have been selected prior to exploring mitigation options aimed at avoiding, minimizing or rehabilitating impacts.

5.3 BIODIVERSITY MANAGEMENT DURING IMPLEMENTATION

The management of biodiversity during the implementation stage of EIA will be discussed in this section and will include insights into the quality of the EMPrs produced to manage impacts in the construction and operational phases, as well as compliance and enforcement. This section will also summarise the flaws in terms of practice and implementation of EIA. This section will therefore include the following subsections: 5.3.1 Environmental Management Programmes; 5.3.2 Compliance and Enforcement; and 5.3.3 Decision-making and Flaws in EIA.

5.3.1 Environmental Management Programmes

The overall compliance with best-practice requirements for producing EMPrs is comparable to the compliance by specialist in meeting best-practice biodiversity reporting requirements. Notably, Figure 5 shows that 56% of KPIs were fully complied with, 20% were partially complied with, and 14% were not addressed at all in the cases' EIA documentation

The document analysis process identified two broad issues with regard to the production of EMPrs. Firstly, four of the five cases produced their EMPrs only after receiving environmental authorisation. As these documents are required for decision-making regarding environmental authorisation, this is in direct conflict with this legal requirement. Furthermore, as the substance and quality of these documents should be assessed prior to granting environmental authorisation, it is argued here that this significantly undermines the overall quality of EMPrs. It is possible that a draft EMPr was submitted for these cases prior to receiving environmental authorisation, however these were not accessible to the researcher. If this is the case, however, the evidently poor quality of these documents identified by this research would therefore be the result of poor decision-making. The approval of an EMPr by the competent authority which lacks adequate planning, guidance and site specific components will significantly undermine the ability of EIA to act as a safeguard to biodiversity.

Secondly, many of the environmental authorisation documents and conditions of authorisation omitted specific mitigation measures and simply stated, "the mitigation measures contained within the EMPr must be implemented and complied with". This too is argued to greatly undermine the quality of EMPrs and the enforceability of conditions of authorisation, and inhibits the conversion of specialist recommended mitigation measures into legally binding responsibilities. The decision-maker interviewed in this process stated that mitigation measures are often included in EMPrs because, "amending environmental authorisations is difficult as it requires an assessment into these changes. Amending an EMPr does not require this assessment and is therefore easier for us to do" (DM1). The reasons for needing to amend an EA or an EMPr was not made clear in this interview, but it is suggested here that careful thought and assessment into the quality of these documents should be undertaken prior to granting authorisation to ensure amendments are not necessary. Furthermore, it is also recommended here that mitigation measures recommended by specialists should be included in the conditions of authorisation as well as in the EMPr, as this provides a more direct means for compliance monitoring and reporting.

Another issue has been identified in the document analysis process that relates to the Commercial Development case only. Specifically, no publically accessible EMPr was produced and submitted to the competent authority, and the management of this development in the operational phase is controlled by an IT software system only accessible by the EAP. This case was therefore omitted in the evaluation of EMPr quality and is argued here to represent a significant flaw in the management system of this development.

Morrison-Saunders et al. (2007) have shown that the quality of management documents is increased when all relevant stakeholders are involved in its design. All the cases are noncompliant in this regard (Table 17: KPI 2.1) for two confounding reasons. Firstly, as the EIA regulations require the inclusion of an EMPr in the S&EIR application process (EIA Regulation 26 (d) (iv)), the second public participation opportunity should theoretically allow for the involvement of I&APs in EMPr design. However, given that I&APs are often responded to inadequately (PA4), the influence that public participation has on controlling the quality of EMPrs may therefore be limited. Secondly, as four of the five cases only produced their EMPrs after receiving environmental authorisation, it's unlikely that these documents were subject to a formal public participation process. These reasons are therefore argued here to greatly undermine the overall quality of EMPrs, as the mechanisms which control the quality of these documents (public participation and the decision-making process) is effectively absent.

The results of this research have shown that the cases performed well in terms of complying with generic requirements of EMPrs, such as defining auditing programmes, provisions for review and updating and environmental awareness training. However, these results have also shown that the cases performed poorly in terms of defining site-specific issues that require monitoring, as well as time bound and measurable goals and objectives. The Housing Estate provides a good example to substantiate the latter. Notably, of all the mitigation measures recommended by the specialist for this case, only the mitigation measure relating to 40m buffers was included in either the conditions of authorisation or the EMPr. Only the Commercial Development case adequately represented all of their specialist recommendations in the conditions of authorisation, and due to the absence of a publicly accessible EMPr for this case, the quality of the EMPr in terms of representing these conditions cannot be determined.

The fact that so few mitigation measures were included in the EMPrs substantiates the opinions of three interviewees that EMPrs are often generic documents without measurable outcomes (Table 18: Opinion 1). One interviewee elaborated on this stating that, "as a result of poorly defined EMPr goals and objectives, developments in the construction and operational phases incur unmitigated impacts on biodiversity" (C1). This therefore greatly undermines the contribution of EIA towards biodiversity conservation. However, while this is certainly a flaw in the decision-making process, adequately defining mitigation measures in terms of measurable outcomes is the responsibility of the specialist and EAP. One interviewee elaborated on this explaining that this issue is confounded because, "specialists and EAPs often recommend highly unreasonable mitigation measures which are often impractical and financially unfeasible" (PA3). Specialists and EAPs are therefore required to pay careful attention when practically defining mitigation measures in terms of desired outcomes.

5.3.2. Compliance with Biodiversity Mitigation Measures

While this research has not included many aspects of compliance in EIA, such as the role of ECOs in monitoring impacts, the results of the site inspections are used here as a basis for the following discussion of the general practice of compliance monitoring in the Western Cape.

The overall compliance in terms of implementing mitigation measures is unacceptably low, indicating a mere 18% full compliance, 36% partially compliance and 46% non-compliance. Notably, one public advisor indicated that these figures are in fact rather high when compared to compliance on a provincial level (PA3).

The interview process identified two primary reasons for the evident low levels of compliance with biodiversity related mitigation measures in EIA in the Western Cape. Firstly, many interviewees were of the opinion that low levels of compliance with mitigation measures is the result of poorly defined conditions of authorisation and EMPrs, which makes the process of compliance monitoring difficult and confusing for inspectors. Interestingly, the decision-maker interviewed in this research stated that, "compliance monitoring only takes place for management measures included in the conditions of authorisation" (DM1). Secondly, compliance with biodiversity related mitigation measures is undermined by capacity constraints of the competent authority and CapeNature. One interviewee elaborated on the latter, stating that, "a mere 10% of developments are audited every year due to insufficient funding and staff to perform these functions. Developers therefore take risks by actively avoiding biodiversity mitigation measure implementation, because they know the chances of being audited are slim" (PA3). Furthermore, compliance and enforcement of biodiversity-related mitigation measures is primarily reactive in that inspections only take place once a formal complaint has been lodged. It should be noted that in the Search & Rescue case, a large amount of natural vegetation was illegally bulldozed prior to receiving environmental authorisation, and apparently no consequences have come of this transgression, despite the lodging of formal complaints by many public advisors and consultants (PA1, PA4).

Another instance of an environmental crime was noted at the Golf Course & Housing Estate case, where a watercourse and wetland had been physically altered to create a scenic pond near the development. This highlights the limited capacity for the competent authority to undertake routine site-inspections. Another factor undermining compliance is the judiciary value system;

one interviewee stated that, “we have so many severe social crimes that environmental crimes are often seen as victimless by the courts” (PA3).

5.3.3 Decision-making and Flaws in EIA

This section will summarise the instances where poor decision-making has negatively influenced the capacity for EIA to act as a safeguard to biodiversity. This section will also summarise the flaws in EIA procedure and implementation which have undermined the conservation of biodiversity. The importance of decision-making in EIA cannot be emphasized enough, as this is the primary mechanism which controls the quality of information generated by EAPs and specialists, as well as the implementation success of EIA in the stages subsequent to receiving environmental authorisation.

A major flaw identified by this research regarding the identification of impacts is the poor quality of terms of reference. Terms of reference were found to be generic, and typically lacked research questions aimed at investigating impacts on biodiversity process and ecosystem goods and services. Furthermore, terms of reference were limited to identifying impacts on site, and failed to address the potential for the proposal to impact on biodiversity outside of the property borders. A failure to adequately formulate terms of reference has been shown by this research to have a knock-on effect on the generation of information. For instance, as terms of reference are typically aimed at investigating impacts on site only, spatial boundaries were found to be poorly defined as a result. This research has shown that decision-makers are not involved in the formulation of terms of reference, and this is considered a significant flaw by this research. Terms of reference should be considered the foundation of EIA investigation, and decision-makers should rigorously assess their appropriateness with the submission of the screening report. This research recommends that more attention should be given to the formulation of terms of reference at the outset of EIA.

The inability of EIA to account for seasonal variations in biodiversity greatly undermines EIA as a safeguard to biodiversity. It is therefore recommended that seasonal assessments of biodiversity should be conducted prior to entering the formal EIA process, or this uncertainty needs to be accounted for in the evaluation of impacts.

This research has shown that EIA is unable to account for the cumulative impacts on biodiversity. As EIAs are usually conducted in a site-specific approach, development in the CFR is resulting in reduced biological connectivity in the landscape. Given that many interviewees were of the opinion that EIA should not be responsible for dealing with cumulative impacts, the responsibility falls with the competent authority to ensure that individual decisions are strategically justifiable. This research has shown that developments have been authorised despite obvious impacts on ecosystem connectivity, and this is therefore considered a significant flaw in the decision-making process.

This research has also identified the inadequate formulation alternatives as a significant flaw in this research. Specifically, two cases identified only the proponent’s preferred alternative and the no-go. This greatly undermines the ability of EIA to avoid impacts on biodiversity. The authorisation of an EIA application with effectively only one layout design is considered a significant flaw by this research. Furthermore, the absence of site alternatives shown by this research greatly limits the ability of EIA to safeguard biodiversity by avoiding impacts and ensuring development is strategically justifiable.

Two cases performed poorly in terms of applying mitigation hierarchically. Specifically, neither the Search & Rescue nor Industrial Development cases explored any mitigation aimed at avoiding the impacts on site. This may be the result of the inadequate development of layout alternatives for these cases. Notwithstanding, it is argued that neither of these cases should have been authorised in the absence of adequate alternatives and avoidance mitigation measures. This is therefore considered a significant flaw in the decision-making process.

This research has also shown that trade-offs in the decision-making process, which greatly undermines EIA as a safeguard to biodiversity. For instance, critically endangered and endangered vegetation has been irreversibly impacted on in the Industrial Development case. This impact was approved as the development was motivated by the local authority as an important source of employment for the area. This has resulted in a trade-off where social values outweigh biodiversity values and is considered a significant flaw in the decision-making process. It should be noted that all the cases were authorised to irreversibly impact on biodiversity, and this too is considered a significant flaw in the decision-making process.

This research has shown that mitigation measures such as alien clearing and search and rescue have been included as conditions of authorisation with little to no planning. The result is a high degree of uncertainty in conducting these operations, and this research has shown major failures in this regard. This research therefore recognizes this as a significant flaw in the decision-making process. It is recommended that such mitigation measures only be approved provided adequate planning has been undertaken in the stages preceding environmental authorisation.

A major shortfall identified in this research is the poor conversion of specialist recommendations into conditions of authorisation. Many instances have been noted in this research where mitigation measures are entirely absent in conditions of authorisation. As a result, all of the cases investigated in this research have incurred unmitigated impacts on biodiversity. As converting specialist recommendations and mitigation measures into conditions of authorisation is the responsibility of the competent authority, this is considered a significant flaw in the decision-making process.

This research has also shown that EMPrs are typically generic documents and provide little guidance on implementing mitigation measures. Notably, very few mitigation measures have been included in the EMPrs investigated by this research. Notably, this research has shown that compliance with biodiversity mitigation measures is improved when these are included in conditions of authorisation and EMPrs. Low conversion rates of biodiversity mitigation measures into conditions of authorisation and EMPrs may therefore be responsible for the low rates of compliance. This is identified as a flaw in the decision-making process. EMPrs should be carefully assessed in the decision-making process to ensure that all mitigation measures are included in the conditions of authorisations and the EMPrs, and that adequate guidance and planning is provided in terms of implementation.

6. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of this research will be organised in relation to the research objectives and questions as stated in Chapter 1 of this research. This chapter will also provide some general concluding remarks regarding the effectiveness of EIA in the CFR. This research sought to achieve two broad objectives. Firstly, this research sought to determine the procedural effectiveness of EIA, or how well EAPs and specialists comply with meeting legal and best-practice requirements. Secondly, this research sough to determine the substantive effectiveness of EIA, or how well EIA is implemented in the stages subsequent to receiving environmental authorisation. This chapter will therefore have the following three sections: 6.1 Conclusions and Recommendations on the Procedural Effectiveness of EIA; 6.2 Conclusions and Recommendations on the Substantive Effectiveness of EIA; and 6.3 General Concluding Remarks.

6.1 CONCLUSIONS AND RECOMMENDATIONS ON THE PROCEDURAL EFFECTIVENESS OF EIA

This objective relates specifically to the production of EIA documentation, and how well EAPs and specialists perform in terms of fulfilling their legal and best-practice requirements in this regard. Three research questions have been posed in relation to this objective, and conclusions and recommendations will be made accordingly.

Research Question 1.1: To what extent do biodiversity specialists and Environmental Assessment Practitioners (EAPs), or consultants, comply with legal and best-practice requirements for incorporating biodiversity into EIA?

A Key Performance Indicator method has been used to answer this research question. By evaluating the cases against various legal and best-practice principles, this research has shown that biodiversity specialists and EAPs complied with approximately half (53%) of their responsibilities in this regard. EAPs and specialists partially complied with 29% and did not address 18% of the legal and best-practice requirements in terms of incorporating biodiversity in EIA.

These figures are argued to be unacceptably low. This research has shown that many EAPs and specialists don't have the technical competencies or skills to deal with certain of these requirements. Notably, while there was variability in compliance for most of the KPIs, certain KPIs were not complied with by any of the cases. For example, none of the cases investigated the potential for their proposals to impact on ecosystem goods and services. Similarly, none of the cases made any statements regarding the main beneficiaries and losers associated with impacts on biodiversity.

This research therefore concludes that the performance of EAPs and specialists in this regard is average. The capacity for EIA to act as a safeguard to biodiversity is undermined because of this performance. It is recommended that workshops and training be conducted by the competent authority in specific areas of weakness, which will be discussed below under research question 1.2.

Research Question 1.2: To what extent are the full range of impacts on biodiversity as a result of a development identified in the Environmental Impact Report (EIR), and how well are these mitigated in the construction and operational phases by means of the Environmental Management Programme (EMPr)?

This research has shown that impacts on biodiversity pattern (typically on-site impacts) are adequately identified in EIA in the CFR. This was the result of the early involvement of biodiversity specialists at the outset of the EIA. All specialists referenced spatial biodiversity information (typically the NBA, as per Mucina and Rutherford (2006), and the BioNet plan where applicable) in their biodiversity assessments. Furthermore, biodiversity assessments were supported by rigorous site inspections for all the cases investigated by this research, which yielded valuable information on biodiversity pattern present in the development site. This research has also shown that the requirement for specialists to identify potential impacts on biodiversity pattern was clearly identified in the terms of reference for the cases.

On the contrary, the findings of this research indicate that EIA performs poorly in terms identifying impacts on biodiversity processes (typically off-site impacts) and ecosystem goods and services. Notably, many impacts on biodiversity process have been identified in the site inspections of this research that were evidently not addressed in the EIA. Examples of such include the potential for the cases to impact on downstream environments and the potential to disturb the natural fire regime. Fire is widely understood as a crucial ecological process for the persistence of biodiversity in the CFR, yet the potential impacts of the developments on this process was not adequately investigated in any of the cases.

This research has shown that ecosystem goods and services are inadequately addressed in EIA due to a poor understanding of EAPs and specialists with respect to identifying impacts in this regard. It is recommended that EAPs and specialists begin by qualitatively identifying potential impacts on ecosystem goods and services (without economic valuation) as this has been shown to elevate the value of biodiversity to decision-makers. Additionally, EAPs and specialists will benefit from training in this regard, and it is recommended that the competent authority provide such training.

This research has identified inadequate terms of reference as a major cause of the above-mentioned weaknesses. As terms of reference were typically only aimed at investigating impacts on-site, spatial boundaries have been found to be poorly defined. As a result, many impacts on biodiversity processes and ecosystem goods and services have not been identified and have therefore gone unmitigated. It is recommended that more effort should be made towards defining study areas based on an ecological basis, rather than arbitrarily such as by property borders. Furthermore, it is recommended that EAPs and specialists should include terms of reference specifically addressing impacts on biodiversity processes and ecosystem goods and services.

The strict time constraints associated with EIA have been shown to undermine the identification of impacts by precluding seasonal assessments of flora. It is therefore recommended that seasonal assessments of flora should be conducted prior to applying for environmental authorisation, which will allow for a more accurate estimation of biodiversity value on site.

The mitigation of impacts has been addressed by this research in relation to the mitigation hierarchy. In order of preference, the mitigation hierarchy includes measures aimed at avoiding, minimizing, rehabilitating and offsetting impacts. The avoidance of impacts in South African EIA is primarily achieved by adopting a positive planning approach to proposal formulation. In three of the cases, EAPs and specialists adopted a positive planning approach by actively avoiding areas of high biodiversity value which may have otherwise not been avoided in the absence of EIA. However, positive planning is significantly undermined by the poor formulation of alternatives. Notably, no site alternatives were included in any of the cases. Furthermore, despite the availability of information on biodiversity pattern on site, all layout alternatives for all the cases impacted on threatened vegetation. It is therefore concluded that EIA has contributed poorly to the avoidance of impacts. This is primarily the result of inadequate consideration of alternatives and poor decision-making in terms of authorising irreversible impacts. It is recommended by this research that the competent authority should not consider applications with too few alternatives and irreversible impacts on biodiversity.

Three of the cases recommended mitigation measures in accordance with the hierarchy of selection (i.e. avoidance measures were pursued prior to minimization, and minimization prior to rehabilitation, etc.) and two did not. Notably, the Industrial Development case was authorised to offset impacts without investigating whether such impacts could be avoided, minimized or rehabilitated. Similarly, avoidance of impacts was not pursued by the Search & Rescue case investigated by this research. It is therefore concluded that mitigation measures are poorly recommended in EIA. The authorisation of applications which have not practiced mitigation in the hierarchy of selection is considered a flaw in the decision-making process. However, more research should be done in this regard, possibly increasing the number of cases, in order to arrive at more statistically robust conclusions of these findings.

EMPrs were found to contribute poorly to the mitigation of impacts. The cases performed well in terms of including the generic requirements of EMPrs, such as auditing programmes, provisions for review and updating, and environmental awareness training. However, very few mitigation measures recommended by specialists were found in the EMPrs. Little to no guidance was therefore noted in terms of the implementation of mitigation measures. It is therefore concluded that EMPrs contribute poorly to the mitigation of impacts. The mitigation of impacts on biodiversity will be significantly improved if EAPs can ensure that all mitigation measures recommended by specialists are included in the EMPr.

Research Question 1.3: How practical, appropriate and enforceable are biodiversity-specific mitigation measures?

Mitigation measures were found to be impractical in many instances. For example, the Commercial Development case included the following mitigation measure relating to alien management, “no aliens will be allowed anywhere on the property”. Such a mitigation measure provides little direction in terms of implementation. Furthermore, two search and rescue mitigation measures were recommended in the cases without adequate planning and guidance. This research has shown that inadequate planning for technical mitigation measures, such as alien clearing and search and rescue, has been particularly detrimental to the conservation of biodiversity. It is recommended that such mitigation measures are accompanied by a detailed plan which should be submitted prior to granting environmental authorisation. Such plans should include details pertaining to the following: planning the translocation (goals, objectives,

actions, monitoring program design); feasibility and design (biological feasibility, social feasibility, regulatory compliance, resource availability); a risk assessment; and implementation (monitoring, continued management).

This research has shown that the enforceability of biodiversity mitigation measures is greatly undermined by poor conditions of authorisation in this regard. Many mitigation measures recommended by specialists were entirely absent in the conditions of authorisation. This was a common finding for all the cases. As the enforceability of mitigation measures is contingent upon their inclusion in the conditions of authorisation, this finding greatly undermines capacity for EIA to act as a safeguard to biodiversity. It is therefore recommended that the competent authority carefully construct conditions of authorisation to ensure they include the mitigation measures recommended by specialists.

6.2 CONCLUSIONS AND RECOMMENDATIONS ON THE SUBSTANTIVE EFFECTIVENESS OF EIA

This objective relates specifically to how well the cases performed in the implementation stage of EIA. Three research questions have been posed in relation to this objective, and conclusions and recommendations will be made accordingly.

Research Question 2.1: How capacitated are government institutions to perform compliance monitoring of biodiversity-specific conditions of authorisation?

This research question was largely covered in the interview process. However, the overall compliance with biodiversity mitigation measures covered in research question 2.2 will also provide insights in this regard.

Interview data revealed that government institutions are severely under capacitated to conduct compliance inspections. It was revealed by one public advisor that a mere 10% of developments are audited every year. Furthermore, compliance inspections were found to be mostly reactive in response to complaints. This research has shown that the primary reasons behind these findings is inadequate funding and staff of the competent authority, DEA&DP, and the provincial conservation agency, CapeNature.

Research Question 2.2: To what extent do authorised developments comply with biodiversity-related mitigation measures?

This research has shown that compliance with biodiversity mitigation measures is unacceptably low, indicating a mere 18% full compliance, 36% partial compliance and 46% were not complied with. It is concluded that these values would be significantly improved with increases in the funding and staff of the competent authority and provincial conservation agencies. However, this research has identified poor conditions of authorisation and EMPrs as a primary cause for the evident low levels of compliance. As many of the mitigation measures were not included in the condition of authorisation or the EMPr, very little urgency was noted in terms of implementation. Failed attempts at implementing mitigation measures, particularly for alien clearing and search and rescue, have also contributed negatively to the above-mentioned levels of compliance. It is recommended that EAPs and the competent authority ensure that mitigation measures are included in conditions of authorisation and EMPrs, and that these are accompanied by adequate planning.

Research Question 2.3: Are biodiversity-specific mitigation measures working?

This research has shown that mitigation measures are largely unsuccessful, and are not fulfilling their intended ecological purpose. Notably, only four mitigation measures which were subject to site inspection were fully complied with. A summary of the weaknesses of avoidance, minimization, rehabilitation and offset mitigation measures is given below.

Avoidance mitigation measures, which are typically in-situ conservation areas and buffer zones, have been relatively successful. No development was noted inside any of the conservation areas investigated in this research and this is considered a positive contribution to the avoidance of impacts in EIA. However, this research has found that the value of these conservation areas is undermined by the fact that none have been rezoned or incorporated into stewardship agreements. As a result, the conservation areas were found to be poorly managed and heavily infested with alien vegetation. The buffer zones subject to site inspections were all found to be narrower than stipulated in the recommendation.

Low levels of compliance has been noted for all but one mitigation measure aimed at minimizing impacts. The two search and rescue mitigation measures displayed high mortality rates and provided little to no ecological function or benefit. This research has shown that search and rescue in general has a very low rate of success, which is exacerbated by inadequate planning and implementation. It is recommended that search and rescue should not be considered a mitigation measure which can reduce the significance rating of an impact, but rather a best-practice exercise to augment other indigenous landscaping efforts.

Rehabilitation mitigation measures in most cases involved the management of alien vegetation. Very low success was noted in this regard, and large areas of the sites were heavily infested with alien vegetation. Alien management was found to be undermined by poor planning, unsuccessful methods and very little urgency on behalf of the proponents. This research has also shown that rehabilitation mitigation measures are undermined by poorly defined conditions of authorisation and planning. It is recommended that alien management plans should be submitted prior to receiving environmental authorisation which include aspects such as: planning (goals, objectives, actions, monitoring, methods); feasibility and design (biological feasibility, regulatory compliance, resource availability); a risk assessment; and implementation (monitoring, continued management).

This research has shown that biodiversity offsets are largely accepted in the EIA community. However, low rates of success have been noted in terms of biodiversity offset implementation. The Golf Course & Housing Estate and Commercial Development cases are both required to secure land ex-situ for the conservation of biodiversity, yet neither of the cases have complied in this regard. This may be due to the biodiversity offset guideline being published after these cases were authorised. Interesting, the Industrial Development case fully complied with their responsibilities in this regard, and this case was authorised after the publication of the offset guideline. Biodiversity offsets are therefore encouraged by this research and should be promoted as a last resort where impacts cannot be avoided, minimized or rehabilitated/restored.

6.3 GENERAL CONCLUDING REMARKS

This research has shown the various strengths and weaknesses of EIA as a safeguard to biodiversity in the CFR. Arguably the most significant finding of this research is the difference in the procedural and substantive effectiveness of EIA. This finding is represented graphically in Figure 8 by plotting the procedural and substantive effectiveness data on the same axis.

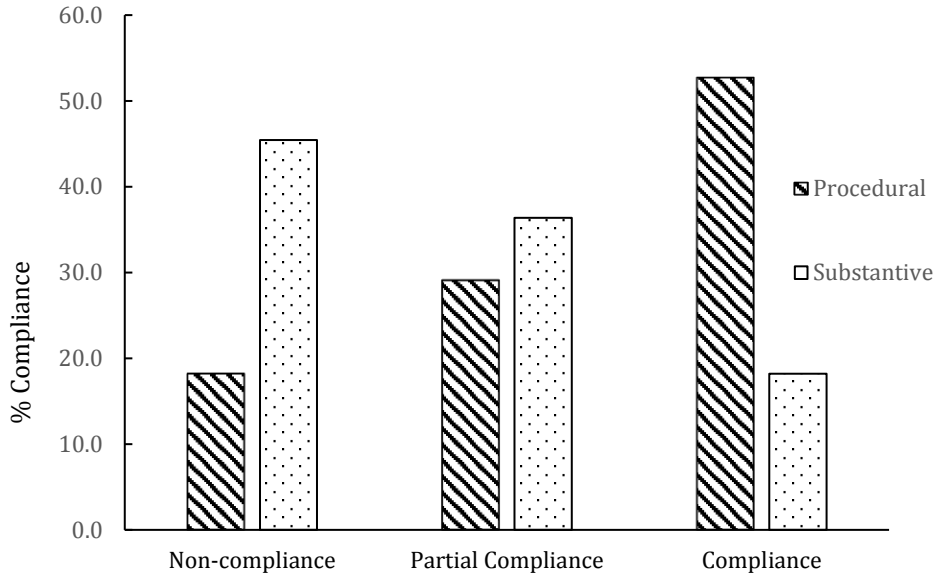


Figure 8: Bar graph showing the difference in procedural and substantive effectiveness of the cases investigated in this research

This graph shows that the majority of procedural components are complied with, while the majority of substantive components are not complied with. The procedural effectiveness of EIA in the CFR can be increased by improving the integration of biodiversity policy into EIA. Best-practice guidelines for incorporating biodiversity in EIA are abundant, and EAPs and specialists could greatly improve their procedural performance by familiarising themselves with these requirements. This can be brought about by conducting training as well as by increasing the initiation of EIA review. Improving the substantive effectiveness of EIA is likely to be more difficult and resource consuming. One solution is to increase the capacity of the competent authority and conservation agencies by increasing funding and staff. This will improve compliance with biodiversity mitigation measures, as well as improve the quality of decisions. However, it is argued here that EIA can benefit most from increased environmental awareness of all those involved in EIA. Proponents and landowners should educate themselves on the value of biodiversity and familiarise themselves with their mitigation measures to ensure that they themselves are contributing the conservation of biodiversity.

Reference List

- Arts J., Caldwell P., and Morrison-Saunders A., 2001. Environmental impact assessment follow-up: good practice and future directions—findings from a workshop at the IAIA 2000 conference. *Impact assessment and project appraisal* 19.3: 175-185.Millennium Ecosystem Assessment, 2003. *Ecosystems and Human Wellbeing: A Framework for Assessment.* Washington, DC: Island Press. www.millenniumassessment.org/en/products.aspx.
- Bartlett R.V., and Kurian P.A., 1999. The theory of environmental impact assessment: implicit models of policy making. *Policy and Politics* 27.4: 415-433.
- Beanlands G.E., Duinker P.N., 1983. An ecological framework for environmental impact assessment in Canada. Halifax, Nova Scotia: Institute for Resource and Environmental Studies, Dalhousie University.
- Bowen G.A., 2009. Document Analysis as Qualitative Research Method. 9(2): pp. 27-40
- Brown A.L. and Hill, R.C., 1995. Decision-scoping: making EA learn how the design process works, *Project Appraisal* 10:4, 223-232, DOI:10.1080/02688867.1995.9727001
- Brownlie S., De Villiers C., Driver A., Job N., Von Hase A. and Maze K., 2005. Systematic Conservation Planning in the Cape Floristic Region and Succulent Karoo, South Africa: Enabling Sound Spatial Planning and Improved Environmental Assessment. *Journal of Environmental Assessment Policy and Management*, vol 7 no 2, 201-228.
- Brownlie S, Walmsley B, Tarr P., 2006. Guidance Document on Biodiversity, Impact Assessment and Decision-making in South Africa: As part of IAIA's capacity building in biodiversity and impact assessment project. South African Institute for Environmental Assessment
- Brownlie S. and Wynberg R., 2001. The Integration of Biodiversity into National Environmental Assessment Procedures – National Case Studies: South Africa. UNDP/UNEP/GEF Biodiversity Planning Support Programme. Komex Europe Ltd, Bristol, UK.
- Brownlie, S. 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
- Brownlie, S., Walmsley W., Tarr P., 2006. Guidance document on biodiversity, impact assessment and decision-making in South Africa. The Southern African Institute for Environmental Assessment.
- Byron H.J., Treweek J.R., Sheate W.R., Thompson S., 2000. Road developments in the UK: an analysis of ecological assessment in Environmental Impact Statements produced between 1993 and 1997. *Journal of Environmental Planning and Management,* 43(1):71-97.
- CapeNature. 2013. About Us. [ONLINE] Available at: http://www.capenature.co.za/about-us/. [Accessed 05 April 16].
- Cashmore M., 2004. The role of science in environmental impact assessment: process and procedures versus purpose in the development of theory. *Environmental Impact Assessment Review.* (24) pp. 403-426.

- Cashmore, M., Bond A., and Cobb D., 2008. The role and functioning of environmental assessment: Theoretical reflections upon an empirical investigation of causation. *Journal of Environmental Management*, *88*(4), pp.1233-1248.
- CBD, 1992. Text of the Convention on Biological Diversity
- CBD, 2000. Convention on Biological Diversity: Decision V/6 Ecosystem Approach. Accessed on 22/08/16. Available at [www.cbd.int/convention/cop-5-dec.shtml?m=COP-05&id=7148&lg=0]
- CBD, 2004. Decision VII/11 Ecosystems Approach. Accessed on 22/08/16. Available at[www.cbd.int/convention/cop-7-dec.shtml?m=COP-07&id=748&lg=0]
- CBD, 2006. Decision VIII/28. Impact assessment: Voluntary guidelines on biodiversity-inclusive impact assessment.
- City of Cape Town, 2013. Integrated Development Plan 2013/2014 review.
- Corbin J., and Strauss A., 2008. Basics of qualitative research: Techniques and procedures for developing grounded theory (3rd ed.). Thousand Oaks, CA: Sage.
- Council for Scientific and Industrial Research (CSIR), 2004. Ecosystem Services in Southern Africa: A regional assessment. A regional-scale component of the Southern African Millennium Ecosystem Assessment.
- Council on Environmental Quality (CEQ), (2005), Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, (Reprint) 40 CFR Parts 1500-1508. USA: Executive Office of the President.
- Cowling R.M, Proches S., Partridge T.C., 2009. Explaining the uniqueness of the Cape flora: incorporating geomorphic evolution as a factor for explaining its diversification. *Molecular Phylogenetic Evolution*. 51: 64–74.
- Cowling R.M., Pressey R.L., Rouget M., Lombard A.T., 2003. A conservation plan for a global biodiversity hotspot- the Cape Floristic Region, South Africa. *Biological Conservation.* Vol 112, pp. 191-216
- Cowling, R. M., Holmes P. M., Rebelo A. G., 1992. Plant diversity and endemism. Pages 62-112 in R. M. Cowling, editor. *The ecology of fynbos: nutrients, fire and diversity*. Oxford University Press, Cape Town, South Africa.
- Cowling, R.M., Bond, W.J., 1991. How small reserves can be? An empirical approach in the Cape fynbos. *Biological Conservation* 58: 243–256.
- Cross-sector Biodiversity Initiative (CSBI), 2015. A cross-sector guide for implementing the mitigation hierarchy. The Biodiversity Consultancy.
- De Villiers C.C and Hill R.C, 2008. Environmental Management Frameworks as an alternative to farm-level EIA in a global biodiversity hotspot: A proposal from the Cape Floristic Region, South Africa. *Journal of Environmental Assessment Policy and Management* 10(4): 333-360.
- De Villiers C.C, 2003. Integrating strategic conservation planning with environmental impact assessment in the Western Cape: A report card. In IAIAsa 2003 National Conference Proceedings, September 1-3, Wilderness
- De Villiers C., Holmes P., Rebelo T., Helme N., Brown D.E., Clark B., Milton S., Dean W.R., Brownlie S., Snaddon K., Day L., Ollis D., Job N., Dorse C., Wood J., Harrison J., Palmer G., Cadman M., Maree K., Manuel J., Holness S., Ralston S and Driver A., 2016. Fynbos Forum ecosystem guidelines for environmental assessment in the Western Cape. In *Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.*

- DEA&DP (2011) Information Document on Biodiversity Offsets, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), October 2011.
- DEAT (2004) Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11.
- Department of Environmental Affairs (DEA) 2014. GNR 982 of GG 38282 of 4 December 2014
- Department of Environmental Affairs (DEA), 2010. National Protected Areas Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. South Africa, Pretoria
- Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. and Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- Eisenhardt, K.M., 1989. Building Theories from Case Study Research. *The Academy of Management Review.* 14(4): pp. 532-550.
- Ekstrom, J., L. Bennun, and R. Mitchell, 2015. "A Cross-Sector Guide for Implementing the Mitigation Hierarchy." Cross Sector Biodiversity Initiative, Cambridge.
- Fischlin, A., Midgley G.F., Price J.T., Leemans R., Gopal B., Turley C., Rounsevell M.D.A., Dube O.P., Tarazona J., Velichko A.A., 2007. Ecosystems, their properties, goods, and services. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, 211 272.
- Geneletti D., 2002. Ecological evaluation for environmental impact assessment. Netherlands Geographical Studies 301. Accessed online on 28/11/2016 at [http://www.itc.nl/library/papers/phd_2002/geneletti.pdf]
- Gillham B., 2000. Case Study Research Methods. Continuum, London
- Glasson, J., Therivel, R., Chadwick, A., 2005. Introduction to Environmental Impact Assessment: Principles and Procedures, Process, Practice and Prospects. Spon Press, London.
- Glazewski, J. "Environmental assessment. Chapter 8 in." *Environmental Law in South Africa* (2000).
- Goldblatt, P., Manning, J., 2000. Cape Plants: a conspectus of the Cape Flora of South Africa. Strelitzia 9. National Botanical Institute and Missouri Botanical Garden, Cape Town.
- Gontier, M., Balfors, B. and Mörtberg, U., 2006. Biodiversity in environmental assessment—current practice and tools for prediction. *Environmental Impact Assessment Review*, *26*(3), pp.268-286.
- Greco S., Figueira J., Ehrgott M., (2005). *Multiple criteria decision analysis*. Springer's International series.
- Hardner, J., R.E. Gullison, S. Anstee, M. Meyer. 2015. Good Practices for Biodiversity Inclusive Impact Assessment and Management Planning. Prepared for the Multilateral Financing Institutions Biodiversity Working Group
- Hatting J., Maree G.A., Ashton P.J., Leaner J.J., Turton A.R., 2007. A trialogue model for ecosystem governance. *Water Policy* 9 Supplement 2. pp 11-18

- Hill, R.C. (2009) Alternatives as the 'Soul' of Environmental Assessment: Where Applicable, and How Comprehensive? In web-based proceedings of the National Conference of the South African Affiliation of the International Association for Impact Assessment – IAIAsa 09 – on *Environmental Impact Assessment and Beyond*, Theme – Re-looking at EIA: pp. 1-13, Wilderness, 23-26 August.
- Holmes P., Stipinovich A., Purves A., 2012. Cape Town Biodiversity Network: Methods and Results Technical Report. Environmental Resource Management Department (ERMD), City of Cape Town
- Holmes, P., 2012. Can Cape Town's unique biodiversity be saved? Balancing conservation imperatives and development needs. *Ecology and Society*. 17(2)
- Hulett, J. and Diab, R., 2002. EIA follow-up in South Africa: Current status and recommendations. *Journal of Environmental Assessment Policy and Management*, *4*(03), pp.297-309.
- International Association for Impact Assessment, 2005. Biodiversity in impact assessment. IAIA Special Publication Series 3, Fargo, Narth Dakota.
- IUCN/SSC (2013). Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission, viiii + 57
- Kemper, J., Cowling, R.M., Richardson, D.M., 1999. Fragmentation of South African renosterveld shrublands: effects on plant community structure and conservation implications. *Biological Conservation* 90, 103–111.
- Lafferty W., Hovden E., 2003. Environmental policy integration: towards an analytical framework. *Environmental Politics.* Vol 12: p 1-22.
- Lamont, B., 1982, 'Mechanisms for enhancing nutrient uptake in plants, with particular reference to Mediterranean South Africa and Western Australia', *The Botanical Review* 48, 597-689.
- Lawrence D.P., 1997. Integrating Sustainability and Environmental Impact Assessment. Environmental Management; 21:23-42.
- Lee B, Haworth L, Brunk C, 1995. Values and science in impact assessment. *Environments*. 23(1):93– 100.
- LeMaitre, D. C., and Gelderblom, C. M., 1998. Biodiversity Impact Assessment: putting the theory into practice. Paper presented at the 18th annual meeting of the International Association for Impact Assessment (IAIA), Christchurch, New Zealand, 19-24 April 1998. Accessed online at [https://www.cbd.int/impact/case-studies/cs-impact-iaia-za-lemaitre-etal-1998-en.pdf]
- Mandelik Y., Dayan T., Feitelson E., 2005. Planning for biodiversity: the role of Ecological Impact Assessment. *Conservation Biology* 2005; 19(4):1254-61.
- Manders, P. T., D. M. Richardson, and P. H. Masson, 1992. "Is fynbos a stage in succession to forest? Analysis of the perceived ecological distinction between two communities." Fire in South African mountain fynbos. Springer Berlin Heidelberg: 81-107.
- Maree, K.S. and Vromans, D.C. 2010. The Biodiversity Sector Plan for the Saldanha Bay, Bergrivier, Cederberg and Matzikama Municipalities: Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas. Produced by CapeNature as part of the C.A.P.E. Fine-scale Biodiversity Planning Project. Kirstenbosch.

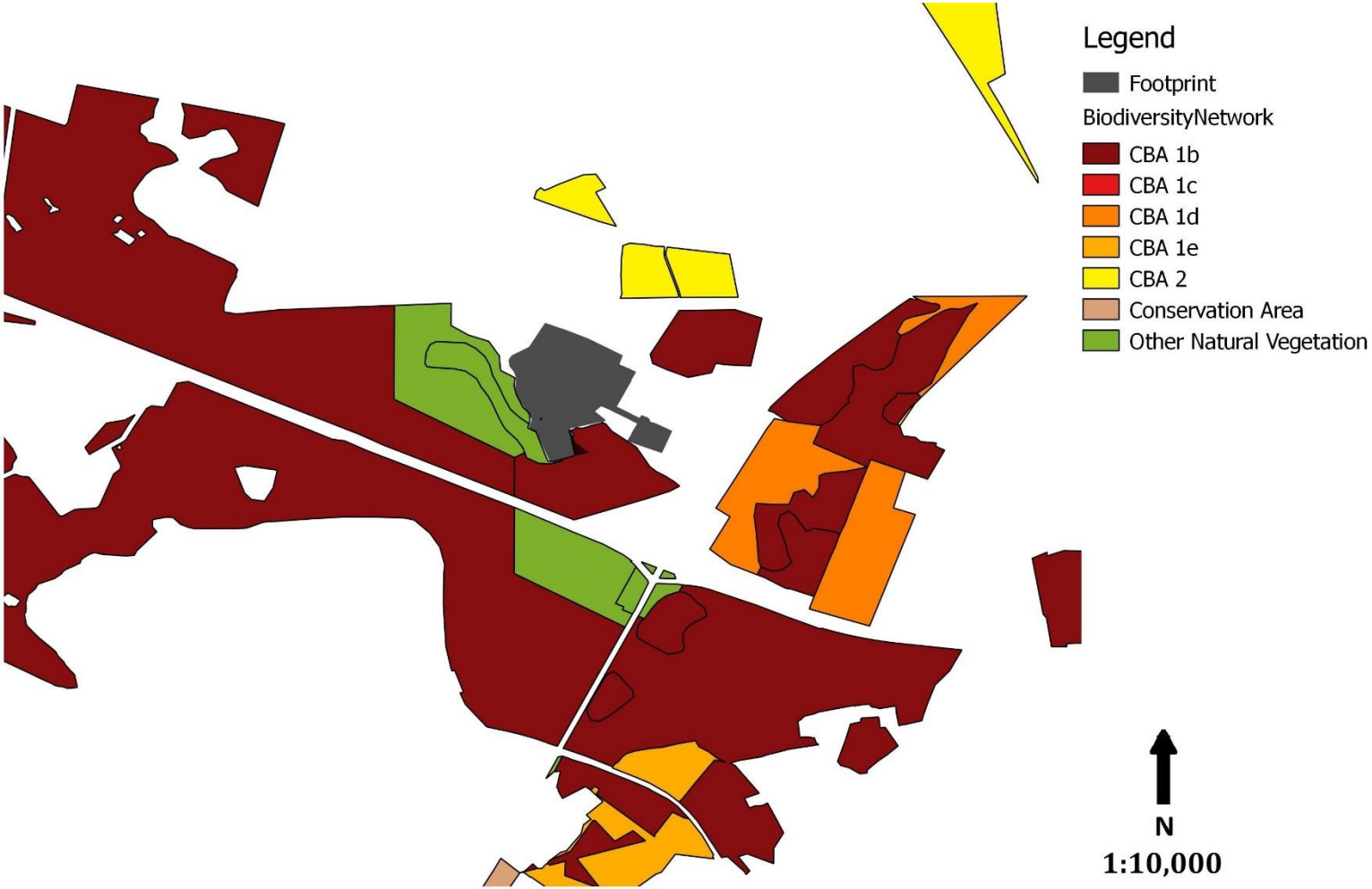
- Masson, P.H. and Moll, E.J., 1987, 'The factors affecting forest colonization of fynbos in the absence of recurrent fire at Orange Kloof, Cape Province, South Africa', *South African Journal of Forestry* 143, 5-10.
- Mgidi, T.N., Le Maitre, D.C., Schonegevel, L., Nel, J.L., Rouget, M. and Richardson, D.M., 2007. Alien plant invasions—incorporating emerging invaders in regional prioritization: a pragmatic approach for Southern Africa. *Journal of Environmental Management*, 84(2), pp.173-187.
- Miles M.B., Huberman A.M., 1994. *Qualitative Data Analysis* (2nd edition). Thousand Oaks, CA: Sage Publications
- Mittermeier, R.A., Myers, N., Thomsen, J.B., da Fonseca, G.A.B., Olivieri, S., 1998. Biodiversity hotspots and major tropical wilderness areas: approaches to setting conservation priorities. *Conservation Biology* 12, 516–520.
- Mucina, L., and M. C. Rutherford, 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria. Memoirs of the Botanical Survey of South Africa.
- Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J., 2000. Biodiversity hotspots for conservation priorities. *Nature* 403, 853–858.
- National Biodiversity Strategy and Action Plan (NBSAP), 2005. Prepared by the Department of Environmental Affairs and Tourism.
- Nilsson, M., Dalkmann, H., 2001. Decision-making and strategic environmental assessment. *Journal of Environmental Assessment Policy and Management* 3, 305–327.
- Noss, R.F., O'Connell, M.A., Murphy, D.D., 1997. The Science of Conservation Planning: Habitat Conservation under the Endangered Species Act. *World Wildlife Fund and Island Press*, Washington, DC.
- Olson, D.M., Dinerstein, E., 1998. The global 200: a representation approach to conserving the Earth's most biologically valuable ecoregions. *Conservation Biology* 12, 502–515.
- Owen M., Rogers P., 1999. Program Evaluation: Forms and approaches. *Sage Publications*
- Parmenter D., 2007. Key Performance Indicators: developing, implementing and using winning KPIs. John Wiley & Sons, Inc.
- Pence, G., 2008. CAPE Fine-scale systematic conservation planning assessment. Technical Report, produced for CapeNature as part of the GEF-funded CAPE Fine-Scale Biodiversity Planning Project, Cape Town, South Africa.
- Peterson K., 2010. Quality of Environmental Impact Statements and variability of scrutiny by reviewers. *Environmental Impact Assessment Review; 30*(3):169-76.
- Pierce SM., Cowling RM., Sandwith T., MacKinnon K., 2002. Mainstreaming Biodiversity in Development: Case Studies from South Africa. *The World Bank Environmental Department.*
- Pressey, R.L., Cowling, R.M., Rouget, M., 2003. Formulating conservation targets for biodiversity pattern and process in the Cape Floristic Region, South Africa. *Biological Conservation* 112, 99–127.
- Pressey RL. Cabeza M., Watts ME., Cowling RM., Wilson KA., 2007. Conservation planning in a changing world. *Trends in Ecology and Evolution.* Vol 22 (11), pp. 583-592
- Pritchard, D., 2005. International biodiversity-related treaties and impact assessment-how can they help each other? *Impact Assessment and Project Appraisal.* Vol 23. Pp 7-16

- Rajvanshi A. and Slootweg R., 2010. Reconciling conservation and development: the role of biodiversity offsets. *Biodiversity in Environmental Assessment*. Cambridge University Press.
- Rajvanshi, A., Mathur, V.B. and Slootweg, R., 2010. Biodiversity in environmental impact assessment. Biodiversity in environmental assessment: enhancing ecosystem services for human wellbeing.
- Ralston S., De Villiers C., Pence G., Manuel J., Roller K., 2009. Where are we going? Fine scale systematic conservation plans and their contribution to environmental assessment. Unpublished. CapeNature Scientific Services
- Reid, W.V., H.A.Mooney, Cropper, D. Capistrano, S.R. Carpenter, K. Chopra, P. Dasgupta, T. Dietz, A.K. Duraiappah, R. Hassan, R. Kasperson, R. Leemans, R.M. May, A.J. McMichael, P. Pingali, C. Samper, R. Scholes, R.T. Watson, A.H. Zakri, Z. Shidong, N.J.Ash, E. Bennett, P. Kumar, M.J. Lee, C. Raudsepp- Hearne, H. Simons, J. Thonell and M.B. Zurek, Eds., 2005: Ecosystems and Human Well-being: Synthesis. Island Press, Washington, District of Columbia, 155 pp.
- Republic of South Africa (RSA): Department of Environmental Affairs (DEA), 2014. Environmental Impact Assessment Regulations
- Retief F., 2007. A performance evaluation of strategic environmental assessment (SEA) processes within the South African context. *Environmental Impact Assessment Review* 27.1: 84-100.
- Rouget, M., D.M Richardson, R.M Cowling, J.W Lloyd and A.T Lombard, 2003. Current patterns of habitat transformation and future threats to biodiversity in terrestrial ecosystems of the Cape Floristic Region, South Africa. *Biological Conservation.* 112 pp. 63-85
- SANBI. 2014. Factsheet on biodiversity stewardship, first edition. South African National Biodiversity Institute, Pretoria
- Sandham, L.A. and Pretorius, H.M., 2008. A review of EIA report quality in the North West province of South Africa. *Environmental Impact Assessment Review*, *28*(4), pp.229-240.
- Schmidt O.L., 1993. The Statement of Underlying Need Determines the Range of Alternatives in an Environmental Document. In Hildebrand S G and Cannon J B (Eds) Environmental Analysis: The NEPA Experience: pp. 42-65. Boca Raton, Florida: Lewis
- Schnitzler J., Barraclough TG., Boatwright JS., Goldblatt P., Manning JC., Powell M.P., Rebelo T., Savolainen V., 2011. Causes of Plant Diversification in the Cape Biodiversity Hotspot of South Africa. *Systematic Biology*. 60(3) pp. 343-357
- Slootweg R., 2005. Biodiversity assessment framework: Making biodiversity part of corporate social responsibility. *Impact Assessment and Project Appraisal*; 23:37-46.
- Slootweg R., Rajanshi A., Mathur V.B., Kolhoff A., 2010. Biodiversity in Environmental Assessment: Enhancing ecosystem services for human wellbeing. Cambridge University Press
- Slootweg, R., Vanclay, F., van Schooten, M.L.F, 2001. Function evaluation as a framework for integrating social and environmental impacts. *Impact Assessment and Project Appraisal,* pp. 19-28
- Söderman T. Treatment of biodiversity issues in Impact Assessment of electricity power transmission lines: A Finnish case review (2006). *Environmental Impact Assessment Review*; 26(4):319-38.

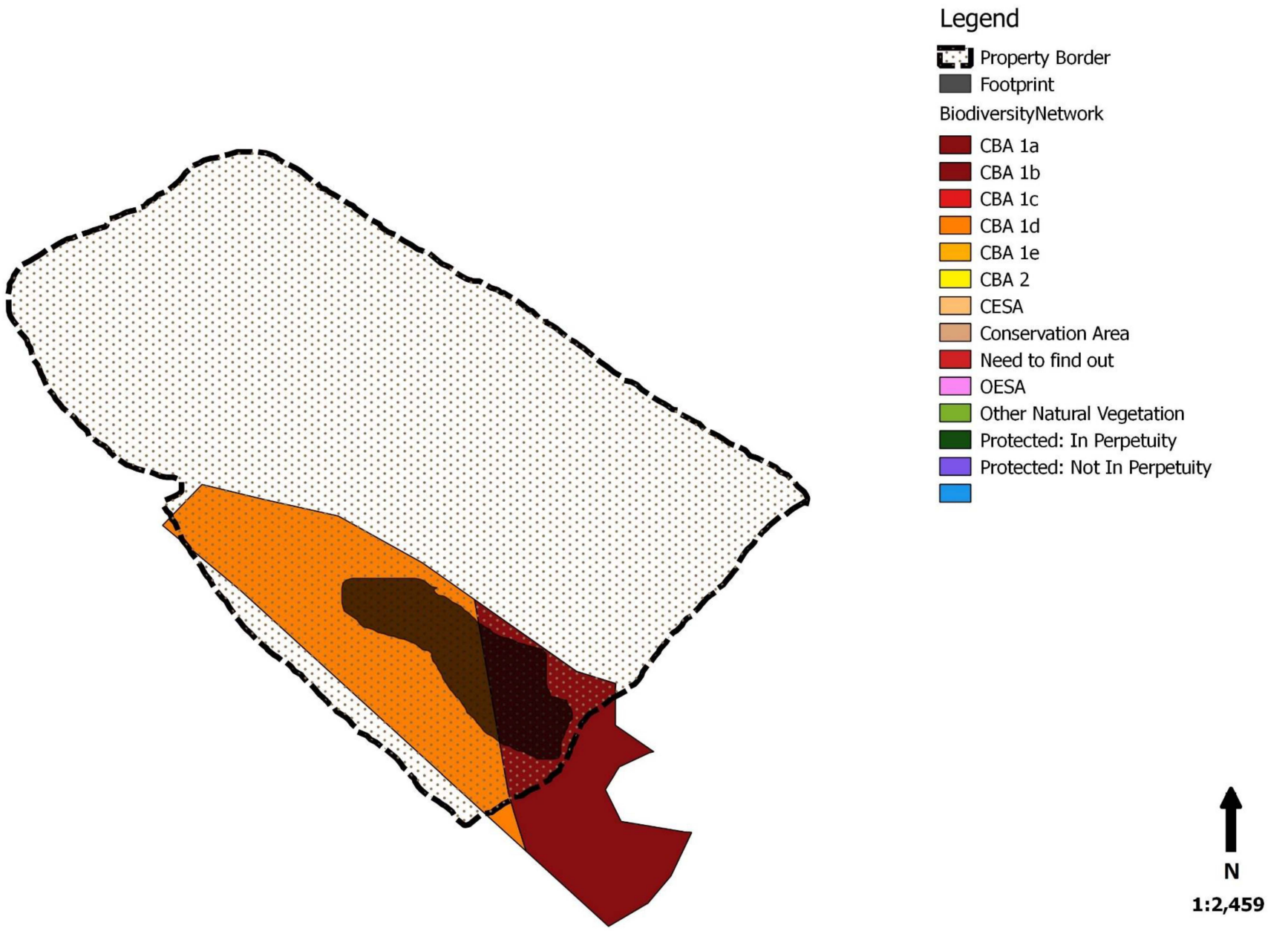
- Söderman T., 2005. Treatment of biodiversity issues in Finnish Environmental Impact Assessment. *Impact Assessment Project Appraisal*; 23(2):87-99.
- South African National Biodiversity Institute (SANBI). 2014. Mainstreaming Biodiversity. [ONLINE] Available at: http://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity. [Accessed 04 April 16].
- Stattersfield, A.J., Crosby, M.J., Long, A.J., Wedge, D.C., 1998. Endemic Bird Areas of the World. *Birdlife Conservation Series 7*. BirdLife International, Cambridge.
- Steinemann A., 2001. Improving alternatives for environmental impact assessment. *Environmental Impact Assessment Review.* 21(1): pp. 3-21
- Stock, W.D., Wienand, K.T. and Baker, A.C., 1995, 'Impacts of invading N2-fixing Acacia species on patterns of nutrient cycling in two Cape ecosystems: Evidence from soil incubation studies and 15N natural abundances', *Oecologia* 101, 375-382.
- Ten Kate, K., Bishop J., Bayon R., 2004. Biodiversity Offsets: views, experience and the business case. IUCN, Gland, Switzerland and Cambridge, UK and Insight Investment, London, UK.
- Thompson, S., Treweek, J.R. and Thurling, D., 1997. The ecological component of environmental impact assessment: a critical review of British environmental statements. *Journal of environmental Planning and Management*, *40*(2), pp.157-172.
- Treweek J. Ecological Impact Assessment. Malden, USA: Blackwell Science; 1999. Accessed online on 28/11/2016 at [http://samples.sainsburysebooks.co.uk/9781444313291_sample_384249.pdf]
- Treweek JR, Thompson S, Veitch N, Japp C., 1993. Ecological assessment of proposed road developments: A review of environmental statements. *Journal of Environmental Planning and Management*; 36(3):295-307.
- Treweek, J. 1996. Ecology and environmental impact assessment. *Journal of Applied Ecology,* 33(2):191-199
- Turpie J., Heydenrych B.J., Lamberth S.J., 2002. Economic value of terrestrial and marine biodiversity in the Cape Floristic Region: implications for defining effective and socially optimal conservation strategies. *Biological Conservation.* Vol 112: pp 233-251.
- Van Beukering and Slootweg, 2010. Valuation of ecosystem services: lessons from influential cases. *Biodiversity in Environmental Assessment: enhancing ecosystem services for human wellbeing. Cambridge University Press: Cambridge*, pp.287-327.
- WCED (1987). Our common future, report of the world commission on environment and development, world commission on environment and development. Published as an annex to general assembly document A/42/427, Development and International Co-operation: Environment 2 August 1987.
- Wessels, J-A, Retief, F., Morrison-Saunders A., 2015. Appraising the Vale of Independent EIA follow-up verifiers. *Environmental Impact Assessment Review*. 50, pp. 178-189
- Wilcove, D.S., Rothstein, D., Dubow, D., Phillips, A., Losos, E., 1998. Quantifying threats to imperiled species in the United States. BioScience 48, 607–615
- Witkowski, E.T.F. and Mitchell, D.T., 1987, 'Variations in soil phosphorus in the fynbos biome, South Africa', *Journal of Ecology* 75, 1159-1171.
- Wood C (2003) Environmental Impact Assessment – A Comparative Review, Second Edition. Harlow: Prentice Hall.
- WWF (World Wildlife Fund) and IUCN (the World Conservation Union), 1994. Centres of Plant Diversity: A Guide for their Conservation. IUCN, Cambridge.

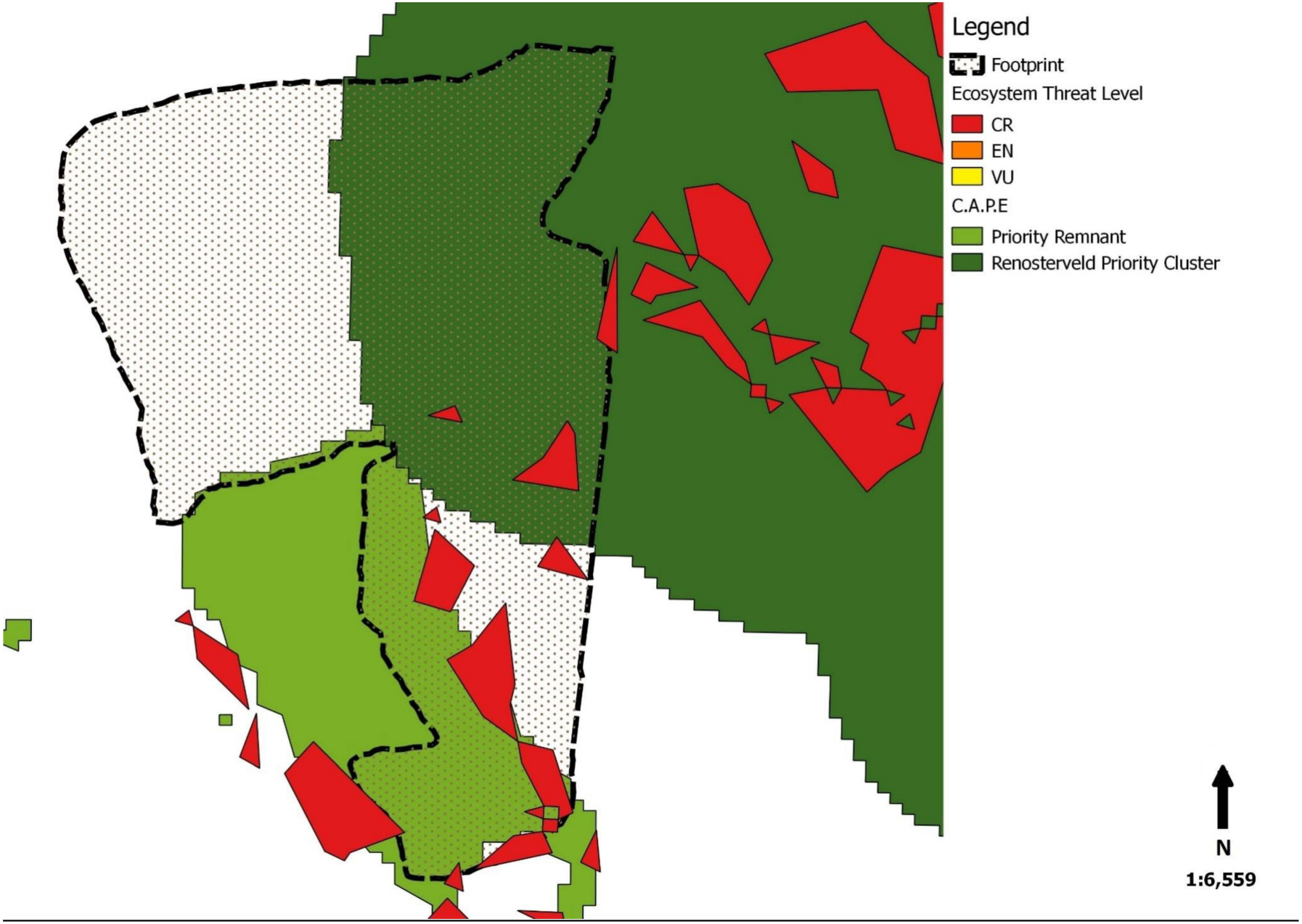
- Yin R., 2003. Case Study Research: Design and Methods. *Applied Social Research Methods Series.* Volume 5

APPENDIX A – CASE SPECIFIC SPATIAL BIODIVERSIT DATA



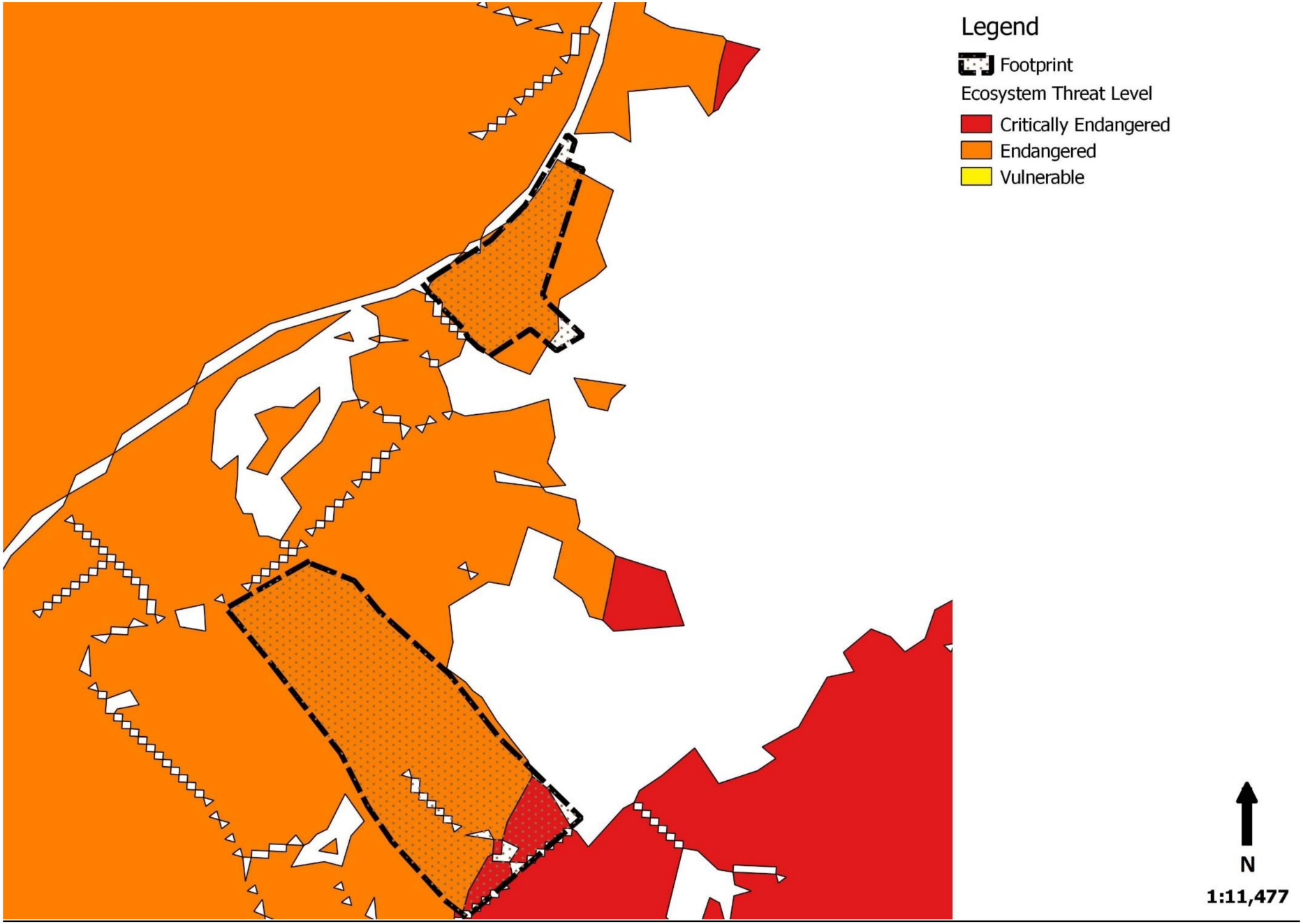
Commercial Development


Legend
Property Border
Footprint
BiodiversityNetwork
CBA 1a
CBA 1b
CBA 1c
CBA 1d
CBA 1e
CBA 2
CESA
Conservation Area
Need to find out
OESA
Other Natural Vegetation
Protected: In Perpetuity
Protected: Not In Perpetuity
N
1:2,459

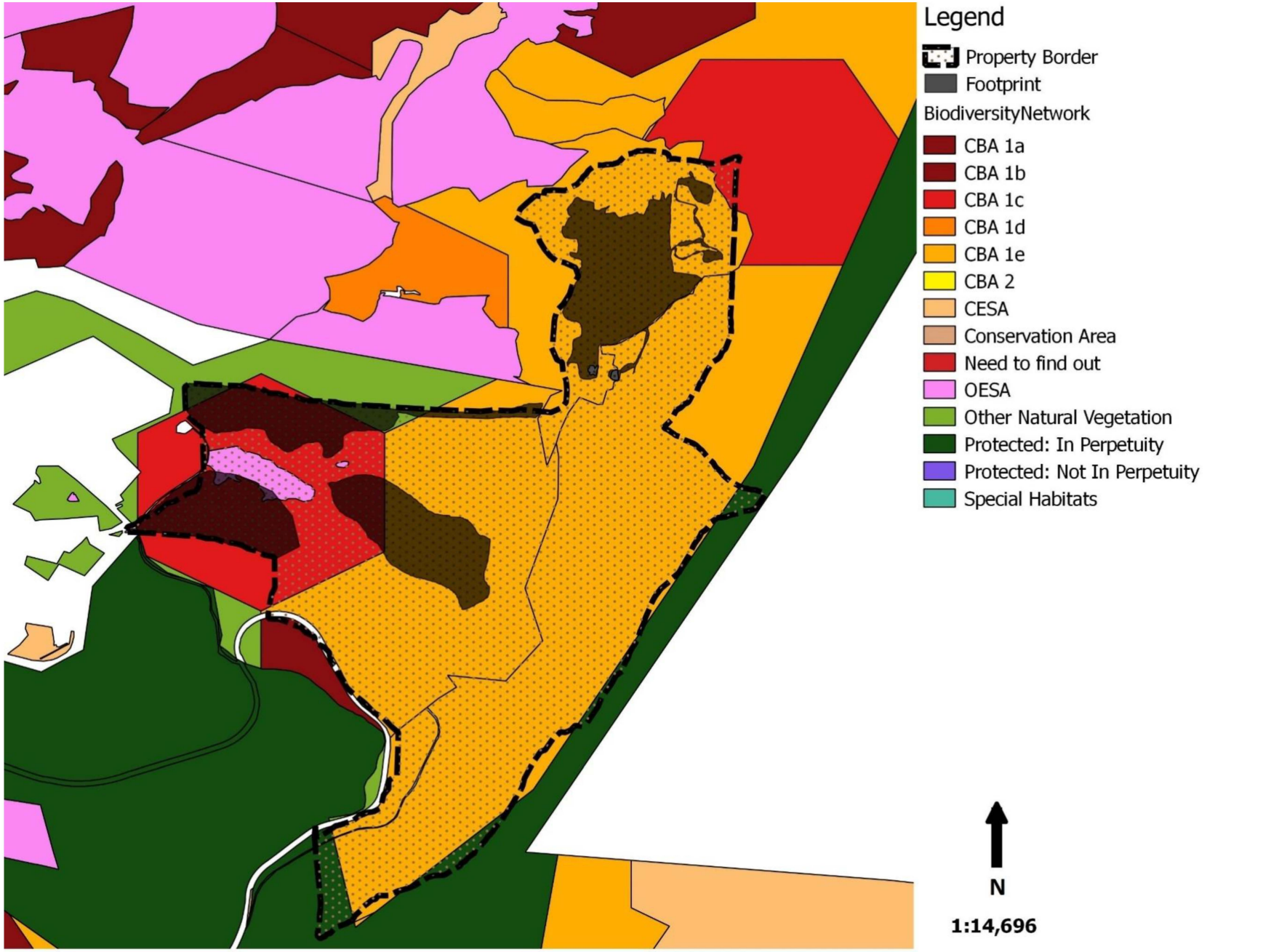


Golf and Housing Estate

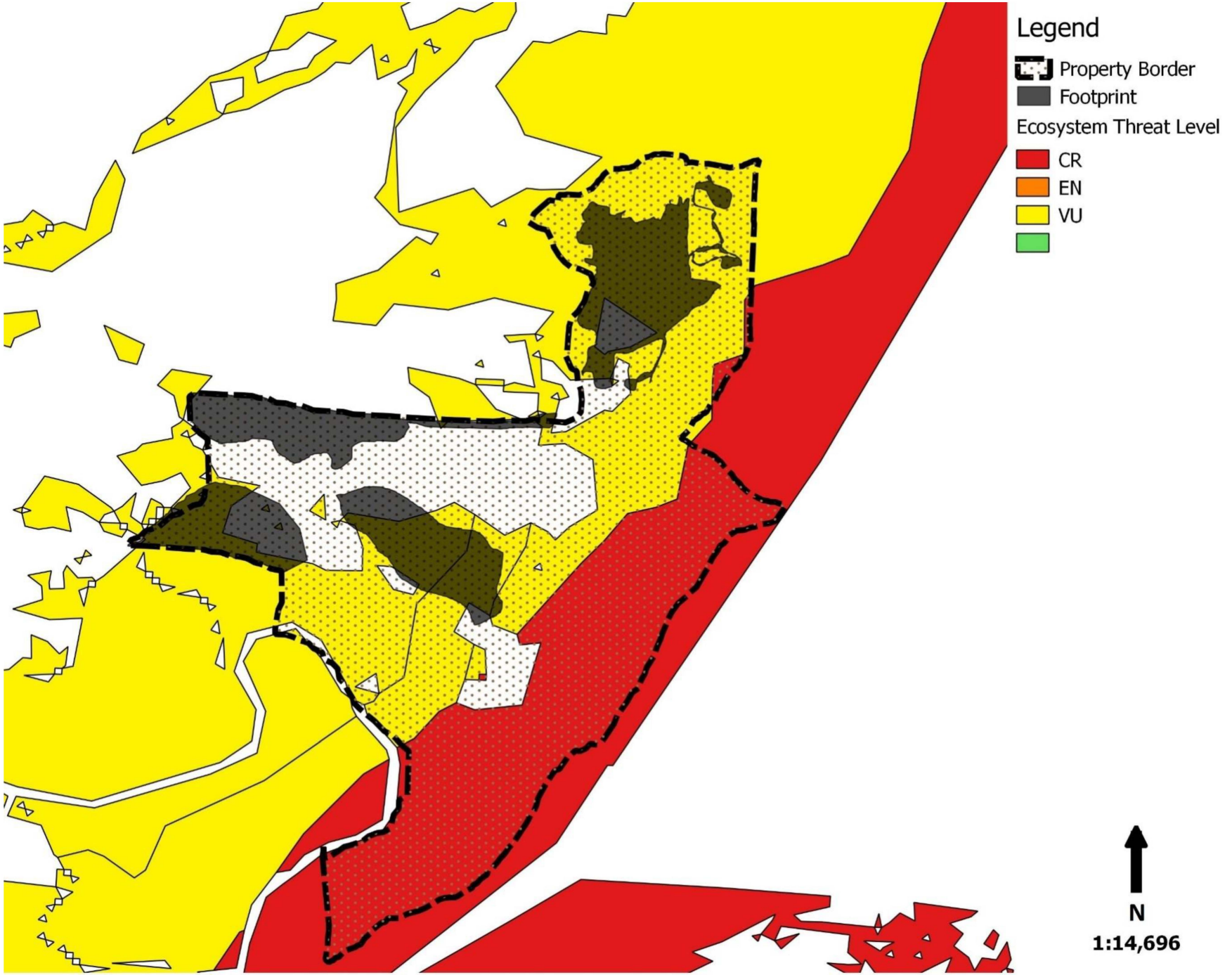
Industrial Development



Industrial Development



Housing Estate



Housing Estate

APPENDIX B – SITE INSPECTIONS

B.1 Golf Course & Housing Estate

Affected Vegetation: Swartland Granite Renosterveld (CR) & seasonal wetland

Mitigation Measures			
Condition Number	**Condition details**	**Compliance Rating**	**Details**
5.	A conservation area must be established in the northern section of the development site in accordance with area identified by the botanist; must be rezoned to Open Space III and incorporated as Contract NR into CapeNature's stewardship programme before Phase III construction begins.	1	Conservation area established and rezoned. However, incorporation of this conservation area into CapeNature's stewardship agreement has not yet taken place. This is likely due to the conditional relationship between the stewardship incorporation condition and the completion of phase III of the developed.
6.	A renosterveld management trust fund must be established and used for the management of the conservation area and off-set sites within the Swartland Municipal Area. R1.5-million must be deposited in the trust before 80% of the Phase II plots have been transferred and before development houses may take place in Phase III. The trust must be used to finance: the conservation area on site; Driehoekspad north-east of Malmsbury; Die Koppie to the south of Malmsbury; Farm 1054 opposite the entrance to Abbottsdale.	0	A management trust fund has not been established. All funds for management of the in-situ conservation area are sourced from the landowner. As the management of the other listed conservation areas is only required once phase III has been complete, no funds have been allocated for these areas. Although these sites were not included in this inspection, one can assume that in the absence of management, these areas will have degraded in biodiversity value as a result of ongoing pressures (incorrect fire frequency, alien invasives, pollution, transformation) that are common to the Swartland Renosterveld ecosystems.
19.2	Ensure public access to the conservation area	1	The only access to the conservation area is through the Mount Royal Golf Estate. This condition seems a bit unrealistic considering the entirety of the conservation area is contained within the property's boarders. Signage on the outside of the development informing the public of the opportunity to enter the estate to visit this area would seem more appropriate.
23	Removal of all woody aliens in the conservation area	0	Although efforts have been made to remove the Port Jackson in the conservation area, little follow-up has been made in this regard and areas of the conservation area are still densely populated with Port Jackson. Large gum trees are also present in the conservation area
	The OEMP must include a fire management program for the conservation area	0	The management plan for ecological corridors and conservation areas states that veld age and burning cycles will be part of the management plan for the conservation area.
	The riverine and wetland areas should be rehabilitated (alien plants removed), and erosion must be controlled in the lower parts of the northern	0	Kikuyu was very abundant in the riverine areas. Apparently efforts have been made to clear this but to no success. Bulrush has been actively cleared in the riverine areas

	wetland		
	Search and Rescue of all appropriate plants from development prior to any development, as contained in the revised addendum to the botanical assessment (dated March 2004)	1	May not be meeting its desired objectives - individuals specimens have been planted in an open gravel track that was apparently 'ripped' beforehand. The plants have reputedly been vulnerable to foraging porcupines and Guinea fowl. The road is an unsuitable habitat for the plants which, besides being readily accessible to foraging animals, would experience many of the environmental pressures associated with edge effects – chiefly desiccation resulting from a combination of wind and heat, and evaporation. Drivers who are not aware of the special nature of the plants along the verge and may do U-turns etc.
25	• All infrastructure must be situated above the 1:100-year flood line • Maintain 30 m buffer between development and center of wetland • Maintain 15 m buffer for drainage lines Silts traps for all storm water points draining into aquatic habitats (river, wetland, drainage lines)	1	1:100-year flood line not clear and not marked on site so compliance with this condition is unclear. A buffer to the 'center' of the wetland seems obscure; it would be more appropriate for the buffer to be determined for the edge of the wetland. Although this condition has been complied with as it is, a buffer taken from the edge of the wetland would have resulted in non-compliance as a house was noted to be within 30m of the wetland. Various instances were noted in which houses were developed within 15m of a drainage line.
26	Buffer strip of at least 15 m must be maintained along N7. Berm with average height of 3 m must be constructed within the buffer and must be landscaped with indigenous vegetation	1	Measuring the width of this buffer was not possible due to substantial electric fencing, however a minimum distance of 15m seems to be complied with. Certain areas of this buffer have no elevation. This buffer strip has been indigenously landscaped.

Other Environmental Concerns	
Environmental Aspect	**Issues raised**
Contact with electric fence that surrounds the property and extends from ground-level to about two meters above, may be fatal for mammals and larger species of bird; one Blue Crane fatality attributed to this. Spacing of wire too narrow to allow particularly larger mammals through, e.g. duiker (that is, if animals not electrocuted). The connectivity value of the two major drainage lines that bisect the property on E-W axis is possibly reduced due to the presence of the electric fence that isolates the Mt Royal Golf Course from the surrounding agricultural matrix (admittedly a highly transformed one).	• Type of fencing and its environmental implications does not feature in the RoD. • Was the issue of fencing and its environmental implications raised in the environmental assessment process? More attention may need to be paid to fencing in future environmental assessments as this style fence is definitely not only potentially hazardous to birds and other animals but for humans too. • Fencing may be dealt with in the development's Environmental Management System (Construction or Operational), but the EMS does not form part of the RoD – it is left to be developed later as a condition of authorisation (cf. conditions 11, 12 and 13, etc.).
Uncontrolled water run-off from adjacent farm (to N) and resulting sheet and gully erosion on property, which appears to be relatively severe in affected areas.	• Was the potential impacts of run-off from the farm to the North identified as an issue that needed further investigation in the EIA? The summary of the freshwater recommendations appended to the RoD does refer to rehabilitation of eroded areas, but not here. • The RoD does not seem to specifically address the issue of storm water management, run-off control and the prevention of erosion, and rehabilitation of eroded areas. The 'key factors affecting the decision' record the issue of run-off that under the theme of freshwater ecosystems, but the implications of this for actual project and site management are not spelled out or taken up in the RoD as conditions of authorisation. This issue may have been relegated to the EMS. • Run-off-related impacts have various negative implications for biodiversity, including the loss of topsoil, and siltation and pollution of downstream aquatic systems. • Geological/soil/geotechnical aspects need to be evaluated alongside climatic and hydrological ones, as they have mutual implications for the environment.

	• Conditions of authorisation need to be more specific than seems to be the case in this RoD, both with regards to erosion prevention measures and the timing of their implementation.
Perimeter fence patrolled by vehicle for security purposes, resulting in an informal, unpaved road exacerbating storm water and erosion problems.	• Was the need for vehicle access to perimeter fence assessed in EIA? More attention may need to be paid to this in future environmental assessments. • Was this addressed in EMP? If so, were timeframes prescribed (it would appear that the timing of mitigation measures/construction etc. could have significant implications).
Allegedly unauthorised retention pond in 'Channel 1' (i.e. parallel to N boundary of property)	An existing retention pond was enlarged, apparently without authorisation, in a bid to control storm water run-off contributing to erosion and siltation of the Platteklip River. The activity was stopped, but there were apparently no administrative or legal repercussions.
Two fords, constructed from gabions, allow security staff to cross the Platteklip River to patrol the northern fence of the property with four wheel-drive buggies. The gabions appear to have impeded flow, trapped silt, raised the level of the bed of the river, and encouraged the growth and spread – both within and laterally to the watercourse – of *Phragmites* reeds that themselves serve as silt traps that reinforce this dynamic. This process of flow disruption and siltation has caused a layer of mud to form over the gabions, reducing their utility as a hardened surface on which to cross the river. The electric fence and its slatted supports in the channel seem to exacerbate the problems outlined here. The fence traps debris (such as reeds) and silt, and may be at risk from flood damage.	• The construction of river crossings over the Platteklip River is not addressed in the RoD, or in the appended summary of recommendations. • River crossings often seem to be included within general or road infrastructure when actually specific attention should be given to each and every place that any water body will need to be crossed. This links to the comment about the need for a road adjacent to the perimeter fence and whether this was adequately assessed. • This would have been a listed activity at the time of the EIA process, viz. 'the construction, erection or upgrading of... canals and channels, including structures causing disturbances to the flow of water in a river bed...' (Item 1(i) of GN R1182 of 5 Sept 1997 as amended. It would also be a listed activity in terms of Item I (m) of the 2006 NEMA EIA regulations. • The management of the problems outlined here would probably need to be investigated by an aquatic ecologist and civil engineer with the view of securing the river crossings while addresses what appear to be potentially significant environmental problems.
Wash away of golf course earthworks by winter rains. The development does not seem to have taken the effects of rainfall on the local granitic soils into account when the golf course, which lies against a slope, was excavated. Topsoil was set aside and secured, but large volumes of exposed and unconsolidated material were washed downslope towards and into the Platteklip River. It could not be established when this incident occurred, except that it appeared to have been in winter a year or two ago.	The RoD does not seem to explicitly address the management of bulk earthworks (it refers to "construction of the golf course" at 11.3.b), particularly with respect to protecting exposed and loosened soil surfaces against erosion by water, wind or as a result of soil creep. This may, again, have been addressed in the construction EMS as required by the RoD, but if it had, it was not effective. The incident would have had an impact on the Platteklip River, and vegetation seems to have been smothered by soil deposited on the slope the leads down to the river.

B.2 Commercial Development Site Inspection Form

Commercial Development

Date: 2 September 2016

Attendees:

Affected Vegetation: Cape Flats Sand Fynbos (CR), Cape Flats Dune Strandveld (EN)

Mandatory Mitigation Measures			
Condition Number	**Condition details**	**Compliance rating**	**Details**
5.1	Ongoing financing of an Environmental Management Trust Fund should be established for the long term ecological management of all conservation areas.	0	The management fund has not yet been established apparently because of the conditional relationship with the housing development that has yet to commence. The landowners wish to amend their application to switch the housing development to an industrial one. Public advisors expressed concern that if this were authorised it may exempt them from establishing the fund.
5.2	No development or infrastructure of any sort should impact on the high conservation value areas identified, namely Areas 1 and 2 in the botanical report in the draft EIR.	2	Conservation area 1 had no development and access to conservation area 2 was restricted on the day due to filming activities that were occurring close to this area
5.3	There should be an ecological corridor at least 100m wide between area 1 and the Vergenoegd Renosterveld area. This corridor will require extensive rehabilitation, including that of the portion of the Stellenbosch road reserve crossed by the corridor strip.	2	This distance was measured using GIS and equated to approximately 200m at its most narrow point.
5.4	All conservation areas should be rezoned Open Space 3 (Private Open Space)	0	No rezoning or stewardship commitments have been finalized. This process is apparently awaiting 'buy in' from the landowner.
5.5	Only indigenous plants used in residential gardens and no invasive plants anywhere on the property	0	No residential developments have commenced as of yet. The latter half of this condition relating to alien vegetation seems unrealistic considering the majority of the property is covered in bulrush and port Jackson. Conditions such as those relating to alien invasives should be
5.6	A limited network of footpaths should be encouraged in conservation area 1, and no footpaths allowed in conservation area 2. Footpaths should not be wider than 2m.	1	No footpaths are present in conservation area 1 or 2.
5.7	A fire management plan must be included in the EMP to allow for 10-15yr cycles of fire events	0	No conventional operational EMP has been established for this site. The environmental management of this development in the operational phase is controlled by an environmental management system software interface.
5.8	An alien invasive management plan must be included in the EMP to ensure ongoing annual alien invasive plant removal	1	Also contained in the EMS software. Invasives management has begun in conservation area 1 and has proven to be successful; indigenous regrowth is indicative of naturally occurring vegetation types. Invasives clearing

			accompanied by appropriate plans and methods statements, but apparently only begun in 2013, 7 years after authorisation. Alien clearing in conservation area 2 and wetland systems has been limited.
5.9	The rehabilitation of all the undeveloped natural areas is highly recommended and public spaces should be indigenously landscaped.	1	Public spaces have been indigenously landscaped. However vast areas of the property are still covered with invasives and no obvious commitment to clearing these areas have been made. This is apparent in the lack of plans/methods statements for invasives clearing in areas others than conservation area 1 and the dune slack
6.1	The developer should further undertake to improve the water quality. This would include prevention against pollution and actively combating alien vegetation infestations	1	Water quality testing is undertaken on a weekly basis. Furthermore pollution in the visible freshwater systems looked well managed.
6.2	The retention pond in the south-western corner should be designed to attract certain bird species such as by establishing heronries. This should not be limited to the retention pond but should include the entire wetland system on the south-western boundary.	0	There have been no efforts to encourage bird activity apart from managing pollution.
6. 3	Speed limits of 45km/h should be imposed by a visible signage. Speed humps at regular intervals would greatly help these efforts.	2	Signage and speed bumps were present
6.4	Due to the presence of wetlands in this area, the construction of under-road culverts would be deemed necessary	1	The main culvert near the dune slack did not seem sufficient to ensure connectivity. This comprised of an infilled section with a concrete pipe to allow water movement but this structure is unlikely to encourage biological connectivity
7.1	Ongoing control of alien vegetation	1	See 5.8 and 5.9 above
7. 2	The road passage through the green corridor should be re-aligned outside the green corridor in order for this area to function effectively as a link for remnant wetland patches		
7.3	Where crossing of wetlands is required, to allow access to infilled areas, wide-span bridges/culverts rather than roads should be used	0	No wide-span bridges were noted. See 6.4 above for notes on culvert construction.
7.4	All remnant sensitive wetland areas and their associated dunes should be rezoned and managed as conservation areas	0	No rezoning has taken place

B.3 Search & Rescue Receptor Site Inspection

Attendees:
CapeNature: Rhett Smart, Rupert Coopman, Khungeka Lindani
Biodiversity Management Branch (CCT): Patricia Holmes, Clifford Dorse
Translocation of Lourensford Alluvium Fynbos (CR)
2 September, 2016

Inspection	
Aspect	**Details**
Alien Species: Grasses (*Kikuyu),* Port Jackson (*Acacia Saligna*),Black Wattle (*Acacia Mearnsii*), Gum Trees (*Eucalyptus*)	Kikuyu dominated much of the wetter areas in the reserve and notably close to the translocation site. No other aliens were noted, which is probably due to an apparent high fire frequency.
Bare Patches: The presence of bare patches may be indicative of low survival rates, incorrect fire frequencies and alien species	The entire translocation site was, for all intents and purposes, bare. Although fire frequency in the reserve is unacceptably high and aliens are present, the reason for the bareness is rather due to the failed translocation process.
Bulb Survival: Notable Species: *Babiana, Eciostachys, Watsonia, Ixia*	Bulbs were abundant in the reserve but unacceptably sparse in the translocation site.
Rubbish and Pollution Access to Harmony Flats Nature Reserve uncontrolled due to lack of fencing	Rubbish and pollution in the park is well managed by a team of conservationists that visit the site regularly.
Erosion Illegal sand harvesting has been noted in the reserve, which may contribute to erosion	Erosion does not appear to be affecting the biology in the translocation site and in the reserve in general.
Biodiversity Pattern: Note pattern of Lourensford Alluvium Fynbos, grasses and proteoid plants; high presence of grasses and low proteoids may be an indication of incorrect fire freq.	The reserve is dominated by grasses, bulbs, perennials and low-growing shrubs. The lack of proteoid plants in the reserve is certainly the result of high fire frequency.

Questions	
Pre-translocation Questions	**Answers and other details**
1. Was an offset ever considered for the Helderberg site (CN recommendations and also discussed in meeting on 18/05/2015 at Strand Municipal Offices)? The financial implications of such should certainly be more favourable for the developer, and in CapeNature's comments on the DBAR an offset alternative was encouraged, yet no offset alternative was included in the 2015 final BAR	A translocation was agreed to be more favourable for biodiversity conservation due to the critically endangered nature of Lourensford Alluvium Fynbos. However, an offset option should have been included in the EIR alternatives so as to receive adequate procedural consideration and public participation.
2. Was the specialist report in 2011 ever updated before the translocation?	No. This was not deemed necessary. However, alien vegetation had apparently increased over this period.
3. Was a detailed translocation plan compiled? Is this the Methods Statement?	The translocation plan is the methods statement. The methods statement seemed vague and not detailed.
Translocation Methodology Questions	**Answers and Other Details**
4. Was the receptor site stripped and were all was all weed-dominated topsoil removed to ensure aliens did not persist post-translocation?	Yes.
5. Was the LAF relocated onto course sediments associated with natural LAF, or finer sediments associated with renosterveld?	Fine sediments.
6. Was the translocation process conducted reasonably close to the optimum time of year (October/November) for such an operation?	Translocation conducted in late January. This greatly affected the success of the translocation.
6. Were seeds of threatened and common habitat-specific plants collected from the receptor site and sown to augment the restoration efforts?	No.
7. Were any rescued propagules (bulbs and seeds) rescued and planted in gaps after the excavated material was placed?	Some restios were relocated but transplanted outside of the translocation site.

8. Were individual bulbs and plants rescued and relocated?	No. The translocation was supposed to have been done in sods, but topsoil was just stockpiled and translocated without any vegetation.
Post-translocation Questions	**Answers and Details**
9. Has the translocated area been frequently deweeded and cleared of aliens since the translocation?	Yes
10. How active is the HFWG and how often do alien clearing programs take place? Is there still a partnership with TAG Changers of Cassablanca and Sector Park communities?	HFWG is currently non-functional as a result of bad relationships in the community. All alien clearing is done by conservationists employed with the local municipality
11. Was finance made available by the developer for the following: mitigation and enhancement actions; training and environmental awareness requirements; monitoring; auditing; and corrective actions? This amount should equate to the fees necessary for 5 years of management; was the amount realistic?	No funds were made available.
12. Is there currently a student in place to conduct monitoring?	Yes.
13. How long was an ECO present to conduct audit reports?	ECO was present only for the day of the translocation. Determining the frequency and duration of ECO audit reports is the responsibility of DEA&DP to include in EA, but not present.
14. How often does the reserve burn?	The reserve has burnt annually for approximately the last 8 years.
15. Has a rehabilitation plan been developed for the reserve to manage soil erosion,	No.