PROPOSED HOUSING DEVELOPMENT ON ERVEN 2954, 2955 & 2956 KINGSBURGH EXTENSION 9
eThekwini Municipality, KZN

FOREST CONSERVATION MANAGEMENT PLAN

Version 1.0

Rev0

DRAFT PLAN FOR COMMENT

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Eco-Pulse Environmental Consulting Services

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DEFINITION OF TERMS

Biodiversity	The wide variety of plant and animal species occurring in their natural environment (habitats). The term encompasses different ecosystems, landscapes, communities, populations and genes as well as the ecological and evolutionary processes that allow these elements of biodiversity to persist over time.
Buffer zone	The strip of vegetation maintained to limit impacts to natural ecosystems from adjoining land use activities.
Conservation	The safeguarding of biodiversity and its processes (often referred to as Biodiversity Conservation).
Critical Biodiversity Area	Areas that are considered critical for meeting biodiversity targets and thresholds.
Ecosystem	An ecosystem is essentially a working natural system, maintained by internal ecological processes, relationships and interactions between the biotic (plants & animals) and the non-living or abiotic environment (e.g. soil, atmosphere). Ecosystems can operate at different scales, from very small (e.g. a small wetland pan) to large landscapes (e.g. an entire water catchment area).
Ecosystem Goods and Services	The goods and benefits people obtain from natural ecosystems. Various different types of ecosystems provide a range of ecosystem goods and services. Aquatic ecosystems such as rivers and wetlands provide goods such as forage for livestock grazing or sedges for craft production and services such as pollutant trapping and flood attenuation. They also provide habitat for a range of aquatic biota.
Ecotone	A transitional zone in which one type of ecosystem or habitat tends to merge with another type of ecosystem or habitat (e.g. forest margin between a forest and grassland). These transitional zones usually contain a mix of species from both ecosystems and habitats, and the species diversity as a consequence are often higher there than in the two adjoining habitats.
Endemic	Refers to a plant, animal species or a specific vegetation type which is naturally restricted to a particular defined region (not to be confused with indigenous). A species of animal may, for example, be endemic to South Africa in which case it occurs naturally anywhere in the country, or endemic only to a specific geographical area within the country, which means it is restricted to this area and grows naturally nowhere else in the country.
Flushing	A bird or flock of birds that has been frightened from cover.
Forest	Indigenous forests are characterized by groups of indigenous trees whose crowns form a largely closed canopy.
Function/functioning /functional	Used here to describe natural systems working or operating in a healthy way, opposed to dysfunctional, which means working poorly or in an unhealthy way.
Grassland	A grassland is a vegetation community in which grasses are the most conspicuous plants
Habitat	The general features of an area inhabited by animal or plant which are essential to its survival (ie. the natural "home" of a plant or animal species).
Indigenous	Naturally occurring or "native" to a broad area, such as South Africa in this context.
Intact ecosystems/ environments	Used here to describe natural environment that is not badly damaged and is still functioning in a largely natural manner.
Invasive alien species	Invasive alien species means any non-indigenous plant or animal species whose establishment and spread outside of its natural range threatens natural ecosystems, habitats or other species or has the potential to threaten ecosystems, habitats or other species.

Mitigate/Mitigation	Mitigating impacts refers to reactive practical actions that minimize or reduce in situ impacts. Examples of mitigation include "changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites". Mitigation actions can take place anywhere, as long as their effect is to reduce the effect on the site where change in ecological character is likely, or the values of the site are affected by those changes (Ramsar Convention, 2012).
Pristine	Unspoiled, used here to describe the natural environment in its undisturbed state.
Red Data Book or Red List	Provides information on the status of threatened species: endangered species are most at risk of extinction, followed by rare and vulnerable species
Residual Impacts	Impacts that remain after the proponent has made all reasonable and practicable changes to the location, siting, scale, layout, technology and design of the proposed development, in consultation with the environmental assessment practitioner and specialists (including a biodiversity specialist), in order to avoid, minimize, and/or repair/restore negative impacts on, amongst others, biodiversity (DEA&DP, 2007). That is, after consideration has been given to the first three measures in the mitigation hierarchy.
Riparian (area)	Includes the physical structure and associated vegetation within a zone or area adjacent to and affected by surface and subsurface hydrologic features such as rivers, streams, lakes or drainage ways and are commonly associated with alluvial soils.
Risk	A prediction of the likelihood and impact of an outcome; usually referring to the likelihood of a variation from the intended outcome.
Systematic conservation plan	An approach to conservation that prioritises actions by setting quantitative targets for biodiversity features such as broad habitat units or vegetation types. It is premised on conserving a representative sample of biodiversity pattern, including species and habitats (the principle of representation), as well as the ecological and evolutionary processes that maintain biodiversity over time (the principle of persistence).
Threatened ecosystem	In the context of this document, refers to Critically Endangered, Endangered and Vulnerable ecosystems.
Threat Status	Threat status (of a species or community type) is a simple but highly integrated indicator of vulnerability. It contains information about past loss (of numbers and / or habitat), the number and intensity of threats, and current prospects as indicated by recent population growth or decline. Any one of these metrics could be used to measure vulnerability. One much used example of a threat status classification system is the IUCN Red List of Threatened Species (BBOP, 2009).
Transformation (habitat loss)	Refers to the destruction and clearing an area of its indigenous vegetation, resulting in loss of natural habitat. In many instances, this can and has led to the partial or complete breakdown of natural ecological processes.

ABBREVIATIONS USED

CBA	Critical Biodiversity Area
CPLAN	(Biodiversity) Conservation Plan
CR	Critically Endangered (species threat status)
DAFF	Department of Forestry and Fisheries
DEFF	Department of Environment, Forestry & Fisheries (formerly DAFF)
D'MOSS	Durban Metropolitan Open Space System
EIA	Environmental Impact Assessment
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EMA	eThekwini Municipal Area
EN	Endangered(species threat status)
GIS	Geographical Information Systems
GPS	Global Positioning System
IAPs	Invasive Alien Plants
LC	Least Concern (species threat status)
NEMA	National Environmental Management Act No.107 of 1998
NEM:BA	National Environmental Management: Biodiversity Act No.10 of 2004
NFA	National Forest Act No. 84 of 1998
SANBI	South African National Biodiversity Institute
VU	Vulnerable (species threat status)

1 INTRODUCTION

1.1 Project background

The planned development of a housing project on Erven 2954, 2955 & 2956 Kingsburgh Extension 9 (eThekwini Municipality, KZN) is situated within a steep valley comprising mixed woodland, thicket, grassland and forest vegetation communities that are likely to be impacted to varying degrees. A locality map showing the development site and properties is included below in Figure 1.

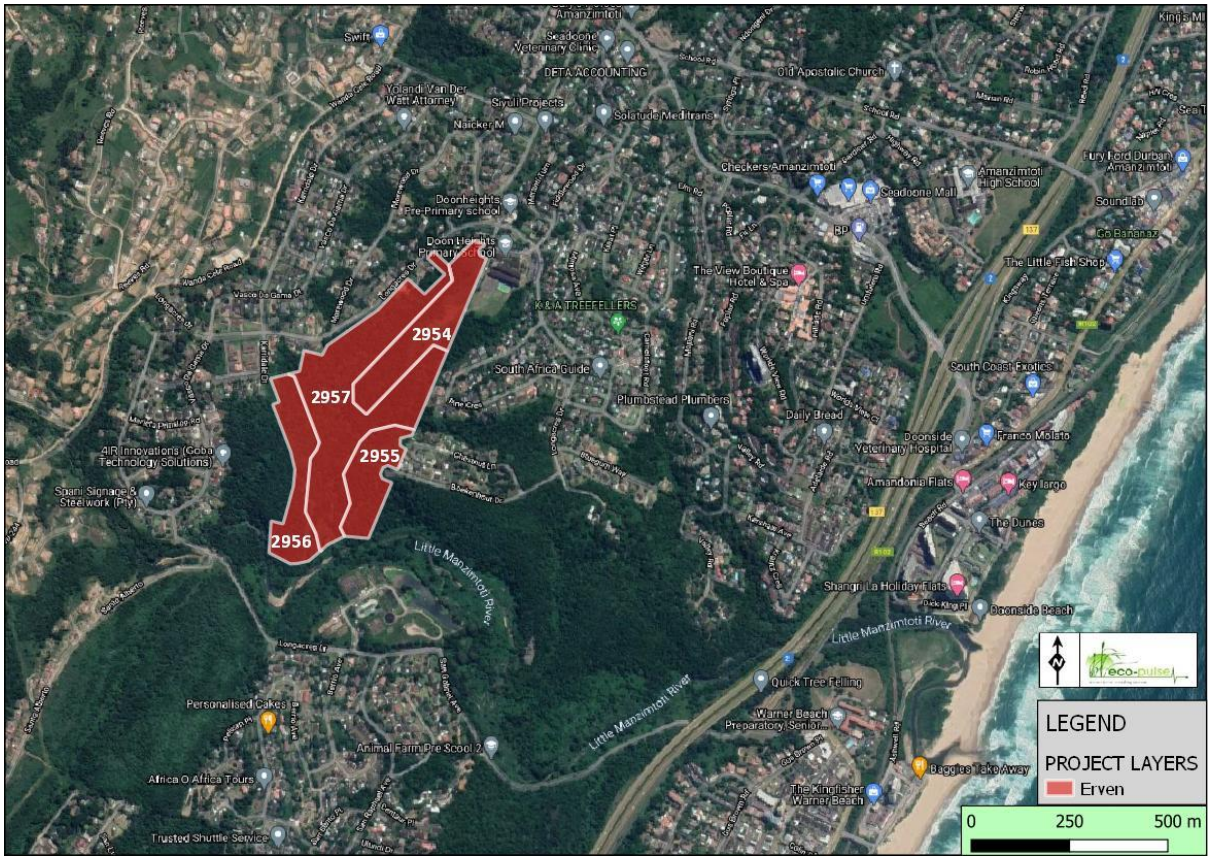

Figure 1. Locality map showing Erven 2954, 2955, 2956 & 2957 Kingsburgh Extension 9 on the 'Little Manzimtoti' River west of Amanzimtoti town off the National Route N2.

According to the specialist Vegetation Assessment Report for the development project (Styles, 2018), consultations and negotiations with the EPCPD (Environmental Planning &, Climate Protection Department) of the eThekwini Municipality[1] resulted in a provisional agreement supporting potential development on areas of the site where there will be the "*least impact on better quality vegetation at the site*". This includes areas of young, seral forest vegetation focused away from the primary instances on the property. The vegetation specialist (botanist: David Styles), as well as the various competent environmental authorities, have recommended that a suitable plan be prepared to inform the management and conservation of forest habitat within the remaining undeveloped areas of the site.

[1] Whilst it is acknowledged that this process of engagement began with the local municipal authority, this was critical to proceeding with any viable environmental authorization process, even if the Provincial KZN EDTEA (Department of Economic Development, Tourism & Environmental Affairs) is the competent authority ultimately responsible for reviewing the Environmental Assessment Report (DBAR) and confirming environmental authorization for the development. Furthermore, the need for consultation with the Provincial Conservation Authority (Ezemvelo KZN Wildlife, EKZNW) and the Department of Environment, Forestry & Fisheries (DEFF) is also acknowledged.

1.2 Purpose of this Document

Given the potential to impact forest on the properties and the provisional development on the least sensitive areas of the site, Styles (2018) recommended that "…*a long-term rehabilitation and management plan be implemented for the undeveloped portions of the development properties*". This is also reflected in the comments received from the eThekwini Municipality EPCPD (Environmental Planning &, Climate Protection Department) in response to the DBAR (draft Basic Assessment Report), which are contained in the formal written response letter dated 20th October 2020, reference: DPM/EIA 818A) requiring that a "*comprehensive conservation management plan*" be compiled "…*for the mitigation of any forest loss, rehabilitation of the remaining forested areas and the long-term management and maintenance of the open spaces on the development sites*".

The management plan will also contribute to meeting the requirements of the National Department of Environment, Forestry & Fisheries (DEFF) with regards to natural forest management, and as reflected in the comments of DEFF to the DBAR in the letter dated 08 September 2020:

> *"The natural/indigenous forests occurring within the property but outside of the development footprint should be retained, strictly conserved and managed as a conservation areas and ecological corridor. Furthermore, the condition of these forests should be improved by eradication of alien invasive plants/vegetation and planting of indigenous species."*
>
> *"A forest/biodiversity conservation/management plan should be compiled inclusive of rehabilitation plan and plant rescue plan."*

In addition, the management plan will also contribute towards meeting the requirements of the Provincial Conservation Authority, Ezemvelo KZN Wildlife (EKZNW), as per the comments received (dated 03 September 2020) from the Conservation Planning: IEM Section of EKZNW in response to the DBAR.

Eco-Pulse Environmental Consulting Services (Eco-Pulse) was subsequently appointed by the developer and applicant to compile the **'Forest Conservation Management Plan'** contained in this document, for the purpose of fulfilling the requirements of the EPCPD, DEFF, EKZNW and the recommendations contained in the Vegetation Assessment Report (Styles, 2018) for the development project at Kingsburgh Extension 9.

1.3 Spatial Scope & Context

The FCMP serves to inform the management, conservation and monitoring of forest vegetation communities and associated habitat within the future 'undeveloped' portions of the properties, including Erven 2954, 2955 & 2956 Kingsburgh Extension 9, within the eThekwini Local Municipality.

1.4 Legal & Policy Framework

The protection and management of natural forests is reflected in several policies and pieces of legislation, at the international, national, provincial and local level. A brief overview of the most relevant legislation and policy has been provided below.

International Policy & Legislation:

Legislation	Potential Relevance to the FCMP
Convention on Biological Diversity	The convention has a bearing on the management of biodiversity and forest ecosystems at the site. Countries such as South Africa that ascribe to the convention are to rehabilitate or restore degraded ecosystems through the formulation of appropriate strategies and plans.
United Nations Convention to Combat Desertification	South Africa has responded to the UN Convention to Combat Desertification by developing a National Action Plan (NAP). The aim of the NAP is to implement at current and future policies that affect natural resource management and rural development, and establish partnerships between government departments, overseas development agencies, the private sector and NGOs.
United Nations Framework Convention to Combat Climate Change	South Africa is a signatory of the UNFCCC and according to the Department of Environment Forestry and Fisheries (DEFF) is already acting on climate change. The country has significant investment in renewable energy, public transport, energy efficiency, waste management and land restoration initiatives. South Africa is also striving to enhance efforts to transition to a lower carbon economy and society, as well as to adapt in the short, medium and long term to the impacts of increasing temperatures, and reduced rainfall in many parts of the country.
The World Summit on Sustainable Development (Johannesburg, 2002)	The Implementation Plan promotes the implementation of the Ramsar Convention and highlights actions that reduce the risk of flooding in drought-vulnerable countries by promoting the restoration and protection of wetlands and watersheds, for example.

National Policy & Legislation:

At a national level, the protection and management of natural forests is reflected in several national legislation, with the principal one being the National Forest Act No. 84 of 1998 (NFA).

The NFA defines a 'forest' as "*a natural forest, a woodland and a plantation; the forest produce in it; and the ecosystems which it makes up*". A 'natural forest' is defined in the NFA as "*a group of indigenous trees whose crowns are largely contiguous, or which have been declared by the Minister to be a natural forest…*"

The NFA provides measures for the protection and management of natural forests in South Africa, with the national Department of Environment, Forestry & Fisheries (DEFF) mandated to implement and enforce the provisions of the Act at a national level. Of particular relevance is Chapter 2 which provides principles for the sustainable management of forests, Chapter 3 which provides special measures to protect forest and indigenous trees, and Chapter 4 which guides the access and use of forests for recreation and related purposes.

In addition to the NFA, there are several additional pieces of legislation that have a bearing on the management and protection of natural ecosystems such as forests in South Africa, and these are briefly summarised below:

Legislation	Potential Relevance to the FCMP
National Environmental Management Act (Act 107 of 1998)	This Act promotes ecological sustainability and environmental protection. NEMA provides the legislative backing (including Impact Assessment Regulations) for regulating development and ensuring that a risk-averse and cautious approach is taken when making decisions about activities with a potential impact on the environment. It also obligates anyone who causes significant pollution or degradation of the environment to take reasonable steps to ensure that further degradation is prevented or minimized.
National Environmental Management: Biodiversity Act (Act 10 of 2004)	A three-tier hierarchy of plans is also catered for, providing for both spatial and strategic management planning. Of particular relevance, is Biodiversity Management Agreements (BMA) to implement any Biodiversity Management

Legislation	Potential Relevance to the FCMP
	Plan. This is intended to formalise the emerging relationships between government and landowners and communities but remains an adaptable and flexible option. The latest published list of invasive and alien species published as well as the latest regulations and guidelines for monitoring and control plans will inform invasive and alien plant control and eradication. The latest list of threatened and protected species and relevant permitting requirements will be relevant if their presence is confirmed within the project area. The latest list of threatened and protected ecosystems and associated regulations will also need to be reviewed if any intact or semi-intact habitat on-site is listed.
National Environmental Management: Protected Areas Act (Act 57 of 2003)	This act may govern future offset sites flagged for conservation and the management of associated biodiversity impacts and risks.
Draft National Offset Policy (DEA, 2017)	A Draft National Biodiversity Offsets Policy (DEA, 2017) was developed in 2017 in terms of the National Environmental Management Act No. 107 of 1998 (NEMA). The draft offset policy sets out the principal objective of biodiversity offsetting as being "*to slow and progressively reverse ecological deficit through counterbalancing human induced negative effects on the environment that remain after every effort has been made to avoid, minimise and then rehabilitate impacts through avoiding, minimising and rehabilitating impacts or impacted areas elsewhere*". The proposed policy will need to be taken into consideration with all development applications that will still have residual impact after the mitigation sequence has been followed in the environmental impact assessment process.

Provincial Legislation:

Legislation	Potential Relevance to the FCMP
Nature Conservation Ordinance 25 of 1974	A number of flora and fauna are listed as protected species under this ordinance and relevant permitting requirements will need to be followed if any protected species are confirmed on-site.

1.5 Relevant Policy, Principles & Guidelines

A review of available national, provincial and local level policy and guidelines supporting forest conservation, management and impact mitigation recommendations was also undertaken to inform the recommendations for buffers for the site in question. These include policy and guidelines compiled at a National Level by the Department of Environment, Forestry and Fisheries (DEFF, formerly DAFF), at a Provincial level by Ezemvelo KZN Wildlife (EKZNW) and at a local municipal level by the eThekwini Municipality's environmental planning department (EPCPD).

1.5.1 Policy Principles & Guidelines for the Control of Development Affecting Natural Forests (DAFF, 2010)

In South Africa, the mandate for the management of natural forests and the responsibility for implementing the National Forest Act No. 84 of 1998 (NFA) resides with the national Department of Environment, Forestry and Fisheries (DEFF), formerly DAFF (Department of Forestry & Fisheries). DAFF has compiled a relevant policy and guideline document for development potentially affecting natural forest, titled "*Policy Principles and Guidelines for the Control of Development Affecting Natural Forests*" (Department of Agriculture, Forestry and Fisheries, 2010). According to this document, and in line with

the 'precautionary principle' in environmental impact management, due consideration must be given towards incorporating the following forest management principles into project design and planning:

- Natural forests may not be destroyed save for "exceptional circumstances".
- In terms of the National Forest Act, all forests are protected and no trees (dead or alive) may be cut, damaged or removed without a license from DAFF (or a delegated authority).
- Forests must be managed to conserve biological diversity, ecosystems and habitats.
- Maintaining natural forests in a good state and the rehabilitation of degraded forests must be promoted.
- The levels of environmental significance, conservation value, functional value (ecosystem goods and services), sensitivity or threatened ecosystem status must be taken into account in all decisions affecting natural forests, with priority given to the protection of forest types and forest patches listed as threatened ecosystems.
- The impacts of the proposed land use or development on any natural forests must be comprehensively investigated, including impacts on the buffer areas, the forest fauna and flora, and the forest ecosystem and dynamics.
- Landowners are accountable for managing potential impacts and activities that may affect natural forests.
- Potential impacts of development or land use change must be considered pro-actively as early in the proposed activity's planning stages as practicable.
- Any decisions on land use or development that will affect natural forests must be taken with the utmost care (the *precautionary principle*) and with due consideration for:
    - Keeping the dynamic forest processes intact;
    - Preventing disturbance to forest ecosystems, fauna and flora;
    - The most sensitive parts of forests have to be avoided;
    - Keeping forest margins and surrounding mosaics of habitats in place as far as possible (inter alia through sufficient buffer zones, corridors and protected areas);
    - Natural corridors linking forests and other habitats must be retained as far as possible; and
    - Not allowing disturbance caused by poor land management to be used as a motivating factor for land use change that transforms natural forest.
- Where environmental authorization is given for development, strict conditions must be set for appropriate mitigation measures, subject to an approved environmental management plan, to be overseen by an appropriately qualified environmental manager, and to be monitored by the relevant government bodies.
- Under the NEMA: EIA regulations, a basic assessment is required for the removal of natural vegetation above 3 hectares (this threshold falls away for listed threatened ecosystems).
- Building structures must be placed outside the forest with a sufficient buffer area to keep the forest margin intact (buffer usually more than 20m).
- Environmental assessments must consider the national and provincial conservation importance and planning for the forest types and individual forest patches involved.
- The appropriate levels and types of access and use of natural forests must be in keeping with the environmental potential, sensitivity and carrying capacity of the various forests.
- Due consideration must be given to the minimum width of corridors and buffer zones and the minimum size requirements of natural habitats to enable fully functional ecosystems to be retained.
- Retaining or promoting controlled public access to forests must be a prime consideration.
- The ecotones and vegetation types surrounding forest patches must be kept intact as a vital part of maintaining the forest habitat and its fauna and flora.
- Invader plant species often populate disturbed forest and must never be an excuse for allowing land use change or development that could be detrimental to a forest.

Further guidance is provided in terms of forest conservation 'buffer zones' as follows:

- Due consideration must be given to the minimum width of corridors and buffer zones and the minimum size requirements of natural habitats to enable fully functional ecosystems to be retained;
- Building structures must be placed outside the forest with a sufficient buffer area to keep the forest margin intact (buffer usually more than 20m); and
- The ecotones and vegetation types surrounding forest patches must be kept intact as a vital part of maintaining the forest habitat and its fauna and flora.

1.5.2 Guidelines for Biodiversity Impact Assessments in KZN (EKZNW, 2013)

The Provincial "*Guidelines for Biodiversity Impact assessments in KZN*" (EKZNW, 2013) recommend buffer widths for forests (measured from the forest edge), which generally range from 20m up to 200m. Based on the guideline document, whilst a 40m buffer is generally applied, this standard buffer width may not always account for the forest and development type and has been inappropriate in some instances in the past. As such, the determination of an appropriate and site-specific buffer depends rather on a number of factors, which EKZNW have proposed an iterative and scaled approach to buffer width determination.

1.5.3 Development Assessment Guidelines for eThekwini (EPCPD, 2010)

Development Assessment Guidelines have also been developed by eThekwini Municipality's Environmental Planning & Climate Protection department (eThekwini Municipality, 2010) and include guidelines for development potentially affecting indigenous forest ecosystems within the Municipality:

- Development within a natural forested area is generally not supported;
- Generally, a minimum development buffer of 40m must be maintained from the forest canopy drip line.
- The size of the standard 40m buffer may however be increased or decreased depending on the forest size, its ecological functionality and the form of the proposed development; and
- The buffer area must be managed as an ecotone area (i.e. an area of transition from one ecosystem to another) as this ecotone is often more diverse - containing elements from both ecosystems and allows for development-associated impacts to be absorbed before impacting on the forest.

1.6 Assumptions, Limitations & Gaps in Information

The following assumptions, limitations and gaps in existing information apply to the forest conservation management plan contained in this document:

1. The original Vegetation Assessment and Report (Styles, 2018) was used primarily to inform the compilation of this management plan, with no further or additional ground truthing or verification exercises undertaken by Eco-Pulse Consulting. Therefore, the relevant assumptions, limitation and information gaps pertaining to the 2018 vegetation assessment, as reflected in the Styles (2018) report apply in this instance. Some of these that are most relevant are as follows:
    a. An approximate boundary between forest types has been defined only as the botanist (David Styles) expressed his difficultly in determining the precise boundary between older and early successional forest, due to lack of resolution in aerial imagery and interpolation and graduation between the two.

b. In spite of the forest being of recent origin, the definition of a 'forest' and 'natural forest' in the National Forests Act (No. 84 of 1998) is broad and captures both the older-growth forest and the early successional forest and thicket.

c. Although transitioning into forest, the botanist and author of the report, David Styles, expressed his opinion that the vegetation community would probably be better described as thicket as the canopy is mostly low.

d. Despite nearly all of the woody vegetation onsite being considered to be of recent origin (as reflected in the species composition), a distinction has been made between older forest (that is estimated to have included trees that established 30 years ago), and younger/seral successional forest and thicket (where trees appear to have been emergent or absent 30 years ago).

e. According to Mr. D. Styles, the presence of Scarp Forest on the site is uncertain, however based on the composition and structure of the forest and the location on Dwyka Group Tillite geology with clay soils in the eThekwini Municipality coastal zone, this is markedly different to that of most Northern Coastal Forest on sandy soils in the same area. The forest vegetation is therefore inherently difficult to classify according to Provincial and National forest classification systems and types.

2. Whilst buffer zone requirements have been informed by best available science/literature, there is still no formally accepted method for determining appropriate buffer zone widths for forests in South Africa. There is therefore a risk that Authorities may differ in their interpretation of appropriate buffer zone/setback requirements.

3. Additional information used to inform the assessment was limited to data and GIS coverage's available for the province and municipality at the time of the assessment.

4. It is assumed that these limitations will be clearly communicated by the EAP to the relevant environmental authority / authorities responsible for reviewing the DBAR (Draft Basic Assessment Report).

2 INSTITUTIONAL FRAMEWORK

2.1 Roles & Responsibilities

Roles and responsibilities for the implementation of the Forest Conservation Management Plan (FCMP) are summarised in Table 1, below.

Table 1. Roles & responsibilities for FCMP implementation.

Party	Key Roles and responsibilities
Developer / Landowner / Project Manager	• The ultimate responsibility for ensuring the implementation of the FCMP lies with the landowner / developer during the construction phase. • They will be tasked with overseeing the management of the forest habitats and buffer zones on the relevant properties, and/or appointing appropriately qualified / experienced contractor(s) or implementing agent(s) to undertake the required management tasks should they not have the required expertise needed to complete the recommended tasks. • Tasked with appointing relevant environmental staff (ECO and EO's) for the relevant phases of the project. • Shall be responsible for the actions of all sub-contractors as well as disseminating information pertaining to the management of wetlands on the site;

Party	Key Roles and responsibilities
ECO: Environmental Control Officer	• The ECO (Environmental Control Officer) appointed to the project will be responsible for undertaking general monitoring and site inspections to fulfil the required EMPr and EA Conditions. • Also responsible for general monitoring to inform the management of the undeveloped forest areas and to identify problems requiring remediation.
Contractors / Sub-Contractors	• The contractors and all relevant parties involved in the development project must be familiar with the FCMP and most relevant measures contained therein. • Responsible for implementing appropriate forest management and mitigation of potential impacts in accordance with the guidelines and requirements contained in the FCMP and EMPr. • Contractors are answerable to the ECO for non-compliance with the requirements of the FCMP and EMPr.
Landowner / Home Owner's Association	• The ultimate responsibility for ensuring the implementation of the FCMP lies with the landowner / home owner's association during the operation of the housing development. • They will be tasked with overseeing the management of the forest habitats and buffer zones on the relevant properties, and/or appointing appropriately qualified / experienced contractor(s) or implementing agent(s) to undertake the required management tasks should they not have the required expertise needed to complete the recommended tasks.
Ecologist	• Where appointed by the landowner/developer, shall be responsible for providing remote and/or on-site ecological support pertaining to various aspects of the implementation and review/updating of the FCMP.

2.2 Financial Requirements & Funding

This management plan has not attempted to address the details of the likely finances / costs involved in implementing the FCMP and further work will be required to estimate costs for alien plant clearing, rehabilitation and long-term forest management, amongst others. In this respect it is recommended that an annual budget for implementation be prepared for each property once the FCMP has been endorsed by the various competent authorities reviewing the EIA application (DBAR).

Ultimately, it will be the responsibility of the lead agent (developer/landowner/homeowners association) to secure adequate funding to implement the FCMP to specification and to show that adequate provisions have been made, in terms of the provisions of NEMA. The financial arrangements for implementation, as per the annual operational budget, will need to be finalised once the budget has been prepared and agreed to by the relevant parties.

2.3 Collaboration, Transparency & Accountability

Active stakeholder involvement and support is recognised as an important aspect of effective management. Accordingly, the development of this forest conservation management plan has been undertaken through a collaborative process, in an open and transparent manner. This management plan is also intended to be a public document and is freely available to interested and affected parties. On-going interaction with interested and affected parties throughout the implementation and future management review processes is actively encouraged.

Transparency in the dissemination of information, including monitoring and performance of management plan implementation, will be important for ensuring that the various environmental authorities are satisfied with progress and to ensure accountability is maintained during the various phases of the development. It is therefore recommended that the environmental authorities be

consulted in terms of their requirements from an information dissemination perspective and the timeframes and frequency of communication required.

2.4 Key Supporting Environmental Authorities

The key environmental authorities, competent authorities and government departments that will need to be consulted during the compilation and implementation of the FCMP are listed and described below in Table 2.

Table 2. Key environmental authorities to be consulted.

Level	Authority	Role / responsibility
National	**DEFF:** Department of Environment, Forestry & Fisheries	Responsible for providing comment on the BAR with respect to natural forests and monitoring and enforcing the provisions of the National Forest Act (No. 84 of 1998) with respect to sustainable forest management and protection of natural forest ecosystems and their various components.
Provincial	**EKZNW**: Ezemvelo KZN Wildlife	Provincial conservation authority responsible for ensuring sustainable development and natural ecosystem management and conservation occurs at the provincial level in KZN.
Local	**EPCPD:** Environmental Planning & Climate Protection Department (eThekwini Municipality)	Local municipal authority responsible for reviewing development applications and providing comment with respect to ensuring development takes place in a sustainable manner accounting for natural ecosystems, processes and services and ensuring these are maintained at acceptable levels.

2.5 Term of the Plan

The implementation of this Forest Conservation Management Plan (FCMP) shall be an on-going process and the FCMP is likely to continue to be relevant in perpetuity or until such time as the Plan has been revised or replaced by an alternative management plan.

3 SITUATIONAL ASSESSMENT

3.1 Summary of the Status Quo

The original Vegetation Assessment Report (Styles, 2018) for the development project was reviewed, and the key findings briefly summarised below to provide the background, ecological context and a basis to inform recommendations around forest management for future undeveloped portions of the site:

- A review of aerial photography shows that between 1937 and 1968 the vegetation overwhelmingly comprised grassland. While a very small amount of woody vegetation had begun to appear by 1968, by 1996 it had converted to mosaic of grassland and woody vegetation. By 2017 the emergent woody vegetation had closed up, with only a small 0.16 ha instance of grassland remaining.
- All or nearly all of the woody vegetation is considered to be of recent origin and this is reflected in the species composition. However, a distinction is made between older forest (that is estimated to have included trees that established 30 years ago), and younger/seral successional forest and thicket (where trees appear to have been emergent or absent 30 years ago).

- The botanist expressed difficultly in determining the precise boundary between older and early successional forest, due to lack of resolution in aerial imagery, and interpolation and graduation between the two. Therefore, an approximate boundary only has been defined.
- In spite of the forest being of recent origin, the definition of forest in the National Forests Act No. 84 of 1998 is broad and captures both the older-growth forest and the early successional forest and thicket.
- Some protected tree species also occur. Protected trees include: *Pittosporum viridiflorum* (Cheesewood).
- Vegetation within the planned development areas comprised alien-dominated communities (especially *Chromolaena odorata*, Triffid weed), with much vegetation having been cleared in 2017 with re-growth by 2018.
- Although transitioning into forest, the botanist and author of the report, David Styles, expressed his opinion that the vegetation community would be better described as thicket as the canopy is mostly low.

A map showing the location and extent of the various vegetation communities identified, delineated and classified for the property has been provided in Figure 2.

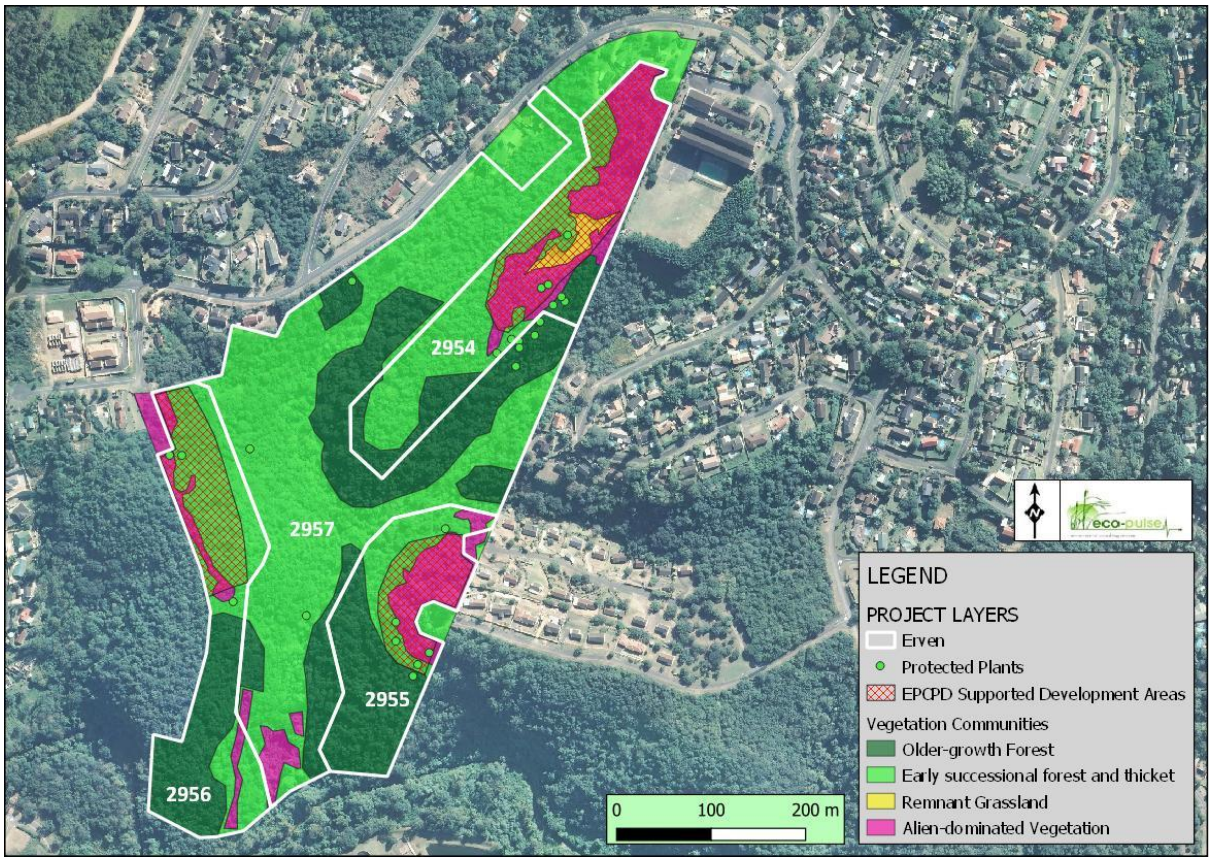

Figure 2. Vegetation map (after Styles, 2018).

Further consultation with the botanist and author of the original Vegetation Assessment Report, Mr. David Styles, was undertaken to obtain additional insight into the classification of the young, seral forest occurring on the properties, which remains relatively unclear in the Vegetation Assessment Report of 2018. According to Mr. Styles, the presence of Scarp Forest on the site is uncertain, however based on

the composition and structure of the forest and the location on Dwyka Group Tillite geology with clay soils in the eThekwini Municipality coastal zone, this is markedly different to that of most Northern Coastal Forest on sandy soils in the same area. The forest vegetation is therefore inherently difficult to classify according to Provincial and National forest classification systems and types.

3.2 Opportunities & Constraints Analysis

Key opportunities and constraints from the perspective of forest management on the relevant properties have been summarised below in Table 3 and have a bearing on what can realistically be implemented on site.

Table 3. Key opportunities & constraints to forest management.

OPPORTUNITIES	CONSTRAINTS
➢ Degraded vegetation at the site presents an opportunity to develop these areas whilst protecting the more intact forest areas. ➢ A management plan for the forests at the site is likely to improve the long-term prospects and viability of the forest communities on the relevant properties. ➢ The forest growth on the site appears to be young and development of the site presents an opportunity to improve the management of the remaining forest patches towards a more mature successional state. ➢ Removal of weeds and alien plants is likely to significantly improve the condition of the remaining forest ecosystem. ➢ Herbicide use for selected invasive alien plants may make control and eradication less challenging than purely manual removal. ➢ A portion of the recommended forest 'buffer zones' could be used for low intensity development such storm water management infrastructure, gardens and lawns and land uses such as common recreational use. ➢ Smaller protected plants can be easily translocated and do not need to be destroyed. ➢ The absence of wetlands from the development properties allows for more flexibility around future land use and development planning. ➢ The absence of 'Critically Endangered' or 'irreplaceable' ecosystems reduces the likelihood of the development being considered 'fatally flawed'.	➢ Proximity to other (semi) urban areas complicates the management of the remaining forest patches as there are likely to be disturbances and legacy impacts beyond the control of the landowner. ➢ Existing pollution impacts (i.e. leaking sewers) pose a long-term pollution risk to the forest ecology at the site. ➢ The steep slopes that characterise the site are likely to exacerbate erosion risk and magnitude of potential erosion impacts should these occur. ➢ Forest ecosystems are adapted to the exclusion of fire, hence burning as a management tool for alien plants and undesirable / moribund vegetation is not advocated. ➢ Natural forests present at the site are protected by law and require a license from DEFF for development to take place here. ➢ Several protected plant/tree species are present and require permits for their removal or destruction. ➢ Large protected tree species will be difficult to relocate and may require a replacement strategy to be implemented. ➢ Clearing of alien plants from dense wooded areas (such as forest, woodland and thicket) can be challenging and labour intensive. ➢ There are areas of connected forests where connectivity is high, and existing linkages between forest areas should therefore not be severed. ➢ The inherent difficultly in determining the precise boundary between older and early successional forest means that only approximate boundaries have been defined, which may affect forest management implementation.

4 FOREST MANAGEMENT PLAN

4.1 Aim & Objectives

The FCMP (Forest Conservation Management Plan) aims to provide a suitable and practically implementable management framework and action plan to inform sustainable forest conservation management within the remaining undeveloped forest habitat on the properties.

Key objectives include:

- Providing key management themes and associated actions that can be readily implementable;
- Providing a plan to monitor and evaluate management actions and the relative success thereof;
- Providing an institutional framework with key roles, responsibilities and financial obligations; and
- Providing for an adaptive management approach towards revising the plan in order to to meet changing circumstances, as relevant.

4.2 Action Plan

4.2.1 Environmental Awareness

Environmental awareness around the importance and sensitivity of natural forests in South Africa and the dangers and implication of polluting and impacting on these environments will be important amongst all employees and workers accessing the property and undertaking various activities on the property. To this end, the following is recommended:

- All employees and staff accessing the property are to be informed of the ecological importance and sensitivity of natural forests and the need to avoid damaging/polluting these sensitive aquatic environments, as well as their respective buffer zones.
- Appropriate signage around the forest resources could also be erected to raise awareness amongst employees.

4.2.2 Avoidance of 'Older Forest Growth'

Styles (2018) recommends that in order to minimize impacts on forests and the concern of DEFF, it is recommended that development avoid older, better-developed forest and minimize loss of early successional forest and thicket and that these areas be buffered from proximate development to the extent that this may otherwise disturb the more intact vegetation. Based on vegetation surveying which occurred in 2017, subsequent presentation of results to, and negotiation with the EPCPD, development areas were provisionally agreed that will least impact on better quality vegetation. *The EPCPD's support is subject to conditions including that future management of the undeveloped parts of the properties be addressed.* Furthermore, based on the mitigation measures outlined in the Vegetation Report (Styles, 2018), the botanist and author expressed his opinion that if these are well implemented, they will offset or largely offset the loss of early successional forest and thicket lost in consequence of the proposed development. Special recommendations were provided for Erf 2956 & ERF 2955, as summarised below.

Special recommendations for ERF 2956:

- General coverage of the property by forest does not commend it as suitable for any kind of extensive development and it is not possible to develop this property to any more than very minor extent without impacting on some of this forest;
- However, if confined to the eThekwini supported development area it will have lower impact than if situated elsewhere.

Special recommendations for ERF 2955:

- The property includes an area invaded by alien vegetation (mainly *Chromolaena odorata*) with the balance covered by thicket transitional to early successional forest, earlier successional forest and older forest.
- The older-growth forest should be avoided.
- The 'eThekwini supported development area' is mostly situated on the alien plant invaded area but includes early successional forest and thicket.
- The botanist expressed his opinion that he considered it a "good trade-off" if the eThekwini-supported development area was moved 15 metres from the older-growth forest edge, with a comparable area of early successional forest on the western edge included instead.

Access controls and measures to prevent disturbance of 'No-Go' conservation areas shall include:

- The edges of the permitted developable area and construction footprint/zone must be clearly staked-out by a surveyor and demarcated using highly visible material (e.g. danger tape) prior to construction commencing;
- The demarcation work must be signed off by the Environmental Control Officer (ECO) before any work commences;
- Demarcations are to remain until construction and rehabilitation is complete;
- All areas outside of this demarcated working servitude must be considered no-go areas for the entire construction phase;
- No equipment laydown or storage areas may be located within the non-development / conservation areas;
- Access to and from the development area should be either via existing roads or within the construction footprint only; and
- Any contractors found working inside the 'No-Go' areas (areas outside the construction/ working servitude) should be fined as per a fining schedule/system setup for the project.

4.2.3 Forest Conservation Buffer Zones

A separate report has been compiled with recommendations pertaining to buffer zones[2] for the protection of the remaining forest patches on the properties to be developed. This report has been attached as **Appendix 1** ('Forest Buffer Zones Recommendations') and should be referred to for the following:

- Background to buffer zones and site context;
- Legislative context to buffer zones in South Africa (national, provincial and local municipal level guidelines and policy);
- Literature review;

[2] **Buffer zones** or "development set-backs" are essentially strips of land typically designed to act as a protective barrier between human activities and sensitive ecosystems/habitats such as natural forests, grasslands, wetlands and rivers. *Research shows that buffer zones are useful at performing a wide range of functions such as sediment trapping and nutrient retention, and in doing so, play an important role in protecting natural resources from the adverse impacts that are typically associated with various forms of land-use and development.*

- Recommended buffer widths;
- Accounting for erosion & sediment risks;
- Buffer management recommendations; and
- Key references.

Based on the status quo review and assessment undertaken, it is recommended that a modified variable buffer zone be implemented, with a **reduction from 40m width to 20m width** from the older forest growth in selected areas where the following applies:

- The buffer zone is already heavily degraded/transformed;
- Dense alien vegetation dominates the 40m buffer area;
- Proposed development is separated from adjacent forest by a steep valley and watercourse (stream/river); and
- Where small, isolated patches of forest occur with the vegetation being in poorer condition.

The modified buffer zone map is shown in Figure 3 and provides a potential solution that will favour both development (within financially viable areas) and the conservation of the more sensitive forest communities on the property.

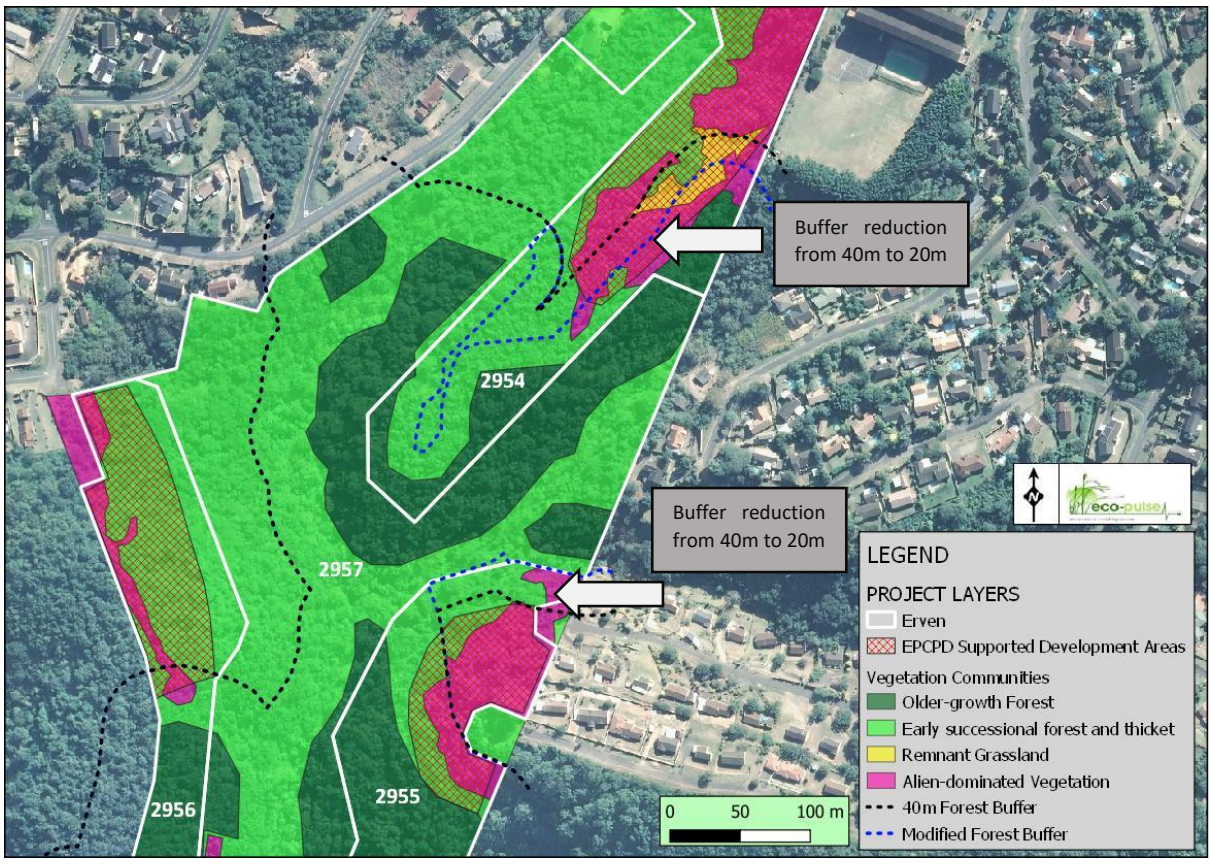

Figure 3. Recommended 'forest conservation buffer zones' relative to planned development footprints on each property. *A modified variable buffer zone has been recommended, with a 40m buffer width recommended from 'older-growth forest' reduced to 20m width in places.*

Note that buffer zone width recommendations are subject to the following assumptions and conditions being met:

- Construction phase impacts including pollution, sediment risk, noise disturbance and physical destruction of forest vegetation can potentially be quite easily managed and mitigated by implementing a range of on-site management and source-directed control and mitigation measures;
- The developer commits to implementing the impact mitigation/management recommendations detailed in the specialist Vegetation Assessment Report, DBAR and EMPr compiled for the project; and
- An appropriate Storm Water Management Plan (SWMP) will be developed for the project to attenuate storm water to approximate pre-development conditions, with suitable erosion protection to prevent soil erosion and sedimentation.

The following general buffer zone management and maintenance guidelines (based on a number of guidelines and literature reviewed) will also need to be implemented:

- In order to maximise their effectiveness, buffer zones will need to be established and maintained with indigenous vegetation cover (without erosion features/concentrated flow paths) as open space natural grassland areas with appropriate alien plant control and/or slashing to maintain grass cover where appropriate;
- Buffers consisting of sparse trees may not be as effective as those mixed with grasses for reducing incoming runoff and filtering sediment and nutrients, therefore a mixture of woody vegetation with dense ground cover (grasses / herbaceous plants with fibrous root systems) to provide roughness and flow resistance is recommended for the buffer zones;
- Maintain vegetation cover, avoid soil compaction and rutting within the buffer and overland flow area (i.e. minimize driving in this area and use ground protection on soft ground);
- Woody species with deeper roots will be better at increasing soil cohesion and reducing mass slope failure and this should guide species selection when re-vegetation buffer zones;
- Reduce soil erosion risk by locating any eco-trails within the buffers on soils with low erodibility (e.g., coarse-textured, low organic matter, low soil moisture);
- Design trails located within buffers to follow the contour;
- Use relevant measures to route any concentrated runoff away from trails;
- Construct small bridges across wet soils in buffer zones where trails are to be maintained and avoid steep slopes as far as possible; and
- Consider using trail surface materials such as mulch or crushed gravel to reduce erosion risk within the buffer.

4.2.4 Vegetation Management

The following measures are to be strictly implemented during vegetation clearing for construction and any future site maintenance:

- Vegetation removal/stripping must be limited to the approved construction footprint;
- No clearing of indigenous vegetation outside of the defined working servitudes is permitted for any reason (i.e. for firewood or medicinal use);
- Grubbing is not permitted as a method of clearing vegetation and any trees needing clearing must be cut down using chain saws and hauled from the site using appropriate machinery where practically possible;
- Vegetation clearing/stripping must only be done as construction progresses to minimise areas of open areas with bare soil left standing for prolonged periods; and

- Access to sensitive habitat types (e.g. primary forest) outside of the construction zone is not permitted.

4.2.5 Protected Flora Management

Styles (2018) recommends that development should also avoid or minimize cutting or clearing of protected indigenous trees and where protected trees/plants are likely to be damaged or destroyed, the relevant permitting process will need to be followed according to the DEFF and/or EKZNW protocols. Ideally, plants should be rescued and translocated if possible, however for larger individuals this may not be possible and a suitable replacement strategy should then be formulated and implemented. Ultimately, a relevant Protected Plant/Tree Rescue and Translocation/Replacement Plan and Programme should be formulated and submitted together with the relevant permit applications to DEFF/EKZNW. This Plan will then form an Appendix to the FCMP for implementation purposes.

A map showing the location of protected trees identified on the properties to be developed, relative to the planned development footprints, has been included as Figure 4 (below). Protected tree species include:

- *Pittoporum viridiflorum* (Cheesewood)
- *Sideroxylon inerme* (White Milkwood)

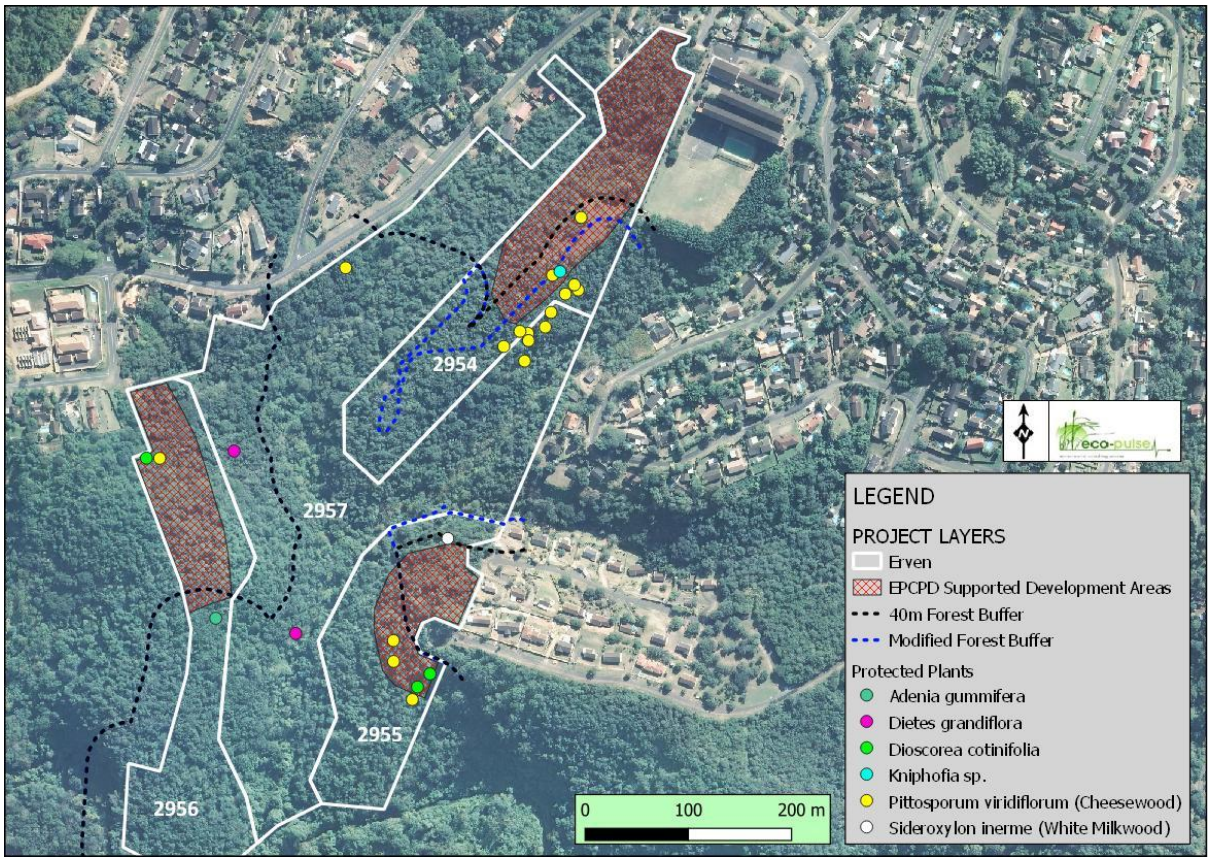

Figure 4. Map showing the approximate position of protected plant species identified in the vegetation assessment report (Styles, 2018) relative to forest buffer zones and the planned development footprint for each property.

The Styles (2018) vegetation assessment report also suggests that another protected tree species, *Milletia grandis* (Umzimbeet), may potentially be present within the forest on the properties (was seen just outside the properties) and this species may also therefore be relevant where observed within the planned development footprints.

There may also be a number of 'Specially Protected' plant species occurring within the forest and wooded areas on the site, including *Scadoxus membranaceus*, *Scadoxus puniceus* and *Dietes grandiflora* (among others that would need to be confirmed). These plants are specially protected in terms of Schedule 12 of the Natal Nature Conservation Ordinance (25 of 1974), and these plants require ordinary permits through Ezemvelo KZN Wildlife to destroy and/or remove / relocate these species.

4.2.6 Invasive Alien Plant Control

Styles (2018) suggests in the Vegetation Assessment Report for the development properties, that the main component of the site rehabilitation and management plan will be the "*control of alien vegetation within the remaining undeveloped forested areas*".

Annexure A: 'Background to IAPs and Legislative Requirements' at the back of this document contains background information to IAPs (Invasive Alien Plants) and the various legislative requirements pertaining to their control and/or eradication. This information was used to guide the necessary recommendations for eradicating/controlling IAPs on the properties of the planned development, including the remaining forest and woody vegetation to remain undeveloped on the site, and part of the area to be conserved and managed.

Invasive alien plant management is only effective if it is approached from the perspective that it is a systematic task that will take time and generally require an initial clearing action and a series of follow-up treatments before you start to see clear results (eThekwini Municipality, Ecofiles Sheet 4: Invasive Alien Plants). It is important that the alien control programme takes into consideration the setting of control, eradication and rehabilitation targets over the short, medium and long term.

The following alien plant control targets have been recommended for the project:

Target Area	Targets	Time Period	Level of Difficulty in Achieving Target
Forest Buffer Zones	Initial clearing of all Category 1 and 2 alien plants from forest buffer zones.	Year 1	Low
	Follow-up control of Category 1, 2 and 3 alien plants to achieve low infestation levels (5-15% cover) for forest buffer zones	Year 2	Moderate
	Follow-up control of Category 1, 2 and 3 alien plants to achieve maintenance [very low infestation levels (<5% cover)] for forest buffer zones.	Year 3	Moderate
Densely infested areas	Initial clearing of all Category 1 and 2 alien plants from densely infested areas.	Year 2	High
	Follow-up control of Category 1, 2 and 3 alien plants to achieve low infestation levels (5-15% cover) for densely infested areas.	Year 3	Moderate

Target Area	Targets	Time Period	Level of Difficulty in Achieving Target
	Follow-up control of Category 1, 2 and 3 alien plants to achieve maintenance [very low infestation levels (<5% cover)] for densely infested areas.	Year 4	Moderate
Remaining forest areas	Initial clearing of all Category 1 and 2 alien plants from remaining forest areas.	Year 3	Moderate
	Follow-up control of Category 1, 2 and 3 alien plants to achieve low infestation levels (5-15% cover) for remaining forest areas.	Year 4	Moderate
	Follow-up control of Category 1, 2 and 3 alien plants to achieve maintenance [very low infestation levels (<5% cover)] for remaining forest areas.	Year 5	Moderate

Based on the baseline vegetation assessment and report (Styles, 2018), the key IAP species present within habitats and vegetation communities on the properties assessed include:

Dominant alien woody (tree/shrub) species:

- ***Acacia mearnsii*** Black Wattle
- ***Ardisia crenata*** Coral-berry
- ***Casuarina equisitifolia*** Horsetail
- ***Cestrum laevigatum*** Inkberry
- ***Eucalyptus grandis*** Saligna Gum
- ***Eugenia uniflora*** Surinam Cherry /Brazillan Cherry
- ***Grevillea robusta*** Australian Silky-oak
- ***Jacaranda mimosifolia*** Jacaranda
- ***Litsea sebifera*** Indian Laurel
- ***Melia azedarach*** Syringa
- ***Montanoa hibiscifolia*** Tree Daisy
- ***Morus sp.*** Mulberry
- ***Pinus patula*** Patula Pine
- ***Psidium guajava*** Guava
- ***Ricinus communis*** Castor-oil Plant
- ***Schinus terebinthlfolius*** Brazilian Pepper Tree
- ***Senna didymobotrya*** Peanut Cassia
- ***Senna septemtrionalis***
- ***Solanum maurituanum*** Bugweed
- ***Tecoma stans*** Yellow Bells

Dominant smaller herbaceous/woody alien species:

- ***Ambrosia artemissifolia*** Ragweed
- ***Ageratum conzyzoides*** Blue Weed
- ***Andredera cordifolia*** Madeira Vine
- ***Arunda donax*** Spanish Reed
- ***Bidens sp.*** Blackiack
- ***Canna indica*** Indian Shot
- ***Cardiospermum grandiflorum*** Balloon Vine
- ***Catharanthus roseus*** Periwinkle
- ***Chromolaena odorata*** Triffid Weed
- ***Ipomea sp.*** Morning Glory
- ***Mimosa pigra*** Giant Sensitive Plant
- ***Pennisetum purpureum*** Napier Grass
- ***Lantana camara*** Lantana
- ***Rivina humilis*** Blood berry
- ***Solanum seaforthianum*** Potata creeper
- ***Stachytarpheta urticifolia*** Blue Porterweed
- ***Tagates minuta*** Khaki Weed
- ***Tithonia diversifolia*** Mexican Sunflower

There are various means of controlling invasive alien plants in South Africa. The primary methods are discussed below. The suitability of control methods depends on a number of factors, including practical constraints, economic constraints and applicability of methods for particular species of alien plants. It is generally advised that a form of integrated control be implemented, based on a combination of two or more of the control measures outlined below (depending of course on the species present at the site). Further information on species-specific control recommendations can be found in **ANEXURE A** of this document. Selection of the appropriate methods of control should be based on the following criteria:

- **Species to be controlled:** herbicides are registered for specific species. Selection should be based on "*A Guide to the use of Herbicides*" issued by the Directorate: Agricultural Production Inputs and labels and information brochures provides by herbicide suppliers.
- **Size/age of target plants:**
    - For **seedlings:** hand-pulling or hoeing and foliar applications of herbicides for dense stands.
    - For **saplings:** hand-pulling or hoeing, foliar applications of herbicides for dense stands, basal stem treatments and cut stump treatments recommended.
    - For **mature trees**: ring barking, frilling, basal stem treatments and cut stump treatments recommended.
- **Density of stands:** Overall applications of herbicide can be made to dense stands of seedlings or saplings. Where dense stands of large trees are present, treatment of standing trees may be appropriate to obviate the problem of disposing felled trees.
- **Accessibility of terrain:** In inaccessible areas, methods that rely on the minimum amount of transportation of equipment and chemical should be given preference.
- **Environmental considerations:** Riparian/wetland areas require a careful approach to treatment/control. Only herbicides approved for use in wetland/riparian areas are to be considered. Washing of equipment or disposal of any chemical substances is prohibited in or near areas where there is a potential risk of contamination of wetlands/riparian areas.
- **Desirable vegetation:** Control methods that will cause the least damage to desirable vegetation must be considered. Selective herbicides or mixes that will not damage other desirable vegetation should be applied where relevant.
- **Disposal of dead vegetation:** Where possible, utilizable wood should be removed after tree felling. This is also the case for trees that could cause the blockage of water courses. Brushwood should be spread rather than stacked to limit soil damage in instances where burning is planned.
- **Cost of application:** the cost of application and re-treatment should be taken into consideration when selecting methods/herbicides, etc.

BOX 1: Alien Plant Control Methods

The control methods detailed below have been adapted from the ARC-PPRI (Agricultural Research Commission: Plant Protection Research Institute) Weed Research Programme (online at www.arc.agric.za/arc-ppri/), the DWA Working for Water Programme ((http://www.dwaf.gov.za/wfw/Control/) and eThekwini Municipality's *Practical tips on the management and eradication of invasive alien plants* (EcoFiles Sheet 4. Local Action for Biodiversity).

1 Mechanical control

Mechanical control entails physically damaging or removing the target alien plant. Mechanical control is generally labour intensive and therefore expensive, and can also result in severe soil disturbance and erosion. Different techniques can be applied and include uprooting/hand-pulling, felling, slashing, mowing, ring-barking or bark stripping. This control option is only really feasible in sparse infestations or on a small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice (e.g. *Eucalyptus spp., Melia azedarach)* need to have the cut stumps or coppice growth treated with herbicides following mechanical treatment.

2 Chemical control

Chemical control involves the use of registered herbicides to kill the target weed. The use of herbicide is often essential to the success of an eradication/control programme as it greatly reduces the re-growth potential of alien plants. Unfortunately, if the wrong herbicide is chosen, one can potentially cause more harm than good to the environment. When choosing the most appropriate herbicide, one needs to consider the following:

- **Relative toxicity to humans/animals**
- **Selective vs non-selective herbicides**: There are advantages and disadvantages to using each type. When dealing with light to moderate infestations in grass-dominated veld types, a broad-leaf selective herbicide is recommended so as to reduce the danger that spray drift could kill natural grass. In areas of heavy infestation, a non-selective herbicide is recommended.
- **Residual effect**: Some active ingredients in herbicides will remain in the environment for months, even years, before denaturing. Others start to denature as soon as they enter the soil. If a persistent herbicide is used, ensure that it is not used near any watercourse or area with a high water table (such as wetlands & riparian areas).
- **Is the herbicide registered for the target species:** A list of registered herbicides can be obtained from the Department of Water Affairs: Working for Water Programme – Policy on the Use of Herbicides for the Control of Alien Vegetation (January 2002). Also see http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Specific-IAP-Species-and-their-control-according-to-botanical-names.aspx

Some additional recommendations regarding herbicide use include:

- Herbicides should be applied during the active growing season.
- Always observe all safety precautions printed on the labels and manufacturer's instructions when mixing and applying herbicide.
- Herbicides can be applied in various ways. They can be sprayed onto dense infestations or painted onto the main stem of the plant or cut stump.
- Spraying herbicide on small infestations is not recommended, rather cut and apply herbicide to the stumps either with a brush.
- Spraying should be restricted to windless days when there is less risk of droplets drifting onto non-target species.
- Pressure or flow regulators should be fitted to sprayers for overall application. Spraying should be restricted to plants waist height or lower, but also ensuring there is sufficient foliage to carry the applied herbicide to the root system of the target plant.
- For water-based applications, Actipron Super Wetter should be added where recommended on the herbicide label, at a rate of 1.75/ha for dense-closed stands of alien vegetation.
- For all water-based treatments, a suitable brightly coloured dye should be added to the mix to ensure that all target plants are treated. For diesel-based applications, Sudan Red Dye should be added.

3 Biological control

Biological weed control involves the releasing of natural biological enemies to reduce the vigor or reproductive potential of an invasive alien plant. Research into the biological control of invasive alien plants is the main activity of the Weeds Research Programme of ARC-PPRI and a list of biocontrol agents released against invasive alien plants in South Africa can be downloaded from their website. To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF).

4 Mycoherbicides

A mycoherbicide is a formulation of fungal spores in a carrier, which can be applied to weeds in a similar way as a conventional chemical herbicide (using herbicide application equipment). The spores germinate on the plant, penetrating plant tissues and causing a disease which can eventually kill the plant. Mycoherbicides are indigenous to the country of use and therefore are already naturally present in the environment and do not pose a risk to non-target plants. Under natural conditions they do not cause enough damage to the weed to have a damaging impact and are therefore mass produced and applied in an inundative inoculation, which leads to an epidemic of the disease knocking the weed population down. Mycoherbicides need to be re-applied at regular intervals.

5 Integrated control

It is frequently advisable to use a combination of two or more of the control method mentioned above, which is referred to as *integrated control*. Killing plants without cutting down causes the least disturbance to the soil and is the ideal.

The following integrated control options are available:

- **Hand pulling/uprooting:** This method should be reserved for small plants and shrubs (not recommended for trees with a stem diameter of more than 10cm). Grip the young plant low down and pull out by hand (using gloves).
- **Basal bark**: apply recommended herbicide mixed in diesel carrier to the base of the stem of trees (<25cm stem height) and saplings. Do not cut the bark. Apply herbicide mix with paintbrushes or using a coarse droplet spray from a narrow angle solid cone nozzle at low pressure.
- **Strip bark:** Using a bush knife, strip bark away from tree from waist height down to soil. Cambium is stripped with the bark. No herbicide used.
- **Ring barking**: Invasive trees growing away from any structures or roads can be ring-barked, poisoned and left standing rather than felled. They will slowly collapse over time and can establish habitat for birds, etc. Strip all bark and cambium from a height of 75cm to 100cm down to just below soil level. Cut a ring at the top and pull strips. All bark must be removed to below ground level for good results. Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out. Bush knives or hatchets should be used for debarking.
- **Frill:** Using an axe or bush knife, make angled cuts downward into the cambium layer through the bark in a ring. Ensure to effect the cuts around the entire stem and apply herbicide into the cuts.
- **Tree-felling:** Where trees can be felled and removed use chainsaws, bowsaws, brushcutters or machetes. Where trees are felled on slopes, they should be felled across the slope to act as natural barrier lines against soil erosion.
- **Cut stump treatment**: Apply recommended herbicide mixture to the cut surface with hand sprayers, a paintbrush or knapsack sprayer at low pressure. Apply only to the cambium or outer layer of large stumps and the entire cut surface of small stumps. Ensure the stumps are cut as low to the ground as practically possible (about 10 – 15 cm or as stipulated on specific herbicide label). Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.
- **Burning**: Spindly invasive alien plant species, such as Triffid Weed (*Chromolaena odorata*), growing on sandy soils, where there is between 30-40% grass still present, can be eradicated using annual controlled burns. Moderate to low infestations in wetland areas can be treated by controlled burning at the beginning of autumn, followed by mechanical removal or herbicide application in mid spring. *Note that no heavy machinery should be used to remove invasive alien plants, no matter how high the infestation, without prior authorization from relevant government departments when operating in wetlands and riverine areas.*

The relevant NEM:BA status/category, mitigation requirements and recommended control measures have been summarised below in Table 4 for each species.

Table 4. List of IAP species and relevant control / eradication recommendations.

Species Name	Growth Form	NEM:BA Category	Requirement	Recommendations
Acacia mearnsii Black Wattle	Tree	2	Eradicate	Cut-stump and treat, remove entire tree
Ardisia crenata Coral-berry	Shrub	1b	Eradicate	Physical removal, cut-stump and herbicide
Casuarina equisitifolia Horsetail	Tree	2	Eradicate	Cut-stump and treat, remove entire tree
Cestrum laevigatum Inkberry	Tree / Shrub	1b	Eradicate	Cut-stump and treat with herbicide (Triclopyr, Imazapyr), remove entire tree
Eucalyptus grandis Saligna Gum	Tree	2	Eradicate	Cut-stump and treat, remove entire tree
Eugenia uniflora Surinam Cherry /Brazillan Cherry	Tree	1b	Eradicate	Cut-stump and treat, remove entire tree
Grevillea robusta Australian Silky-oak	Tree	1b	Eradicate	Cut-stump and treat, remove entire tree
Jacaranda mimosifolia Jacaranda	Tree	1b	Eradicate	Chop down, cut-stump and treat
Litsea sebifera Indian Laurel	Tree	1b	Eradicate	Cut-stump and treat, remove entire tree, Basal stem treatment with herbicide
Melia azedarach Syringa	Tree	1b	Eradicate	Cut-stump and treat, remove entire tree

Species Name	Growth Form	NEM:BA Category	Requirement	Recommendations
Montanoa hibiscifolia Tree Daisy	Tree / Shrub	1b	Eradicate	Physical removal, cut-stump and herbicide
Morus sp. Mulberry	Tree	3	Control spread	Cut-stump and treat, remove entire tree
Pinus patula Patula Pine	Tree	2	Eradicate	Physical removal, cut-stump and herbicide
Psidium guajava Guava	Tree	2	Eradicate	Cut-stump and herbicide
Ricinus communis Castor-oil Plant	Tree / Shrub	2	Eradicate	Physical removal, cut-stump and herbicide
Schinus tererebinthlfolius Brazilian Pepper Tree	Tree	1b	Eradicate	Physical removal required (herbicide: Triclopyr)
Senna didymobotrya Peanut Cassia	Tree / Shrub	1b	Eradicate	Physical removal, cut-stump and herbicide
Solanum maurituanum Bugweed	Tree	1b	Eradicate	Cut-stump and treat
Tecoma stans Yellow Bells	Tree	1b	Eradicate	Physical removal required
Ambrosia artemissifolia Ragweed	Herb	-	Control spread	Hand-pull, apply herbicide
Ageratum conzyzoides Blue Weed	Herb	1b	Eradicate	Hand-pull, apply herbicide
Andredera cordifolia Madeira Vine	Creeper / climber	1b	Eradicate	Hand-pull, herbicide (spot spray: Triclopyr)
Arunda donax Spanish Reed	Reed / grass	1b	Eradicate	Dig out rhizomes, apply poison
Bidens sp. Blackiack	Herb	-	Control spread	Hand-pull, apply herbicide
Canna indica Indian Shot	Herb	1b	Eradicate	Hand-pull, apply herbicide
Cardiospermum grandiflorum Balloon Vine	Creeper / climber	1b	Eradicate	Hand-pull, apply herbicide
Catharanthus roseus Periwinkle	Flowering plant	3	Control spread	Hand-pull, apply herbicide
Chromolaena odorata Triffid Weed	Shrub	1b	Eradicate	Cut-stump and treat with herbicide, remove large plants
Ipomea sp. Morning Glory	Creeper / climber	1b	Eradicate	Hand-pull, apply herbicide
Mimosa pigra Giant Sensitive Plant	Shrub	1b	Eradicate	Chop down, uproot
Pennisetum purpureum Napier Grass	Reed / grass	1b	Eradicate	Chop down, uproot
Lantana camara Lantana	Shrub	1b	Eradicate	Cut-stump and treat with herbicide
Rivina humilis Blood berry	Herb	1b	Eradicate	Hand-pull, apply herbicide
Solanum seaforthianum Potato creeper	Creeper / climber	1b	Eradicate	Hand-pull, apply herbicide
Stachytarpheta urticifolia Blue Porterweed	Herb	3	Control spread	Hand-pull, apply herbicide
Tagetes minuta Khaki Weed	Herb	-	Control spread	Hand-pull, apply herbicide

Species Name	Growth Form	NEM:BA Category	Requirement	Recommendations
Tithonia diversifolia Mexican Sunflower	Shrub	1b	Eradicate	Chop down, uproot

4.2.7 Forest Rehabilitation

Styles (2018) suggests in the Vegetation Assessment Report for the development properties, that the main component of the site rehabilitation and management plan will be the ***"control of alien vegetation within the remaining undeveloped forested areas".***

There may however be incidences where large enough sections of forest within the undeveloped areas are cleared during alien removal/control or through unauthorized / accidental incursions/clearing during construction. For these areas, forest rehabilitation (beyond simply IAP control/removal) may be warranted. The exact areas where forest rehabilitation may be required will need to be confirmed once the initial phase of IAP clearing work has been completed or should there be any unauthorized / accidental clearing of forests outside of the approved development footprint. This is also in line with a number of laws that compel the rehabilitation of disturbed natural areas. Of particular importance is the requirement of 'duty of care' with regards to environmental remediation, stipulated in Section 28 of NEMA (National Environmental Management Act, Act 107 of 1998):

> **Duty of care and remediation of environmental damage**: *"(1) Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."*

Conceptual-level forest rehabilitation guidelines have therefore been prepared and are include in this section of the plan and provide a clear and practical means of implementing basic / simple post-construction revegetation of affected forest vegetation and habitat.

1. <u>General Land preparation measures</u>

The following are general land preparation requirements for all wooded areas requiring rehabilitation (prior to any re-vegetation occurring):

- All rubble, litter, foreign materials and waste products need to be removed from the construction area and disposed of at licensed local waste disposal/landfill facilities. Minimise additional disturbance of natural forest areas by limiting the use of heavy vehicles and personnel during clean-up operations.
- Any soil stockpiles/spoil material must spread evenly on the ground to match the natural slope.
- All Invasive Alien Plants (IAPs) and weeds must be removed from target sites, preferably by uprooting.
- All embankments are to be shaped to the specification of the project or recommendations of the engineer/ECO.
- Any erosion features within the construction site must be stabilised. Compacted soil infill, rock plugs, gabions, excavation and reshaping or any other suitable measures can be used for this purpose.

- Where significant soil compaction has occurred, the soil may need to be ripped in order to reduce its bulk density thus improving the chances that vegetation can become established at the site. Rip and / or scarify all disturbed and compacted areas of the construction site. The ECO, with the assistance of the engineer, will specify whether ripping and / or scarifying is necessary, based on the site conditions.
- Immediately after ripping and scarifying disturbed areas, about 300mm of topsoil must be applied on top. The thickness of the topsoil may be reduced at the instruction of the engineer only if the recommended 300mm of topsoil compromises the integrity of the works.
- Topsoil must be placed in the same area from where it was originally stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas. Where topsoil is lost during construction as a result of erosion, topsoil will need to be imported to the site and re-established. Such topsoil must be sourced commercially and legally.
- The topsoil must be compacted to similar compaction levels as natural soils in the area. The engineer will provide detailed advice on this.
- For seeding, the soil needs to be prepared to optimise germination. This is typically undertaken by hand hoeing to loosen the soil in the seedbed but should be firm enough to facilitate good contact between the seeds and the soil.

2. Stabilising steep slopes

The following is recommended for stabilisation of steep slopes:

- Prior to rehabilitation the site must be stabilised where necessary using soft interventions including Grass Fences, Sandbags, geo-cells, fibre rolls and creating benches on the slope. The purpose of these mitigation measures is to reduce soil erosion which may compromise rehabilitation efforts.
- Where necessary, sediment retaining structures such as silt fences, sandbags, hay bales, brush packs, timber logs must be placed in continuous lines across the slope at regular intervals. The interval between rows of sediment retaining structures will depend on the slope gradient. The steeper it is, the shorter the interval.
- Temporary sediment barriers will need to remain in place until such time as re-vegetation and stabilization of disturbed areas is judged to be a success and the risk of erosion/sedimentation has been reduced to a respectfully low level.
- Creating a benched slope will also help in controlling the velocity of runoff.
- It is important to note that bioengineering interventions are vulnerable to failure if not adequately implemented or poorly maintained.

3. Revegetation of disturbed terrestrial areas

Immediately after preparing the soil, re-vegetation must commence in order to help bind the soil and prevent soil erosion and to inhibit IAP/weed establishment which will compete with the natural vegetation for space, light, nutrients and water. In this regard, the following mitigation measures is to be implemented for disturbed wooded habitats/vegetation:

Re-vegetation Method 1: Planting of plugs / sprigs (for disturbed grassland areas)

The following recommendations apply to re-vegetation of areas disturbed during construction or through IAP clearing activities:

- Where large gaps in the riparian forest canopy have resulted (i.e. where indigenous vegetation has been replaced by dense alien plant infestations), it is recommended that herb, shrub and tree canopy cover components be reinstated appropriately.
- The timing of planting is best done shortly before or at the beginning of the growing season (i.e. spring, or at the onset/early summer).
- Once the soil surface is prepared and stabilised, plugs are to be established at moderate densities in alternating rows / patches with areas to be planted. The pattern of planting is to be determined as part of a detailed planting plan for implementation.
- When using vegetation plugs, the spacing of plugs should not be too wide and planting should be done in patches rather than wider spacing.
- If the soil into which the plugs are to be planted is dry, it will be necessary to add a suitable hydroscopic gel to the receiving cavity at the time the plug is planted (Granger, 2014).
- It is essential that when a plug is planted that the receiving cavity is slightly deeper than the length of the root ball so that when the cavity is pinched closed a slight depression remains around the base of the leaves. This is especially important if the plugs are small and planted into dry soil even though hydroscopic gel has been added to the cavity.
- Live plugs of suitable indigenous grasses can be obtained from a commercial source.
- Note that any harvesting from donor areas must be undertaken with caution so as not to unduly disturb the donor site. For whole/growing plants, ensure that plants are dug up with as much of their roots intact and such that the soil around the roots is not disturbed (i.e. intact root ball). Care also needs to be taken that weeds/alien plants are not transplanted with the donor plants.
- Collected plants should be replanted as quickly as possible following removal (i.e. within hours of harvesting).
- Large clumps of plants can be carefully separated into smaller clumps or into several individual stems with attached roots, known as slips.
- The plants should be planted with their roots in as much of the original soil medium as possible from which they were removed.
- When planting the material, dig a hole deep enough to ensure that the roots do not bend upwards.
- The soil around the plant should be firmly compacted.
- The following planting procedure applies for trees and shrubs:

    - All tree holes shall be square in plan (minimum of 600mm length x 600mm width x 700mm deep).
    - Holes are to be backfilled with excavated soil in a ratio of 3:1 with compost. Where possible, any available topsoil should be placed in the hole at the level where the tree root ball will rest.
    - All trees shall be tied (using a tree tie) to a suitable timer stake planted in the ground to a depth of at least 500mm. The stake shall have a minimum diameter of 35mm and shall be at least 300mm taller than the planted tree.
    - The planting of shrubs will be in accordance with the tree planting method with the exception that the holes are to be smaller.
    - Do not plant trees in straight lines but at random with approximately 3-5m gaps between trees.
    - Indigenous tree and shrub species identified as important in the original Vegetation Assessment (David Styles, 2018) should be considered when developing a tree/shrub planting palette, supplemented with species appropriate to coastal forests in the Region. These plants can be sourced from local nurseries and specifications regarding plant size and height are at the discretion of the contractor and developer.

- Temporary erosion protection measures must only be removed once good vegetation cover has established.
- It is essential that survival of all plants be monitored closely for at least the first eight weeks from the day following their planting and any dead plants be replaced as soon as possible.
- No exotic/alien plants are to be used in re-vegetation.

Re-vegetation Method 2: Seeding by broadcasting or hydroseeding (for areas with bare soils/completely cleared of vegetation)

- Hydroseeding or manual broadcasting of seed is the second preferred option to re-vegetating slopes and areas with bare soils completely void of vegetation. The advantages of hydroseeding include faster germination, increased plant survival, and the ability to cover large, often inaccessible areas rapidly.
- The slurry (basic materials) for hydroseeding must consist of water, seed, fertiliser, anti-erosion compounds (soil binders) and organic supplements to enhance grass growth.
- Prior to seeding, water must be sprayed over the target area to provide added moisture.
- The target groundcover of re-vegetated areas shall be no less than 80% of specified vegetation and there must be no bare patches of more than 500 x 500 mm in maximum dimension.
- Ideal species for seeding are mat forming or tufted pioneer grasses that can become quickly established at the site to provide immediate cover in order to stabilise soils and reduce erosion risk. Recommended pioneer grasses for attaining an initial cover at disturbed sites (based on the climate and soil occurring at the site) may include a number of fast-growing and mat-forming (stoloniferous or rhizomatous) runner grasses such as *Cynodon dactylon*[3] (Couch grass) and *Chloris gayana* (Rhodes grass).
- No exotic/alien plants are to be used in re-vegetation.

4. <u>Post-revegetation</u>

- Immediately after planting the recommended seed mix (hydroseeding / broadcasting of seed), slopes may be covered with an erosion control blanket such as a SoilSaver, which serves to conserve moisture and hold seeds and soil firmly in place.
- The SoilSaver will require pegging with wooden pegs which can be made from vegetation cleared from the construction footprint.

4.2.8 Landscaping Recommendations

It is recommended that landscaping promote the use of indigenous species common to the region and that as much natural ground cover is established (naturally) on the site to help with binding soils and encouraging water infiltration, thus reducing overland flows and the pressure on stormwater management infrastructure.

Species such as *Ficus natalensis / Ficus sur* (Fig trees) and *Acacia xanthophloea* (Fever tree) are not recommended for use near roads, wastewater and storm water infrastructure, swimming pools and houses as their extensive rooting systems can damage road and subsurface drainage infrastructure.

[3] Note that *Cynodon dactylon* has recently been listed as an "invasive" species in terms of NEMBA and requires a plant permit to be obtained for the use this species in planting projects. A sterile (non-invasive) cultivar should be sourced if this species is to be used and the relevant permit obtained.

4.2.9 Erosion Control

Forests are particularly vulnerable to erosion due to inherently sparse ground cover associated with these ecosystems (EKZNW, 2013). Land slopes exceeding 1 in 10 have been documented in the literature as being particularly significant in increasing erosion risk to downslope areas (Finér *et al*., 2018 ; Bentrup, 2008). Given that the average slopes for the properties concerned have been estimated to range between 1:2.5 (40% slope) and 1:3.5 (30% slope) (based on available 2m elevation contours and calculations performed using GIS), erosion risk is considered to be potentially of high significance at the site.

Given the steep slopes and soils that characterise the majority of the site, erosion control will be particularly important during the construction and operational phases. The following measures to control erosion risk:

- According to EKZNW (2013), buffers from activities that tend to exacerbate erosion risk should be large enough to protect the forest and ecotone. Erosion risk has therefore been factored into forest buffer zone recommendations and these are contained in Section 4.3.2.
- Buffer zones will also need to be maintained with sufficient vegetation cover to reduce erosion potential (refer also to Section 4.3.2 for further guidance).
- It needs to be recognised that buffer zones for steep sloping sites and where concentrated flows may be involved are likely to have limited effectiveness for reducing concentrated flow/gully formation and in trapping sediment - regardless of their size and state (Baumhardt & Blanco-Canqui, 2014 ; Hebblethwaithe & Somody, 2008 ; Bentrup, 2008). In this instance, rather than relying on buffer zones, buffer should be viewed as one of a number of possible approaches and specific 'source-directed controls' aimed at controlling surface flow volumes and velocity are recommended as part of a broader suite of best management practices to reduce erosion risks & impacts (Macfarlane & Bredin, 2016) – *see site control measures and recommendations below.*
- During construction, best practice erosion control measures will need to be implemented as follows:
    - Wherever possible, existing vegetation cover on the development site should be maintained during the construction phase (particularly the recommended forest buffer zones);
    - The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes which will not be developed;
    - Clearing activities must only be undertaken during agreed working times and permitted weather conditions - if heavy rains are expected, clearing activities should be put on hold;
    - All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of hay-bales, sandbags and/or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2m) to break the energy of surface flows;
    - Once shaped, all exposed/bare surfaces and embankments must be re-vegetated immediately;
    - If re-vegetation of exposed surfaces cannot be established immediately due to construction phasing issues, temporary erosion and sediment control measures must be maintained until such a time that re-vegetation can commence;
    - All temporary erosion and sediment control measures must be monitored for the duration of the construction phase and repaired immediately when damaged;
    - All temporary erosion and sediment control structures must only be removed once vegetation cover has successfully recolonised the affected areas;
    - After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately - erosion rills and gullies must be filled-in with

appropriate material and silt fences or fascine work must be established along the gulley for additional protection until vegetation has re-colonised the rehabilitated area.

- During operation, the management of storm water runoff from the site will be of key concern. The development of a suitable SWMP (Storm Water Management Plan) will be crucial and will need to integrate SUDS (Sustainable Urban Drainage Systems) principles as far as possible. This must include relevant attenuation and velocity control measures aimed at reducing erosion potential at all storm water outlets to the environment. The following recommendations are to be considered when developing and implementing the SWMP for the site:
    - Stormwater needs to be attenuated within the development footprint to pre-development levels prior to discharge to the environment. Infrastructure for attenuating storm flows needs to be located outside of the forest conservation areas and buffers where possible.
    - Wetlands/rivers are not to be relied upon for any attenuation capacity.
    - Onsite water harvesting measures for rainwater are recommended where possible.
    - Possible recycling of grey water is recommended where possible.
    - Where bulk collection points are unavoidable, bulk attenuation interventions / structures will need to be installed to attenuate and treat the bulk runoff volumes prior to discharge to the environment.
    - In terms of general stormwater conveyance, stormwater runoff generated by developed and hardened surfaces should be directed into, and conveyed by, open, impermeable[4] swales rather than into underground piped systems or concrete V-channels wherever feasible and practical. These features should be well vegetated with appropriate species and stabilised by means of gabion or concrete check walls to prevent erosion and vertical incision. This will provide for some filtration and removal of urban pollutants (e.g. oils and hydrocarbons), provide some attenuation by increasing the time runoff takes to reach low points, and reduce the energy of storm water flows within the stormwater system through increased roughness when compared with pipes and concrete V-drains.
    - Wherever possible, the gradient of bulk collector pipes and discharge pipes should be reduced as far as practically possibly so as to not unnecessarily increase the velocity of flows after onsite attenuation.
    - Many smaller stormwater outlets must be favoured over a few large outlets. This also applies to roads.
    - All stormwater outlets must be designed to dissipate the energy of outgoing flows to levels that present a low erosion risk. In this regard, suitably designed energy dissipation (e.g. stilling basins) and erosion protection structures (Reno-mattresses) will need to be installed at appropriate locations. Pre- and post-discharge velocities at each outlet should be calculated to inform the appropriate design of the energy dissipation and erosion protection measures. All erosion protection measures (e.g. Reno-mattresses) must be established to reflect the natural slope of the surface and located at the natural ground-level.
    - Measures to capture solid waste and debris entrained in stormwater runoff must be incorporated into the design of the system and should include the use of either curb inlet/inlet drain grates and/or debris baskets/bags.
    - All stormwater generated from urban surfaces must ideally receive basic filtering and treatment onsite prior to discharge into the environment. The higher the watercourse pollution risk, the more stringent the basic treatment methods.

[4] Minimal infiltration will likely be planned within/on each platform.

4.2.10 Waste Management & Pollution Control

Waste in the form of hazardous substances/chemicals, rubble and construction debris and general litter has the potential to contaminate the environment and be transported via wind/water to areas further afield. These waste products pose a great risk of environmental degradation that can persist for long periods of time. Guidelines to manage waste appropriately in order to prevent environmental degradation and pollution are dealt with below:

- The contractor shall be responsible for the establishment of a refuse control and removal system that prevents the spread of refuse within and beyond the construction site;
- Builders' rubble and other construction debris shall be confined to the site and shall not be stored or discarded on any open space outside the construction area;
- Water from washing concrete-mixing equipment (mixers and the like) shall not be discharged into natural areas. Such activities shall be managed to limit impacts on the environment;
- Refuse and solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste, etc. must be controlled and appropriately removed from the site;
- The contractor shall ensure that all refuse is disposed of in adequate refuse bins which the contractor shall supply and arrange to be emptied on a regular basis;
- Waste shall be separated and reused / recycled as far as possible;
- Refuse shall not be burned or buried on or near the site;
- The site is to be cleaned and cleared of waste, including litter and building materials, on a regular basis;
- The contractor shall be warned, in writing, of any infringement and shall be expected to clear litter or other waste within 24 hours of the notification; and
- A culture of "conserve, reduce, reuse & recycle" should be promoted with regards to the use and disposal of products to minimise resource consumption and reduce the amount of potential waste.

4.2.11 Fire Management

Forest ecosystems typically develop in the absence of regular fire. Therefore, fire is not prescribed as a suitable environmental management tool for the various properties, for the control of weeds and alien plants for example, and fire is to be avoided both during construction and operation. Strict fire controls are therefore to be implemented, including:

- Ensure that workers are aware of the potential for fires and the damage that could be caused;
- Contractors shall take all reasonable measures to ensure that fires are not started as a result of negligence of contractor employees (e.g. cigarettes);
- Basic functional fire-fighting equipment shall be made available on site at all times;
- The contractor shall notify the site supervisor / relevant person in charge in case of a fire starting on site;
- Strict controls on the storage and use of flammable substances are to be enforced;
- All relevant national, regional and local legislation with regard to the transport, use and disposal of hazardous and/or flammable materials shall be strictly complied with and advice of the manufacturer (e.g. MSDS - Material Safety Data Sheets) with regard to the safe handling and disposal of hazardous materials shall be obtained;
- No burning of waste or vegetation on site or within undeveloped areas; and
- Smoking to be prohibited within wooded areas and permitted only in open areas.

4.2.12 Wildlife Management

Working and residing in and adjacent to natural wooded areas often means that wildlife and habitat may be affected in a negative sense. The following guidelines should be followed for managing local wildlife in natural wooded areas:

- No wild animal may under any circumstance be hunted, snared, captured, injured, killed, harmed in any way or removed from the site;
- The feeding, or leaving of food, for animals in the area must be strictly prohibited;
- Species may not be killed or otherwise deliberately disturbed, including snakes and species considered vermin (such as monkeys, mice and rats);
- Should fauna (animals) be encountered they should be safely relocated to a suitable site;
- Experts should be consulted for handling any dangerous or potentially venomous species, such as snakes; and
- All vehicles accessing the site should adhere to a suitably low speed limit (30km/h is recommended) to avoid collisions with susceptible species such as reptiles (snakes and lizards).

4.2.13 Noise control

Noise pollution from vehicles, machinery and laborers can affect local wildlife and becomes a nuisance to neighbouring areas. The following guidelines are proposed to manage noise levels generated during construction activities:

- Local/Municipal and Provincial Noise Regulations shall be complied with at all times.
- Construction shall be limited to normal working hours, in order to limit disturbance from vehicles and construction activity. Working hours for all operations shall be limited to between 08h00 and 17h00 on weekdays. No work shall take place on a Saturday, Sunday and or Public Holidays. Any deviations to these work hours shall be cleared with the ECO prior to implementation.
- Every effort shall be made to limit exceedingly noisy activities. Construction vehicles shall be in good working order such that they do not create a noise nuisance. No amplified music shall be allowed on site. Sound amplification equipment is not to be used on site unless for an emergency situation.

4.2.14 Heritage Resources

Should any artifact / suspected artifact / site of cultural significance be encountered during construction, then the Contractor must cease work in that vicinity and alert the relevant authorities. AMAFA (the provincial heritage resources authority in KZN) has offices located in Pietermaritzburg and can be contacted at (+ 27) 33 394 6543. Also see: https://www.heritagekzn.co.za/

4.2.15 Contingency Measures

The contractor shall ensure that there is an emergency procedure in place to deal with accidents and incidents and must ensure that all employees are aware of such procedures.

Contingency measures will need to be considered for the site in order to address potential emergency and unforeseen situations that may include (but are not necessarily limited to):

- Uncontrolled fire or explosion;
- Mass failure of steep slopes / embankments due to soil erosion;
- Failure of any planned rehabilitation interventions;
- Failure of storm water infrastructure;

- Failure of wastewater (sewage) infrastructure;
- Spillage of waste or water containing waste into the environment; and
- Other unforeseen environmental situations / hazards.

Note that the development of detailed contingency measures for the above potential risks/hazards is beyond what the FCMP attempts to address or achieve and should rather be considered as part of a site-wide emergency response and preparedness plan (as required).

4.3 Timeframes for Implementation

Preferably, the implementation of the FCMP should coincide with the construction phase of the project, with various measures to be implemented during construction and others post-construction and additional measures during the longer-term operational phase of the housing development. Broad timeframes are provided in Table 5 for the various measures associated with each project phase.

Table 5. Broad timeframes for implementing key measures per project phase.

Project Phase	Management Measure(s)	Recommended Timeframes for Implementation
Pre-construction Phase	Apply to DEFF for license/permit to clear 'forest areas' within the development footprint/buffer zone	Prior to construction activities commencing.
	Prepare protected tree/plant translocation and/or replacement plan	
	Apply to DEFF and EKZNW for permits for protected plant species to be destroyed / relocated	
	Undertake protected plant translocation / relocation	
	Forest buffer zones and 'No-Go' areas demarcation	
Construction Phase	Buffer zone maintenance	For the duration of the construction phase.
	IAP (Invasive Alien Plant) control	
	Erosion control	
	Waste management	
	Fire management	
	Wildlife management	
	Noise control	
	Heritage resources management	
	Rehabilitation of buffer zones and any forest areas outside of the development footprint disturbed during construction	To be implemented immediately as concerns arise or at the completion of the construction phase.
	Contingency measures	To be implemented on an 'as needed basis' should any unforeseen incidents take place (such as a fuel/oil spill, etc.)
	Monitoring	Regular ECO monitoring for the duration of the construction phase, as per the requirements of the EMPR and conditions of the Environmental Authorization.
	Buffer zone maintenance	For the duration of the construction phase.
Post-construction & Operational Phase	IAP (Invasive Alien Plant) control	On-going during long-term operational phase, recommended follow-up control frequency every 3-6 months, depending on infestation levels.
	Erosion control	On-going during long-term operational phase, particularly during the wet summer season.
	Waste management	On-going during long-term operational phase.

Project Phase	Management Measure(s)	Recommended Timeframes for Implementation
	Fire management	On-going during long-term operational phase, particularly during the dry winter season.
	Wildlife management	On-going during long-term operational phase, particularly during the wet summer season.
	Contingency measures	To be implemented on an 'as needed basis' should any unforeseen incidents take place.
	Monitoring	On-going during long-term operational phase (see monitoring recommendations below).

4.4 Monitoring Recommendations

It is essential to know, and to be able to demonstrate to others, that the Forest Conservation Management Plan (FCMP) is being or has been successfully implemented and that the vision and objectives have been achieved within permissible limits. It will also be necessary to evaluate whether the aims, objectives and targets of the management plan have been successfully achieved.

Monitoring then forms the basis for evaluating the performance of any management / rehabilitation / remediation activity, which is defined as the extent to which an action plan has achieved what it set out to do. Without appropriate monitoring, it will be impossible to gauge the level of success of the wetland rehabilitation and management planned for the project. Furthermore, natural ecosystems such as forests are known to be inherently dynamic systems that may not always respond predictably to impact mitigation and management measures. It is therefore also important to recognize that forest conservation and management should be viewed as a 'process', driven by ecological knowledge and research rather than simply the 'product' of specific rehabilitation and management activities (Cooke and Johnson, 2002). In this regard, monitoring can assist greatly in identifying any potential unforeseen problems that may occur during the implementation process, which if left uncorrected could undermine the success of forest management for the target properties.

Monitoring will generally be required during all phases of the project, including the long-term/lifespan of the residential development, in order to ensure that the remaining forest patches are not negatively impacted and such that their current ecological state and functioning is maintained and possibly even improved or enhanced wherever possible. Monitoring will also assist with identifying any problems requiring further management/mitigation and addressing these timeously and appropriately through the implementation of the relevant management recommendations and guidelines presented in this document. It is therefore recommended that monitoring be implemented in accordance with the following guidelines.

4.4.1 Approach to Monitoring

The general approach to monitoring adopted in this document provides a means of monitoring changes to natural wooded (forest) habitats and vegetation communities potentially affected by development activities and identifying impacts/problems, their causes and ways of managing/mitigating impacts. The monitoring is intended to be proactive in terms of managing impacts to forest ecosystems and associated biodiversity. This should be achieved by using the outcomes of monitoring to inform the management of development activities. The approach typically relies on more rapid assessment techniques that rely mainly on visual observations of changes/impacts to natural areas and which can

be undertaken cost-effectively and regularly, rather than costly and intensive technical monitoring which could probably be performed at less frequent intervals.

4.4.2 Rapid Visual Monitoring

This involves the regular monitoring of forest habitat and vegetation on the property that may be affected by the development, in order to ensure that potential risks and impacts are being effectively managed through the management measures and principles contained in this FCMP. This will be achieved through basic visual inspections by the landowner and support staff, documenting issues such as:

- Alien Invasive Plant infestations;
- Erosion features such as gulley's/donga's and headcuts;
- Scouring and deposition associated with storm water runoff;
- Blockage of any road culverts/pipes;
- Sedimentation within forests and buffer zones;
- Erosion and soil compaction, vegetation loss/damage within buffer zones; and
- Slope erosion and collapse / mass failure (general slope instability concerns).

Annexure B of the FCMP contains a number of useful rapid survey methods and data capture sheets that could be used to facilitate the long-term management of wetland habitat at the site. These include:

- **B1:** Rapid habitat disturbance survey: method and checklist
- **B2:** Alien plant survey: data capture sheet assessing IAP cover
- **B3**: Visual survey of erosion/siltation

4.4.3 Monitoring Targets & Performance Indicators

It should also be made clear through regular monitoring undertaken, as to whether further monitoring will be required, whether monitoring has picked up critical issues that need addressing or the need for further management interventions that will be required to successfully fulfil the management objectives for the site. The evaluation of monitoring outcomes and recommended actions could be undertaken using a management effectiveness rating scheme, such as the one outlined in Table 6.

Table 6. Example of a rating scheme used in monitoring management effectiveness.

Level of Management Effectiveness	Outcome of Monitoring of Management Intervention(s)	Recommended Action(s)
5: Excellent	Management and/or rehabilitation is generally progressing as expected.	No action required
3: Good	Management and/or rehabilitation progress is slower than expected but will probably meet the objectives within a reasonable amount of time. Additional intervention may be required to keep management/rehabilitation on course.	Maintenance of objectives
2: Poor	Significant changes in parts of the implemented management plan might be needed. These might entail revisiting the overall plan as well as considering changes in the design of individual components and types of intervention planned.	Modifications to management plan elements
1: Very Poor	Monitoring might indicate that management/rehabilitation is not progressing towards meeting the objectives but is progressing toward a system that has other desirable functions or goods and services. In this case, the most cost-effective action may be to modify the management objectives rather than to make extensive intervention changes to meet the original objectives.	Modification of objectives
0: Non-compliance	Monitoring indicates that management and/or rehabilitation activities are currently not currently fulfilling the management objectives. Revisiting the overall plan as well as considering changes in the design of individual components and types of intervention planned will be necessary.	Assess and refine management plan

Key performance areas to monitor and report on management effectiveness in the long-term (using the scheme in Table 6) have been summarised for the forested areas on the development properties and are included in Table 7. A monitoring performance review template for potential use for forest habitat monitoring in the long-term has been included as Box 2.

Table 7. Key performance areas to monitor and report on forest management effectiveness.

No.	Performance Indicators	Description
1	**Implementation of the management plan**	*Have management activities been implemented successfully?*
2	**Forest habitat condition**	*How has the condition of habitat changed?*
3	**Alien plant levels**	*What are the levels of alien infestation?*
4	**Vegetation composition**	*Are the correct species occurring in the desired locations as per a detailed rehabilitation and/or landscaping plan?*
5	**Erosion & sedimentation risks**	*Are there any erosion/sedimentation risks?*
6	**Water quality**	*Are there any water quality issues/risks?*

Box 2. Monitoring Performance Review Template (adapted from USACE, 2008)

1. **Overview of Monitoring Requirements:**
   - Description of monitoring undertaken, timing and frequency.
   - Map showing the location of interventions and monitoring points (where applicable)
   - Photographic record of the site with accompanying map showing location of -point photos.

2. **Summary of Monitoring Results:**
   - List of performance indicators and success standards.
   - Table of monitoring results compared with baseline data (where applicable).
   - Summary of success standards including an evaluation of whether management is successfully achieving these standards or trending towards success. Examples of key questions to ask include:
     - Were the **outputs of wetland rehabilitation** achieved or completed to specification and in the appropriate time?
     - Were any **problems during implementation** of rehabilitation and site management identified and corrective actions appropriately implemented?
     - To what degree **were success standards met**?
     - Were the **outcomes in relation to the defined management objectives** achieved?
     - Was **project risk** dealt with adequately?
     - To what degree were **existing and potential future threats** identified and were these threats catered for in the management of the site (i.e. were they monitored and accounted for)?
   - Summary of any problems or significant events that occurred on the site that may affect the long-term success of wetland management.

3. **Describe Management Interventions/Remedial actions**:
   - Concisely describe any management/remedial actions done during the implementation and post-implementation phase monitoring to meet the success standards – actions such as removing debris, replanting, controlling invasive plant species, etc.

4. **Summary of Progress and Way-Forward**:
   - Summary of progress made in wetland management and what needs to be done going forward to meeting the objectives of the plan based on monitoring outcomes.
   - Outcomes to feed into management and review of the management plan where necessary.

4.5 Adaptive Management & Review of the FCMP

Active review and refinement of the plan is generally encouraged so long as updates are clearly identifiable and communicated to the relevant stakeholders.

4.5.1 Adaptive Management

The FCMP is intended to be a 'living document' that can be easily updated and informed by an 'adaptive management' approach to forest management, conservation and impact mitigation. This will ensure that the Plan remains current and relevant in the face of potentially changing environmental conditions.

The principle of 'Adaptive Management' involves a structured, iterative process in which decisions are made using the best available information, with the aim of obtaining better information through monitoring of performance (see diagram in Figure 5). This process enables those responsible for managing the site to:

- Learn through experience;
- Take account of, and respond to, changing factors that affect the site;
- Continually develop or refine management processes; and
- Demonstrate that management is appropriate and being effectively undertaken.

In this way, decision making is aimed at achieving the best outcome, whilst accruing the information needed to inform and improve future management of the site. This can and usually does lead to the revision of a part, or if necessary, the entire management plan to better suit the needs of the site and the stakeholders engaged in the process.

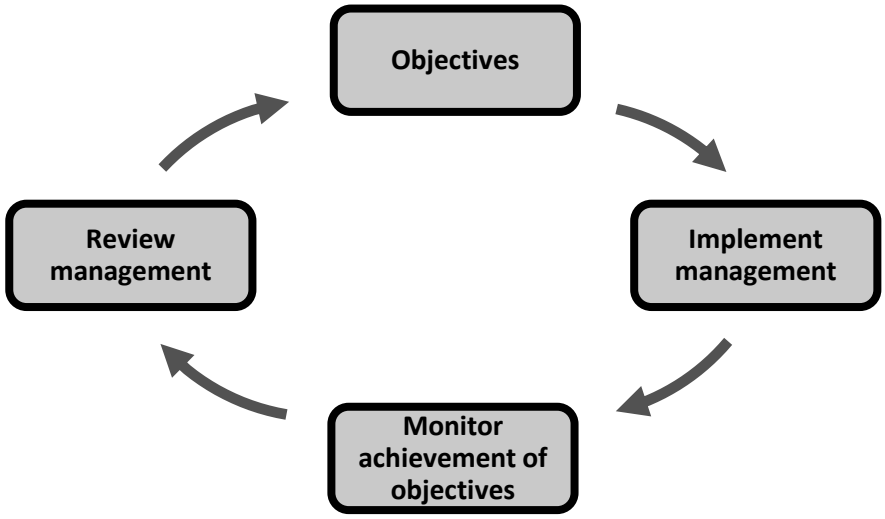

Figure 5. The 'adaptive management' cycle.

4.5.2 Record of Revisions

None.

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6 ANNEXURES

Annexure A: Background to IAPs and Legislative Requirements.

Alien plants are non-indigenous plants that are foreign or "exotic" species introduced from other countries, either intentionally (for domestic or commercial use) or accidentally. Some alien plants are regarded as being "invasive" species (Invasive Alien Plants or IAPs) that have the ability to reproduce and spread without the direct assistance of people (WESSA, 2008). Alien plants become invasive for a number of reasons (e.g. local environmental conditions are superior to their native country of origin, plants are immune to negative environmental effects such as disease/parasites that indigenous varieties are susceptible to and alien plants may be naturally fast growers that rapidly colonise natural areas).

Box 3. Negative Effects of Alien Plants on Biodiversity

While invasive alien plants can bring certain benefits, these benefits are generally outweighed by the negative impacts, which may continue to grow unless more effective solutions to alien plant control can be identified and implemented (Mooney, 2005). IAPs are widely regarded as the single greatest threat to South Africa's biodiversity, water security and productive use of land as they can rapidly colonise natural habitat and out-compete/replace indigenous vegetation (Robertson *et al.,* 2003). Alien plant invasions are a large and growing threat to ecosystem integrity in many parts of the world, where they negatively affect the structure and functioning of ecosystems (Mooney, 2005). They are known to negatively affect the delivery of ecosystem goods and services provided by indigenous vegetation, such as water purification and nutrient cycling. In South Africa, the annual economic cost of alien plant invasions at current levels of invasion (2008) was estimated to be R 6.5 billion, and it has been suggested that had no control been carried out, the annual economic losses from alien plant invasions would have been as high as R 41.7 billion (Van Wilgen *et al.,* 2012). A substantial portion of these savings, depending on the group of plants, arose from the biological control of invasive alien plants.

Some of the benefits of eradicating/controlling alien plants include an increase in the value of a property, increased productivity of land, improved aesthetic value, improved capacity for biodiversity maintenance, increased natural plant diversity, better soil properties (e.g. more stable soil pH), improved soil water levels and more efficient nutrient recycling ability (eThekwini Municipality, Ecofiles Sheet 4: Invasive Alien Plants). Preventing or reversing the negative ecological/biological impacts associated with invasive alien plants (IAPs) is the primary goal of IAP control programs, and is an extremely important component of natural resource management (Mooney, 2005). These call for reducing the risk of new introductions of invasive species, the control of existing invasions to mitigate impact and the establishment of management and legislative capacity to guide implementation (Van Wilgen *et al.,* 2012). The following are considered critical for increasing the effectiveness of alien plant control strategies according to Van Wilgen *et al.* (2012):

- In areas where control programs have focused on smaller areas and adhered to systematic control schedules, substantial progress has been made;
- Investing an appropriate portion of funds into the prioritization of control operations, planning, monitoring and evaluation;
- Implementation of clear, time-based targets;
- Improved integration of mechanical, chemical and biological control;
- Dealing with conflicts (several important invasive alien plant species bring both benefits and negative impacts);
- The need for on-going monitoring and evaluation to keep track of the effectiveness of operations and to inform adaptive management; and
- Adopting a framework of adaptive management to allow for ongoing improvement of management in a complex environment where the outcomes of management cannot be accurately predicted.

From a legislative perspective, national legislation governing alien plants in South Africa are contained under the Conservation of Agricultural Resources Act 43 of 1983 (CARA) and the National Environmental Management Biodiversity Act 10 of 2004 (NEMBA). CARA was originally enacted to regulate IAPs that may have an impact on agricultural resources, but in the absence of alternate relevant legislation, CARA regulations have been applied to date in order to regulate IAPs that impact on biodiversity, water resource management and fire management (Badenhorst, 2011). CARA was revised in 2001 and is administered by the National Department of Agriculture Forestry and Fisheries. CARA and NEMBA both include categorised lists of IAPs with associated instructions on the control and eradication of IAPs. The lists differ in content, with the NEMBA list including an additional 47 species to that contained in the CARA, bringing the total list of IAPs to 345. This includes the "X-list", a list of species which are pending formal categorization.

The NEMBA or National Environmental Management: Biodiversity Act (No. 10 of 2004) provides for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act No. 107 of 1998 (NEMA). The NEMBA regulates all invasive organisms, with flora contributing only partly to the overall list of taxa presented in the Act. The drafting of new legislation under NEMBA proposes invasive alien plant regulations that "radically reforms South Africa's IAPs legislation, as it contains provisions with specific relevance to IAPs and emerging species control" (Badenhorst, 2011). The new NEMBA: Alien and Invasive Species Regulations (August 2014) are contained within Government Gazette No. 37885 (Vol. 590) with a list of Invasive Alien Species contained within Government Notice 599 (Government Gazette No. 37886). These regulations were issued on 1 August 2014 and will automatically come into effect on 1 October 2014 (60 days from date of issue). A summary of the latest (August 2014) NEMBA: Invasive Species legislation has been provided in the text below. This forms the legislative background to this Invasive Alien Plant Management Strategy.

Restricted activities in terms of NEMBA:

Any species designated under section 70 of NEMBA (i.e. Lists of invasive species) will not be permitted to be propagated, grown, bought or sold without a permit (these activities are considered restricted activities involving listed invasive species that require a permit under Chapter 7 of the Act). Under section 69 of NEMBA, should an alien species establish itself in nature as an invasive species because of the actions of a specific person, a competent authority may hold that person liable for any costs incurred in the control and eradication of that species. In addition to those activities defined in terms of NEMBA, a number of additional restricted activities have also been identified in Government Notice R. 598 National Environmental Management: Biodiversity Act (No. 10 of 2004): Alien and Invasive Species Regulations, 2014, as contained within Government Gazette No. 37885 (Vol. 590), 1 August 2014. These include:

- spreading or allowing the spread of, any specimen of a listed invasive species;
- releasing any specimen of a listed invasive species; and
- the transfer or release of a specimen of a listed invasive fresh-water species from one discrete catchment system in which it occurs, to another discrete catchment system in which it does not occur; or, from within a part of a discrete catchment system where it does occur to another part where it does not occur as a result of a natural or artificial barrier.

Plants are categorized according to the NEMBA *Alien and Invasive Species List 1: National list of Invasive Terrestrial and Fresh-water Plant Species*, contained within Government Notice 599 (Government Gazette No. 37886, 1 August 2014) in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). NEMBA classifies three categories of invasive alien plants according to Government Notice R. 598 National Environmental Management: Biodiversity Act (No. 10 of 2004): Alien and Invasive Species Regulations, 2014, as contained within Government Gazette No. 37885 (Vol. 590), 1 August 2014. These categories and relevant management requirements are summarized in Table 1, below. Note that some species which are beginning to display invader species tendencies (and need to be controlled) have not yet been included in the NEMBA list of

invasive species. A number of these species are being investigated by the South African Biodiversity Institute (SANBI): Emerging Weeds Early Detection and Rapid Response (EDRR) Project, and once scientifically verified, these species may then be categorized under the NEMBA.

Table 8. NEM:BA categories for IAPs with relevant management requirements.

NEM:BA Category	NEM:BA Management Requirements
1a	Category 1a invasive species are those species listed as such by notice in terms of section 70(1)(a) of the NEM:BA as species which must be combated or eradicated immediately. By law, any specimens of these plants require compulsory eradication from the environment (to be removed and destroyed so they can no longer persist in the environment). No permits will be issued for Category 1a species. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the NEMBA, a person must combat or eradicate the listed invasive species in accordance with such programme.
1b	Category 1b invasive species are those species listed as such by notice in terms of section 70(1)(a) of the NEM:BA as species which must be controlled. By law, any specimens of these plants require compulsory control as part of an invasive species control programme.
2	Category 2 invasive species are regulated by area. These species require a permit to carry out a restricted activity specified in the permit (e.g. import, possess, grow, breed, move, sell, buy or accept as a gift) or an area specified in the permit. No permits will be issued for Category 2 plants to exist in riparian zones. Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 Listed Invasive Species without a permit. A landowner on whose land a Category 2 Listed Invasive Species occurs or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the permit or over which they have control. Any species listed as a Category 2 species that occurs outside the specified/permitted area is to be considered a Category 1 b Listed Invasive Species and must be managed accordingly.
3	Category 3 invasive species are regulated by activity and are as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of NEM:BA. No permits will be issued for Category 3 plants to exist in riparian zones and any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas will be considered to be a Category 1b Listed Invasive Species and must be controlled in accordance with an invasive plant control programme.

Landowner obligations and IAP control/eradication in terms of NEMBA:

In terms of **section 73** of NEMBA, a person who is the owner of land on which a listed invasive species occurs must:

- notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
- take steps to control and eradicate the listed invasive specimens to prevent it from spreading; and
- take all the required steps to prevent or minimise harm to biodiversity.

In terms of **section 75** of NEMBA, the following applies to the control & eradication of invasive species:

- The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs;
- Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment; and
- The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent

such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Requirements for Invasive Species Monitoring, Control & Eradication Plans are included under **section 76** of NEMBA and need to include the following:

- a detailed list and description of any listed invasive species occurring on the relevant land;
- a description of the parts of that land that are infested with such listed invasive species;
- an assessment of the extent of such infestation;
- a status report on the efficacy of previous control and eradication measures;
- the current measures to monitor, control and eradicate such invasive species; and
- measurable indicators of progress and success, and indications of when the control plan is to be completed.

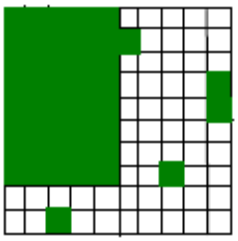
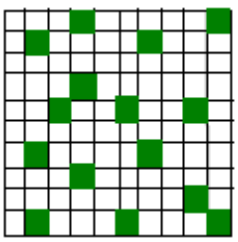
Annexure B: Rapid forest habitat monitoring assessment methods.

B1. Rapid habitat disturbance survey: method and checklist

A rapid forest habitat disturbance survey datasheet has been provided below. The survey will need to be undertaken by providing the field assessor(s) with a map of the areas to be assessed. The assessor will need to walk through the forest habitat and rate the extent and intensity of a range of potential impacts that could affect the interior and edge of the habitat (as described in the datasheet below). In the case of dense wooded areas such as forests and thicket, the assessor should ideally assess impacts to edge habitat separately from interior habitat.

RAPID HABITAT DISTURBANCE ASSESSMENT			
A. Interior habitat condition			
Disturbance/Impacts affecting interior	**Description**	**Rate Extent of Impact** (see Table B1)	**Rate Intensity of Impact** (see Table B2)
Clearing of vegetation	*Estimate the extent of natural vegetation that has been cleared, partially or completely*		
Harvesting of plants, bark, timber, etc.	*Estimate the extent of habitat that has been subject to plant harvesting*		
Concentration of runoff	*Estimate the extent of concentrated runoff*		
Natural storm damage	*Are there signs of natural storm damage*		
Human tracks/paths	*Are there any human tracks/paths created, estimate the extent of habitat disturbed*		
Alien plants/weeds	*Are there any alien plants in the interior, estimate the extent*		
B. Edge habitat condition			
Disturbance/Impacts affecting edge	**Description**	**Rate Extent of Impact** (see Table B1)	**Rate Intensity of Impact** (see Table B2)
Harvesting of plants	*Estimate the extent of edge habitat that has been subject to plant harvesting*		
Alien plants/weeds	*Are there any alien plants along the edge, estimate the extent*		

Table B1. Rating of impact extent for areas affected by each impact / disturbance type.

Extent of Impact	Description	Cover Estimate
High (H)	*The impact has affected the majority (more than 50%) of the habitat unit assessed*	
Moderate (M)	*The majority (>50%) of the habitat unit remains unaffected by the impact*	

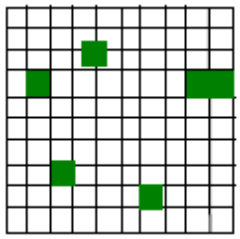
Extent of Impact	Description	Cover Estimate
Low(L)	*A small proportion of the habitat unit has been affected by the impact (<25%)*	

Table B2. Rating of the intensity of impacts (the degree to which habitat characteristics have been altered within the affected area).

Intensity of impact	Description of affected areas
Very low	There is very little discernible impact.
Low	A slight impact on natural habitat is discernible but with very little effect on habitat condition.
Moderate	The impact is clearly evident but limited, resulting in moderate alteration of habitat condition.
High	The impact has a serious impact on affected areas, with little natural vegetation remnants remaining in affected areas.

B2. Alien plant survey: data capture sheet assessing IAP cover

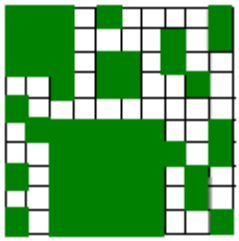
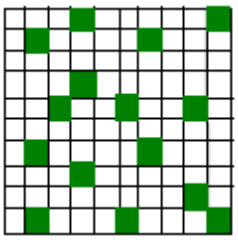
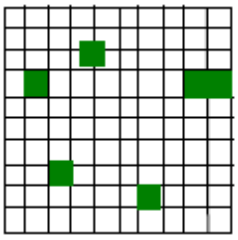
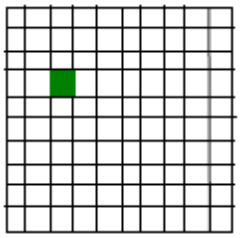
An alien plant survey is intended to be a rapid visual assessment of the extent of alien plants within predefined habitat units. The assessor captures species and density information and uses this to estimate overall alien plant density (expressed as % ground cover) using the rating classes in Table B3 below.

Reference to area/site assessed:	*Provide a reference code/number assigned to the area/site assessed for easy reference. Assessor to indicate the area assessed on field maps to be provided.*
Date:	*Date on which the assessment was undertaken.*
Assessor(s):	*Details of the person(s) responsible for the assessment.*
Overall extent:	*Estimate the overall extent of alien plants, expressed as a % cover based on visual observations*
Overall Extent Class	*Estimate the overall/combined extent of alien plants*

Assessment of IAPS:

Species Info:		**Maturity Level:** (Tick relevant box(es) below		
Species Name	**Extent** Class (as per Table B3)	**Mature**	**Young/Seedling**	**Coppice**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

Table B3. Classes used to rate alien plant cover.

Cover Class	Description	Ground Cover (%)	Example
High	Areas with high levels of alien vegetation where the proportion of alien species exceeds that of indigenous species.	50 - 75	
Moderate	Areas with high levels of alien vegetation but generally with a higher proportion of indigenous vegetation than alien vegetation.	30-50	
Low	Areas are dominated by natural vegetation with relatively low infestation levels.	5-30	
Very Low/Negligible	Largely natural areas with very low infestation levels that could be cleared with very little effort.	<5	

B3. Visual survey of erosion/siltation

The assessment of erosion/siltation is a visual survey done in the field with data to be captured using the data capture sheet below.

Site Reference:	*Quick reference to the management unit/site assessed*
Date:	*Date on which the assessment was undertaken.*
Assessor(s):	*Details of the person(s) responsible for the assessment.*
GPS Coordinates of erosion/deposition features:	*Provide GPS coordinates of any problem identified in the field*
Description of erosion/deposition features:	*Provide a brief description of the problem*

Photo:	*Include photograph of the feature(s) where possible*
Source of erosion/sedimentation:	*Attempt to identify the source and cause of the erosion/deposition of sediment (e.g. increased runoff from mining areas, discharge of water from mine)*
Additional Observations:	*Capture any additional visual observations at the site (e.g. reduced vegetation cover, etc.)*
Corrective/Management Recommendations:	*Include any recommendations to address erosion/sedimentation including rehabilitation requirements and actions to address the source of erosion/sedimentation*

Annexure B4: Standard checklist for visual assessment of rehabilitation interventions/structures.

SITE NUMBER:		**STRUCTURE TYPE:**	
DATE OF INSPECTION:		**PREVIOUS INSPECTION DATE:**	
INSPECTED BY:			
PREVIOUS PROBLEMS IDENTIFIED:	*List/description of problems identified from previous inspections*		

ASPECT	**COMPONENTS**	**CHECKED** (Y/N)	**SATISFACTORY** (Y/N)	**REQUIRED ACTIONS** (*WHERE NOT SATISFACTORY*)
STRUCTURAL INTEGRITY	Are there any signs of defects/cracks evident in the structure?			
	Are there any signs of damage to sidewalls?			
	Are gabion baskets still intact?			
	Is there evidence of sliding, tilting, slumping or overturning of the structure?			
	Are there any signs of undercutting below the structure?			
	Evidence of tunnelling upstream/around the structure?			
	Any signs of inflicted damage/vandalism?			

ADJACENT IMPACTS	Is there evidence of bank erosion at the structure or immediately upstream/downstream that could threaten the structure?			
	Are there any signs of sediment or debris (e.g. tree stumps) accumulation behind the structure?			
	Is topsoil in place?			
	Has soil around structure been adequately compacted?			
	Has adequate vegetation cover been reinstated around structure?			
DOWNSTREAM IMPACTS	Is there evidence of downstream scouring of the channel bed?			
	Is there evidence of outflanking?			
	Is there evidence of downstream bank erosion?			
PERFORMANCE	Does the structure shown any major/significance signs of under-performance (i.e. is the structure performing in the way it has been designed)?			

STRUCTURE TYPE	SPECIFIC MONITORING FOCUS
Gabion structures	• Correctly packed rock • Correctly sized rock • Lacing and bracing correctly implemented • Evidence of rusting • Evidence of sliding, tilting, slumping of structures • Evidence of undercutting • Scouring downstream of structures • Evidence of outflanking • Evidence of tunneling • Dimensions according to specifications • Authorized deviations from plan
Concrete weirs	• Evidence of sliding, tilting, slumping of structures • Concrete mixed to specifications • Evidence of cracks within concrete • Scouring downstream of structures • Evidence of undercutting due to poor founding • Evidence of outflanking • Evidence of tunneling • Dimensions according to specifications • Authorized deviations from plan
Earthen berms/plugs	• Erosion • Scouring downstream of structures • Evidence of undercutting due to poor founding • Evidence of outflanking • Evidence of tunneling • Adequate compaction of soil achieved • Dimensions according to specifications • Authorized deviations from plan
Earthworks	• Hydrological monitoring wells located and demarcated prior to excavations • Work areas and "no-go areas" clearly demarcated • Vegetation to be used in re-vegetation removed prior to excavations • Re-shaping undertaken in line with profiles included in the wetland rehabilitation plan • Backfilling and compaction of soil in main drains • Erosion control measures • Authorized deviations from plan

7 APPENDICES

Appendix 1: Forest Buffer Zones Recommendations.

See separate PDF document attached.