

APPENDIX B:

CITY OF CAPE TOWN

BIODIVERSITY NETWORK PRIORITISATION PROJECT

NOTE:

- 1. Data and result presented in this report are superseded by the 2007 revised analyses.*
- 2. The land use guidelines presented in this report are superseded by a) the results of the 2007 analysis, b) the national conservation status of the vegetation types represented in the City and c) the WC Provincial and draft City Biodiversity Offsets Policies and Guidelines.*

Final Draft Report

presented by

Marlene Laros & Associates – Sustainability Matters

in association with

**Biodiversity & Conservation Biology Department
University of the Western Cape**

Settlement Planning Services

GISCOE

and

The Freshwater Consulting Group

December 2004

CONTENTS

1.	Introduction.....	2
1.1.	The City of Cape Town Biodiversity Prioritisation Project	2
1.2.	Purpose of this draft Final Report.....	2
2.	Building on city-wide biodiversity conservation and metropolitan open space initiatives.....	3
2.1	Prioritising the Biodiversity Network: background and purpose	3
2.2	The City of Cape Town’s Biodiversity Strategy.....	4
2.3	The identification of the Biodiversity Network	5
2.4	Cape Metropolitan Open Space System Synthesis Project	6
2.5	Assessment of Rivers and Vleis in the City of Cape Town.....	6
2.6	Catchment, Stormwater and River Management Strategy	7
2.7	Coastal Zone Management Strategy and proposed Marine Protected Area	7
2.8	Conservation Management Models for the City of Cape Town	7
2.9	Other related initiatives of the City of Cape Town	8
3.	Prioritisation and categorisation of the Biodiversity Network.....	9
3.1	Introduction.....	9
3.2	Criteria and decision tree for prioritisation of the network	9
4.	Nodes and corridors: key concepts for the Biodiversity Network	13
4.1	Introduction.....	13
4.2	Some initial considerations and definitions	13
4.3	Nodes - definition and function within the CCT’s Biodiversity Network.....	14
4.4	Corridors – definition and function within the CCT’s Biodiversity Network	16
5.	Results of the Biodiversity Network prioritisation analysis	19
5.1	Introduction.....	19
5.2	Summary of GIS methods used in assigning prioritisation to NHRs, wetlands and rivers	19
5.3	Comments on the data used	20
5.4	Results of the prioritisation analysis	20
6.	Identification of nodes	26
6.1	Summary of GIS method used to identify nodes	26
6.2	Result of nodes selection analysis.....	26
6.3	Comments on the further development of nodes and corridors	27
7.	Development planning and land use guidelines.....	28
7.1	Background.....	28
7.2	Integrating the Biodiversity Network into the city’s development planning system.....	29
7.3	Land use guidelines for categories A, B, & C of the Biodiversity Network	30
8.	Recommendations for further implementation of the Biodiversity Network.....	42

Appendices:

Appendix 1: Terms of Reference

Appendix 2: Discussion Document of Nodes, Corridors and Criteria for Prioritisation

Appendix 3: Record of Workshop One

Appendix 4: Comments from Dr Bruce McKenzie, Botanical Society of South Africa

Appendix 5: Record of Workshop Two

1. Introduction

1.1. The City of Cape Town Biodiversity Prioritisation Project

The City of Cape Town is committed to implementing a Biodiversity Strategy as part of the Integrated Metropolitan Environmental Management Strategy (see section 2.1). One of the key outcomes of the Biodiversity Strategy is the establishment of a city-wide Biodiversity Network which protects and enhances a minimum set of the unique biodiversity of Cape Town. During 2001/2002, a systematic conservation planning study was undertaken to identify a Biodiversity Network. To enable a systematic yet pragmatic approach to securing the Biodiversity Network, the City requires that the network be prioritised on the basis of biodiversity conservation priority (categories A, B and C), described in terms of the functions of its component parts (nodes and corridors) and that development planning and landuse guidelines are developed to assist in implementation.

The City of Cape Town has commissioned MLA-Sustainability Matters, in association with the Biodiversity & Conservation Biology Department of UWC, Setplan, GISCOE and the Freshwater Consulting Group to undertake the Biodiversity Network Prioritisation Project. The goals of the project are as follows (see Terms of Reference in Appendix 1):

- 1) To develop a scientifically valid and defensible rationale for the concept of Biodiversity Nodes (Biodiversity Anchors) and the role these nodes would play within a functional Biodiversity Network;
- 2) The development of a well argued, pragmatic, practical and realistic set of criteria and framework for what would constitute a functional biological corridor within the urban context of Cape Town and the ecology of the Cape Floristic Kingdom;
- 3) The development of defensible criteria for prioritising the Biodiversity Areas into a range of categories;
- 4) Using the clear and well-developed criteria, prioritise the Biodiversity Network areas into Category A, B or C;
- 5) Identification of all areas to be classified as Biodiversity nodes in the network;
- 6) Preparation of development planning and land-use guidelines for Category A, B and C biodiversity areas; and,
- 7) Preparation of development planning and land-use guidelines for biological corridors.

1.2 Purpose of this draft Final Report

The purpose of this document is to present the draft consolidated set of project products including: background to the study; prioritisation criteria to be used in the categorisation and prioritisation of the Biodiversity Network; concepts that set the overall approach for the establishment and functioning of an urban Biodiversity Network within the CCT, including key concepts of nodes and corridors; the results of the Biodiversity Network prioritisation analysis and biodiversity node identification; and, landuse and land management guidelines.

The concepts and criteria presented in this document have built on the best practice research and background information presented in a Discussion Document (see Appendix 2). This document provides a summary of all key related initiatives and informed Workshop One within the project process. Inputs received during and after this workshop (Appendices 3 and 4) as well as peer review by a Reference Group have informed the further development of the concepts and criteria for prioritisation. Workshop Two (record included as Appendix 5) focussed on the development of the landuse and land management guidelines.

The document structure is as follows:

Sections 1 & 2: Project background and key current open space and biodiversity initiatives within the City are Cape Town are presented together with the previous steps undertaken in establishing the Biodiversity Network. Readers are referred to further background presented in the Discussion Document.

Sections 3 & 4: The prioritisation criteria are presented in a “decision tree” together with the approach to their use. The draft concepts of Biodiversity Nodes and Biodiversity Corridors are presented as two key conceptual elements defining the Biodiversity Network and its functions.

Section 5: The results of the prioritisation analysis for Natural Habitat Remnants (the terrestrial component), wetlands and rivers are presented.

Section 6: The biodiversity node identification process and outcomes are presented.

Section 7: Land use management guidelines for the categories A, B and C of the network are presented.

Section 8: Recommendations are presented.

2. Building on city-wide biodiversity conservation and metropolitan open space initiatives

2.1 Prioritising the Biodiversity Network: background and purpose

Background

The City of Cape Town has undertaken a number of initiatives towards the sustainable conservation of biodiversity. These and other related initiatives are summarised in section 2.9.

The driving normative framework for biodiversity conservation in the City has been the developing national biodiversity legislative and policy framework and the City's own Biodiversity Strategy (see section 2.2). The developing conceptual approaches for the Cape Metropolitan Open Space System (CMOSS) (see section 2.4) provide the overarching strategic urban spatial planning framework (including categorisation) within which the Biodiversity Network will be located. It is envisaged that the Biodiversity Network will form the "backbone" of the CMOSS, conserving the pattern and process of the City's biodiversity. This approach is similar to the "Greenways" approach adopted elsewhere in the world, where the conservation of biodiversity and the maintenance of ecosystem goods and services are integrated into the planning of open space in a manner that makes them a key structuring element of the urban form, and a resource to City's residents.

The prioritisation of the Biodiversity Network, in terms of biodiversity value, is informed by the systematic conservation planning undertaken to identify the network (described in section 2.3), the assessment of rivers and vleis (described in section 2.5), the development of a Coastal Management Strategy and detailed mapping and categorisation of coastal areas (section 2.7). Furthermore the CCT has undertaken a study to research conservation management models for the Network (section 2.8).

During the course of this prioritisation project two significant national and provincial strategic processes have been published. The first is new Vegetation Map for South Africa that has informed the National Spatial Biodiversity Assessment and the assessment of ecosystems in terms of their conservation status and threats. The second is Western Cape Provincial Spatial Development Framework (PSDF). This Framework identifies key spatial principles and provincial-level spatial strategies for the protection of important biodiversity of the Western Cape Province.

Purpose

From the background summarised above and below (and in Appendix 2 in more detail), the City has reached an important milestone at which it needs to prepare for the planned implementation and sustainable management of the Biodiversity Network. In the context of limited resources being made available to conservation through City budgets and the fact that the City will not be able to purchase or place in formal conservation areas each terrestrial site or river and wetland identified as part of the Biodiversity Network, the city will need to direct its limited conservation resources towards areas of highest biodiversity conservation priority and find innovative and co-operative ways of securing the Network. As implementation will take place over time, landuse planning for areas making up the network must be guided in a manner that directs investment to optimise the social and economic benefits, enables conservation and prevents or minimises the further loss or damage of important areas of the Network.

For reasons described above, it is very likely that the process of implementation will need to develop co-operative approaches on land with existing land rights or private ownership. In this regard the City has decided to adopt a proactive approach in prioritising the Network and in developing supporting landuse guidelines that could direct potential investment in the Network.

One of the key outputs of this project is therefore prioritisation of the network's biodiversity areas into categories A, B and C, where:

- Category A areas are those areas that must be protected as key biodiversity areas and will include amongst others existing nature reserves and other areas that meet the established criteria. These areas will be managed primarily for maintenance of biodiversity.
- Category B areas will be those areas that are managed for maintenance of biodiversity but which will also support other appropriate activities and landuse types.
- Category C areas will be those areas that will fulfil a primary function of supporting an activity or landuse that is mutually inclusive of maintenance of biodiversity but not managed primarily as a biodiversity area.

It is important to note that while this study will prioritise wetlands and rivers as part of this study, the freshwater component of the Biodiversity Network will not be subject to the same land use management guidance as that recommended for the terrestrial component. However, the prioritisation process will assist in the future management of the network in concert with the implementation of catchment management and stormwater management guidelines that have been developed by the City.

Further, the definition and function of the Network's components is vital for ensuring that resources are directed to areas that support a range of ecological, social and economic benefits, i.e. "biodiversity nodes". Essential linkages within the Network that support biodiversity process, i.e. "biodiversity corridors", need to be supported. To this end, the definition of the concepts "biodiversity nodes" and "biodiversity corridors" are being developed. These concepts are presented in section 3 below.

2.2 The City of Cape Town's Biodiversity Strategy

The City of Cape Town Integrated Metropolitan Environmental Policy (IMEP) and implementation strategy, the Integrated Metropolitan Environmental Management Strategy (IMEMS) provide the super-ordinate framework for the sectoral strategies approved by Council to date: Biodiversity Strategy; the Coastal Zone Strategy; and the Environmental Education and Training Strategy. The City of Cape Town formally adopted the Biodiversity Strategy in on the 29th October 2003. The Biodiversity Strategy provides some specific guidance on the proposed definitions and functions and prioritisation of the components of the Biodiversity Network.

The Strategic Objectives of the Biodiversity Strategy are:

- Primary Biodiversity (conservation and biodiversity nodes)
- Secondary Biodiversity (conservation through corridors, links and mixed use areas)
- Conservation of biodiversity in freshwater aquatic systems
- Invasive alien species management
- Biodiversity legislation and enforcement
- Biodiversity information and monitoring system, and
- Biodiversity education and awareness

The first three of these strategic objectives provide the strategic spatial concepts that must inform the Biodiversity Network Prioritisation Project. The following are summarised extracts from the Biodiversity Strategy, providing a description of the strategy and the goal and principles for these first three objectives:

Relating the Biodiversity strategy to the prioritisation of the Biodiversity Network

Primary Biodiversity Conservation (Conservation Areas and Biodiversity Nodes)

This Strategic Objective (Primary Biodiversity Conservation) refers to the establishment and effective management of a network of biodiversity areas and biodiversity nodes that are actively managed with the primary function of conserving Cape Town's biodiversity. Primary Biodiversity of the Network refers to all terrestrial and freshwater components of the network prioritised as categories A and B or which are defined as "biodiversity nodes" in the network.

Secondary Biodiversity Conservation (Corridors, links and mixed areas)

The CCT recognises the urban context within which the conservation of biodiversity will take place. As such the importance and role of open space, that although serving other primary functions, may play in the conservation of biodiversity is recognised. This type of open space includes amongst others rivers, ecological buffer zones along rivers, areas forming part of the Stormwater Management System, linear parkways, parks, scenic drives, road verges, servitudes and transport routes. These areas can facilitate the movement of species from one area to the next by acting as corridors and links. The Secondary Biodiversity Strategic Objective refers to all areas that are not actively and specifically managed with a primary function as biodiversity conservation areas but which connect the Primary Biodiversity Areas and “biodiversity nodes” into a complete and functional Biodiversity Network.

Secondary Biodiversity within the Network therefore includes all areas that act as mixed-use areas, corridors, links and stepping-stones and will be all terrestrial and freshwater components that are prioritised as category C and all identified “biodiversity corridors”.

Conservation of Biodiversity in Freshwater Aquatic Systems

Cape Town’s unique rivers, wetlands, vleis, dams and estuaries, form important ‘green corridors’ between the mountains and the coastline as well as providing habitats for a rich diversity of terrestrial and aquatic life. These freshwater systems are essential components of the Biodiversity Network. The freshwater Network components (wetlands and rivers) have also been prioritised (categories A, B and C) and are seen as a vital part of the primary and secondary biodiversity.

2.3 The identification of the Biodiversity Network

During 2001/2002 a project aimed at identifying a representative conservation network was initiated by the Environmental Resource Management Department of the City Cape Town. The project used the Systematic Conservation Planning approach to identify remnants of land within the City of Cape Town that would need to be conserved to ensure the protection of a representative sample of the area’s biodiversity. This same approach was also used during the C.A.P.E. project, and has also subsequently been applied in *inter alia* the Succulent Karoo (SKEP) and Subtropical Thicket (STEP) projects.

The identification of these areas was based on a set of conservation targets aimed at setting benchmarks for the conservation of vegetation types, floral species and a selected set of ecological processes. The setting of the conservation targets was done through a consultative process, which engaged key stakeholders involved in conservation within the City of Cape Town. The vegetation map developed by Barrie Low in 2000 was used as the primary biodiversity layer (surrogate for habitat) for this study, with plant species data from the Protea Atlas and the Species and Sites database (Low 2000) used to supplement this.

This study identified a set of 261 remnants (32 262ha) from an initial set of 886. These selected remnants are in addition to the existing protected areas representing about 54 293ha. A set of corridors were then identified, which linked the following significant areas; Zandvlei, Macassar, Gordons Bay, Cape Point, Noordhoek Wetlands, West Coast, Mamre and Paardeberg. These corridors were identified to ensure that ecological gradients are conserved, and to account for the predicted impacts of global climate change. Effectively, these corridors optimise routes containing natural vegetation. Nineteen corridors were identified, along with 18 nodes. The nodes were originally seen as areas where the corridors intersect, and potentially represent critical “biodiversity intersections”. However, the nodes were not necessarily represented by large contiguous remnant areas. Stakeholders have subsequently understood the concept of nodes to be a term that best describes large remnants or groups of remnants (“biodiversity hubs” or “nodes”) meeting a significant proportion of conservation targets and providing a range of conservation-related uses. It is this concept that the CCT wishes to explore further with stakeholders.

An initial prioritisation of the selected remnants was based on remnant size and the conservation of three critical vegetation types. These three types (sand plain fynbos on inland older non-marine derived acid sands, west coast

renosterveld on shale and west coast renosterveld on granite) were listed as critical because the extant area was smaller than the area required for representative protection as described by the conservation targets.

- Level 1 sites (70 sites identified) were those larger than 10ha area conserving any of the three critical vegetation types (plus the existing protected areas and Core Botanical Sites – which made a total of total of 150 terrestrial sites). Over and above this, all wetlands, rivers and estuaries were also included in Level 1.
- Level 2 sites (97 sites identified) were those conserving at least one of the three critical vegetation types, but irrespective of size.
- Level 3 sites (69 sites identified) were those remaining remnants greater than 10ha.
- Level 4 sites (25 sites identified) were the remaining remnants from the selected set of 261 not falling into the previous three levels.

The remaining unselected remnants (475) were grouped into level 5.

Levels 1 to 4 (a total of 261 new sites in addition to the existing protected areas and Core Sites) should be considered the minimum viable network needed to adequately conserve the biodiversity of the City of Cape Town and should be protected from incompatible land uses. Levels 1 and 3 focus on relatively large units of habitat for species and processes and levels 2 and 4 concentrate on conserving the rare and threatened habitats of species with restricted distributions. The most important levels are 1 and 2, as these represent the areas on which any of the three vegetation types for which there does not currently exist sufficient land to meet their targets are found. These should thus assume the highest priority.

The document that described in detail the methodologies used and the results obtained, “Identification of a Biodiversity Network for the City of Cape Town”, is available from the City of Cape Town’s Environmental Management Department. This study has identified the key components of the network. The 261 terrestrial sites and existing protected areas and Core Botanical Sites selected as the Biodiversity Network (411 sites) as well as the freshwater component comprise the starting point for this prioritisation project.

2.4 Cape Metropolitan Open Space System Synthesis Project

The Cape Town Metropolitan Open Space System (CMOSS) Synthesis Project has developed a vision and criteria for the identification of open space in the City of Cape Town. A pilot study was undertaken in the Metro South East to test the identification and mapping methodology. After the successful conclusion of the pilot project the remainder of the metropolitan area was mapped. As part of this study a Framework for Management Guidelines for CMOSS was developed. The CMOSS Mapping Project has used an open space typologies or categories that were originally developed for the CMOSS Value Study, a further initiative of the CCT that undertook research based on resource economics methodologies to establish the value of open space in two pilot areas. These definition and typologies of CMOSS are presented in Section 4 of Appendix 2. The full report is available from the City of Cape Town’s Spatial Planning Department.

The City is currently in the process of planning for integration of the implementation of the Biodiversity Network within CMOSS. As described above, the Biodiversity Network is seen as the “backbone” of the open space system. This approach is being piloted in the Southern Component of the Biodiversity Network.

2.5 Assessment of Rivers and Vleis in the City of Cape Town

In 2001 the Catchment, Stormwater and River Management Branch (the then Catchment Management Department) commissioned a study that assessed many of the rivers and wetlands in the CCT. (River & Vlei Assessment and Monitoring in the CMA: assessment of rivers and wetlands). This study has provided a firm basis for the further strategic prioritisation of rivers (focusing on river reaches) and wetlands with specific reference to criteria of habitat integrity, rehabilitation potential and ecological importance and sensitivity. In this prioritisation project, this assessment framework will be used to prioritise the freshwater component of the Network (see section 3.2.2 below).

2.6 Catchment, Stormwater and River Management Strategy

Developed in 2002 and effective until review in 2007, the proposed outcomes of this strategy that are directly relevant to guiding role and function and prioritisation of rivers and wetlands as part of the Biodiversity Network and include:

- Effective stormwater drainage;
- Improved water quality of surface, ground and coastal waters;
- Ecologically healthy rivers, vleis, dams and wetlands;
- Multi-functional, sustainable use of river corridors; and,
- Active support of the CCT Indigenous Fauna and Flora Policy.

This Strategy provides a further policy mandate for the landuse guidelines component of this prioritisation project.

2.7 Coastal Zone Management Strategy and proposed Marine Protected Area

One of the three approved IMEMS Strategies, the Coastal Zone Management Strategy, identifies the following strategic objectives:

- Development and implementation of Sustainable Coastal Management Plans for each area of the coast
- The establishment of Blue Flag Beaches
- The implementation of a Coastal Recreation Plan
- Effective estuary management
- Monitoring of coastal water quality
- Coastal legislation
- Coastal education and awareness
- The conservation of natural coastal areas
- The management of developments within the coastal zone, and
- Coastal engineering.

Many of these objectives are linked to the Biodiversity Strategy implementation, specifically “effective estuary management” and “the conservation of natural coastal areas”. A critical challenge in the future will be the integration of natural coastal areas, including estuaries, into the Biodiversity Network.

The Table Mountain National Park (TMNP) is planning to establish a Marine Protected Area along its coastline. The zoning definitions of this MPA will assist in the conservation of natural coastal areas and estuaries contiguous with the TMNP. The CCT’s attention will therefore need to be focused on the areas along the False Bay Coast and coastal areas on the west coast to the north of the currently proposed MPA.

2.8 Conservation Management Models for the City of Cape Town

During 2002, the CCT commissioned Envirocentric and Common Ground Consulting to undertake research on the legislative status, management implications and resource requirements for an identified set of conservation models. The aim of the work was to identify the full range of conservation management models that could be used to conserve and protect the wide range of biodiversity areas that make up the Biodiversity Network. This work was focused on learning from a range of national and international case studies. The final report recommended four complementary strategies to guide biodiversity conservation strategies together with a set of tools described within a “toolkit”:

- i) Designation of private and public key conservation areas with formal protected area status together with detailed assessment of the management planning considerations and funding arrangements.
- ii) Establishment of a suite of complementary “off-reserve” mechanisms for private and public land zoned agricultural or rural in the zoning scheme. These include formal and informal land management agreements, statutory land covenants, financial or technical assistance, advice and financial incentives.

- iii) Negotiated planning solutions for private and public land zoned other than agricultural or rural or land earmarked for development through approved planning processes. This proposes the use of structure plans, guided development schemes, subdivision and development controls and density trade-offs.
- iv) Negotiated management solutions for public land including designated for public infrastructure (e.g. road reserves), service requirements (e.g. water catchments) or other broader community needs (e.g. Parks) and/or under different public agency management (e.g. public works).

Even though this report was finalised prior to the final publication of the Protected Areas Act, the research, recommendations and associated toolkits will be helpful in the implementation of the Biodiversity Network.

2.9 Other related initiatives of the City of Cape Town

Many of the studies identified below have also informed the need for prioritisation of the network and the development of landuse guidelines.

Table 1: Related initiatives of the City of Cape Town		
Title	Description	Shortened Title
Identification of Key Nature Conservation Areas in the City of Cape Town	The selection of a minimum set of nature areas within Cape Town that, together with existing protected areas, if managed and protected, would ensure the long term protection and enhancement of Cape Town's biodiversity	Key Nature Conservation Areas
Cape Flats Flora Core Conservation Sites	38 sites, which, if managed and protected will together, conserve 97 % of the flora species on the Cape Flats.	Core Flora Sites
Mainstreaming Biodiversity on the Cape Flats	To design and implement sustainable management and funding systems for conservation management in important biodiversity areas on the Cape Flats with emphasis on community involvement.	Mainstreaming Biodiversity on the Cape Flats
Environmental Significance Mapping	Mapping of environmentally significant sites (according to certain criteria) in terms of aquatic, marine, terrestrial, social, geophysical, heritage, social and visual information.	ESM
Towards a Conservation and Development Framework for the False Bay Coast	Initial stage of a project aimed at establishing a conservation and development framework along the north-eastern portion of False Bay from Strandfontein to Kooelbaai.	Towards a False Bay CDF
Status Quo Assessment of the Core Flora Sites	A study to assess and gather all relevant information on each of the Core Flora Sites	Status Quo Assessment of the Core Flora Sites
Natural Interface Study	The development of guidelines for more effective management of the interface between urban and natural areas, with specific reference to fire and stormwater management.	Natural Interface Study
Urban Edge for the City of Cape Town	The definition of the urban edge demarcating the outer limits of urban expansion and the development of management guidelines associated with management zones on either side of the demarcated line.	Urban Edge Study

3. Prioritisation and categorisation of the Biodiversity Network

3.1 Introduction

A key output of this project is a set of criteria for prioritising the network's biodiversity areas into categories A, B and C, as described in section 2. The challenge is to develop a prioritisation and categorisation system that is appropriate in the context of the objectives of the CCT's Biodiversity Strategy. Further, the prioritisation and categorisation must be effectively integrated *inter alia* with the Metropolitan Open Space System, Spatial Development Framework and Integrated Zoning Scheme, ensuring the long-term conservation of the City's biodiversity while promoting opportunities for social and economic benefit.

The starting point for this study is to use the 261 land parcels or "natural habitat remnants" (NHRs) that were previously identified together with the existing protected areas, rivers and wetlands as the minimum viable network needed to adequately conserve the biodiversity of the City of Cape Town (i.e., Levels 1 to 4 described in 2.3 above). It is important to note that at the time of these previous studies a comprehensive dataset for freshwater systems was not available and hence all wetlands and estuaries were identified as Level 1 sites.

3.2 Criteria and decision tree for prioritisation of the network

The development of a prioritised Biodiversity Network will involve a scoring of category A, B or C for each protected area, NHR, wetland and river reach. In order to achieve this, a decision tree (incorporating a set of criteria) has been formulated. The following is a proposal based on the presentation at Workshop 1 and feedback from the workshop. A written input received from Dr Bruce McKenzie of the Botanical Society of South Africa has significantly helped to shape the decision tree presented below (see Appendix 4). The following two sections explain how the criteria for prioritisation will be applied for the terrestrial and freshwater (rivers and wetlands) components of the network. It is important to note that these criteria are either applied on their own or in combination with other criteria in the decision tree.

3.2.1 Criteria for prioritising the terrestrial component of the Biodiversity Network

A *Category A* NHR is principally defined by its:

- current protection status (i.e., protected area or Core Botanical Site);
- representation of a proportion (>5%) of the extant areas of the three vegetation types¹ for which the conservation targets could not be met;
- size (i.e., ≥ 10 ha); and,
- irreplaceability² (i.e., ≥ 0.9) as defined by the original study.

Category B NHRs are defined by:

- irreplaceability value (i.e., ≥ 0.75 and < 0.9); and,
- size (i.e., ≥ 10 ha).

Category C NHRs are all of those areas of the Biodiversity Network that are not included in categories A and B.

¹ Si - Sand plain Fynbos on inland older non-marine derived acid soils; WSh - West Coast Renosterveld on Shale; and, Wg - West Coast Renosterveld on granite.

² In the process of identifying the Biodiversity Network, each NHR was given an irreplaceability value. This is a value ascribed to a site according to its contribution in meeting biodiversity conservation targets, where 0 = lowest irreplaceability value and 1 = highest irreplaceability value. E.g., if a NHR with an irreplaceability value = 1 is lost to the Biodiversity Network, it is likely that the City's biodiversity conservation target will not be met.

3.2.2 Criteria for prioritising the freshwater component of the Biodiversity Network

The river and wetland prioritisation will draw directly on the results and dataset of the study: River & Vlei Assessment and Monitoring in the CMA: assessment of rivers and wetlands assessment. Readers are referred to the above report for further technical or detailed explanation of the assessment methodology. The following outlines the relationship between the classification system used in that study and the proposed prioritisation of rivers and wetlands within the Biodiversity Network.

Wetlands prioritisation

Table 2 below indicates how this assessment will be used to inform prioritisation of wetlands into categories A, B and C.

Table 2: Wetlands prioritisation based on Ecological Importance and Sensitivity assessment

Importance class (one or more attributes may apply)	Range of Median	Wetland Management Class	Prioritisation for Biodiversity Network
High to Very high Representative of wetlands that: - support populations of rare or endangered species, or fragments of such populations that are present in other similar and geographically-adjacent wetlands; - contain areas of habitat and species richness; - contain elements of taxonomic uniqueness and/or intolerant taxa; - provide unique habitat, or habitat suitable for specific species (e.g. salt marsh or ephemeral pan; physiognomic features, spawning or nursery environments); - is a crucial avifaunal migratory node (e.g. RAMSAR wetlands); - may provide hydraulic buffering and sediment retention for rivers that originate largely outside of urban conurbations, or within residential fringes of urban areas; - have groundwater recharge/discharge comprising a component of the hydrological regime of the wetland; - may be sensitive to changes in hydrology, patterns of inundation, discharge rates, water quality and/or human disturbance; - are of importance for conservation, research or education.	> 2 <= 4	A – B	A
Moderate Representative of wetlands that: - contain small areas of habitat and species richness; - provide limited elements of habitat that has become fragmented by development (e.g. salt marsh, ephemeral pan; roosting sites and heronries); - provide hydraulic buffering for rivers that originate in urban areas; - are moderately sensitive to changes in hydrology, patterns of inundation, discharge rates and/or human disturbance; - perform a moderate degree of water quality enhancement, but are insensitive to sustained eutrophication and/or pollution; - are of importance for active and passive recreational activities.	>1 <= 2	C	B
Low/marginal Representative of wetlands that: - contain large areas of coarse (reeds / bulrushes) wetland vegetation with minimal floral and faunal diversity; - have a high urban watershed:wetland area ratio; - are important for active and passive recreation, or may primarily provide some service within the urban context (e.g. stormwater retention); - provide moderate to high levels of hydraulic buffering; - may be eutrophic and generally insensitive to further nutrient loading; - are generally insensitive to changes in hydrology, patterns of inundation, discharge rates and/or human disturbance; - have regulated water; - contain large quantities of accumulated organic and inorganic sediments.	>0 <= 1	D	C

River prioritisation based on River Priority Ranking assessment

River reaches will be prioritised on the basis of River Priority Ranking. The River Priority Ranking procedure takes into account habitat integrity, present ecological status and rehabilitation potential and will therefore be used in the following way to categorise river reaches into the proposed categories A, B, and C.

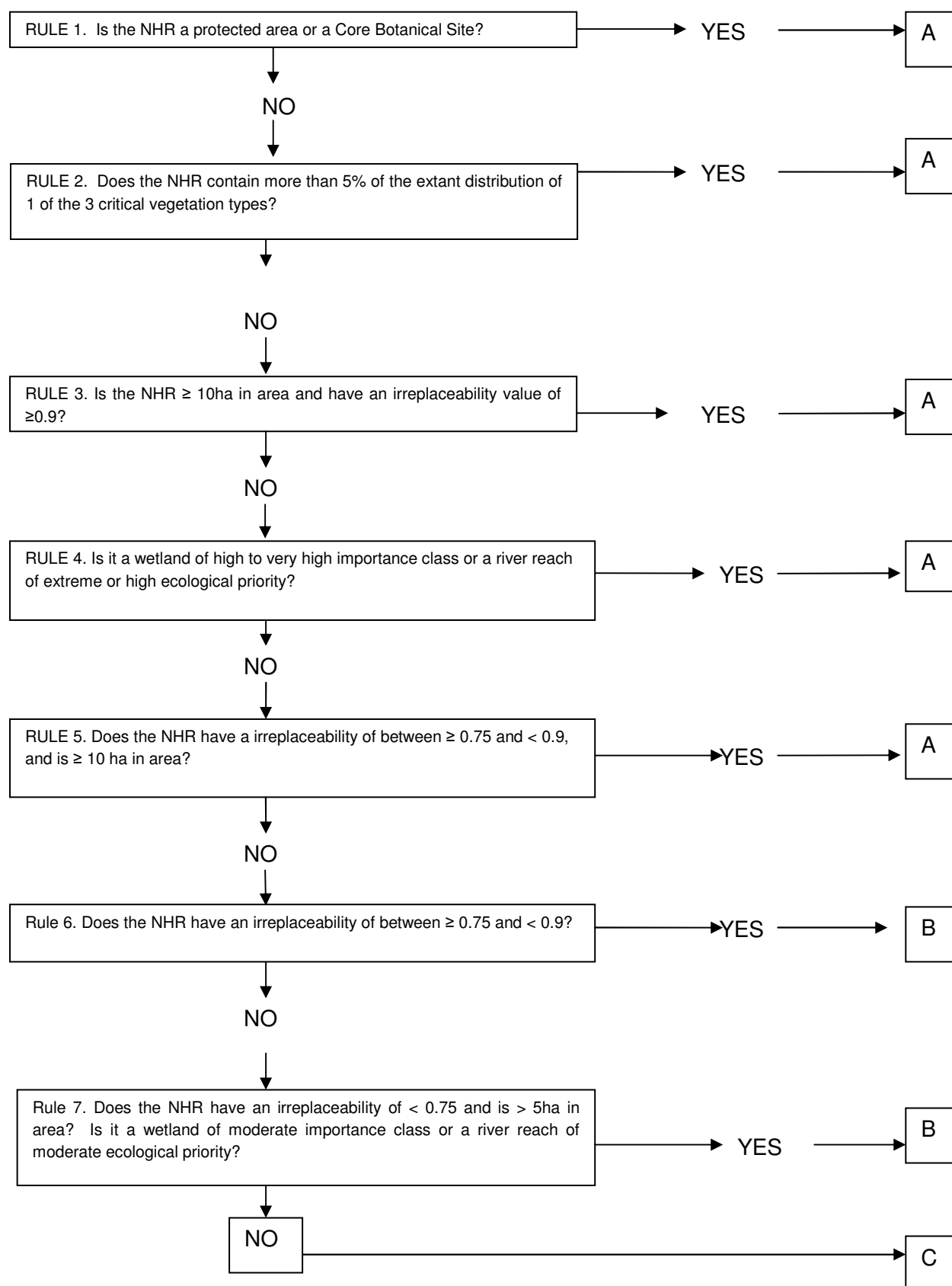
Category A includes all river reaches falling into Categories 1 and 2 of the River Priority Ranking system. This includes river reaches that are considered to be of extreme or high ecological priority, due to the fact that the river reach:

- Displays biological (e.g. the presence of populations of rare / endangered species) or geomorphological features (e.g. gorges, waterfalls) that are unique among river reaches of the same river type;
- Has Habitat Integrity / Present Ecological Status (HI/PES) and a Relative Rehabilitation Potential ranking which places it in the top 10% of that particular river type;
- Has a Class A or B HI / PES;
- Is situated upstream of a river unit that has been assigned an Ecological Priority of Category 1, or if it is situated upstream of an important (local, regional, national or international significance) system (such as a wetland or estuary) or upstream of a biodiversity node;
- Has a high Relative Rehabilitation Potential ranking, despite having a PES lower than Category 1 (i.e., based on HI / PES) rivers.

Category B includes all river reaches that are considered as having moderate or modest ecological priority, i.e., those that are classified as Category 3 and 4 based on HI / PES scores.

Category C would then include all reaches that are considered as having a low ecological priority (Category 5), i.e., having a Class F HI / PES. These are river reaches that are highly modified, with an extremely limited rehabilitation potential. Many of these river reaches would be canalised.

Figure 1: Decision tree for prioritisation of NHRs into A, B and C



4. Nodes and corridors: key concepts for the Biodiversity Network

4.1 Introduction

The Biodiversity Network has the primary objective of protecting and enhancing a minimum set of the unique biodiversity of Cape Town. This study has therefore focused on this specific objective – i.e. biodiversity conservation. This network however, is within an urban context, an area that must and does provide for a wide range of urban human needs. The Biodiversity Network must therefore play an equally important role of being part of the fabric of the urban environment. As such, the network must serve a wide range of social and economic needs. Indeed, it is the need to ensure that the Biodiversity Network accommodates and facilitates range of social and economic opportunities that is driving its further prioritisation. This approach may not sit comfortably with interests that feel that the conservation areas must exclude all other land-uses; however, this is the reality of the challenges facing the conservation of biodiversity in the City of Cape Town. Sustaining and developing the social and economic services that the Biodiversity Network will provide are vital to its long-term conservation.

Cape Town's 2020 Vision expressed in the latest draft IDP states that Cape Town aims to be a city with “*a safe green area within walking distance for all*”. The IDP also identifies the unique biodiversity of the City as a key competitive advantage over other South African cities, providing opportunities for conservation-based education and youth development, a range of recreational activities and tourism development. There is thus a clear policy commitment to implementing the MOSS.

Urban renewal and environmental upgrading are important components of the IDP, suggesting that in the prioritisation of the network consideration should be given to the contribution that a functional network could play in the upgrading of dysfunctional urban settlements. Well-managed urban open space is essential to the health and wellbeing of urban dwellers. Great caution must therefore be taken to ensure that we plan for living environments that provide for these social needs and that current resource constraints do not result in the development of an urban fabric devoid of open space and the social services they provide.

The perspectives presented above have led the City to conceptualise the Biodiversity Network as the “backbone” of the Metropolitan Open Space System (MOSS). This approach is consistent with approaches elsewhere in the world and is an essential element to implementing a Biodiversity Network within a highly transformed and fragmented (from a biodiversity pattern and process perspective) landscape.

4.2 Some initial considerations and definitions

The following presents some of the informants from an international review (see Appendix 2) that has informed the suggested approach in describing the network components.

Biodiversity: *this reflects the diversity of genetic composition of organisms, diversity of species including maintenance of subpopulations, maintenance of species assemblages including the diversity of co-existing communities and the maintenance of ecosystem services at the landscape level.*

From the review of urban conservation at global and national levels it is evident that the City of Cape Town is unique with respect to the high level of biodiversity and turnover of species within a relatively small area. A secondary process that adds to the City's uniqueness is that Cape Town has a long history of human impact (colonization) and is facing the urban challenges of a developing country's economic circumstances. Responding to very rapid urban growth and poverty can also result in open space and biodiversity conservation areas being seen as having a very low priority. However, if Cape Town is to provide a healthy living environment for its people, it cannot condemn them to living in areas without open space. Hence the challenge is to find socially relevant and economically viable approaches to conserving biodiversity within a Network that is a vital part of an open space system for the metropolitan area.

An off-the-shelf solution for conserving biodiversity in any urban context does not exist and in this regard the City of Cape Town is no different to any other city. However, clear trends in the approach to urban biodiversity planning are evident, with Northern European cities having a focus on maintaining environmental services (since their biodiversity has largely been irreversibly altered through centuries of urbanisation), whereas the North American cities have a focus on planning and maintenance of biodiversity by using the Greenways planning framework.

Since no other major city has a combination of high biodiversity levels and high turnover of species over such short distances (called beta diversity) together with developing country economic circumstances, it makes the planning of biodiversity management especially difficult since the development needs of the City must inevitably lead to increasing fragmentation of the landscape and compromised biodiversity conservation. In this regard, South American cities present urban situations most analogous to Cape Town; however, few of them have progressed as far as Cape Town has towards the implementation of a biodiversity strategy within their urban development frameworks.

It is proposed that the Biodiversity Network for the City of Cape Town should lean towards the “*Greenways*” concept, which is very explicit and structural rather than the North European planning frameworks which are more inferred and conceptual in nature. The *Greenways* concept embraces planning for a sustainable physical environment that is less altered but also ensures maintenance and even increasing economic activities within urban areas (in contrast to the North European situation which largely sees economic development as being maintained at a status quo). As a consequence spatial components need to be identified that correspond to the Greenways planning framework which uses *nodes* and *corridors*. Within this context, a *node* is an area with a “concentration” of biodiversity features or an area of “attraction” of features that enable the maintenance of biodiversity pattern and process, while a *corridor* maintains flows or fluxes between these areas of concentration/attraction.

In applying the Greenways concept to the City of Cape Town’s Biodiversity Network, we will refine its specific use for the maintenance of the biodiversity within the City, rather than as an overall spatial planning objective. Consequently, the concept of a node and a corridor are qualified as “biodiversity node” and “biodiversity corridor”.

4.3 Nodes - definition and function within the CCT’s Biodiversity Network

Nodes are discrete and circumscribed spatial objects usually identified by cadastral parcels of land or which have a clearly defined “edge” and can be made up of one or a number of Natural Habitat Remnants or wetlands in close proximity presenting a concentration of conservation-related opportunities. By adding the qualifier of “biodiversity” to a node concept we wish to imply that biodiversity nodes are essentially areas to attract and maintain biodiversity. They can be seen as anchors within the Biodiversity Network supplying essential services of biodiversity conservation and a range of conservation related services such as recreation, tourism, environmental education, conservation youth skills development. Furthermore, these nodes should be well-managed areas that serve as flagships of the City’s conservation initiatives. As such these nodes should be profiled and marketed as providing the range of services mentioned above and broadly accessible to the people of Cape Town.

From a conservation planning perspective, these “biodiversity nodes” should have relatively high area to edge ratio, or be of a sufficient size (i.e. ecologically viable) so that they can maintain ecological processes, or be a remnant of a highly threatened and valuable (in terms of ecosystem functioning) habitat of any size (e.g. wetlands and areas of groundwater recharge). They are the key areas that “anchor” the maintenance and flows of biodiversity at a landscape level. These nodes are analogous to refugia - areas where species can remain protected from the effects of environmental stress. The physical processes associated with urban development generally promote fragmentation of habitat and increase environmental stress - the nodes function to mitigate these effects.

The “biodiversity node” concept strongly parallels concepts developed from the theory of Island Biogeography. For example small islands have fewer species (lower biodiversity) and with increasing area more species may coexist and thereby increase species richness/biodiversity. Similarly, small islands that are close to a mainland may have more species (higher biodiversity) than the same sized island that is situated further from the mainland. This outcome reflects that an island closer to a source of new species is more easily colonised than an island further

away. A cluster of islands in close proximity tends to support more species (higher biodiversity) than islands that are more distantly dispersed. Consequently, clear functional analogies exist between the concepts of Island Biogeography and the spatial planning processes required to define a suitable biodiversity node. This definition of a biodiversity node directly addresses the maintenance of biodiversity at both the site-specific level (alpha-diversity) and in terms of spatial turnover of biodiversity (beta diversity).

Thus, biodiversity nodes can be a discrete, large, contiguous NHR, a collection of discrete adjacent NHRs (that can be smaller), or a collection of discrete NHRs in close proximity to each other (that can be of smaller size). Furthermore, the NHRs that constitute a biodiversity node may have different levels of prioritisation within the network (see section 4 below). An additional qualification to the definition would be a smaller discrete NHR that has exceptional value with respect to biodiversity or maintenance of ecosystem services (e.g. wetland or site important for the recharge of underground aquifers).

In the context of the shortage of capacity and resources for conservation management in the City, the development of “biodiversity nodes” that provide a full range of biodiversity conservation and social and economic resources, also makes sense from a pragmatic and institutional management perspective. This means that nodes made up of larger sites or clusters of smaller sites can be managed coherently as one management unit. Further, these “biodiversity nodes” can be seen as focal areas for local stakeholders who can benefit from and be involved in conservation areas close to their homes.

In summary then, the identification of biodiversity nodes are driven by three perspectives:

- Biodiversity conservation function;
- Social and economic functions and opportunities; and
- Management practicalities.

The following is a “decision tree” incorporating some of the above functions of nodes as criteria for their identification within the Biodiversity Network. This will be applied to the prioritised Network to further assist in implementation and management.

Figure 2: Decision tree for the identification of biodiversity nodes

Rule 1: Is it a large protected area/NHR/wetland greater than 100 hectares?

YES? - becomes a node/part of a node

NO? - go to rule two

Justification:

100 ha represents a ten-fold increase in size compared to the threshold of 10 ha used in the ranking of the NHRs. A collective area of NHRs smaller than this would not have a significant impact with respect to the overall reserve network. One larger area is easier to manage compared with many small areas.

Rule 2: Are there several protected areas/NHRs/wetlands adjacent and physically connected that have a summed area of greater than 100 hectares?

YES? – together these areas form a node

NO? - go to Rule 4

Rule 3: There are nodes (identified in 1 or 2 above) that are closer than 1 km to each other.

Yes? – these nodes are combined into a single node/nodal cluster

No? – these remain as individual nodes

Rule 4: There are protected areas/NHRs/wetlands that are closer than 1 km to a node identified in 1, 2 or 3 above?

YES? -become part of a node/nodal cluster

NO? go to Rule 5

Rule 5: Is there an Environmental Education Centre or proposals for Environmental Education Centre or an active Environmental Education/conservation-related youth development curriculum that uses the protected area/NHR/wetland?

YES? becomes a node

NO? will not become a node or be part of a nodal cluster in the Biodiversity Network.

4.4 Corridors – definition and function within the CCT’s Biodiversity Network

4.4.1 Definition of a biodiversity corridor

A biodiversity corridor in structural terms is non-discrete (i.e. does not have a specific edge) and has an essential function that reflects linearity and connection so as to ensure that flows/fluxes are maintained within larger spatial processes. Within an urban development context corridors are seen as allowing physical movement such as transportation, or conceptual movement such as flows of economic investment between development nodes. Corridors are most usefully defined using models such as transport networks and are often mathematically generated through processes of optimisation. Consequently a *biodiversity corridor* should provide for movement of species and organisms along and between ecosystems, which is an essential process for the maintenance of biodiversity at the landscape level. Whereas the biodiversity node is essentially a planning unit, the biodiversity corridor is more of a spatial concept informing a management approach. An example is a corridor of private gardens connecting two urban protected areas. While the gardens themselves may have no formal conservation status, their development and management as natural refuges (e.g. appropriate plantings, removal of physical barriers such as boundary walls, exclusion of pesticides) could significantly support the connectivity between the two protected areas. Consequently the appropriate planning and management of biodiversity corridors will complement the ecological sustainability of biodiversity nodes.

Natural linear ecosystems provide physical corridors which promote and maintain levels of biodiversity and include rivers, coastlines and skylines. Rivers, by their linear nature, are corridors. This would apply even to canalised systems. However, the effectiveness of rivers as corridors varies according to the location of the river, its river type, condition, etc. In the case of the City of Cape Town, mobile sand dunes also represent potential biodiversity corridors. Generally, natural corridors are not as transformed by economic activities as other urban areas and therefore provide ideal conduits for the movement of species and organisms. Consequently, biodiversity corridors should be seen as the natural routes that species/organisms would have used in the past when migrating towards "refugia" during periods of adverse environmental change, or which are used simply as routes of movement (e.g. upstream migration of adult insects to lay eggs in the upper reaches of streams, dispersal of plant propagules or feeding). For many invertebrate species, these corridors may be essential for the completion of a particular life history stage.

In terms of the corridors that have been identified using the friction analysis (described below), the “biodiversity corridors” in the City may be described as:

- Enabling the east-west and north-south linkages of NHRs and nodes;
- Incorporating “stepping stones” – i.e. NHR’s or open space in the path of the corridor and may not be continuous routes like river corridors;
- Including corridors of differing scales with a number of narrower corridors contributing to wider conceptual corridors;
- Incorporating a range of land uses compatible with maintaining biodiversity processes, e.g. private gardens; and,
- Promoting a conservation ethic on private land.

In order that biodiversity corridors can perform their intended function, land use management must support the persistence of the biodiversity function performed by these areas. For example, riparian zones of important river corridors should be maintained in as natural state as possible, mowing of verges on an important transport route serving as a corridor should be limited and the use of indigenous plants should be encouraged in private gardens and within road reserves etc.

4.4.2 Identification of corridors using friction analysis

A friction analysis³ was undertaken to identify corridors in a previous study (see section 2.2 above). This aimed to set the framework and “flow direction” for corridor identification. In this analysis, corridors were defined based on the assumption that different land uses accommodate the conservation of biodiversity to different extents - a concept defined as “biodiversity compatibility” within the study. So, highly impacted areas such as densely developed industrial areas had relatively little potential to support biodiversity whereas a natural habitat remnant had a large potential to support biodiversity. In order to define the ideal corridor, a surface was created that integrated all of these land uses as a biodiversity compatibility layer by applying a score from 1 (highest biodiversity compatibility) to 256 (lowest biodiversity compatibility)⁴. This layer represents a cost surface (also known as a friction surface) from which biodiversity corridors can be developed between defined start and end points, connecting areas using the shortest route with the highest biodiversity compatibility. The process was optimised by dividing the perimeter of the City into segments with defined start and end points placed in the middle of each of these segments. Corridors linking all possible combinations of these mid points were then identified to ensure that corridors in every direction were evaluated. Since many routes overlapped on one another it produced a network that has optimised efficiency in all directions.

During the initial process of identifying the Biodiversity Network, terrestrial, freshwater and coastal components were integrated through the biodiversity compatibility mapping exercises which, together with the least-cost surface analyses, produced the final corridor solution (original of frictions used – see Table 3).

Table 3: Friction values ascribed to various features and landscapes for the development of the corridors for conservation management. The base value of 1 is all areas that are either protected or been selected for protection. As friction values increase the area becomes increasingly unattractive for biodiversity. The corridors ensure the viability of existing biodiversity is optimised through a network of areas most compatible for supporting it.

Base Friction = 1

Existing Nature Reserves, Core Floral Sites, Selected remnants (all), Wetlands, Estuaries, Vleis

Friction = 3

Rivers with natural banks, non-selected remnants

Friction = 5

Dams, waste water treatment works’ water bodies

Friction = 10

Major powerlines, reservoirs, detention ponds, retention

Friction = 15

Irrigation ponds, canals, composite canal, open channels, weirs

Friction = 30

Major Roads and Freeways, Urban Open Spaces

Friction = 60

Low intensity agriculture*, wheat fields*, built up areas

Fiction = 120

High intensity Agriculture, Vegetable growing, Commercial areas

Friction = 240

Industrial areas, Settlements

*Originally run with frictions of 120 but no difference was observed in the network

³ Friction modelling is based on a defined resistance to movement through an area, with the level of resistance dependent on the characteristics of that area. Friction modelling in essence identifies the path of least resistance (friction) between a defined start and end point, and is thus specifically focussed on movement.

⁴ 256 classes were used to keep the processed raster images within limits of an 8-bit image to save processing time and disk space

The development of these spatial modelling approaches, such as the above, ensures that ecological gradients and possible effects of global changes are managed within corridors. Such corridors linked the following significant areas: Zandvlei, Macassar, Gordons Bay, Cape Point, Noordhoek Wetlands, West Coast, Mamre, and Paardeberg. Effectively, these corridors optimise routes containing natural vegetation and all major vegetation types. The advantages of this procedure is that it looks at the viability of patches in relation to where neighbouring viable patches are located and therefore provides a spatially explicit solution.

4.4.3 The role of riverine corridors within the Biodiversity Network

The connected nature of aquatic ecosystems requires that the protection of nodes of freshwater biodiversity calls for the protection (or at least, sustainable management) of areas that are beyond the borders of the node. For instance, the maintenance of a natural flow regime within a river or stream may be much more important for the protection of biodiversity within a node, than the protection of the node itself. This has implications for appropriate landuse within those corridors that include aquatic ecosystems, or that are linked to aquatic ecosystems, specifically:

- The basis for selecting corridors within the City should not only be the “ease of movement” criterion described above for the friction analysis, but also the status of the water quantity and quality⁵ regime within the river reach concerned. The assumption here is that a river in a near-natural state will best fulfil the function of an effective corridor linking nodes of biodiversity. An assessment of the extent of alteration of both water quality and quantity is contained within the assessment of habitat integrity (HI) described above for biodiversity nodes, and so the results of this assessment can be used to describe the river reaches that are potential corridors.
- The width of a corridor should be determined through assessment of the type of river reach within the corridor, and should include the river itself and an appropriate buffer⁶ or setback zone. Appropriate buffers have already been set for a number of river reaches within the CMA.
- The management of both water quality and quantity within a corridor should take into account the types of ecosystems located downstream of the corridor. For instance, the management of corridors leading into Category A biodiversity nodes should aim to approximate the natural flow regime and acceptable water quality conditions. Appropriate action should be taken to rehabilitate important riverine corridors that have been impacted by changes in water quality and quantity.
- Landuse guidelines for riverine corridors should be influenced by the criteria described above regarding water quantity and quality, i.e. those activities that alter these characteristics of a river reach should be excluded. For instance, agricultural activities that lead to the release of organic effluents (e.g. cattle feedlots) should be excluded, whereas harvesting of natural vegetation could be compatible with corridor functioning.

⁵ It is important to note that sediment transport is an important aspect of the water quality within a river reach.

⁶ Extract from “Floodplain Management Guidelines” (CCT, 2003): “Determination of ecological buffer widths is based on an assessment of the ecological status and importance of a particular watercourse. Ecological importance is based on the uniqueness of the ecological features and rehabilitation potential. Systems with high ecological status and importance require a larger buffer than those which have been exposed to considerable modification (e.g. canalised rivers). Buffer widths are either determined from watercourse centreline or “top of bank” as appropriate. They have been determined for all the significant watercourses and certain wetlands within the metropolitan area and vary in width between 10 and 60m.”

5. Results of the Biodiversity Network prioritisation analysis

5.1 Introduction

The Biodiversity Network prioritisation analysis was undertaken iteratively, with draft results being presented to the client and at the stakeholder workshops. Feedback at these work sessions assisted in refining the decision tree and the analysis. All analyses were undertaken using ArcGIS 9.0 (ESRI, Redlands, California). While a single set of decision rules, aimed to integrate the terrestrial and aquatic elements of the network, were used, in practice the analyses needed to be undertaken separately using the separate datasets for the terrestrial component of the Biodiversity Network, rivers and wetlands. Furthermore, a number of analyses were run as checks on the resulting prioritisation and categorisation. The following summarises the GIS methods used, comments on the data and the results obtained in the analysis as well as the follow-up analyses undertaken to check the results.

5.2 Summary of GIS methods used in assigning prioritisation to NHRs, wetlands and rivers

The NHRs, wetlands and rivers were provided in three separate GIS layers:

1. The NHR layer described the terrestrial remnants, which were selected as Key Nature Conservation Areas during the study entitled “*Identification of Key Nature Conservation Areas in the City of Cape Town*”. This layer also included the current network of protected areas and the Core Flora Sites.
2. The wetland layer described a set of 14 wetlands which were assigned importance and sensitivity by the study entitled “*River and vlei assessment and monitoring in the CMA: Revisiting and refining the river importance and sensitivity maps*”. This river and vlei assessment study actually included 17 wetlands, however the location and extent of three of these were not available in the data supplied by the City of Cape Town.
3. The river layer described the river centerlines and separate reaches for the primary riverine systems in the study area. This data was also used by the river and vlei monitoring and assessment study to assess the ecological importance and sensitivity of these key systems.

The decision tree for prioritisation of the NHRs, wetlands and rivers into A, B and C categories was then applied to each individual through a spatial model developed using the Model Builder Extension for ArcGIS 9.0. Three separate sub-models were developed for each of the three layers.

1. Each NHR was attributed for the information needed by the decision tree:
 - a) Protected area of core flora site status (yes or no).
 - b) Percentage of the extant distribution of the three critical vegetation types contained by the NHR. The three critical vegetation types are; sand plain fynbos on inland older non-marine derived acid sands, west coast renosterveld on shale and west coast renosterveld on granite.
 - c) NHR area
 - d) Irreplaceability value as assigned by the Key Conservation Areas study.

The GIS model stepped through a series of selections based on the criteria for each rule within the decision tree and assigned each NHR with a category based on its compliance with each rule. The decision tree and model were designed in such a way that each NHR was assigned the highest category in cases where more than one category could apply. The model also kept an audit of which rules applied to each NHR.

2. Each wetland feature was assigned a value for wetland importance class as defined in the river and vlei assessment and monitoring study. The wetland model used this value during the process of stepping through a series of selections based on the criteria for each rule in the decision tree that applied to wetlands. Using this process, the highest relevant prioritisation category was assigned to each wetland feature.

3. Each river feature was assigned a value for ecological priority ranking as defined in the river and vle assessment and monitoring study. The river model used this value during the process of stepping through a series of selections based on the criteria for each rule in the decision tree that applied to rivers. Using this process, the highest relevant prioritisation category was assigned to each river feature.

5.3 Comments on the data used

It is important to note that the prioritisation analysis is entirely based on existing data used in the study that initially identified the Biodiversity Network. This data and the ground-truthing undertaken in this previous analysis may well be out of date in terms of developments that may have taken place on these NHR's over the past two years. However, the Environmental Resource Management Department of the City of Cape Town has undertaken some studies that amended certain of the NHRs on the basis of recent developments. For example, the Status Quo Assessment Project assessed the current status of the Core Flora Sites and made some adjustments to the spatial data.

There is some concern about the quality of the data used to describe the wetlands and the rivers. The concerns are primarily concerned with the completeness of these datasets, especially the wetland data.

As this prioritisation process has used the results of the previous analysis, it too is subject to the data limitations of the initial study. The results of the original analysis are not presented in any detail in this report. A summary is provided in section 2 and the reader is referred to the report⁷ for further details on the results of that analysis.

5.4 Results of the prioritisation analysis

5.4.1 Prioritisation of NHRs/terrestrial component of the Biodiversity Network

Figure 3: *Prioritisation of the terrestrial component of the Biodiversity Network* and associated GIS database present the results of the analysis for prioritisation of Natural Habitat Remnants (NHRs) or the terrestrial component of the Biodiversity Network. Table 4 presents a summary of the analysis results in terms of the numbers of NHRs and total land area selected for each category (A, B and C) as well as mean, largest and smallest NHRs selected for each category.

Table 4: Summary of the prioritisation selection of NHRs for categories A, B and C

Prioritisation Category	Total number of NHRs selected	% of total no. of sites	Total Area (ha)	Mean area of NHRs (ha)	Largest NHR (ha)	Smallest NHR (ha)
A	228	61.8	76848	337.0	12693	0.3
B	46	12.5	6327	137.5	1328	12.0
C	95	25.7	314	3.3	9	0.3

Table 5 presents the effect that each rule made in the selection process. From this data, it is apparent that protection status, size and irreplaceability values selection rules (rules 1 and 3) have had a major impact on the selection for prioritisation of the network. It is interesting to note that even though rule 3 selected 44% fewer NHRs compared to rule 1, when compared by area rule 3 sites represent over 84% of the area of sites selected by rule 1. This is due to rule 3 restricting its selection to sites larger than 10 ha in size, but also illustrates the critical role played by site area in the assigning of irreplaceability values. Rule 7 on the other hand operated as a catch-all rule for those sites which had not already been classified according to rules 1 – 6. It is also important to note that some of the NHRs have met a number of the decision rules for being selected, for example, for category A.

⁷ Identification of a Biodiversity Network for the City of Cape Town, 2002, prepared by GIMS and Department of Botany, UWC.

Table 5: Summary of the effect of each decision rule applied in the prioritisation selection analysis of NHRs

Decision rules applied in prioritisation selection	Total number of NHRs selected	Total area (ha)
Rule 1: Is the NHR a protected area or a Core Botanical Site? – Yes then A	170	66840
Rule 2: Does the NHR contain more than 5% of the extant distribution of 1 of the 3 critical vegetation types? – Yes then A	12	10514
Rule 3: Is the NHR ≥ 10 ha in area and have an irreplaceability value of ≥ 0.9 ? – Yes then A	95	56359
Rule 4: Is it a wetland of high to very high importance class or a river reach of extreme or high ecological priority? – Yes then A	Only applied to rivers and wetlands	
Rule 5: Does the NHR have an irreplaceability of between ≥ 0.75 and < 0.9 , and is ≥ 10 ha in area. – Yes then A	4	2402
Rule 6: Does the NHR have an irreplaceability of between ≥ 0.75 and < 0.9 ? – Yes then B	4	2402
Rule 7: Does the NHR have an irreplaceability of < 0.75 and is > 5 ha in area? Is it a wetland of moderate importance class or a river reach of moderate ecological priority? – Yes then B, No then C	106	24311
Selected as C	95	314

A further analysis was undertaken of the results in terms of the threatened types of vegetation classified by Low, for which there is not enough land to meet the originally set conservation targets (i.e. Si - Sand plain Fynbos on inland older non-marine derived acid soils; WSh - West Coast Renosterveld on Shale; and, Wg - West Coast Renosterveld on granite). For these three vegetation types, the category A includes the following percentages of available land: Si - 98%; Wg - 98.76%; and, Wsh - 95.56% (also see table 7 below).

5.4.2 Prioritisation of Wetlands

The results of the wetlands prioritisation analysis are presented in Figure 4: *Prioritisation of the Wetlands of the Biodiversity Network*, which shows the wetlands as an overlay in addition to the terrestrial component (NHRs) of the Network. Table 8 presents the 14 wetlands and their respective prioritisation category.

Table 8: Results of the wetlands prioritisation analysis

Wetland name	Classification	Water Catchment	EIS (Wetland Ecological Importance and Sensitivity Class)	Biodiversity Network Prioritisation Category
Rietvlei	Vlei	Diep River	A	A
Blouvlei	Vlei	Diep River	A	A
Zoarvlei	Vlei	Diep River	C	B
Door de Kraal	Detention pond	Salt River	No EIS rating given	-
Fynbos Dam	Dam (urban wetland)	Salt River	No EIS rating given	-
Amandal Dam	Dam (urban wetland)	Salt River	C	B
Kreupelboom Dam	Dam (urban wetland)	Salt River	C	B
Kannonberg Dam	Dam (urban wetlands)	Salt River	No EIS rating given	-
Princessvlei	Vlei	Zeekoevlei	C	B
Little Princessvlei	Vlei	Sand River	C	B
Langevlei	Vlei	Sand River	C	B
Rondevlei	Vlei	Zeekoevlei	A	A
Zeekoevlei	Vlei	Zeekoevlei	C	B
Zandvlei	Vlei	Sand River	B	A
Lake Michelle	Vlei (excavated salt pan)	Noordhoek Wetlands	B	A
Pick 'n Pay Reedbeds	Wetland	Noordhoek Wetlands	C	B
Wildevleivlei	Vlei	Noordhoek Wetlands	No EIS rating given	-
Westlake	Wetland	Sand River	B	A

Comments on the results of wetlands prioritisation

The consultant team recommends that all wetlands as identified are seen as important and retain a different relative ranking to the terrestrial categorisation. As can be seen, present ecological state is only one informant and while reflective of current ecological value, this may not reflect the desired future state of a river or river reach. Due to the significant role of wetlands in the City, the team suggests that all wetlands are seen as category A components of the Biodiversity Network, regardless of present ecological status. Therefore, the prioritisation category assigned (based on the wetland importance class, EIS) should rather be used as a management tool informing the management and conservation interventions required to enable wetlands to arrive at a desired future state.

Furthermore, the wetlands database is far from complete. The wetlands database only included 19 wetlands, all of which are perennial types and only 14 of which were assigned an EIS rating in the river and vleis assessment and monitoring study. Due to the ecological importance of small and ephemeral wetlands, it will be vital to continuing ecological service delivery to accurately map and prioritise these as they are identified. Wetlands mapping work currently being commissioned by the Western Cape Wetlands Forum should be included in the analysis over time.

5.4.3 Prioritisation of Rivers

Figure 5: *Prioritisation of the river reaches of the Biodiversity Network*, presents the results of the prioritisation analysis for rivers in the City of Cape Town as an overlay on top of the terrestrial and wetland components of the Biodiversity Network. Table 9 presents a summary of the analysis results, showing the length of river reach classified into categories A, B and C.

Table 9: Summary of the prioritisation selection of rivers for categories A, B and C

Prioritisation Category	Total length of river selected (km)	% of total river length
A	391.7	47.4
B	328.6	39.8
C	105.3	12.8

Again, it must be noted that this database used for the analysis is incomplete. Due to the significant ecological, social and economic value of freshwater systems in urban areas, all freshwater systems should be protected. However, for river systems, the classification of different reach types and associated biodiversity pattern are more defined. Further work is required in mapping and classification of rivers systems in the City of Cape Town.

The team believes that overall, the data available for freshwater systems is insufficient to effectively prioritise rivers/river reaches or wetlands for management purposes. On the precept that all rivers and wetlands are important and should be protected, we suggest that all rivers and wetlands be classified as category A components of the Biodiversity Network and that the categorisation be used more to inform future management.

5.4.4 Discussion of the Biodiversity Network in the context of strategic national and provincial initiatives

National Spatial Biodiversity Assessment

While the vegetation map produced by Low vegetation types is the basis for the identification and prioritisation processes for the Biodiversity Network undertaken within the City of Cape Town, it will be essential be able to confirm how effective the Biodiversity Network is in protecting the vegetation types presented in the new national Vegetation Map for South Africa, Lesotho and Swaziland (South African National Botanical Institute, SANBI). Below, presented in table 7 is a comparison showing the area of the new SANBI National Vegetation map vegetation types that are captured within the City of Cape Town and the City's Biodiversity Network. Further, Table 7 provides an indication of the ecosystem and protection status of each type. Table 6 below shows the percentages of each vegetation type (as described by Low and used in the initial identification of the Biodiversity Network) captured in the Biodiversity Network. Should the City decide to motivate for protection of the Biodiversity Network in terms of the Biodiversity Act, 10 of 2004, it will be essential for the City to use the National Spatial Biodiversity Assessment as the overarching framework, should this be accepted as the basis of identification of ecosystems categorised according to the proposed system listed in Box 1 below. As the general principle to apply is that the finer-scale the conservation planning, the more relevant this will be at a local scale, the City should attempt to relate the NSBA and the Biodiversity Network spatially and in terms of prioritisation for protection.

BOX 1: Threatened and Protected Ecosystems in the Biodiversity Act (after Driver, *et al* 2004⁸)

The Biodiversity Act includes the following provisions for listing of threatened and protected ecosystems:

52 (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. (b) An MEC for environmental affairs in a province may, by notice in the Gazette, publish a provincial list of ecosystems in the province that are threatened and in need of protection.

52 (2) The following categories of ecosystems may be listed in terms of subsection (1):

- (a) **critically endangered ecosystems**, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- (b) **endangered ecosystems**, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- (c) **vulnerable ecosystems**, being 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 ecosystems or endangered ecosystems; and
- (d) **protected ecosystems**, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs (a), (b) or (c).

An example that will help to illustrate the content of Table 6 is the national vegetation type classification “Lourdesford Alluvium Fynbos” (critically endangered and poorly protected). Table 6 shows that the entire historical extent of this vegetation type falls within the boundaries of the City of Cape Town. Of the historical 5527.81 ha, only 541.30 (9.79%) is theoretically available for conservation. Of this total area of this vegetation type still theoretically available for conservation, the Biodiversity Network includes 514.14 ha, which is 9.30% of the historical area and 94.98% of the current available area.

The national vegetation types which fall almost entirely within the City and which are critically endangered (Cape Flats Sand Fynbos – hardly protected, Peninsula Shale Renosterveld – moderately protected and Lourensford Alluvium Fynbos – poorly protected) or endangered (Cape Flats Dune Strandveld – poorly protected and Peninsula Granite Fynbos – well protected) will require prioritisation in the Biodiversity Network (see recommendations, section 8).

Provincial Spatial Development Framework

The Provincial Spatial Development Framework (PSDF) is currently being compiled and is likely to be made available for public comment around the middle of 2005. The PSDF is being informed by some draft principles related to biodiversity and ecosystem integrity:

- Avoid all further loss of natural habitat in **critically endangered ecosystems**;
- Further loss of natural habitat in **endangered ecosystems** should take place only if there are significant biodiversity offsets/gains;

⁸ Driver, A., Maze, K., Lombard, A.T., Nel, J., Rouget, M., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2004. *South African National Spatial Biodiversity Assessment 2004: Summary Report*. Pretoria: South African National Biodiversity Institute.

- Identify priority **ecological corridors** at the provincial scale. In these corridors, prevent further loss of natural habitat and, where ecologically and economically feasible, restore connections between remaining natural habitat; and,
- Encourage **community-based natural resource management** (Mandy Driver, pers. comm.⁹).

These principles need to be taken into account in the implementation of the Biodiversity Network.

Table 6: Percentages of each Vegetation Type described by Low (2000) captured in the Biodiversity Network

Vegetation Type		Historical (Ha)	Remnants (Ha)	Amount lost/transformed %	Total in Biodiversity Network (ha)	% of Current existing remnants
Wsh	West coast renosterveld on shale (critical)	46,930	4,610	90.2%	4,600	99.8
Wg	West coast renosterveld on granite (critical)	7,450	1,850	75.1%	1,850	100
Wq	West coast renosterveld on inland non-marine derived clay loam, loam and sand loam (granite and shale)	30	30	0.0%	30	100
Dc	Dune thicket on sands	35,670	13,650	61.7%	11,980	87.8
DI	Dune thicket on sands over or on limestone	5,300	3,160	40.4%	2,950	93.3
DS	Dune thicket/sand plain fynbos transition (slightly calcareous to acidic/neutral sands)	9,560	9,540	0.2%	9,440	98.9
Si	Sand plain fynbos on inland non-marine derived acid sands (critical)	9,490	1,160	87.8%	1,160	100
Sm	Sand plain fynbos on marine-derived acid sands	63,070	12,300	80.5%	11,390	92.6
Sq	Sand plain fynbos on non-marine derived acid sands (recent non-aeolian colluvium)	23,290	5,810	75.0%	5,670	97.6
Mq	Mountain fynbos on inland non-marine derived acid sands (older non-aeolian colluvium)	590	580	1.3%	510	87.9
Mgk	Mountain fynbos on granite koppies	340	150	55.4%	150	100
Ms	Mountain fynbos on shale	35,870	33,030	7.9%	28,860	87.4
Mshm	Mountain fynbos on shale > 800m rainfall per annum	980	820	16.1%	580	70.7
Msh	Mountain Fynbos on shale	1,130	930	17.8%	750	80.6
Mg	Mountain fynbos on granite	6,900	2,900	58.1%	2,660	91.7

⁹ Mandy Driver, Conservation Unit, Botanical Society of South Africa

Table 7: Comparison showing area of the new national Vegmap types in South Africa, within the City of Cape Town and the City's Biodiversity Network

Ecosystem status is based on the percentage of the original area remaining untransformed in relation to the biodiversity target and a threshold for ecosystem functioning (CE: Critically Endangered; EN: Endangered; VU: Vulnerable, LT: Least Threatened). Protection level is based on the % of the biodiversity target conserved in Type 1 protected areas (Rouget *et al.*, 2004¹⁰).

National Vegetation Map Classification		S A National Spatial Biodiversity Assessment Status		Total in Unicity (Current)		Total in Biodiversity Network						
VMID	Vegetation Description	Ecosystem Status	Protection Status	HECTARES	% of SA Total	HECTARES	% of SA Total	% of City (Historic) Total	HECTARES	% of SA Total	% of City (Historic) Total	% of City (Current) Total
12	Atlantis Sand Fynbos	EN	Poorly protected	26190.11	37.52	15970.89	22.88	60.98	15746.95	22.56	60.13	98.60
26	Cape Flats Sand Fynbos	CE	Hardly protected	53089.18	97.29	5663.19	10.38	10.67	5066.69	9.29	9.54	89.47
27	Cape Flats Dune Strandveld	EN	Poorly protected	41740.96	98.41	16988.28	40.05	40.70	15237.14	35.92	36.50	89.69
30	Peninsula Granite Fynbos	EN	Well protected	8986.05	100.00	3996.05	44.47	44.47	3437.07	38.25	38.25	86.01
32	Peninsula Shale Renosterveld	CE	Moderately protected	2970.25	100.00	606.63	20.42	20.42	566.74	19.08	19.08	93.43
42	Elgin Shale Fynbos	CE	Poorly protected	840.48	3.01	813.28	2.91	96.76	8.05	0.03	0.96	0.99
54	Hangklip Sand Fynbos	VU	Moderately protected	2514.36	30.96	1210.48	14.90	48.14	1088.74	13.41	43.30	89.94
58	Lourensford Alluvium Fynbos	CE	Poorly protected	5527.81	100.00	541.30	9.79	9.79	514.14	9.30	9.30	94.98
78	Langebaan Dune Strandveld	VU	Well protected	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Peninsula Sandstone Fynbos	LT	Well protected	23234.80	100.00	20996.22	90.37	90.37	20137.11	86.67	86.67	95.91
140	Swartland Alluvium Fynbos	CE	Poorly protected	1673.25	3.56	120.25	0.26	7.19	120.24	0.26	7.19	100.00
142	Swartland Alluvium Renosterveld	EN	Not protected	4.29	0.07	0.18	0.00	4.25	0.18	0.00	4.24	99.84
912	Boland Granite Fynbos	EN	Poorly protected	7214.97	14.46	4114.57	8.25	57.03	4113.40	8.24	57.01	99.97
2328	Swartland Granite Bulb Veld	CE	Hardly protected	7303.78	7.71	2087.89	2.20	28.59	2045.06	2.16	28.00	97.95
4190	Southern Afrotemperate Forest	LT	Moderately protected	180.17	0.22	180.17	0.22	100.00	180.17	0.22	100.00	100.00
8009	Swartland Shale Renosterveld	LT	Poorly protected	48659.82	9.84	4882.49	0.99	10.03	4816.34	0.97	9.90	98.65
8031	Southern Coastal Forest	LT	Well protected	15.56	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8047	Cape Lowland Freshwater Wetlands	VU	Poorly protected	1289.98	16.70	199.78	2.59	15.49	190.30	2.46	14.75	95.25
8048	Cape Coastal Lagoons	N/A	N/A	57.68	0.89	15.88	0.24	27.53	15.88	0.24	27.53	100.00
8084	Cape Inland Salt Pans	EN	Poorly protected	67.16	0.84	19.59	0.24	29.17	19.59	0.24	29.17	100.00
9216	Cape Winelands Shale Fynbos	EN	Poorly protected	4135.36	48.01	2286.28	26.54	55.29	2229.27	25.88	53.91	97.51
9225	Kogelberg Sandstone Fynbos	LT	Well protected	9463.93	10.34	8834.03	9.65	93.34	6993.96	7.64	73.90	79.17
9232	Western Coastal Shale Band Vegetation	LT	Well protected	336.80	1.20	319.30	1.13	94.80	308.83	1.10	91.69	96.72
9233	Swartland Silcrete Renosterveld	CE	Hardly protected	1475.74	14.78	302.12	3.03	20.47	300.86	3.01	20.39	99.59
9238	Cape Seashore Vegetation	LT	Well protected	276.34	1.22	94.40	0.42	34.16	91.27	0.40	33.03	96.69

¹⁰ Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component*. Pretoria: South African National Biodiversity Institute.

6. Identification of nodes

6.1 Summary of GIS method used to identify nodes

The decision tree for identifying nodes consisted of four rules, with each rule requiring a different method of analysis to identify NHRs and wetlands complying with each rule.

Rule 1: Is it a large protected area/NHR/wetland greater than 100 hectares?

This rule required a simple attribute selection of the NHRs and wetlands greater than 100 hectares in area, with the selected features being assigned a value of yes in a field called “NodeRule1”.

Rule 2: Are there several protected areas/NHRs/wetlands adjacent and physically connected that have a summed area greater than 100 hectares?

This rule involved first dissolving the boundaries between connected NHRs and wetlands. The resulting merged features greater than 100 hectares were then selected and assigned a value of yes in a field called “NodeRule2”.

Rule 3: Are there nodes (identified in 1 or 2 above) that are closer than 1km to each other?

Each node identified in rules 1 and 2 was assigned a unique value, and the distance between each node and all the other nodes calculated. Those nodes with inter-node distances less than 1km were then assigned the same unique node value.

Rule 4: Are there protected areas/NHRs/wetlands that are closer than 1km to a node identified in 1, 2 or 3 above?

Those features, which were not assigned to a node using the rules above, were then assessed as to whether they were located within 1 km of identified nodes. Those that were located within 1km of an already identified node were then assigned the same node value.

Beyond the application of the rule set above, the project team provided a further rationalisation of the node selection. For example, the Driftsands/Khayelitsha node and the Wolfgat/Macassar nodes were initially combined as one node by the analysis. On review, it was recommended that these be separated into two distinct nodes in terms of management practicality.

6.2 Result of nodes selection analysis

Figure 6: *Node selection within the Biodiversity Network* presents the nodes as selected using the nodes decision rules and the above method. Each colour presented on the map in Figure 6 represents a different node together with an identifying number (1-9). The team have assigned the following tentative names to the identified nodes.

1. Wolfgat/Macassar Dunes
2. North West/Diep River
3. Blaauwberg
4. Joostenberg
5. Tygerberg
6. Driftsands/Khayelitsha
7. Helderberg/Kogelberg
8. Zeekoeivlei/Pelican Park
9. Cape Peninsula (including the TMNP)

Table 10 below presents information about the nodes that have been selected through applying the node decision rules. It presents the total number of NHRs and wetlands that make up each node as well as the land area size of each node.

Table 10: Nodes composition and area

Node ID	Name	Total number of NHRs and Wetlands included in Node	Total Area of Node (hectares)
1	Wolfgat/Macassar Dunes	6	1083.1
2	North West/Diep River	79	27615.4
3	Blaauwberg	16	5119.4
4	Joostenberg	10	940.2
5	Tygerberg	27	1326.2
6	Driftsands/Khayelitsha	12	1697.9
7	Helderberg/Kogelberg	28	13592.6
8	Zeekoeivlei/Pelican Park	8	933.8
9	Cape Peninsula (including the TMNP)	84	27581.0

Figure 7: *Selected Nodes and Corridors of the Biodiversity Network* presents an overlay of the biodiversity nodes on the originally identified biodiversity corridors based on the friction analysis described in section 4. While the team believes that this corridor selection process should be rerun for the newly identified nodes, it is likely that the same configuration will emerge due to the nature of the spatial analysis methodology and the choices available for corridors.

6.3 Comments on the further development of nodes and corridors

The consultant team believes that the value of nodes and corridors can only really be realised in the context of the Open Space System and in the context of sub-regional level forward planning that integrates the built and non-built urban fabric. At the metropolitan level, these remain conceptual and focussed on biodiversity pattern and process; whereas the intention is for these concepts to fundamentally influence the planning, design and management of the built and non-built urban components of the City.

7. Development planning and land use guidelines

7.1 Background

As part of the Biodiversity Network prioritisation project two sets of guidelines were formulated. These deal with:

- i) integration of the Biodiversity Network into the City's development planning system; and,
- ii) land use within the Biodiversity Network prioritisation categories (i.e. Category A,B & C natural habitat remnants).

Before presenting these guidelines it is necessary to consider the Biodiversity Network's role in sustainable city development, the purpose of the guidelines, and the limitations of the prioritisation model.

7.1.1 *The Biodiversity Network's Role in Sustainable City Development*

Notwithstanding a long history of human impact on the environment, Cape Town remains a unique city given high levels of biodiversity and turnover of species in a small geographic area. Whilst conserving what remains of the city's Biodiversity Network is thus of importance, Cape Town is also faced with the challenges of a developing city and addressing apartheid's distortions.

In terms of Cape Town's quest to be a sustainable city, the Biodiversity Network has significant contributions to make on the environmental, social and economic fronts. For the health of residents it is necessary to maintain ecological patterns and processes. For the wellbeing of individuals and communities, access to natural areas within the city is necessary. For the livelihood of residents it is necessary that the natural environment contributes to work and income earning opportunities.

7.1.2 *Purpose of Guidelines*

The guidelines are for use by City officials. The guidelines have been prepared to introduce the Biodiversity Network into Cape Town's development planning system, as well as incorporate Biodiversity Network considerations into land use management decisions.

7.1.3 *Limitations of the Prioritisation Model*

Cape Town's Biodiversity Network has been developed and categorised using available metro-wide biophysical spatial data sets. No social, economic or contextual data has been factored into the GIS modelling of the network. Furthermore the biophysical data used in the prioritisation model focuses on an area's contribution to the meeting of city-wide conservation targets. At the same time, national targets for the vegetation types have been identified by the National Spatial Biodiversity Assessment which has also classified these into the Biodiversity Act classification of ecosystems requiring protection (see section 5.4.4). A strategy for the integration of these two prioritisation processes will need to be agreed by the relevant role-players (see recommendations).

In applying development planning and land use guidelines, note should be taken of the following limitations of the prioritisation model:

- The network prioritisation model uses available metro-wide biophysical data which is relatively coarse grained. Where and when detailed site specific data becomes available, this research may increase or decrease an area's overall biodiversity priority rating, or indicate different priority ratings within an area. The findings of recent studies undertaken in the Blaauwberg Conservation Area bear this out. Detailed studies do not detract from the overall network prioritisation study, they merely underscore that the network study only reflects priorities for meeting the city-wide conservation targets.
- Contextual studies to ascertain how surrounding land uses impact on biodiversity (i.e. an area's vulnerability to various threats) have not been considered in the prioritisation of the overall network.

Undoubtedly contextual inputs have a bearing on the prospects of achieving conservation targets and the specifics of compatible land uses within different parts of the network. Contextual inputs need to be factored in on a site-specific basis and will give rise to detailed land use guidelines for specific components of the network.

- An analysis of the properties that make up Cape Town's Biodiversity Network has not been undertaken as part of this study. Considerations such as the size, ownership and zoning of properties all have a bearing on land use and the prospects of achieving conservation targets. When this property information has been analysed it will be possible to refine the guidelines presented here.

In sum the Biodiversity Network prioritisation study has established a useful metropolitan conceptual model for assessing the relative conservation importance of different areas within the city. The model is built on specific biophysical data sets. Accordingly the model's development planning and land use guidelines presented here are generic in nature and have metropolitan applicability. Caution is needed in applying the guidelines on a site-specific basis.

7.2 Integrating the Biodiversity Network into the city's development planning system

7.2.1 The Challenge

The Biodiversity Network prioritisation study has applied scientific methods to identify land within the city borders that needs to be secured for conservation purposes if the city is to meet its biodiversity targets. Collectively these parcels of land identified in the study are called Cape Town's Biodiversity Network, or in other words the conservation 'estate' that the City wants to protect.

The Biodiversity Network is made up of formally protected areas (e.g. Table Mountain National Park, nature reserves, etc), as well as land parcels that have no formal conservation status. Many of the land holdings within the Biodiversity Network are privately owned, and some have land use rights that are inconsistent with conservation objectives. As a rapidly developing city, most land in Cape Town is subject to intense urban development pressures.

For the first time Cape Town has established on a city-wide basis what land needs to be managed for conservation purposes. Whilst the delineation of the Biodiversity Network can be defended on scientific grounds, actually securing Cape Town's Biodiversity Network for conservation purposes presents a major challenge to the City authorities.

New and innovative approaches are required to secure Cape Town's aspirant Biodiversity Network. The network cannot be established by decree; a broad based strategy is needed to integrate it into the city's development planning system.

7.2.2 Mainstreaming the Biodiversity Network

The Biodiversity Network needs to be integrated into the municipal development planning system at various levels. The actions necessary to 'mainstream' the Biodiversity Network into the City's development planning system are as follows:

- Public Information Campaign:** Initiating a broad based publicity campaign on Cape Town's Biodiversity Network that clearly explains to residents what the network entails, how it is configured, and the benefits it offers.
- Land Owner Engagement:** Informing all Biodiversity Network land owners of why their property has been classified as environmentally significant, explaining their rights and

responsibilities as property owners, and giving them opportunity to comment on the Biodiversity Network and make input to the City on how the property should be managed.

- iii) **Political Endorsement:** Motivating to the City Executive that Cape Town's quest to be a sustainable city is dependent on it securing a functional city-wide Biodiversity Network. The socio-economic and environmental benefits of a healthy Biodiversity Network need to be emphasized in this motivation. The aim is to have the importance of the Biodiversity Network explicitly stated in Cape Town's next Integrated Development Plan (IDP), thereby gaining political endorsement of the strategic importance of the network.
- iv) **Legislation:** Making application, in terms of the Biodiversity Act, for Cape Town parts of the Biodiversity Network to be declared by the Minister in terms of the categories set out in Box 1 (section 5.4.4). To obtain this legal protection the City needs to prepare a Biodiversity Network management plan for the Minister's approval. Besides the Biodiversity Act, there is a suite of other environmental legislation that should also be used to promote biodiversity conservation (e.g. Veld and Forest Act, Conservation of Agricultural Resources Act, Water Act, etc). Training programmes for the City's land use management officials should be introduced so that they are aware of all legal requirements and know how and where the law can be applied.
- v) **CMOSS:** Reconfiguring Cape Town's metropolitan open space system (CMOSS) to include open space falling outside the urban edge, and at the same time integrate the Biodiversity Network into the CMOSS programme. This will assist in the Biodiversity Network becoming a significant informant to metropolitan spatial planning. At a sub-metropolitan level (e.g. Noordhoek – Kommetjie Wetlands) the integration of CMOSS and the Biodiversity Network will also assist in identifying what land uses are compatible with biodiversity conservation in a specific context.
- vi) **Integrated Zoning Scheme:** Incorporating the Biodiversity Network as an overlay zone in Cape Town's new Integrated Zoning Scheme (IZS), and introducing scheme regulations for the maintenance of ecological patterns and processes within this overlay zone.
- vii) **Negotiated Agreements:** Research coming out of the CAPE program and interactions with private landowners within the CPPNE highlight that zonings and land use guidelines have limited influence as to how landowners actually use their land. With an understanding of what motivates landowner behaviour as well as an understanding of the economics of land use, there is better chance of negotiating an agreement that promotes biodiversity than attempting to control how land is used by prescription. There is scope to use negotiated agreements where landowners are applying to change or enhance their current land use rights. To facilitate the greater use of negotiated agreements, land use management officials should be trained in negotiation techniques.
- viii) **Fiscal Instruments:** Whilst there is a growing recognition amongst landowners of legal requirements to use their land responsibly, an incentive based approach is proving effective in bringing about a change in attitudes and behaviour. When it comes to securing privately owned land within the network for conservation purposes, fiscal instruments (e.g. rates and taxes) are powerful incentives that should be used to further biodiversity objectives at a landscape level.

Collectively these actions will not only raise awareness of the significance of the Biodiversity Network, but also result in the network becoming part and parcel of Cape Town's development planning system.

7.3 Land use guidelines for categories A, B, & C of the Biodiversity Network

7.3.1 Basis of Categorisation

In the Biodiversity Network prioritisation project natural habitat remnants (NHRs) within the City of Cape Town's area of jurisdiction were classified into Category A, B and C areas. Categorising NHRs involved setting overall area-based conservation targets for Cape Town and specifying criteria against which to test an area's contribution to the meeting of these targets. Each NHR was prioritised by applying the following criteria in the form of a decision tree:

- The NHR's conservation status (i.e. is a NHR a formally protected area or a core botanical site?)
- The extent to which the NHR contains critical vegetation types
- The size of the NHR
- The irreplaceability value of the NHR.

The outputs of this process provide a gradation of all Cape Town's NHRs in terms of their conservation worth. Category A NHRs are those that should be afforded the highest conservation status as there are limited alternative areas within the City's borders, and specifically within the identified Biodiversity Network that meet conservation targets. Category B NHRs also warrant being managed for biodiversity conservation purposes, but compared to Category A there are more alternative sites within the network that meet conservation targets. Category C NHRs also warrant being managed for biodiversity conservation purposes, but compared to Categories A and B there are significantly more alternative areas within the city that meet conservation targets.

7.3.2 Linking Land Use and the Biodiversity Network Categories – Theory and Practice

In theory the following guidelines are relevant:

- Category A areas should be used exclusively for biodiversity conservation purposes,
- Category B areas should be used primarily for biodiversity conservation purposes, but can also accommodate other compatible land uses, and
- Category C areas should also be used for biodiversity conservation purposes, but this will not be their primary use.

In practice, however, the relationship between the conservation worth of a parcel of land and its use is more complex than these guidelines portray. This is especially pertinent within a developing city of over 3 million people. Caution is needed in prescribing land use to specific categories of the Biodiversity Network for the following reasons:

The network has been prioritised on the basis of the relative importance of a NHR to meeting city-wide conservation targets. In categorizing the network no consideration has been given to other important drivers of land use, such as contextual threats and opportunities, land ownership and usage rights.

Most of Cape Town's Biodiversity Network has been, and will undoubtedly continue to be, subject to multiple uses. Multiple use is not something that can be confined to Category B or C areas, or to CMOSS. A case in point is the CPPNE, a vast Category A area the on-going conservation of which is vital for achieving Cape Town's conservation targets. The management challenge here, as in most areas, is reconciling multiple land uses in a manner that sustains ecological patterns and processes.

The prioritisation model provides a powerful management tool to assist in reconciling the multiple use of Cape Town's Biodiversity Network. By interrogating the GIS prioritisation model one can establish what the underlying reasons are for an area being classified as being of conservation worth. With this understanding it is possible to assess how compatible different land uses are with biodiversity conservation, thereby gaining insight into 'the limits of acceptable change'. The prioritisation model thus presents an opportunity to introduce a Strategic Environmental Assessment approach to both forward planning and land use management in the City.

To realise this opportunity close collaboration between the Environmental Management, Spatial Planning and Land Use Management branches of the City is required. The database that has resulted from this study needs to be accessible to a wide range of stakeholders and decision-makers across the City of Cape Town. The individual datasets need to be provided through the most relevant interface (e.g., the City Viewer) and training given in how to interrogate and interpret the prioritisation model.

7.3.3 Generic land use guidelines

Recognising that the compatibility between different land uses and biodiversity varies depending on context, the following generic guidelines are put forward for the network categories.

i) Category A:

- Restore/maintain as natural landscapes, and prevent land uses that transform these qualities
- Avoid motorized access and control access on foot.
- Maintain wild, remote and wilderness experiential qualities (practically, this will not be possible in all instances of category A sites, probably at only in the largest sites)
- Promote consolidation of the conservation estate and prohibit further fragmentation (i.e. no sub-division).
- Facilitate co-management arrangements between private landowners and conservation authorities.
- Strictly enforce the regulatory framework.
- Limited scope for negotiated agreements, preferable to use fiscal incentives (e.g. rates rebate) where limitations sought on existing land use rights.
- Cluster essential structures and facilities, and locate on the periphery of core conservation areas.

ii) Category B:

- Restore/maintain as natural/semi-natural landscapes.
- Where the spatial orientation allows, use as buffer to Category A areas.
- Limit motorised access and manage non-motorised access.
- Promote land consolidation and minimize further sub-divisions.
- Facilitate co-management arrangements between private landowners and conservation authorities.
- Enforce regulatory framework.
- Negotiate agreements with landowners (e.g. transferral of development rights, enhanced development rights at suitable localities in exchange for securing key habitats for conservation purposes, etc), on condition that the conservation worth of the property is not compromised.
- Use fiscal instruments to incentivise biodiversity friendly land uses.
- Consent use for land uses that do not comprises environmental standards, subject to positive EIA and compliance with performance standards.

iii) Category C:

- Maintain as urban transition zone and prevent intrusion of urban land uses.
- Manage form, coverage and intensity of land use to preserve rural character of landscapes.
- Controlled access with restrictions on motorized access to environmentally sensitive areas.
- Promote land consolidation and discourage further sub-divisions.
- Facilitate co-management arrangements between private landowners and conservation authorities for the maintenance of ecological patterns and processes.
- Enforce regulatory framework.
- Negotiate land use agreements with landowners that result in the protection of the area's significant environmental attributes.
- Use fiscal instruments to incentivise biodiversity friendly land uses.
- Consent use for land uses that do not comprises environmental standards, subject to positive EIA and compliance with performance standards.

7.3.4 Managing current land use within the Biodiversity Network

Part of introducing the Biodiversity Network into the City's land use management system involves assessing the extent to which current land use within the network is consistent with biodiversity conservation. Given the vast geographic extent of the network and the City's limited land use management capacity, the auditing of current land use should be phased and tackled on a sub-metropolitan basis (e.g. audit of False Bay component of the Biodiversity Network).

Category A properties within the network should initially be audited with priority given to public land that is not formally managed as a protected area. Where the current use of public land is found to be consistent with biodiversity conservation the City should:

- Investigate introducing an appropriate management model for land parcels that collectively make up a Category A node.
- Check to see that the current zoning does not permit land uses that are inconsistent with biodiversity conservation. If it does the City should initiate the appropriate rezoning of the property (e.g. to the Environment, Heritage and Open Space base zone of the IZS).
- Introduce a monitoring and evaluation system.

Where current use of public land is found to be inconsistent with biodiversity conservation the City should check to see if the property zoning makes provision for the current land use. If the current land use is found to be non-conforming the owner should be served notice to cease illegal activities and rehabilitate the land where necessary. If the current land use conforms to the property's zoning, the City will have to negotiate a solution with the public institution that owns the land. Alternative land should be sought so that the property can be secured for conservation.

Once the audit of Category A public land in a sub-region has been completed the City should then audit current use of privately owned Category A land. The same approach as for public land should be followed, but given the greater complexity of the task the City should preferably make use of specialist land negotiators. Whilst illegal activities cannot be condoned, inevitably negotiated solutions to complex land issues will need to be found. Where current land use is found to conform to the law, land negotiators may need to offer incentives (e.g. rates rebates) to ensure compliance with biodiversity objectives. As part of the negotiation process innovative land management models should be sought. Landowners may seek compensation for limitations placed on their current land use rights.

7.3.5 Managing Applications for a Change of Land Use

When a landowner applies to change his or her current land use rights, the City has greater scope to influence land use and achieve its biodiversity conservation targets. The Land Use Planning Ordinance specifies that applications to change land use must be adjudicated on the basis of the desirability of the change in use.

In the case of properties falling within the Biodiversity Network, the onus rests with the applicant to prove that the proposed change in land use is desirable from a biodiversity conservation perspective. In this regard the applicant needs to give consideration to biodiversity conservation from a city-wide perspective and not only on an individual property level. As a result applicants will need to thoroughly investigate the environmental impacts of their proposals and demonstrate in their motivation how biodiversity conservation will be enhanced by a change of land use.

Guidelines for managing applications for a change of land use in Categories A, B and C of the Biodiversity Network is set out in summary below and in more detail in Table 11. It is important to note that these are **interim guidelines** that will apply until such time as the national Minister of Environmental Affairs and Tourism or the relevant Western Cape MEC publishes the categorised lists of ecosystems requiring protection.

Category A:

i) Public land:

In principle the City should not support development proposals on Category A public land, especially if the property represents one of the three vegetation types for which conservation targets cannot be met. The City should rather assist the applicant in finding alternative suitable land. Should suitable alternative land not be found and the development of the site is motivated on strategic grounds, the City should seek replacement conservation sites that can contribute to the meeting of its area based biodiversity targets (e.g. possible upgrading of Category B site to Category A). Attention should be given to securing the Category A site (and adjacent sites) for conservation purposes and introducing an appropriate management system.

ii) Private land:

In principle the City should not support any enhancement of development rights on privately owned Category A land. The City should rather investigate means of securing the site for conservation purposes (e.g. through land acquisition, contractual agreements, rates rebates, etc). Where an applicant wishes to exercise existing rights the City should also explore means of securing the site for conservation purposes. Should these prove unfeasible the City should explore with the applicant limited use rights that do not infringe on the conservation integrity of the property. In this regard the Consent Uses listed in the IZS Environmental, Heritage and Open Space base zone could be considered.

Category B:

For both public and privately owned Category B land the City should first check to see if the property is classified in CMOSS as non-negotiable. If it is then the City should not support development proposals for the site.

Whilst in principle Category B land offers greater flexibility in terms of subsidiary uses to its primary biodiversity conservation function, the specifics of suitable subsidiary land uses can only be informed by understanding the local context. Socio-economic and spatial considerations thus have a bearing on what is locally appropriate.

Subsidiary land uses for Category B land that undermine the City's urban edge policy should not be considered (e.g. no residential development outside the urban edge). The consent uses specified for Category A can be considered here, as well as the additions of hotels and conference facilities, places of entertainment, 4x4 trails, dwelling and guest houses, bio-friendly cultivation and grazing. In all cases consent uses that are approved need to be made subject to locational, size and operating conditions.

i) Public Land

If public land, the site should be secured and an appropriate management model identified that gives attention to subsidiary land use that are appropriate in the specific context.

ii) Private land

Where existing development rights are not in place attention should be given to securing the site through rates rebates, subsidies, etc. The City can also assist the private landowner identify appropriate land use activities for the site. The underlying reasons for the property's inclusion in the Biodiversity Network should be ascertained and subsidiary land uses sought that do not impinge on the site's environmental integrity. If the evidence indicates that the site's integrity will not be compromised, a minimum 50% or 60% or 75% of existing land area must remain under natural vegetation and all vegetation must be interlinked.

Where development rights exist this minimum of natural areas may be reduced to 35% or 50% or 65%. Where subsidiary land uses do impinge on the site's environmental integrity the GIS model should be used to find replacement land. This may include elevating Category C sites to B status, and finding additional C sites from the sites which were not originally selected as part of the Biodiversity Network.

Category C:

For both public and privately owned Category C land the City should first check to see if the property is classified in CMOSS as non-negotiable. If it is then the City should not support the development of the site.

Whilst in principle Category C land offers the greatest flexibility in terms of alternative uses, biodiversity conservation remains an important function here. The specifics of suitable alternative land uses can best be informed by an understanding of the local context. Socio-economic and spatial considerations thus have a bearing on what land uses are appropriate, and these are best identified through local area and sub-regional spatial development frameworks.

Alternative land uses for Category C land that undermine the City's urban edge policy should not be considered. Outside the urban edge attention should be given to controlling the form, coverage and intensity of alternative land uses to preserve the rural character and maintain ecological patterns and processes. The consent use possibilities specified above for Category B can be considered here, as well as institutional facilities, service stations, extractive industries, crematorium, transport facilities, farm stores, commercial kennels and aquaculture.

i) Public Land

If public land the site should be secured and an appropriate management model identified that gives attention to appropriate land use in the specific context.

ii) Private land

Where existing development rights are not in place attention should be given to ensuring that biodiversity conservation is applied on the property. The City should assist the private landowner identify appropriate land use activities for the site. The underlying reasons for the property's inclusion in the Biodiversity Network should be ascertained and alternative land uses sought that do not impinge on the site's environmental integrity. If the evidence indicates that the site's integrity will not be compromised, a minimum 35% or 50% or 65% of existing land area must remain under natural vegetation and all vegetation must be interlinked.

Where development rights exist this minimum of natural areas may be reduced to 20% or 30% or 50%.

Where alternative land uses impinge on the site's environmental integrity, the GIS model should be used to find replacement land. This may include finding additional Category C sites.

Table 11: Guidelines for managing land use applications affecting the categorised Biodiversity Network – NOTE: STILL TO BE FINALISED

Biodiversity Network Category	Public Land	Private Land
Category A	A: 1. The City should not support development proposals on Category A public land, especially if the property represents one of the three vegetation types described by Low 2000 (Si - Sand plain Fynbos on inland older non-marine derived acid soils; WSh – West Coast Renosterveld on Shale; and, Wg – West Coast Renosterveld on granite) for which there is insufficient remaining habitat to meet conservation targets or if it represents one of the National Vegetation Map (SANBI 2004) types that fall almost entirely within the City and which is critically endangered or endangered (Cape Flats Sand Fynbos, Peninsula Shale Renosterveld Lourensford Alluvium Fynbos and Cape Flats Dune Strandveld). The site should be secured for conservation purposes. 2. Identify alternative public land for proposed development. 3. If during the project feasibility process the local and provincial authorities are intent on proceeding with the development on a category A site, a full EIA should be undertaken in which the local, provincial and national implications of loss of habitat are clearly presented. The EIA should include the investigation of potential off-sets to enable no nett loss to the Biodiversity Network. 4. Should an EIA authorisation be given for the proposed development, <i>biodiversity off-sets</i> must be agreed and enforced as part of the mitigation mechanisms to ensure <i>no nett loss</i> to the Biodiversity Network. This will only be possible for some vegetation types.	<u>A(a): Applications for enhancing development rights</u> 1. The City should not support any enhancement of development rights on privately owned Category A land, especially if the property represents one of the three vegetation types described by Low 2000 (Si - Sand plain Fynbos on inland older non-marine derived acid soils; WSh – West Coast Renosterveld on Shale; and, Wg – West Coast Renosterveld on granite) for which there is insufficient remaining habitat to meet conservation targets or if it represents one of the National Vegetation Map (SANBI 2004) types that fall almost entirely within the City and which is critically endangered or endangered (Cape Flats Sand Fynbos, Peninsula Shale Renosterveld Lourensford Alluvium Fynbos and Cape Flats Dune Strandveld). The City should investigate means of securing the site for conservation purposes (e.g. through land acquisition, tradable rights, land exchange, contractual agreements, rates rebates, etc). 2. Where 1 above is unsuccessful and an applicant wishes nonetheless to pursue a development application, a full EIA should be undertaken in which the local, provincial and national implications of loss of habitat are clearly presented. The EIA should include the investigation of potential <i>off-sets</i> to enable <i>no nett loss</i> to the Biodiversity Network. 3. Should an authorisation be given for the proposed development <i>biodiversity off-sets</i> must be agreed and enforced as part of the mitigation mechanisms to ensure <i>no nett loss</i> to the Biodiversity Network. Note: this will only be possible for some vegetation types and hence the development should not be authorised. 4. Should an EIA authorisation not be given, the City should secure the land for conservation.

Biodiversity Network Category	Public Land	Private Land
		<u>A(b): Applications for exercising existing rights</u> 1. The City should also explore means of securing the site for conservation purposes through negotiation (e.g. through land acquisition, tradable rights, land exchange, contractual agreements, rates rebates, etc). 2. Should 1 prove unfeasible guidelines A(a) 2&3 should be followed and the City should explore with the applicant limited use rights that do not infringe on the conservation integrity of the property in terms of the general landuse guidelines for category A sites). 3. In regard to A (a) 3 above, the Consent Uses listed in the IZS Environmental, Heritage and Open Space base zone could be considered.

Biodiversity Network Category	Public Land	Private Land
Category B	B: 1. If the Category B site is also classified as non-negotiable as part of CMOSS or represents highly irreplaceable natural habitat, the City should not support development proposals on the site. The site should be secured for appropriate uses in terms of its Biodiversity and Open Space value and alternative public land should be identified for the proposed development. 2. Should the 1 above prove unfeasible, follow guidelines A 3&4 for public land.	<u>B (a) Applications for enhanced development rights</u> 1. If the Category B site is also classified as non-negotiable as part of CMOSS or represents highly irreplaceable natural habitat, the City should not support development proposals on the site. The City should try and secure the site for conservation (e.g. through land acquisition, tradable rights, land exchange, contractual agreements, rates rebates, etc) 2. Where 1 above is unsuccessful and an applicant wishes nonetheless to pursue a development application, a full EIA should be undertaken in which the local, provincial and national implications of loss of habitat are clearly presented. The EIA should include the investigation of potential <i>off-sets</i> to enable <i>no net loss</i> to the Biodiversity Network. 3. Should an authorisation be given for the proposed development appropriate <i>biodiversity off-sets</i> must be agreed and enforced as part of the mitigation mechanisms to ensure <i>no net loss</i> to the Biodiversity Network. <i>Note: this will only be possible for some vegetation types.</i> In the context of an anticipated authorisation, the City should explore with the applicant limited use rights that do not compromise the conservation integrity (in terms of the general land use guidelines for Category B) and ensure a minimum of 50% or 65% or 75% of the site (depending on the irreplaceability of the vegetation types) remains under natural vegetation while enabling effective Biodiversity Network linkages within and outside of the site as well as securing the off-set required in terms of the area targets for the specific vegetation types present on the site. 4. Should an EIA authorisation not be given, the City should secure the land for conservation.

Biodiversity Network Category	Public Land	Private Land
		<u>B (b) Applications for exercising existing rights</u> 1. If the Category B site is also classified as non-negotiable as part of CMOSS or represents and irreplaceable natural habitat, the City should not support development proposals on the site. The City should try and secure the site for conservation (e.g. through land acquisition, tradable rights, land exchange, contractual agreements, rates rebates, etc). 2. Should the private landowner wish to pursue an application on a category B site, follow guidelines for A (a) 2 & 3 for private land and the City should explore with the applicant limited use rights (in terms of the general land use guidelines for category B sites) that do not compromise the conservation integrity and ensure a minimum of 35% or 50% or 65% of the site (depending on the irreplaceability of the vegetation types) remains under natural vegetation enabling effective linkages within and outside of the site as well as securing the off-set required in terms of the area targets for the specific vegetation types present on the site.

Biodiversity Network Category	Public Land	Private Land
Category C	C: 1. If the Category C site is also classified as non-negotiable as part of CMOSS or represents highly irreplaceable natural habitat, the City should not support development that removes these functions and should actively seek functional use of public owned C sites that benefits surrounding communities while not seriously comprising the function of the site within the Biodiversity Network or CMOSS.	<u>C (a) Applications for enhanced development rights</u> 1. If the Category C site is also classified as non-negotiable as part of CMOSS or represents highly irreplaceable natural habitat, the City should not support the enhancement of development rights that would remove the function of the site within the Biodiversity Network and Open Space System. 2. Should the private landowner wish to pursue an application on a category C site, follow guidelines for A (a) 2 & 3 for private land and the City should explore with the applicant limited use rights that do not compromise the conservation integrity (in terms of the generic land use guidelines for category C sites) and ensure a minimum of 35% or 50% or 65% of the site remains (depending on the irreplaceability of the vegetation types) under natural vegetation enabling effective linkages within and outside of the site as well as securing the off-set required in terms of the area targets for the specific vegetation types present on the site.

Biodiversity Network Category	Public Land	Private Land
		<u>C (b) Applications for exercising existing rights</u> 1. If the Category C site is also classified as non-negotiable as part of CMOSS or represents highly irreplaceable natural habitat, the City should not support the enhancement of development rights on the site. The site should be secured for appropriate uses in terms of its Biodiversity and Open Space value and alternative public land should be identified for the proposed development. 2. Should the private landowner wish to pursue an application on a category C site, follow guidelines for A (a) 2 & 3 for private land and the City should explore with the applicant limited use rights that do not compromise the conservation integrity (in terms of the generic land use guidelines for category C sites) and ensure a minimum of 20% or 30% or 50% of the site (depending on the irreplaceability of the vegetation types) remains under natural vegetation enabling effective linkages within and outside of the site as well as securing the off-set required in terms of the area targets for the specific vegetation types present on the site.

8. Recommendations for further implementation of the Biodiversity Network

The following recommendations arise out of the data limitations of this study, the biodiversity assessment and planning initiatives being undertaken at provincial and national spheres as well as comment received from stakeholders that participated in the two workshops held as part of the process.

8.1 Legal conservation status of the Biodiversity Network

There are a number of ecosystems that are likely to be listed as critically endangered, endangered, vulnerable or protected within the City of Cape Town in terms of the Biodiversity Act (see table 6). The City should seek ways of enabling the application of provisions of the Biodiversity Act to bolster the legal protection of the network, especially where these are identified as highly irreplaceable in terms of the Low vegetation types and where these have been identified as critical or endangered in terms of the National Spatial Biodiversity Assessment. It may be necessary to pursue interim listing through the DEAT and DEAD&P until such time as an analysis of City-based conservation targets based on the national vegetation map can be undertaken (see below).

8.2 Relating the prioritised Biodiversity Network to the NSBA

The identification and prioritisation of the Biodiversity Network has used the Low (2000) vegetation classification. In order that the City supports national biodiversity conservation policies and that the NSBA is directly related to the prioritisation of the Biodiversity Network, the following additional work should be undertaken and results applied as a further prioritisation layer:

- 8.2.1 The City should add a further data layer to the existing Biodiversity Network database that will relate the national vegetation types and their ecosystem status to each of the remnants. This should be undertaken as soon as possible to enable more informed decision-making when securing the network through the process of implementation and while applying the guidelines for management of landuse applications affecting the prioritised Biodiversity Network.
- 8.2.2 All remnants in the Biodiversity Network that represent a national vegetation type that falls almost entirely within the City's jurisdiction should be considered as a high priority. The City should consider categorising all of these as Category A sites. These include national vegetation types: critically endangered ecosystems (Cape Flats Sand Fynbos – hardly protected, Peninsula Shale Renosterveld – moderately protected and Lourensford Alluvium Fynbos – poorly protected) or endangered ecosystems (Cape Flats Dune Strandveld – poorly protected and Peninsula Granite Fynbos – well protected).

8.3 Mainstreaming the Biodiversity Network into the City's development planning system

It will be vital to the long-term realisation of the Biodiversity Network that it becomes mainstreamed into forward planning and landuse development planning and management. In regard to the latter, the guidelines presented in section 7 will assist. However, beyond responding to landuse applications on a reactive basis, the City must embrace the Biodiversity Network as an informant to development in strategic forward planning, e.g. the Spatial Development Framework and subsidiary land use policy plans. Further, detailed strategies related to public information campaigns, landowner engagement, political endorsement, legal mechanisms, integration with the CMOSS, the Integrated Zoning Scheme, negotiated agreements and fiscal instrument should be pursued in parallel (see section 7.2).

8.4 The development and implementation of official City protocols

The guidelines for responding to land use and development applications presented in section 7 should receive official endorsement through council committees. Beyond this, the City should endorse existing biodiversity and EIA guidelines that have been developed by the Botanical Society of SA until such time as those that are in preparation by DEAD&P are finalised. In addition to the above the following needs have also been identified:

- 8.4.1 The City must ensure that there are specific trigger mechanisms and procedures for response when private landowners submit plans for exercising existing rights on portions of the Biodiversity Network that have high irreplaceability values. This would specifically need to involve departments involved in authorising building plans and land use applications (including departures or any application that enhances existing rights). The procedures may require specific attention to triggers for EIA approvals or detailed habitat

surveys, even in the context of existing rights. These are largely legal in terms of EIA regulations and procedural in terms of any official protocol that the City establishes.

- 8.4.2 As it is likely that “special sites” not included in the network will be identified on an ongoing basis, a protocol should be developed that enables the systematic assessment of such areas in terms of the criteria used for the identification and prioritisation of the network. In effect the prioritised Biodiversity Network database should be used as a decision-support tool to inform land use decisions. Hence, making the information and tools accessible to key City officials must be a priority.
- 8.4.3 In order that the City can secure the network as well as respond to opportunities to negotiate the inclusion of private land on an ongoing basis, it is likely that access to skills to interrogate the database and rerun the prioritisation analysis on a regular basis (annual or twice a year) may become necessary. The City should secure funding for training of staff to internalise these skills over time.
- 8.4.4 It will also be necessary to develop a detailed protocol that can assist City officials in private land negotiations.

8.5 Integration with City Information Management Systems

It is essential that the information generated by this study be integrated into the Cities planning and development processes. This is especially critical for land use applications and where landowners indicate the intention to exercise existing land use rights on portions of the network.

- 8.5.1 The data generated from this prioritisation process should be integrated into the Cities information management system and specifically into the new systems being developed for the management of zoning and property subdivision applications, as well as the planning and building development tracking systems. This integration must also include building issues concerning the conservation of the network into decision-making and related business processes. For example, whenever a new land use application or building plan is submitted the location thereof should be spatially referenced against the network and, specifically the management category of the affected NHRs. If the application impacts on an NHR which is part of the network, the Environmental Management Department should be automatically notified and comment requested. No application should be processed until this comment has been obtained and any potential conflicts ameliorated.
- 8.5.2 The data generated by this study also needs to be kept current when compared to the on-the-ground situation. It is thus essential that a system and related processes be put in place to allow for the management and updating of these key datasets.

8.6 Critical data and information gaps

The following critical data gaps have been identified

- 8.6.1 Research must be undertaken to deliver a more robust system for prioritisation and management of wetlands and rivers, specifically mapping of smaller wetlands. In order to undertake this important work, a partnership research project should be initiated with a local research institution and funding sought from an appropriate source. As a consequence, the consultant team recommends that all wetlands and rivers are assumed to be of category A status.
- 8.6.2 In order that a sound basis for ongoing management of the Biodiversity Network is developed, it will be essential to start to monitor the network. Of primary importance will be management status and quality, habitat quality (including status of invasive alien species) and indigenous species composition of the NHRs, wetlands and rivers. This monitoring and research could also be initiated in partnership with local research institutions. Youth Skills Development graduates and internships could be focused on monitoring.
- 8.6.3 Feedback from participants at the stakeholder workshops, specifically from planners who would be involved in implementing the land use management guidelines, indicates an urgent need for further Status Quo information regarding the Biodiversity Network. Ownership and current zoning of terrestrial areas categorised as A are seen as the most essential pieces of information. This work could be undertaken iteratively, focusing first on category A, then B and then C, or as land decision making processes are triggered.
- 8.6.4 In order that the Biodiversity Network can be implemented and refined over time, implementation and integration with CMOSS at a sub-regional level will be required. This assumes that the open space system (incorporating the Biodiversity Network) will be a key structural informant in the spatial planning and land use decision-making in the City of Cape Town.