

ARABELLA COUNTRY ESTATE PHASE 2

ENVIRONMENTAL MANAGEMENT PLAN

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HPF Properties (Pty) Ltd

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SECTION A: INTRODUCTION

SECTION SYNOPSIS

This section explains the purpose of the Environmental Management Plan and how the document is to be used. In addition, it describes Arabella's vision, goals and objectives, and their *environmental policy*, which forms the basis of all the guidelines and specifications put forward in the document.

1 BACKGROUND

Dennis Moss Partnership was appointed by HPF Properties (Pty) Ltd (HPF) to compile an Environmental Management Plan (EMP) for the proposed Arabella Country Estate Phase 2 development in terms of Section 33 of the National Environmental Management Act (NEMA, Act 107 of 1998).

Dennis Moss Partnership is a South African Planning Institute (SAPI) as well as a South African Council for Planners (SACPLAN) registered company. Dennis Moss Partnership is a multi disciplinary practice specialising in the disciplines of regional and environmental planning, architecture, urban design and landscape architecture. SW van der Merwe, a registered Professional Environmental Scientist at the South African Council for Natural Scientist Professions (SACNASP), acted as head author of this EMP.

The EMP binds all contractors, sub-contractors and other persons working on the site to adhere to the set terms and conditions for the construction and operational management of the Arabella Country Estate Phase 2.

This EMP builds on the Development Framework that was prepared for Arabella Country Estate Phase 2, providing the following in respect of the estate and the project proposals:

- a) Legislative and policy framework, and environmental context.
- b) Overarching goals and objectives.
- c) Fundamental values and management criteria.
- d) Principles of planning design and management.

- e) Principles of sustainable development.
- f) Management guidelines.

2 STRUCTURE OF THE EMP

As illustrated by Figure 1 below, the EMP consists of seven sections together with their appendices (including this section). The various sections and their contents are as follows:

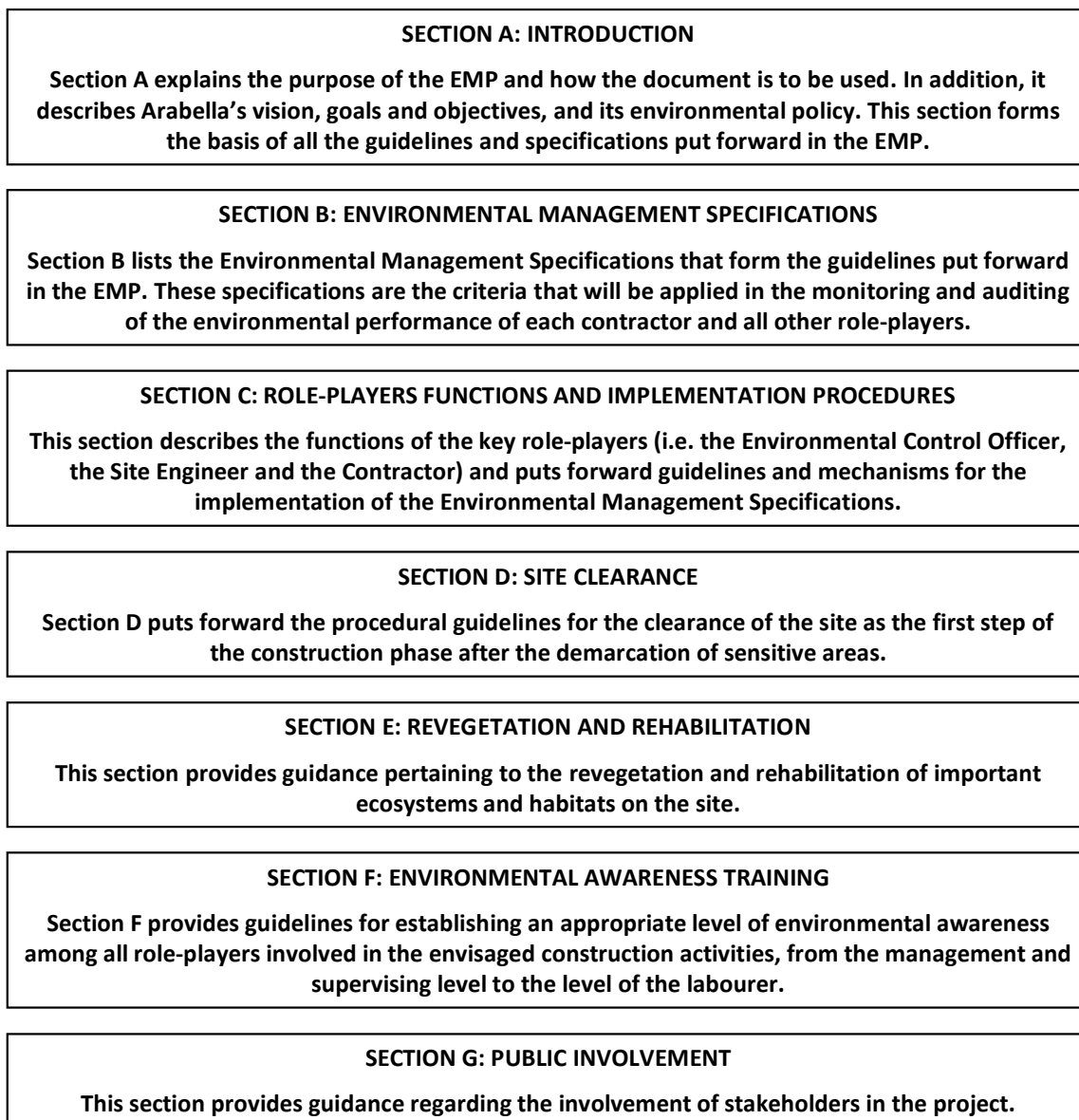


Figure 1: Structure of the EMP

3 GUIDE TO ACRONYMS AND ABBREVIATIONS

Auditing / Monitoring	Regular inspection and verification of construction activities for degree of compliance to the EMP.
Batch plant	Machinery used on site for the large-scale mixing and production of concrete or plaster, and associated equipment and materials.
Bund	Enclosure under/around a storage facility to contain any spillage.
EMP	Environmental Management Plan
ECO	Environmental Control Officer, a person appointed to ensure that all aspects of the development comply with the EMP.
EIA	Environmental Impact Assessment
Emergency	A situation requiring immediate action and where failure to implement appropriate actions timeously may result in environmental damage.
Engineer	A person who represents the client and is responsible for the technical, environmental and contractual implementation of the works to be undertaken.
Environment	<p>The surroundings within which humans exist and that are made up of:</p> <ul style="list-style-type: none">a) The land, water and atmosphere of the earth;b) Micro-organisms, plant and animal life;c) Any part of combination or a) and b) above, and the interrelationships among and between them; andd) The physical, chemical aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being (NEMA, 1998).

Environmental Awareness Course	An environmental education course for the contractors management staff and labour force which informs them of the requirements of the EMP.
Environmental Policy	A statement by the organisation of its intentions and principles in relation to its overall environmental performance, which provides a framework for action and for the setting of objectives and targets.
I&AP	Interested & Affected Party
IEM	Integrated Environmental Management
Method Statement	<p>A written submission by the Contractor to the Engineer in response to the Specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting the Method Statement, in such detail that the Engineer is enabled to assess whether the Contractor's proposal is in accordance with the environmental specifications. The Method Statement shall cover applicable details with regard to the following:</p> <ul style="list-style-type: none">a) Construction procedures.b) Materials and equipment to be used.c) Getting equipment to and from site.d) How the equipment/ material will be moved while on site.e) How and where material will be stored.f) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur.g) Timing and location of activities.h) Compliance/non-compliance with the Specifications.i) Any other information deemed necessary by the Engineer.
No-Go Areas	Areas identified as being environmentally sensitive in some manner and delineated on plan, and on the site with pegs or fencing and which are out of bounds to unauthorised persons. Authorisation must be obtained from the Engineer prior to entry.

Project Specification	A specification that describes the Works in general terms (including the locality, the conditions on Site, the extent of the Contract, the construction programme, and the service facilities available and to be taken into consideration) and that may include clauses that amend or amplify or add to any requirement(s) of a standardized specification (or standard or particular specification) in the sequence in which the requirements and specifications occur in the contract documents.
Site	The boundary and extent of development works and infrastructure, including any areas off the main site on which works are to be carried out in order to allow the development to proceed successfully.
Site Engineer	<p>The person appointed to:</p> <ul style="list-style-type: none">a) Observe the execution of the works, examine and test materials and workmanship and receive from the contractor such information as he shall reasonably require.b) Have the authority:<ul style="list-style-type: none">(i) Given to him by any provisions of the Contract.(ii) Given to him by the Engineer.(iii) To deliver to the Contractor oral or written communications from the Engineer.(iv) To receive on behalf of the Engineer oral or written communications from the Contractor.
Specification	A technical description of the standards of materials and workmanship that the Contractor is to use in the Works to be executed, the performance of the Works when completed and may include the manner in which payment is to be made.
Works	The works to be executed in accordance with a contract.

4 KEY ASPECTS OF THE EMP

4.1 PURPOSE

In the EMP the vision, goals and objectives for Arabella are given effect in the context of the relevant legislation and associated regulations. The EMP is based upon sound economic and technical decisions and careful consideration of alternative strategies.

The compass of the EMP is vast, dealing with, *inter alia*, the formulation of strategies to achieve the general goals and objectives for Arabella Country Estate Phase 2 in a manner that complies with ethical, social, and political norms. The primary aims of the EMP include the following:

- a) Ensuring appropriate management of all aspects of the construction and post construction phases of the development.
- b) Ensuring conformance with the stated environmental policy.
- c) Enabling certification/accreditation of the estate in terms of ISO14001.
- d) Complying with stated zoning conditions.

As stated above, the EMP builds on the Arabella Development Framework, which describes the projects proposed for the estate. In practical terms, the above framework describes the following:

- **What** developments will be undertaken on the estate.
- **Where** these developments will be located.
- **How** the developments were planned (i.e. the planning context).

4.2 PROPOSED ACTIVITIES

The proposed project as illustrated by the Site Development Plan (refer to Annexure A1) includes the following:

- a) 352 Single residential erven together with the required services infrastructure.
- b) 9-hole executive (mashie) golf course.

- c) Long-drive driving range.
- d) Golf academy.
- e) Clubhouse, pro-shop and HOA offices.
- f) Restaurant and winery.
- g) Archery range.
- h) Sports field.
- i) Public gathering site in the form of a boma.
- j) A range of recreational trails within the development footprint and into the adjoining nature areas.
- k) Water purification works.
- l) Electrical substation.
- m) Parameter fencing and security gates.
- n) Upgraded of the Kleinmond road (R44) at the Phase 2 and existing Arabella entrances.

Integration of Phase 1 and Phase 2 will be enhanced through the relocation of the existing golf clubhouse and offices of the home owners' association (HOA) to a site north of the R44. The relocation of the clubhouse will entail a realignment of the golf course as it relates to the 1st tee and 18th green. By freeing up additional space in the existing hotel complex on Phase 1, HPF aims to expand the conference offerings, which, in turn, could make the hotel a more viable conference destination.

The proposed Phase 2 village component south of the R44 will be linked directly with Phase 1 through a golf cart boardwalk to be established over the Laughing Waters corridor. The relevant village component will obtain access from the R44 via a new access point.

4.3 EMP AS PART OF OVERARCHING ESTATE MANAGEMENT

The EMP forms an integral part of an Environmental Management System (EMS) that is to be prepared for Phase 2 in accordance with the standard format provided by SABS ISO 14004:1996(E). The Phase 2 EMS will be incorporated with the existing Phase 1 EMS. In accordance with this format,

the EMS incorporates five distinct phases (refer to Figure 2). The EMP primarily addresses Phase 3 of the EMS, but also contributes to the other four phases.

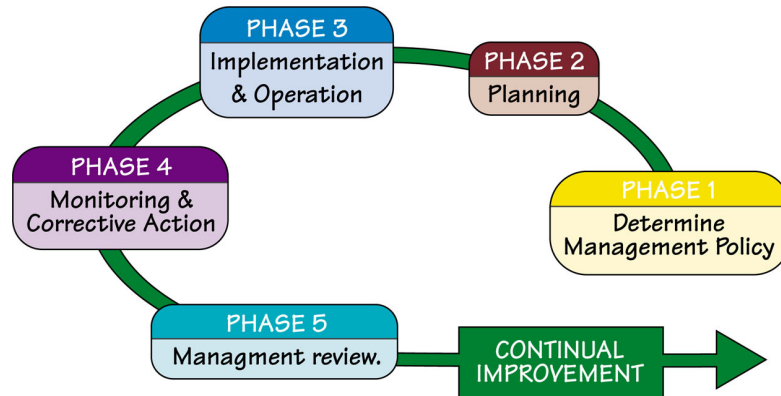


Figure 2: The EMS format (Adapted from SABS ISO 14004:1996)

The EMP addresses all of the comments and recommendations put forward in the specialist study reports that were prepared as part of the environmental impact assessment (EIA) undertaken in respect of the project in terms of the National Environmental Management Act, 1998 (NEMA, Act 107 of 1998).

The EMP and its implementation are strictly guided by Arabella's **environmental policy** and their **vision, goals** and **development principles** described below.

5 ENVIRONMENTAL POLICY, VISION, GOALS, VALUES & CRITERIA

Management and environmental policy is defined as 'a **statement by the organisation of its intentions and principles in relation to its overall environmental performance, which provides a framework for action and for the setting of objectives and targets**' (SABS ISO 14004:1996{E}).

To ensure successful implementation of the EMP, it is imperative for the organisation to make a firm commitment to improve the management of its activities, products and services. Such ongoing commitment and leadership are crucial for the long-term sustainability of the various integrated programmes.

The policy statements are the driver for implementing and improving the EMP so that it can maintain and potentially improve environmental performance. Such policy statements establish an overall sense of direction and set the principles of action for the organisation.

The policy statements for the estate were based on a broad vision, overarching goals, and criteria for ensuring compliance with the ‘triple bottom line’ goals (i.e. balancing the three imperatives for sustainable development, namely **environmental integrity**, **human well-being** and **economic efficiency**).

5.1 VISION

Arabella’s vision for the Phase 2 development is the following:

To develop a country estate that would be a model for sustainable development in the Kogelberg Biosphere Reserve...

recognizing the qualities of natural and human-made places, history and craft, and the limits imposed by both natural and human resources.

5.2 OVER-ARCHING GOALS

5.2.1 PROMOTING SUSTAINABLE DEVELOPMENT

The above vision is supported by a ‘triple bottom line’ approach, which refers to the interrelated goals of **economic development**, **social equity**, and **environmental integrity**. This approach is internationally recognised as the standard against which planning and development actions of government, business, and society at large, are to be measured in order to achieve sustainable development. In accordance with the ‘triple bottom line’ approach, the over-arching goals of Arabella are the following:

a) Economic development

This goal refers to the efficient utilisation of the available community assets, the enhancement of the existing economic sectors, and the establishment of new enterprises that will ensure sustainable socio-economic development in the sub-region within which the estate is located.

b) Social equity

This goal refers to the implementation of a number of strategies to achieve real social equity and promote the well-being of all the people of the sub-region. These strategies include, *inter alia*, sustainable community empowerment, land reform, integration, provision of housing, and providing the previously disadvantaged with access to, and participation in, the mainstream economy.

c) Environmental integrity

This goal refers to the implementation of integrated strategies aimed at restoring and conserving both the natural and the cultural environment within and beyond the boundaries of the estate. The proposed developments will reflect a strong sense of appreciation for the cultural heritage of the sub-region, whilst the conservation of biodiversity would be reflected in, amongst others, the management and use of natural resources, custodianship of the land as it is developed, and the re-use of waste that demonstrates practical ways of reconciling human needs with the requirements of other organisms and the carrying capacity of the environment.

Arabella is contractually committed to develop and manage the estate in accordance with internationally-recognised ISO14001 standards of environmental care, and has appointed specialists to assist in meeting these obligations from the start of the land rehabilitation phase.

5.3 FUNDAMENTAL VALUES OF ARABELLA

Arabella is based on a set of fundamental values, which will guide all developmental and empowerment programmes. These values include the following:

a) Custodianship

This generation is here for only a short time in the life of the sub-region and therefore it is our duty to foster a sense of history and to act as custodians of the present natural, cultivated and built environment for the benefit of this and future generations.

b) Fostering hope

Due to a profound sense that there are limits to our natural, cultural and economic resource base, we try to practise sustainable ways of living and doing business.

c) Community-building, trust and respect

By facilitating connections across historic divides in the community, Arabella aims to promote sustainable community co-operation, integration, social equity, self-esteem, and a sense of place that embodies lifestyles appropriate for a sustainable South African future.

5.4 MANAGEMENT APPROACH

As a point of departure for organisational design and development, Arabella has committed itself to a 'triple bottom line' approach (refer to Chapter 5.2 above). In line with the King Report on Corporate Governance commissioned by the Institute of Directors and published for public comment in July 2001 (which generally follows the approach adopted by the Commonwealth Association for Corporate Governance), Arabella believes that the 'triple bottom line' needs to be applied at the following levels:

- a) Board accountability
- b) Values and strategy
- c) Risk management
- d) Management systems
- e) Performance monitoring and reporting

f) **Stakeholder interaction**

By making the 'triple bottom line' the core discipline of corporate governance, Arabella is breaking away from the traditional dualistic approach which leaves traditional business management systems and governance intact, while environmental and social issues are managed separately as a kind of additional extra tacked onto the side of the business. The global shift from the dualist perspective implicit in most 'Corporate Social Responsibility' approaches to a more integrated 'Corporate Citizenship' approach as advocated in the King Report is strongly promoted by Arabella.

5.5 CRITERIA FOR MANAGING THE 'TRIPLE BOTTOM LINE'

In order to evaluate Arabella's achievement of the vision and goal statements described above, and enable effective management of the estate, each development and management action will be constantly evaluated in terms of the following criteria:

a) **Financial success**

- (i) Managing and sustaining an acceptable debt/equity ratio.
- (ii) Consolidated profit after tax, which provides an acceptable return on capital.
- (iii) Long-term financial sustainability with reduced dependence on donors for the non-profit undertakings.
- (iv) Meeting the empowerment goals and objectives set by the Social Accord.

b) **Social equity**

In the workplace:

- (i) Formal policy statement on social equity ('Equity Plan').
- (ii) Promotion of diversity at all levels.
- (iii) Policies to stop gender harassment/discrimination.
- (iv) Support for training/education/professional development.
- (v) Empowerment of all staff, in particular historically disadvantaged people.
- (vi) Incentive schemes for staff at all levels.
- (vii) Fair and legal retrenchment procedures.

- (viii) Supportive approach to work-life balance.
- (ix) Promotion of health, safety and general wellness.

In the community:

- (i) Local recruitment.
- (ii) Procurement from a range of businesses, including those owned by previously disadvantaged individuals.
- (iii) Support for local businesses.
- (iv) Social responsibility and environmental criteria when appointing contractors.
- (v) Preference for using local banks, especially those that favour local reinvestment.
- (vi) Community participation in development planning.
- (vii) Support for local schools and education.
- (viii) Respect for and promotion of local cultures and heritage.
- (ix) Adherence to human rights codes.
- (x) Providing access to the mainstream economy through tourism and agriculture.
- (xi) Providing for the community's housing and socio-economic needs as stipulated in the Social Accord.

c) Environmental integrity

- (i) Formal policy statement on environmental integrity.
- (ii) Rehabilitation of commonage land, which has been used and abused as waste dump, sewerage farm, sand pit and rifle range, and allowed to become overgrown with invasive alien plants.
- (iii) Minimal ecological impact of materials used ('ecological footprint').
- (iv) Preference for renewable resources.
- (v) Most efficient use of energy, water, land and materials.
- (vi) Lowest possible levels of maintenance.
- (vii) Maximum recycling and re-use of waste and materials.
- (viii) Pollution prevention (air, land and water).
- (ix) Construction of healthy non-toxic environments.
- (x) Promotion of biodiversity.

- (xi) Minimise negative impacts on the scenic, cultural, historical, social and architectural landscape and on infrastructure.
- (xii) Meeting the obligations towards the Kogelberg Biosphere Reserve.

5.6 SUSTAINABLE DEVELOPMENT PRINCIPLES

The array of construction, leisure, and cultural projects that are proposed under Arabella Country Estate Phase 2 will be organised in accordance with a set of principles that will operationalise the vision and goals stated in Chapter 5.1 above. These sustainable construction principles include the following (Hill and Bowen, 1996)¹:

a) Social Sustainability

This principle refers to the concept of need and addresses the following:

- (i) Improve the quality of human life, including poverty elimination.
- (ii) Recognise the extent of cultural diversity and respond accordingly.
- (iii) Protect and promote human health through a healthy and safe working environment.
- (iv) Implement skills training and capacity enhancement for previously disadvantaged people.
- (v) Promote fair and equitable distribution of the social costs and benefits of construction.

b) Economic Sustainability

Economic efficiency (and feasibility) is generally recognised as one of the three imperatives to achieve sustainable development. In the proposed estate development every effort will be made to achieve the following:

- (i) Ensure that as a whole, the for- and non-profit projects combine into a financially viable local economy that benefits all stakeholders, including shareholders, partners, employees, the community, and existing business enterprises.

¹ Hill, R. C. and Bowen, P. A. 1996. **Sustainable Construction: Principles and a Framework for Attainment. Construction Management Economics**, E & F N Spon. London.

- (ii) Promote the creation of new entrepreneurial and employment opportunities and, where practically possible, labour intensive construction, particularly to benefit the previously disadvantaged.
- (iii) Enhance the competitiveness as well as the appeal of the sub-region as tourist destination, within the context of the promotion of policies and practices that advance environmental sustainability.
- (iv) Use full-cost accounting and real-cost pricing to set prices and tariffs.
- (v) Choose environmentally responsible suppliers and contractors.
- (vi) Invest some of the proceeds from the use of non-renewable resources in social and human-made capital, to maintain the capacity to meet the needs of future generations.

c) Biophysical Sustainability

In the proposed development there will be presumption in favour of the environment and a premium will be placed on the conservation of natural resources, wildlife and landscapes. Materials for new development will, for example, be obtained from sustainable sources and in the design of buildings, the use of energy consumption will be minimised. In addition, the following principles will be incorporated into the planning and management of the development:

- (i) Minimise use of the four generic resources, namely energy, water, land and materials.
- (ii) Maximise resource re-use and/or recycling.
- (iii) Use renewable resources in preference to non-renewable resources.
- (iv) Minimise air, land and water pollution.
- (v) Create a healthy, non-toxic environment (all farming and landscaping will be organic).
- (vi) Maintain and restore the Earth's vitality and ecological diversity.
- (vii) Minimise damage to sensitive landscapes, including scenic, cultural, historical, and architectural aspects.

d) Technical Sustainability

A primary aim of the proposed estate developments is to create a **qualitative** cultural environment, which is 'in harmony' with the natural environment that 'contains' it, and with

the heritage of its setting. The following principles will be adhered to in the proposed development:

- (i) Design and construct durable, reliable and functional structures, sympathetic to their natural and cultural environment.
- (ii) Pursue quality in creating the built environment.
- (iii) Use serviceability to promote sustainable construction.

5.7 POLICY STATEMENTS

Arabella's policy statements that represent the basis for the planning and implementation of all actions to be undertaken in the estate are as follows:

5.7.1 NATURAL ENVIRONMENT

Arabella supports the restoration/rehabilitation of all aspects of the natural environment and its community supporting natural processes, and the creation of an environment that enhances the physical, social and economic well-being of its residents and visitors.

In this regard, the focus will be on creating an integrated 'green system' of ecological corridors as an essential development intervention that can significantly contribute to enhancing the quality of life of the residents of the estate. Throughout the developments appropriately landscaped 'green areas' will be linked, or integrated, with ecological corridors. The proposed botanical conservancies will form part of the system of 'green areas'.

The environmental restoration projects will focus on, *inter alia*, the clearing of alien vegetation and the implementation of management interventions that will promote the ecology of the natural vegetation (i.e. biodiversity conservation). The rehabilitation of areas infested with alien plants and disturbed through sand mining and dumping has been a first priority, requiring a sizeable capital outlay and concerted effort due to the very high levels of degradation.

All efforts will be made to mitigate any potentially detrimental impact associated with the various developments. In this regard, the tremendous potential of environmental landscaping for rehabilitating degraded areas and for beautifying the surroundings, will be fully utilised.

An integral part of the environmental management of the estate will be the restoration and conservation of biodiversity. Biodiversity is an abbreviation of biological diversity, which is described as the mix of species in an ecosystem that enables that system both to *provide* a flow of ecosystem services under given environmental conditions, and to *maintain* that flow if environmental conditions change. The loss of biodiversity limits the resilience of the affected ecosystem, which in turn, may have direct negative socio-economic implications.

The diversity of life within ecosystems is an irreplaceable asset to humans. The various components of biodiversity, from the complete ecosystems to the individual organism and its genetic code, provide people with numerous tangible products.

Arabella's aim in respect of the estate is to develop a complex landscape that builds upon the unique environmental attributes of the region and that can accommodate all of the integrated programmes described above in a sustainable manner. Within the estate, there will be effective integration of the human-made and the natural environment into an active system that transfers material and energy and creates an appropriate sense of place, history, craft, nature, and limits (refer to the principles of 'critical regionalism' described in Chapter 9.2 of the Arabella Development Framework).

As stated above, the landscape restoration will aim to create an environment that enhances the physical, social and economic well-being of its residents and visitors. In addition, the proposed environmental restoration programme will imply benefits in respect of the following:

- a) Climate amelioration.
- b) Flood control.
- c) Stormwater management.
- d) Catchment protection.
- e) Erosion control.
- f) Noise and air pollution control.

- g) Biodiversity conservation.
- h) Serving as natural filters of grey water.
- i) Balancing carbon dioxide emissions.
- j) Sensitising visitors to the needs and benefits of the natural environment.

Arabella's objective is to promote environmental sustainability within the estate and beyond. This will be achieved through the promotion of a general ethic of environmental care and the institution of integrated biodiversity conservation projects, including the following:

- (i) Restoring and protecting degraded habitats.
- (ii) Restoring and protecting degraded ecological corridors.
- (iii) Undertaking research to determine the historic components of biodiversity in the area.
- (iv) Reintroducing as many as possible of the historical elements of biodiversity, including primary and secondary producers.
- (v) Undertaking effective environmental education.

Arabella recognises the fundamental importance of biodiversity conservation as a prerequisite for sustainable development, and that for biodiversity conservation to succeed, the maintenance of environmental integrity (as defined by ecological, economic and social criteria) must be one of the primary determinants of the land-use planning of the estate.

In order to facilitate effective management of the estate in accordance with international standards and strategies aimed at environmental sustainability, a Special Management Area (SMA) will be established over the entire estate.

The establishment and effective management of a SMA will not only promote the sustainability of the estate, it will also ensure that it is developed and managed in a manner that will ensure that it fulfils a meaningful role as part of the Kogelberg Biosphere Reserve.

5.7.2 CULTURAL ENVIRONMENT

Some of the Phase 2 development will have an impact on the natural and cultural environment. In order to promote the potentially positive effects and mitigate the potentially negative impacts of the various projects the planning, developmental, and operational phases have to be strongly based on an ethic of environmental sustainability.

In order to promote the above ethic, the proposed development programmes and projects would generally uphold the principles of:

- a) Sustainable development.
- b) Qualitative environmental planning and design.
- c) Biodiversity conservation.

Arabella recognises that high priority needs to be given to reform human values, habits and intuitions, to shift paradigms, and transform culture and change industrial commerce so that society can co-exist with the natural environment more harmoniously in the future than in the past.

Kelbaugh (1997)² stresses that promoting sustainable development is not enough and that any viable programme '*must turn back the resource clock and devote itself actively to restoring damaged and deteriorating systems – restoration is far more compelling than the algebra of sustainability*'. The development site, which has been used for farming and forestry and which has been allowed to become overgrown with alien plants, is a worthwhile subject area for such restoration.

A place-specific approach to planning, design and management was adopted in the preparation of this development framework. This approach recognises that any *place* has a distinct character, which influences human beings, and that the quality and nature of a place have psychic implications. A place such as the estate can therefore not only be considered in functional or biophysical terms – specific attention also has to be given to the existential meanings that the people of the area attach to the place and the values that underpin such meanings.

Therefore, a primary objective of the planning process is to design and create a 'place' that has a distinctive character, nature and atmosphere and encompasses all of the fundamental elements of the concept of 'place'. In order to provide a framework for place-specific planning and design, the design principles known as '**critical regionalism**', were adopted. The Arabella Development Framework provides a comprehensive description of the principles of critical regionalism.

6 IMPLEMENTATION OF THE EMP

Section C of this document describes the functions and responsibilities of the various key role-players regarding the implementation of the EMP, namely the Site Engineer, the ECO and the Contractor. It is however imperative that every institution or individual involved in the construction phase of the various estate projects must take responsibility for the implementation of the EMP.

It is recognised that all individuals will not have the capacity to understand or interpret all aspects of the EMP. It is therefore imperative that the specified environmental awareness training be undertaken as a pro-active intervention and that such education be sustained throughout the duration of the construction phase and into the operational phase.

CHIEF EXECUTIVE OFFICER

HPF PROPERTIES (PTY) LTD

² Kelbaugh, D. 1997 **Common Place: Towards Neighbourhood and Regional Design**. University of Washington Press.

ANNEXURE A1

SITE DEVELOPMENT PLAN

SECTION B

ENVIRONMENTAL MANAGEMENT SPECIFICATIONS

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SECTION B: ENVIRONMENTAL MANAGEMENT SPECIFICATIONS

SECTION SYNOPSIS

This section lists the *Environmental Management Specifications* that inform all the guidelines put forward in the EMP. These specifications also represent the criteria that will be applied in the monitoring and auditing of the environmental performance of each contractor and all other role-players.

The Environmental Management Specifications documented below served as a basis for the formulation and implementation of the environmental mitigation measures stipulated in Annexure B2.

SPEC1 INTRODUCTION

The purpose of the Environmental Management Specifications (EMS) is to ensure that environmental damage during construction phase of the proposed Arabella Country Estate Phase 2 development is minimised.

As part of the EMP the EMS is binding on the proponent, contractors and sub-contractors and is to form part of the construction contractual documentation.

An Environmental Control Officer (ECO), to be appointed by the developer before the start of construction for the duration of the construction phase, will monitor review and verifying contractors' compliance with the EMS.

SPEC2 SCOPE

The general principles contained in this document will apply to all construction activities.

SPEC3 INTERPRETATIONS

3.01 DEFINITIONS

Definitions and/or appropriate clarification will be established by the ECO in collaboration with specialist consultants and the Contractor in respect of any term contained in this document that may be unclear or could give rise to conflicting interpretations.

3.02 ENVIRONMENTAL POLICY, SUSTAINABLE DEVELOPMENT PRINCIPLES AND CRITERIA

All role-players are to adhere to the requirements of the Occupational Health and Safety Act (Act 85 of 1993), Arabella's environmental policy and the principles and criteria that underpin the development and that are intended to ensure its long-term sustainability (refer to Section A).

3.03 SUPPORTING AND CLARIFYING DOCUMENTATION

The environmental management specifications listed below address the key aspects and recommendations put forward in the various specialist study reports and plans (refer specifically to the Site Development Plan {Appended under Section A, Annexure A1} and the Environmental Constraints Plan {Annexure B1}) that form part of the Arabella Development Framework.

The environmental management specifications are supported by the following detailed guideline documents put forward in Section C, D, E, F and G:

- a) Functions and responsibilities of the Environmental Control Officer, the Site Engineer and the Contractor (refer to Section C).
- b) Guidelines for site clearance (refer to Section D).
- c) Guidelines for revegetation and rehabilitation of ecological corridors (refer to Section E).
- d) Awareness courses for management and site staff (refer to Section F).

SPEC4 COMMENCEMENT OF WORKS

No work on site may take place until the:

- Prescribed conditions in the relevant Environmental Authorization have been adhered to and the necessary approvals are in place.
- EMP has been approved by the relevant authorities.
- On-site Start-Up Meeting has been held (refer to Section 5 below).
- Site and No-Go areas has been demarcated (refer to Section 8.5 below).
- Contractors are in possession of the EMP and other relevant documentation.
- Contractors signed the Declaration of Understanding (refer to the EMP Section C, Functions and Implementation Procedures and Annexure C1).
- All mandatory site equipment is in place.
- On Site Environmental Education & Awareness training session has taken place with all relevant construction personnel present (refer to the EMP Section F).

Work referred to above refers to construction camp establishment, earthmoving activities and any pre-liminary construction activities.

SPEC5 START-UP MEETING

A site meeting is to be held at least two weeks before the commencement of site/camp establishment, earthworks and/or construction activities. If the project is implemented through various phases, a start-up meeting must be held for each individual phase.

The following people must be present:

- Representative from the applicant.
- Main contractor's representative.
- Site supervisor/foreman.
- Environmental Site Officer (if appointed).
- Site Engineer.
- Environmental Control Officer.

The following issues must be addressed:

- The EMP & other relevant site documents.
- All uncertainties regarding the EMP & other relevant site documents.
- Method statements.
- Roads and construction areas to be demarcated.
- Materials stockpile and lay down areas to be demarcated.
- Method of stockpiling to be discussed.
- Fire fighting procedures.
- Mandatory fire fighting equipment & fire preventative measures.
- Solid waste removal intentions.
- Placement, type and service of toilets to be agreed on.
- Placement and type of rubbish bins and removal of rubbish to be agreed on.
- Environmental education and awareness training session to all contractors & onsite staff/labour.
- Location & establishment of concrete batching plant facility.

The minutes (indicating all the site-specific issues and arrangements agreed upon) of the start-up meeting must be condensed to report format and circulated to the attendees of the above meeting for approval and comment. Non response in this regard is deemed to be an acceptance of the start-up meeting report content and agreements. The start-up meeting report will then be attached to the EMP, Section B, Annexure B11 (should any discrepancies arise between the start-up meeting report and the EMP, the EMP will take precedence until discrepancies are clarified). Included in the start-up meeting report must be a list of all subcontractors, their scope of work for the contract together with their time schedule. This must be provided by the main contractor.

SPEC6 MATERIALS

6.01 MATERIALS HANDLING, USE AND STORAGE

1 Importation of fill/soil/sand materials

- a) Imported materials shall be free of weeds, litter and contaminants.
- b) Sources of imported material shall be listed and approved by the Site Engineer (SE).

- c) Samples shall be provided by the Contractor to the SE for approval.
- d) Stockpile areas must be approved by the SE before any stockpiling commences.
- e) Stockpiling may not occur within 50 m of wetlands or ecological corridors.
- f) Stockpiles may not exceed 1.5 m in height.
- g) Materials should be obtained from sources less than 50 km from the development site so as to minimise the 'ecological footprint' of the development.

6.02 HAZARDOUS SUBSTANCES

1 Paints

- a) No paint products may be disposed of on Site.
- a) Brush/roller wash facilities shall be established to the satisfaction of the SE.
- b) Oil based paints and chemical additives and cleaners such as thinners and turpentine shall be strictly controlled.

SPEC7 PLANT

7.01 FUEL (PETROL AND DIESEL) AND OIL

1 Fuel storage areas

- a) The Contractor shall prepare and submit a site plan of the construction camp to the SE for approval.
- b) The construction camp must be situated more than 50 m away from wetlands or ecological corridors.
- c) The ECO shall be consulted on the area that the Contractor intends using for the storage of fuel.
- d) The fuel storage area shall be shown on the construction camp plan (refer to Annexure B6).
- e) Fuel storage tanks are to be installed and managed in accordance with the relevant Oil Industry Standards and SANS codes.
- f) The Contractor shall ensure that all liquid fuels (petrol and diesel) are stored in tanks with lids, which are kept firmly shut.

- g) The tanks shall be situated on a smooth impermeable surface (plastic or concrete) base with an earth bund (plastic must have sand on top to prevent perishing). The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be 110% x the total capacity of all the storage tanks. The floor of the bund shall be sloped towards an oil trap or sump to enable any spilled fuel and/or fuel-soaked water to be removed, or the bunded area shall be covered. An Enretech or similar product approved by the ECO shall be installed in the sump to reduce the risk of pollution due to the sump filling up with rainwater.
- h) The Contractor shall keep fuel under lock and key at all times.
- i) No smoking shall be allowed in the vicinity of the stores.
- j) Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected. In addition, if fuel is dispensed from 200 ℓ drums, the proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank shall be stored in a water-proof container when not in use.
- k) Symbolic safety signs depicting 'No Smoking', 'No Naked Lights' and 'Danger' are to be provided, and are to conform to the requirement of SABS 1186. The volume capacity of the tank shall be displayed.
- l) The product contained within the tank shall be clearly identified using the emergency information system detailed in SABS 0232 Part 1.
- m) Any electrical or petrol-driven pump shall be equipped and positioned, so as not to cause any danger of ignition of the product.
- n) Areas for storage of fuels and other flammable materials shall comply with standard fire safety regulations and may require the approval of the Municipal Fire Prevention Officer.
- o) The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.

2 Fuel storage tanks

- a) Temporary above ground storage tanks may be permitted at the discretion of the chief fire officer based on the merit of the situation, provided that the following requirements are complied with:

- (i) Written application together with the construction master plan and authority from the municipal effluent inspector shall be forwarded to the chief fire officer at least fourteen (14) days prior to the installation being erected on site. Written permission shall be obtained from the chief fire officer for the erection of the installation.
 - (ii) The plan must be acceptable to the chief fire officer and to contain the following information:
 - Scale.
 - Name and the quantity of the tanks.
 - Position of the tanks in relation to the boundary, other flammable or combustible materials, etc.
 - Size and construction materials used for the bund.
 - Product to be kept in the tank.
 - Any other information relevant to the situation.
 - (iii) The storage tank shall not have a capacity exceeding 9000 ℓ and shall not be used for the storage of liquids other than those with a flash point in excess of 40°C.
 - (iv) Fuel storage containers may not exceed the combined capacity of 30 m³.
 - (v) The storage tank shall not be on the premises for longer than 6 months.
 - (vi) All such tanks to be designed and constructed in accordance with a recognised code.
 - (vii) The rated capacity of such a tank shall provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage.
 - (viii) The tank shall be erected at least 3.5 m from buildings, boundaries and any other combustible or flammable materials.
 - (ix) Adequate precautions shall be provided to prevent spillage during the filling of any tank;
- b) If larger capacity tanks are required or the tank is to be a permanent installation, then an acceptable rational design based on a relevant national or international code or standard shall be submitted to the relevant municipality for approval in terms of the National Building Regulations.

7.02 EATING AREAS

- 1 The Contractor shall indicate the eating areas on the construction camp plan.

7.03 ABLUTION FACILITIES

- 1 Provision shall be made for employee facilities including shelter, toilets and washing facilities.
- 2 The exact location of the toilets shall be approved by the ECO prior to establishment.
- 3 Sanitation facilities shall be located within 100 m from any point of work and not closer than 50 m to any water body. Toilets shall be within the Contractor's Camp and at work areas more than 50 m from the Contractor's Camp.
- 4 Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 30 workers (preferred 1:15). Combinations of urinal and pan type units shall be carefully considered. These facilities shall be maintained in a hygienic state and serviced regularly. Toilet paper shall be provided.
- 5 The Contractor shall ensure that toilets are emptied before the builders' holidays.
- 6 The Contractor shall ensure that the entrances to toilets are adequately screened from public view.
- 7 All temporary/ portable toilets shall be secured to the ground to the satisfaction of the ECO to prevent them toppling due to wind or any other cause.
- 8 The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from Site.
- 9 Discharge of waste from toilets into the environment and burial of waste is strictly prohibited.

7.04 SOLID WASTE MANAGEMENT

Solid waste must be disposed of at a landfill licensed in terms of the Environmental Conservation Act (Act 73 of 1989). The Contractor will facilitate solid waste management in collaboration with the municipality in accordance with the following guidelines:

1 Dumping

- a) Receipts for hazardous waste disposal shall be copied to the ECO.
- b) Any proposal to dispose of vegetation cuttings, tree trunks or building waste products such as rubble or asphalt or similar such products as part of backfill or landscape shaping shall require a Method Statement.

2 Litter and refuse

- a) Waste and litter shall be disposed of into scavenger- and weather-proof bins.
The Contractor shall then remove the refuse collected from the working areas, from Site at least once a week.
- b) Refuse must be disposed at a site approved by the ECO.
- c) The Contractor shall make provision for workers to clean up the Contractor's camp and working areas at least once a week.

3 Recycling

- a) Whenever possible, materials used or generated by construction shall be recycled.
- b) Containers for glass, paper, metals and plastics shall be provided. Office and camp areas are particularly suited to this form of recycling process.
- c) Where possible and practical, such as at stores and offices, waste shall be sorted for recycling purposes. Recycling protocols shall sort materials into the following categories:
 - (i) Paper / cardboard.
 - (ii) Aluminium.
 - (iii) Metals (other than aluminium).
 - (iv) Organic waste.
 - (v) Glass

4 Litter and oil traps

- a) Refuse screens and oil traps shall be installed at runoff concentration points from large parking facilities, wash bays, stormwater outlets, inlets to detention ponds, workshop forecourt drainage points, ablution and eating areas. These facilities shall be serviced and monitored at the discretion of the ECO.

All building and waste material will be removed after construction.

7.05 CONTAMINATED WATER

1 General

- a) No surface or ground water may be polluted due to any activity on the site (National Water Act [Act 35 of 1998] apply).
- b) The ECO's approval will be required prior to the discharge of contaminated water to the municipal sewer system.
- c) The Contractor shall prevent discharge of any pollutants, such as cements, concrete, lime, chemicals and fuels into any water sources.
- d) Water from kitchens, showers, laboratories, sinks etc. shall be discharged into a conservancy tank for removal from the site.
- e) Runoff from fuel depots/workshops/truck washing areas and concrete swills shall be directed into a conservancy tank and disposed off at a site approved by the ECO and relevant municipality.
- f) The contaminated water, contaminated run-off, or effluent may also require analysis prior to disposal. The relevant South African Water Quality Guidelines implemented by the Department of Water Affairs (DWA) apply.

2 Washing areas

- a) Washing areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas, which include groundwater, are not polluted.
- b) Washing areas will be no closer than 50m from wetlands or watercourses.
- c) A Method Statement shall be required for all wash areas where hydrocarbon and hazardous materials, and pollutants are expected to be used. This includes, but is not limited to, vehicle washing, workshop wash bays, paint wash and cleaning.
- d) Wash areas for domestic use shall ensure that the disposal of contaminated 'grey' water is sanctioned by the ECO.

7.06 DUST

- 1 The Contractor shall be responsible for the control of dust and for any costs against the Developer for damages resulting from dust.
- 2 The Contractor shall take all reasonable measures to minimize the generation of dust as a result of construction activities to the satisfaction of the ECO.
- 3 Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible.
- 4 Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present.
- 5 During high wind conditions, the ECO will evaluate the situation and make recommendations as to whether dust-damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level.
- 6 Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the ECO.
- 7 Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas.
- 8 Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. damping with water, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, chipping etc.).

7.07 LIGHTS

- 1 Where the ECO has authorized nightwork, low flux and frequency lighting shall be used.

7.08 WORKSHOP, EQUIPMENT MAINTENANCE AND STORAGE

Building material must be stored at least 50 m from aquatic ecosystems.

1 Construction camp maintenance

- a) The construction camp shall be kept neat and clean at all times.
- b) Refuse and waste storage areas shall be positioned away from buildings.

2 Drip trays and bunding

- a) Drip trays shall be inspected and emptied daily, and serviced when necessary. In particular drip trays shall be closely monitored during rain events to ensure that they do not overflow.
- b) All repairs done on machinery using hydrocarbons as fuels or lubricants shall have a drip tray placed strategically to avoid incidental spillage.
- c) All static plant shall be located within a bunded area. The bunded area shall have a smooth impermeable surface (plastic) with an earth bund. The impermeable material shall extend to the crest of the earth bund. The floor of the bunded area shall be sloped towards an oil trap or sump to enable incidental spillage to be removed.

7.09 NOISE

- 1 Noise levels exceeding 85dB shall only be permitted where approved by the ECO or during an emergency situation.

SPEC8 CONSTRUCTION**8.01 METHOD STATEMENTS**

A comprehensive Method Statement shall be provided by the Contractor within 14 days after receipt of the Letter of Acceptance of the contract. The Method Statement has to be approved by the SE prior to implementation. The Contractor may be required to submit to the SE supplementary Method Statements in respect of aspects not covered in the original Method Statement.

8.02 ENVIRONMENTAL AWARENESS TRAINING

It is the responsibility of the main contractors to ensure that all sub-contractors that work on the site during and after the civils contract are informed of the environmental conditions pertaining to the site.

1 Environmental Site Officer (Site Agent)

- a) The Contractor shall appoint an on-site Environmental Site Officer, the responsibility of which will be to undertake daily inspections to monitor compliance with the EMP. A daily checklist has been included under Section C to facilitate the daily inspections. Completed checklists must be submitted to the ECO at the end of each week.

2 Awareness training

- a) The Contractor will submit a Method Statement detailing the logistics of the environmental awareness training course.
- b) The ECO will provide the Contractor with the course content for the environmental awareness training and the Contractor will communicate this information to his employees on the site, to any new employees coming onto site and to his suppliers.
- c) The ECO or suitably qualified representative will present the environmental awareness training course to the Contractors' employees on the site, to any new employees coming onto site and to the Contractors' suppliers.
- d) All the Contractors' employees and Sub-Contractors' employees and any suppliers' employees that spend more than 1 day a week or four days in a month on site, must attend an Environmental Awareness Training course presented by the Contractor within one week of the Commencement Date.
- e) No more than 20 people shall attend each course and the cost, venue and logistics for this / these course/s shall be for the Contractor's responsibility.
- f) Within seven days from the Commencement Date the Contractor will ensure that the first course/s is/are held for as many of the employees that are available at this time.

- g) The Contractor will supply the ECO with a monthly report indicating the number of employees that will be present on site during the following month and any changes in this number that may occur during the month.

8.03 CONSTRUCTION CAMP LOCATION

1 Location

- a) The construction camp shall be located at an easily accessible point and within an area of low environmental sensitivity. The location shall be identified in consultation with the ECO.
- b) No site establishment shall be allowed within 15 m of a drainage channel or water body unless otherwise approved by the ECO.

2 Routing of services

- a) Main bulk service providers such as Telkom and Eskom shall be advised of the construction activities as well as the requirements of this specification and the Contractor shall be responsible for their activities with their work areas.
- b) All routes for service infrastructure shall take cognisance of any special features on Site and shall be re-routed around 'no go' areas as indicated by the environmental constraints plan (refer to Annexure B1).
- c) Where possible, service infrastructure shall be located in the same trench.

3 Site establishment

- a) To facilitate the necessary monitoring, the Contractor shall inform the ECO of the intended actions and programme for site establishment.
- b) The site layout shall take cognisance of access for deliveries and services, and future works. Likely disturbance to neighbours as well as security implications shall be considered.

8.04 CONSTRUCTION CAMP ENCLOSURE

1 General

- a) The boundaries of the proposed construction camp and working areas must be shown on a map that will be included in the EMS.
- b) The site will be fenced in accordance the fencing specifications listed below.
- c) The Contractor shall maintain the fence for the duration of the contract.
- d) Fences shall be maintained throughout the construction period. All temporary fencing shall be removed and the site restored to the satisfaction of the ECO on completion of the contract.
- e) All loose wire shall be removed from the site and access roads etc. and stored at the Contractor's camp.

2 Fencing specifications

- a) A diamond mesh or Bonnox fence with a minimum height of 1.8m must be erected around the Site.

8.05 'NO GO' AREAS

1 General

- a) All 'no go' areas will be indicated on the Environmental Constraints Map that will be provided to the Contractor prior to commencement of the Contract.
- b) The Contractor shall ensure that all 'no go' areas are marked with danger tape or appropriate fencing. Such marking is to be undertaken in collaboration with the ECO.
- c) The ECO may identify additional 'no go' areas and request the demarcation thereof during the construction phase.
- d) No unauthorised entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the marked 'no go' areas.

2 Pre-building inspection

Erven must be inspected prior to the commencement of any building activity. This must be done to identify any flora species or high-risk areas where no disturbance will be allowed on or surrounding a given erf. This inspection must be recorded.

Procedure:

- a) The Site Engineer will, in company with the Estate Landscaper and Estate Manager, conduct an inspection of the erf and its surroundings prior to any construction activity (including clearing of the erf in preparation) occurring on the site.
- b) The inspection will include:
 - i Confirming erf location and visual pegs for boundaries.
 - ii Identifying areas where construction equipment and materials may be placed.
 - iii Identifying flora and sensitive areas where no disturbance may take place on the erf and in the area surrounding the erf.
 - iv Taking photograph/s of the site.
- c) A copy of the inspection record must be signed off by the building contractor prior to commencement of building activity.

3 Trees to be protected

- a) Areas where trees are to be retained are to be indicated on the site development plan.
- b) Trees to be retained shall be clearly marked under the supervision of the ECO. Marking techniques include danger tape, paint (be aware of long term aesthetics), strapping and pegs. Tagging by exclusion shall be considered, i.e. where the number of trees to be cleared is fewer than those to be retained then mark trees for felling and all other trees shall automatically be retained.
- c) Markings shall remain in place for the duration of works on site. If damaged, markings shall be repaired or replaced immediately.

4 Special features

- a) Outcrops, rock faces, trees and natural vegetation or any other natural or special features (refer to Section 8.10 below) inside and outside the project site, shall not be defaced, painted for benchmarks or otherwise damaged even for survey purposes without the prior approval of the ECO. These features shall be demarcated as 'no go' areas and may require fencing or similar protection measures, as determined by the ECO.
- b) Special features will be marked on the environmental constraints plan prior to any works commencing on site. These areas may be designated 'no go' areas.

8.06 ACCESS ROUTES / HAUL ROADS

1 Access roads

- a) Access to the Campsite and works area shall utilise existing roads or tracks where possible.
- b) Traffic safety measure, to the satisfaction of the ECO, shall be considered in determining entry / exit onto public roads, and a Method Statement shall be produced to this effect.
- c) All temporary access routes shall be rehabilitated to the satisfaction of the ECO, and a Method Statement is required in this regard.
- d) The Contractor shall erect and maintain marker pegs along the boundaries of the working areas, access roads or paths, to the satisfaction of the ECO, before commencing any other work (in order to prevent unauthorised movement of persons or vehicles outside designated working areas and access road servitudes). Should the Contractor not exercise sufficient control to restrict all work to the area within the marker boundaries, then these areas shall require fencing at the discretion of the ECO.
- e) The movement of any vehicles and / or personnel outside the designated working areas shall not be permitted without the written authorization of the ECO.
- f) Upgrading of the access roads shall be undertaken within the existing confines of the road, unless otherwise agreed with the ECO. The Contractor shall submit a

Method Statement outlining the proposed method of upgrading, for approval by the ECO prior to commencing activities.

- g) Should new access roads or tracks be required then the Contractor shall provide a Method Statement showing the proposed route.
- h) Any materials used for layer-works shall be approved by the SE prior to the activity commencing.

2 Haul roads

- a) Haul roads shall be maintained by the Contractor. Maintenance includes adequate drainage and side drains, dust control and reparation of edges where necessary.
- b) Dust control measures shall be implemented where necessary, as indicated by the ECO.
- c) All users of haul roads shall not exceed 45 km/h, (cars), and 15 km/h, (construction vehicles).

3 Road maintenance

- a) Damage to the existing access roads as a result of construction activities shall be repaired to the satisfaction of the SE, using material similar to that originally used. The cost of the repairs shall be borne by the Contractor.
- b) All public roads shall be kept clear of mud and sand. Appropriate traffic warning signs shall be maintained. Trained and equipped flagmen shall be used where the access road intersects with any public roads.

8.07 CONSTRUCTION PERSONNEL INFORMATION POSTERS

- 1 The Contractor will prepare and display in the eating area, an A3 construction personnel information poster. This document will *inter alia* describe the key environmental requirements and specifications. (Refer to the environmental awareness training course).
- 2 The Contractor shall replace the construction personnel information poster if any part of it becomes illegible.

8.08 FIRE CONTROL

- 1 Fire management is to be undertaken in accordance with the approved fire management plan.
- 2 The Contractor shall take all reasonable and active steps to avoid increasing the risk of fire through their activities on Site. No fires may be lit except at places approved by the ECO.
- 3 The Contractor shall ensure that the basic fire-fighting equipment is to the satisfaction of the SE.
- 4 The Contractor shall supply all living quarters, site offices, kitchen areas, workshop areas, materials, stores and any other areas identified by the SE with tested and approved fire fighting equipment.
- 5 Fire and 'hot work' shall be restricted to a site approved by the SE.
- 6 A braai facility may be considered at the discretion of the SE. The area shall be away from flammable stores. All events shall be under management supervision and a fire extinguisher shall be immediately available. 'Low smoke' fuels shall be used. Smoke free zoning regulations shall be considered.
- 7 Fires within natural areas are prohibited.
- 8 Cooking shall be restricted to bottled gas facilities under strict control and supervision.
- 9 The Contractor shall take precautions when working with welding or grinding equipment near potential sources of combustion. Such precautions include having a suitable, tested and approved fire extinguisher immediately at hand and the use of welding curtains.

8.09 EMERGENCY PROCEDURES

1 Wastewater treatment works

- a) A Method Statement shall be drawn up by the Contractor, in consultation with the SE on the protocols to be followed, and contingencies in place, in the event of an accidental leak, spillage or overflow of raw wastewater, semi-treated wastewater, sludge or final effluent, as a direct or indirect result of construction activities. The Method Statement shall include the following:
 - (i) Comprehensive list of available equipment (*e.g.* pipes and pumps) in the event of a spill.

- (ii) Location of all emergency equipment.
 - (iii) Individual(s) responsible for the upkeep and maintenance of the emergency equipment.
 - (iv) Indication of how regularly the emergency equipment will be checked to ensure that it is working properly.
 - (v) Location of any and all temporary emergency sumps, including old sludge ponds, clarifiers, low lying areas *etc.*
 - (vi) Size of spillage which the emergency procedures could contain.
 - (vii) Where and how any spilled material will be returned to the wastewater works system.
 - (viii) Who shall be notified in the event of an emergency, including contact details.
- b) The Contractor shall ensure that his staff and the staff of Subcontractors are aware of the procedure to be followed for dealing with spills and leaks, which shall include notifying the SE and the relevant municipality. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks are present on Site at all times. The clean-up of spills and any damage caused by the spill or leak shall be for the Contractor's account.

2 Hydrocarbon spills

- a) The site shall have a supply of absorbent material readily available to absorb any emergency hydrocarbon spills, and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to absorb / deal with a minimum of 200ℓ of hydrocarbon liquid spill.
- b) There are a number of products on the market, which are designed and suitable as absorbents and to encapsulate spills. The following are examples of those products used to contain incidental spillage:
 - (i) Spill-Sorb – oil and chemical absorbent & encapsulating products.
 - (ii) Drizzat Pads.
 - (iii) Enretech Powder – absorbent & encapsulator.
 - (iv) Peat moss.
- c) Treatment and remediation of spill areas shall be undertaken to the satisfaction of the SE and ECO.

- d) Treatment and remediation shall require a Method Statement. Examples of products used for treatment and remediation include:
 - (i) Chemcap.
 - (ii) Bio-Systems B110 Series.
 - (iii) Enretech products.
- e) The source of the spillage shall be isolated.
- f) The contractor shall contain the spillage using sand berms, sandbags, pre-made booms, sawdust and/or absorbent materials.
- g) The spill site shall be cordoned off and appropriate actions implemented.

8.10 SPECIAL ENVIRONMENTS

An appointed conservation officer will maintain a list of all fauna encountered on site with dates and exact locations.

Furthermore the sensitive sites indicated on the environmental constraints plan will be managed in accordance with the following specifications:

1 Ecological corridors, rivers and streams

- a) The Contractor shall minimise the extent of any damage to the flood plain to the extent that is necessary to complete the works, and shall not pollute the river system as a result of construction activities. The Contractor shall not cause any physical damage to any aspects of a watercourse, other than those necessary to complete the works as specified and in accordance with the accepted method statement.
- b) Where infrastructure for bulk services cross ecological corridors trenches must be excavated by hand.
- c) Construction activities shall not permanently alter the surface or subsurface flow of water through the flood plain area.
- d) The Contractor shall ensure that all construction activities within the flood plain, including the removal of vegetation, stockpiling of top material, excavating of pipeline route, laying of pipeline, backfilling of excavations and rehabilitation occur within a minimum period as stipulated by the ECO.

- e) Baseline water quality of any rivers, streams, wetlands on the Site shall be established prior to onset of any construction activities. These baseline values (total Suspended Solids, pH, conductivity, nitrates, nitrites, ammonia and temperature) shall not be adversely affected by construction-related activities. (Baseline water quality and monitoring requirements should be established with DWA prior to commencement of construction).
- f) The Contractor shall submit a method statement for review 14 days prior to commencing construction within the 1:50 year floodline. The method statement shall highlight (but not be confined to) the following issues:
 - (i) Detailed plan for any crossings, including pipe protection works.
 - (ii) How water flow will be diverted during construction (if applicable).
 - (iii) Containment of contaminated runoff and contaminated water.
 - (iv) Width of working servitude (if not already detailed in project specification)
 - (v) Final expected profile of river / stream banks.
 - (vi) Reinstatement and rehabilitation of river / stream banks.
- g) Plastic sheeting, sandbags or geofabric approved by the ECO shall be used to prevent the migration of fines through the edges of the fill into the river.
- h) Banks shall be suitably stabilised incrementally immediately after construction allows. Upkeep of stabilisation facilities shall be continuously maintained.
- i) Rocks for use in gabion baskets shall not be obtained from a watercourse.
- j) The introduction of any construction related effluent water into any natural stream or river requires a Method Statement to be approved by the ECO.

2 Areas of natural vegetation

- a) The Contractor shall prevent any damage to sensitive Fynbos habitats indicated by the environmental constraints plan.
- b) The Contractor shall not cause any physical damage to any other habitats, other than those necessary to complete the works as specified and in accordance with the approved Site Development Plan.
- c) Where infrastructure for bulk services runs through sensitive areas trenches must be excavated by hand.

- d) The Contractor shall ensure that all construction activities within or in close proximity to sensitive areas, including the removal of vegetation, stockpiling of top material, excavating of pipeline route, laying of pipeline, backfilling of excavations and rehabilitation occur within a minimum period as stipulated by the ECO.
- e) In areas where natural vegetation has to be removed, the contractor shall remove and stockpile a 30 mm layer of topsoil for rehabilitation purposes.

3 Wetlands

- a) All potential wetland areas shall be indicated by the environmental constraints plan.
- b) The wetland shall be marked on site with danger tape or other suitable visible method. The ECO shall approve the demarcation of prior to the commencement of construction.
- c) Damage to wetland areas shall be minimised.
- d) Construction may not permanently alter the surface or subsurface flow of water through the wetland.
- e) No construction materials shall be stockpiled in any wetland areas.
- f) The post-construction profile of the wetland shall be returned to one similar to that before construction, with no created 'ridge or channel' features present.

4 Bot River Vlei

- a) The Contractor shall minimise the extent of any damage to the vlei to the extent that is necessary to complete the works, and shall not pollute the vlei as a result of construction activities. The Contractor shall not cause any physical damage to any aspects of the vlei, other than those necessary to complete the works as specified and in accordance with the accepted method statement.
- b) Construction activities shall not permanently alter the surface or subsurface flow of water into the vlei.
- c) Baseline water quality of the vlei shall be established prior to onset of any construction activities. These baseline values (total Suspended Solids, pH, conductivity, nitrates, nitrites, ammonia and temperature) shall not be adversely affected by construction-related activities. (Baseline water quality and monitoring

- requirements should be established with DWA prior to commencement of construction).
- d) The Contractor shall submit a method statement for review 14 days prior to commencing construction within 100 m from the high water mark of the vlei. The method statement shall highlight (but not be confined to) the following issues:
 - (i) Containment of contaminated runoff and contaminated water.
 - (ii) Width of working servitude (if not already detailed in project specification)
 - (iii) Final expected profile of vlei banks.
 - e) Plastic sheeting, sandbags or geofabric approved by the ECO shall be used to prevent the migration of fines through the edges of the fill into the vlei.
 - g) Damage to the vlei shall be minimised.
 - h) Banks shall be suitably stabilised incrementally immediately after construction. Upkeep of stabilisation facilities shall be continuously maintained.
 - i) A no-go zone along the edge of the vlei shall be marked on site with danger tape or other suitable visible method. The ECO shall approve the demarcation of prior to the commencement of construction in the vicinity.
 - j) No construction materials shall be stockpiled within the demarcated no-go zone.

5 Rocky outcrops

- a) Rocky outcrops must, as far as possible, be preserved and buffered by 10 m.
- b) In the event that a rocky outcrop can not all together be avoided by the construction of the development the relevant specialist must be consulted as to the way forward.

8.11 PROTECTION OF ARCHAEOLOGICAL AND PALAEOLOGICAL REMAINS

- 1 If remains or artefacts are discovered on Site during earthworks, work shall cease and the Contractor shall contact the ECO who will take the necessary steps to assess the significance of the discovery and formulate appropriate impact mitigation and protection strategies in collaboration with the South African Heritage Resources Agency (SAHRA).

8.12 EROSION AND SEDIMENTATION CONTROL

- 1 During construction the Contractor shall protect areas susceptible to erosion by installing the necessary temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
- 2 Any runnels or erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored to a proper condition.
- 3 Stabilisation of cleared areas to prevent and control erosion shall be actively managed. The method of stabilisation shall be determined in consultation with the ECO. Consideration and provision shall be made for the following methods (or combinations thereof):
 - a) Brushcut packing.
 - b) Mulch or chip cover.
 - c) Straw stabilising (at the rate of one bale/m² and rotavated into the top 10mm of the completed earthworks).
 - d) Watering.
 - e) Planting / sodding.
 - f) Hand sowing.
 - g) Hydroseeding.
 - h) Soil binders and anti erosion compounds.
 - i) Mechanical cover or packing structures such as:
 - (i) Gabions.
 - (ii) Geofabric.
 - (iii) Hessian cover.
 - (iv) Armourflex.
 - (v) Log / pole fencing.
 - (vi) Retaining walls.
- 4 Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised areas shall be repaired and maintained to the satisfaction of the ECO.

- 5 Anti-erosion compounds shall consist of an organic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations.

8.13 STORMWATER CONTROLS

- 1 No residential stormwater will be disposed of in the riverine corridors.
- 2 The Contractor shall take reasonable measures to control the erosive effects of stormwater runoff.
- 3 The Contractor shall place siltscreens or straw bales across stormwater flow areas to prevent erosion.
- 4 The Contractor shall be liable for any damage to downstream property caused by the diversion of overland stormwater flows.

8.14 AESTHETICS

- 1 The Contractor may be required to temporarily screen some areas of the construction site, as determined by the SE and ECO.
- 2 Screening shall be aesthetically acceptable.
- 3 Screening shall be maintained by the Contractor for the duration of the contract.
- 4 Screening may be of the following types:
 - a) Shade cloth
 - b) Hessian
 - c) Berms

8.15 COMMUNITY RELATIONS

- 1 The Contractor shall erect an information board containing background information on the construction activity and listing the relevant contact details for complaint.

8.16 ACCESS TO SITE

- 1 The Contractor shall ensure that access to the Site and associated infrastructure and equipment is off-limits to the public at all times during construction.
- 2 The Contractor shall erect indemnification notices at all access points.

8.17 ANCHORS

- 1 Rock or ground anchors are normally associated with unstable or special engineering circumstances and a Method Statement, to be approved by the SE in consultation with the SE, shall be required for these processes.
- 2 Epoxy and grouting chemical / safety data sheets are to be provided as part of the Method Statement.

8.18 ASPHALT, BITUMEN AND PAVING

- 1 Over-spray of bitumen products outside of the road surface and onto roadside vegetation shall be prevented.
- 2 Bitumen drums / products shall be stored in an area approved by the SE. This area shall be indicated on the construction camp plan. The storage area shall have a smooth impermeable (concrete or thick plastic covered in sand) floor. The floor shall be bunded and sloped towards a sump to contain any spillages of substances.
- 3 When heating bitumen products, the Contractor shall take cognisance of appropriate fire risk controls.
- 4 Stone chip / gravel excess shall not be left on road / paved area verges. This shall be swept / raked into piles and removed to an area approved by SE.
- 5 Milled or cut out bitumen shall be removed to an area approved by the SE.
- 6 Water quality from runoff from newly/fresh bitumen surfaces shall be monitored by the SE and remedial actions taken where necessary.
- 7 Heating of bitumen products shall only be undertaken using LPG or similar zero emission fuels.
- 8 Appropriate fire fighting equipment shall be readily available.

8.19 BLASTING

- 1 A current and valid authorisation shall be obtained from the relevant authorities and copied to the SE prior to any blasting activity.
- 2 A Method Statement shall be required for any blasting related activities.
- 3 All Laws and Regulations applicable to blasting activities shall be adhered to at all times.
- 4 A qualified and registered blaster shall supervise all blasting and rock-splitting operations at all times.
- 5 The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area).
- 6 The Contractor shall allow for good quality vibration monitoring equipment and record keeping on Site at all times during blasting operations.
- 7 The Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site.
- 8 The Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting/drilling shall be repaired at the Contractors expense to the satisfaction of the SE and ECO.
- 9 The Contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given.
- 10 The Contractor shall use blast mats for cover material during blasting (topsoil may not be used as blast cover).
- 11 During blasting, the Contractor shall ensure, where possible, that trees in the area are not damaged.
- 12 Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a Method Statement to be approved by the SE in consultation with the SE, shall be required in this regard.
- 13 At least one week prior to blasting, the relevant occupants/owners of surrounding land shall be notified by the Contractor and any concerns addressed. Buildings within the potential damaging zone of the blast shall be surveyed preferably with the owner present, and any cracks or latent defects pointed out and recorded either using photographs or

video. Failing to do so shall render the Contractor fully liable for any claim of whatsoever nature, which may arise. The Contractor shall indemnify the Developer in this regard.

8.20 BORROW PITS AND QUARRIES

- 1 All borrow pits shall be clearly indicated on the construction master plan.
- 2 Prior to the onset of any quarrying or borrow pit activities the Contractor shall establish from the SE whether authorization has been obtained, both in terms of the Minerals Act (Act 50 of 1991), (via the compilation of an Environmental Management Programme Report) and in terms the National Environmental Management Act (Act 107 of 1998) (via an Environmental Impact Assessment process). No excavation or blasting activities shall commence before the necessary authorizations are in place.
- 3 Borrow pits shall at all times be operated according to the regulations promulgated in terms of Act 50, Mine Health and Safety Act (Act 29 of 1996), and Noise and Nuisance Regulations of the Environment Conservation Act (Act 73 of 1989).
- 4 Only single lane access for construction vehicles shall be provided at borrow pit and quarry sites. New access roads require approval by the SE.
- 5 Stormwater and groundwater controls shall be implemented.
- 6 Machinery, fuels and hazardous materials vulnerable to flooding shall be stored out of flood risk areas.
- 7 Vehicles leaving borrow pits shall not deposit/shed mud, sand and debris onto any public road.
- 8 All loads shall be covered with a tarpaulin or similar to prevent dangers and nuisance to other road users.
- 9 Trees and debris shall not be permitted to fall outside of the clearing limits. Trees shall be cleared or felled so as not to damage other trees or vegetation.
- 10 Borrow pits shall be fenced to prevent unauthorised persons and vehicles from entering the area. Fences shall also be stock and game proof.
- 11 A Method Statement shall be prepared and submitted to the SE in respect of rehabilitation and re-vegetation of borrow pits sites.
- 12 The contractor shall ensure that blasted faces of the pit shall be shape-blasted to the approval of the SE.

- 13 Where required, dust and fly-rock prevention methods shall be detailed in a Method Statement to be approved by the SE.
- 14 During the rehabilitation of borrow pits, the slope of the borrow pit shall be graded to blend with the natural terrain and be stabilised to prevent erosion.

8.21 BRIDGES AND CULVERTS

- 1 All underpasses intended for animal traffic should be at least 5m wide.¹
- 2 The underpasses coinciding with streams should be designed so that there is dry, level ground, to the side of the stream, of at least 3m width, to allow passage of ungulates.
- 3 The stream bed itself should be lined with loose rocks rather than concrete so that aquatic organisms have continuity of natural habitat.
- 4 The approaches to the underpass should not be steep or excessively broken. Both the approaches to the underpass, and the underpasses themselves, should be vegetated where possible, but not densely as to obstruct the movement of animals. The ideal would be a clear path of roughly 3 m width, with vegetation to either side.
- 5 Because the underpass will be relatively dark, consideration should be given to create a central skylight of some kind in the middle of the road so that some plant growth within the underpass can be possible.
- 6 Fencing or stone walls should be judiciously constructed to guide animals towards the underpass and prevent them from attempting to cross the perilous R44 highway.
- 7 The height of all underpasses should be sufficient for relatively large antelope, such as Grey Rhebok, to pass through easily, i.e., at least 1.5m high. Note that the same specification should be applied to all bridges and boardwalks that cross corridors.
- 8 Construction of the underpasses, especially those that coincide with watercourses, will be potentially damaging if sediments are allowed to wash downstream. Adequate measures to prevent this must be taken.
- 9 All the underpasses should be patrolled regularly by the environmental officer, and examined for evidence of predation.
- 10 The Contractor shall ensure that provision is made to facilitate continuity of base water flow at all times during construction of these features.

¹ Guidelines 1-8 drawn from Arabella Phase 2, Kleinmond: Revised Impact Assessment: Fauna, Seventh Draft (James Harrison 2012).

- 11 Reduction of baseline water quality by construction actions/activities shall be prevented (for example dams, silt traps or plastics lining).
- 12 Water quality monitoring regimes shall be established prior to the onset of any construction activity within watercourses (baseline water quality and monitoring requirements should be established with DWA prior to commencement of construction).
- 13 No watercourse or stream may be diverted, dammed or modified without the approval of the ECO.
- 14 Where stream diversion is required, the Contractor shall submit a Method Statement to the SE for approval prior to commencing construction. Following construction, all diverted streams shall be reinstated to the satisfaction of the ECO.

8.22 CEMENT AND CONCRETE BATCHING

1 Location

- a) Concrete shall not be mixed directly on the ground.
- b) The concrete batching activity shall be located in an area of low environmental sensitivity to be identified and approved by the ECO.
- c) The permitted location of the batching plant (including the location of cement stores and sand and aggregate stockpiles) shall be indicated on the construction master plan and approved by the ECO. A Method Statement indicating the layout and preparation of this facility is required in this regard.

2 Maintenance

- a) All wastewater resulting from batching of concrete shall be disposed of via the wastewater management system.
- b) The cement/ concrete batching works shall be kept neat and clean at all times. No batching activities shall occur on unprotected substratum of any kind.
- c) All runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at a site approved by the ECO. Daga boards, mixing trays and impermeable sumps shall be used at all mixing and supply points.
- d) Contaminated water storage facilities shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented.

- e) Contaminated water treatment on Site shall require a method statement approved by the ECO.
- f) Unused cement bags are to be stored so as not to be effected by rain or stormwater runoff.
- g) Used bags shall be stored in weatherproof containers to prevent wind blown cement dust and water contamination. Used bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose.
- h) Transportation of concrete shall not result in spillage.
- i) Cleaning of equipment and flushing of mixers shall not result in pollution of the surrounding environment: Care shall be taken to collect contaminated wash water from cleaning activities and dispose of it in a manner approved by the ECO. To prevent spillage onto roads, ready mix trucks shall rinse off the delivery shoot into a suitable sump prior to leaving Site.
- j) Suitable screening and containment shall be in place to prevent wind blown contamination associated with bulk cement silos, loading and batching.
- k) With respect to exposed aggregate finishes, the Contractor shall collect all contaminated water & fines and store it in sumps for disposal at an approved waste site.
- l) All visible remains of excess concrete shall be physically removed on completion of the plaster or concrete pour section and disposed of. Washing the remains into the ground is not acceptable. All excess aggregate shall also be removed.

8.23 PIPELINES

- 1 Cleaning /flushing of pipelines shall not impair (downgrade) downstream baseline water quality. The water quality of receiving waters shall be monitored by the Contractor during cleaning/ flushing operations (baseline water quality and monitoring requirements should be established with DWA prior to commencement of construction).
- 2 Materials used in the sterilization of pipelines, viz chlorine solutions shall be treated as hazardous substances and disposed of at an approved landfill site.
- 3 Litter traps shall be installed and maintained at the outflow of all pipelines.

- 4 No diversion or alteration of the normal river or flood plain shall occur during the excavation, laying and backfilling of the pipeline.
- 5 Pressurised air may be used to ensure that the pipeline section and associated concrete anchors along the bed of the river are buried below the bed surface. However, appropriate measures shall be taken to minimise the disturbance and sedimentation caused during this process.
- 6 A geotextile curtain shall be installed within the trench on either side of the pipe during these excavation operations to minimise downstream sedimentation. These curtains shall be removed before the filling in of the trench.

8.24 CRANE OPERATIONS

- 1 Drive plants shall be well maintained and drip trays shall be positioned at potential leak areas.
- 2 Over-greasing of crane cables shall be avoided.
- 3 The positioning and direction of lighting associated with crane operations shall not cause a nuisance to the surrounding communities or users of the area.
- 4 Movement and lifting of hazardous materials shall be undertaken such that they do not cause pollution, spillage or safety risks (in particular where concrete buckets are in use). Where necessary, a method statement is required in this regard.

8.25 DEMOLITION

- 1 Hazardous building materials, including asbestos shall be identified prior to demolition of any buildings and dealt with in accordance with the safety and health legislation. A Method Statement, outlining the proposed approach to the disposal of these materials, must be supplied for approval by the SE.
- 2 All buildings older than 60 years require a permit from South African Heritage Resources Agency in terms of the National Heritage Resources Act (Act 25 of 1999).
- 3 A demolition permit is also required from the municipality in terms of the National Building Regulations (this applies to the demolition of all buildings, irrespective age).
- 4 Municipal and other services shall be isolated prior to any demolition occurring.

- 5 Hazardous materials shall be separated on Site and disposed of at appropriate licensed disposal sites. The Contractor shall supply the ECO with a certificate of disposal.
- 6 Safety legislation shall be strictly adhered to in demolishing buildings and structures.
- 7 A Safety Officer shall be appointed to oversee the safe demolition of buildings and structures.
- 8 Demolition sites shall be kept in a neat, tidy and safe condition.

8.26 DRILLING AND JACKHAMMERING

- 1 The Contractor shall submit a Method Statement detailing the proposals to prevent pollution during drilling operations.
- 2 The Contractor shall take all reasonable measures to limit dust generation as a result of drilling operations.
- 3 Noise and dust nuisances shall comply with the applicable standards.
- 4 The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.
- 5 All affected parties shall be informed at least one week prior to the onset of the proposed drilling/jackhammering operations, and their concerns addressed.
- 6 Drill coring with water or coolant lubricant shall require a Method Statement approved by the SE.
- 7 Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the Contractor to the satisfaction of the ECO.

8.27 EARTHWORKS

- 1 The excavation of any material on Site shall be done in accordance with SABS 1200 D or DB and PSD or PSDB, as applicable.
- 2 Prior to earthworks in any sensitive habitat indicated on the environmental constraints plan, all conservation worthy plants must be identified and transplanted by the Contractor.
- 3 All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities.
- 4 Defined access routes to and from the area of operation as well as around the area of operation shall be detailed in a Method Statement for approval by the SE.

- 5 No equipment associated with the activity shall be allowed outside of these areas unless expressly permitted by the ECO.

8.28 PILING, JACKING AND THRUST BORING

- 1 Piling operations require a Method Statement, which shall detail the type of piling operation as well as *in situ* casting or pre-cast pile structures. *In situ* piles shall take cognisance of possible groundwater impacts.
- 2 The Contractor shall take preventative measures, such as screening, muffling, dust control, timing. Pre-notification of affected parties shall be implemented to minimise complaints regarding dust, noise and vibration nuisances.
- 3 The area shall be adequately fenced and warning signs erected.

8.29 POWER TOOLS

- 1 The Contractor shall take preventative measures, such as screening, muffling, dust control, timing and pre-notification of affected parties shall be implemented to minimize complaints regarding dust, noise and vibration nuisances.

8.30 PUMPING AND SUMPING

- 1 Pumps shall be placed over a drip tray in order to prevent fuel spills and leaks from contaminating the water in the pumped area.
- 2 Contaminated water may not be discharged into existing watercourses or streams and a Method Statement for discharge of this contaminated water shall be required.
- 3 Silt-laden water shall be cleaned by putting it through one of the following:
 - a) A perforated 200 ℓ drum containing sand and stone separated by geotextile fabric with a central delivery water pipe.
 - b) Vegetation that disperses the water.
 - c) A geotextile sock tied on the delivery pipe of the pump.
 - d) A constructed wetland.

8.31 SETTLEMENT PONDS

- 1 The Contractor shall submit a Method Statement proposal in connection with settlement ponds prior to the construction of any such ponds. The Contractor shall size settlement ponds in accordance with the envisaged scale of operation.
- 2 Suspended solids and contaminants including oils shall be removed and disposed of by the Contractor at frequent intervals at a site approved by the ECO.

8.32 RETAINING WALLS AND GABIONS

- 1 A Method Statement, approved by the SE, shall be required to deal with these structures.
- 2 Rocks for use in gabion baskets shall be obtained from a source approved by the SE.
- 3 Rocks for use in gabion baskets shall not be obtained from a watercourse.

8.33 ROCK BREAKING

- 1 Mechanical methods of rock breaking, including montibird type breakers, jackhammers and 'boulder busting', have noise and dust impacts that shall be addressed. Boulder buster use requires that blasting protocols shall be followed.
- 2 Residents shall be notified at least one week prior to these activities commencing, and their concerns addressed.
- 3 Chemical breaking shall require a Method Statement approved by the SE.

8.34 STREAM DIVERSION

- 1 The Contractor shall not divert, dam or modify any watercourse or stream without the approval of the ECO.
- 2 The Contractor shall submit a Method Statement to the SE for approval prior to commencing with the diversion.
- 3 Diverted streams shall be reinstated to the satisfaction of the ECO.

8.35 STREAM CROSSING

- 1 Temporary bridges shall be built to cross rivers. The structure of the bridge shall be a single span, where possible.
- 2 The fording of rivers by machinery and vehicle shall be undertaken at slow speed and with clean vehicles (i.e. no oil leaks, etc.) and along a single, marked track.

8.36 TRENCHING

Trenching for services shall be undertaken in accordance with the Engineering Specifications (SABS 1200DB) with the following environmental amplifications, where applicable.

- 1 Trenching shall be kept to a minimum through the use of single trenches for multiple services provision.
- 2 The planning and selection of trench routes shall be undertaken in liaison with the SE and cognisance shall be given to minimising the potential for soil erosion.
- 3 Trench routes with permitted working areas shall be clearly defined and marked with painted stakes prior to excavation.
- 4 The stripping and separation of topsoil shall occur as stipulated by the ECO. Soil shall be excavated and used for re-filling trenches using the rollover method, i.e. soil from the first trench section shall be stockpiled. Thereafter, soil excavated from subsequent trench lengths shall be used to backfill the trench behind it once the services have been laid. The final trench length shall be re-filled using the soil stockpiled from the first length.
- 5 Trench lengths shall be kept as short as practically possible before backfilling and compacting.
- 6 Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an appropriate manner.
- 7 Immediately after re-filling, trenches and associated disturbed working areas shall be planted with a suitable plant species and regularly watered. Where there is a particularly high erosion risk, a fabric such as Geojute (biodegradable) shall be used in addition to planting.

8.37 WATER ABSTRACTION FROM STREAM AND GROUNDWATER

- 1 Abstractions from natural water resources require a Method Statement for prior approval by the SE.

8.38 TEMPORARY SITE CLOSURE

The Contractor's Safety Officers appointed in terms of the Occupational Health and Safety Act (Act 85 of 1993) are to facilitate the temporary closure of the site e.g. during holiday periods. The Safety Officers must inspect and report to the SE on the following aspects:

1 Fuels / flammables / hazardous materials stores

- a) Ensure fuel stores as low in volume as possible.
- b) No leaks.
- c) Outlet secure / locked.
- d) Fire extinguisher serviced and accessible.
- e) Secure area from accidental damage e.g. vehicle collision.
- f) Emergency and contact numbers to be available and displayed.
- g) Adequate ventilation.
- h) Safety officer check prior to closure of site.
- i) No stores or containers in 1:50 year flood line.

2 Safety

- a) All trenches and manholes secured.
- b) Fencing and barriers in place per the Act 85 of 1993.
- c) Notice boards applicable and secured.
- d) Emergency and Management contact details displayed.
- e) Site safety officer checks prior to closure per Act 85 of 1993.
- f) Security persons briefed and have facility for contact.
- g) Night hazards checked eg reflectors, lighting, traffic signage.
- h) Fire hazards identified – municipality notified of any potential threats eg large brush stockpiles, fuels etc.
- i) Pipe stockpile wedged / secured.

- j) Scaffolds secure.
- k) Inspection schedule and log by security or contracts staff.

3 Erosion

- a) Wind and dust mitigation in place e.g. straw, brush packs, irrigation.
- b) Slopes and stockpiles at stable angle.
- c) Revegetated areas watering schedules and supply secured.
- d) Detention ponds or channels in place.

4 Water contamination and pollution

- a) Secure the hazardous fuels stores.
- b) Flood precautions e.g. withdraw out of floodplain / 1:50 year floodplain (where possible).
- c) Stabilise banks for expected normal flow.
- d) Structures in watercourses secured.
- e) Cement and materials stores secured.
- f) Toilets empty and secured.
- g) Refuse bins empty and secured (lids).
- h) Bunding clean and treated e.g. Spill Sorb or Enretech #1 powder.
- i) Drip trays empty & secure (where possible).
- j) Structures vulnerable to high winds secure.

8.39 SITE CLOSURE

The Contractor's Safety Officers appointed in terms of the Occupational Health and Safety Act (Act 85 of 1993) are to facilitate the closure of the site. The Safety Officers must inspect and report to the SE on the following aspects:

1 All fuels, flammables and other hazardous materials have been removed from the site.

2 Safety

- a) All trenches and manholes secured.
- b) Fencing and barriers in place per the Act 85 of 1993.
- c) Notice boards applicable and secured.

- d) Emergency and Management contact details displayed.
- e) Site safety officer checks prior to closure per Act 85 of 1993.
- f) Night hazards checked eg reflectors, lighting, traffic signage.
- g) Fire hazards identified – municipality notified of any potential threats eg large brush stockpiles, fuels etc.

3 Erosion

- a) Wind and dust mitigation in place e.g. straw, brush packs, irrigation.
- b) Slopes and stockpiles at stable angle.
- c) Revegetated areas watering schedules and supply secured.
- d) Detention ponds or channels in place.

4 Water contamination and pollution

- a) All the hazardous fuels stores removed.
- b) Stabilise banks for expected normal flow.
- c) Ablution facilities emptied.
- d) Refuse bins empty and secured (lids).

SPEC9 TOLERANCES

9.01 FINES

1 Spot fines

- a) Spot fines shall be issued per incident and per individual at the discretion of the ECO.
- b) Spot fines shall be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications.
- c) The ECO shall inform the Contractor of the contravention and the amount of the fine, and will deduct the amount from monies due under the Contract.
- d) Spot fines of between R20 and R2000, including but not limited to those activities detailed below, will be imposed by the ECO on the Contractor for contraventions of the environmental specifications by individuals or operators employed by the Contractor and /or his Sub-contractors. Where there are rangers, the amount shall

depend on the severity and extent of the damage done to the environment. Spot fines will be imposed for the following:

(i)	Any personnel or equipment related to the Contractor's operations within the designated boundaries of the 'no-go' area.	R100 – 1000
(ii)	Failing to adhere to speed limit	R50 – 500
(iii)	Driving any earthmoving plant outside the boundaries of the site	R100 – 1000
(iv)	Storage or disposal of material outside the area designated for such purpose.	R500 – 1000
(v)	Ignoring a verbal warning to have an oil leak from his machinery repaired	R50 – 500
(vi)	Littering on site	R50
(vii)	Not making use of the ablution facilities	R50
(viii)	Making an illegal fire on site	R20 – 200
(ix)	Using a funnel for refuelling rather than a pump	R100
(x)	Causing unnecessary damage to flora and fauna on site	R100 – 500
(xi)	Eating a meal outside of the defined eating area	R20

Penalties are subject to revision.

- e) For each subsequent similar offence committed by the same individual, the fine shall be doubled in value to a maximum value of R5000.

2 Penalty fines

- a) Where the Contractor inflicts non-repairable damage upon the environment or fails to comply with any of the environmental specifications, he shall be liable to pay a penalty fine over and above any other contractual consequence. (In terms of the Conventional Penalties Act (1962), a creditor is not entitled to recover both the penalty and damages. Accordingly, were a Contractor causes damage, the Employer can either enforce a penalty or make the Contractor make good the damage, but not both).
- b) The Contractor is deemed NOT to have complied with this Specification if:
- (i) Within the boundaries of the site, site extensions and haul/access roads there is evidence of contravention of the Specification.
 - (ii) Environmental damage ensues due to negligence.

- (iii) The Contractor fails to comply with corrective or other instructions issued by the SE within a specific time.
- (iv) The Contractor fails to respond adequately to complaints from the public.
- c) The amount of the penalty fine shall be determined by the ECO.
- d) Payment of any fines in terms of the contract shall not absolve the offender from being liable from prosecution in terms of any law.
- e) An Environmental Performance Guarantee of 5% of Contract Value shall be deposited by the Contractor with the SE. This fund shall be used in the event of penalties or rehabilitation costs for non-conformance or contraventions of the EMS. The balance shall be given back to the Contractor at Contract closure.
- f) The following penalties are suggested for transgressions:

(i)	Erosion	A penalty equivalent in value to the cost of rehabilitation plus 20%
(ii)	Oil spills	A penalty equivalent in value to the cost of clean up operation plus 20%.
(iii)	Damage to indigenous vegetation	A penalty equivalent in value to the cost of restoration plus 50%.
(iv)	Damage to cultural sites	A penalty to a maximum of R10 000 shall be paid for any damage to any cultural/historical sites.
(v)	Damage to trees	A penalty to maximum of R15 000 shall be paid for each tree removed without prior permission, or a maximum of R5 000 for damage to any tree, which is to be retained on site.

Penalties are subject to revision.

CHIEF EXECUTIVE OFFICER
HPF PROPERTIES (PTY) LTD

ANNEXURE B1

ENVIRONMENTAL CONSTRAINTS PLAN

ALTERNATIVE 4 (13 SEPTEMBER 2012)



CONSTRAINTS

- Botanical Constraints
- High Sensitivity
 - Medium Sensitivity
 - Low Sensitivity

- Freshwater Constraints
- Wetlands, Vleis & Corridors
 - 20m Buffer

- Faunal Constraints
- Surveyed Ponds with Buffer

- Estuarine Constraints
- 5 m MSL Contour Line

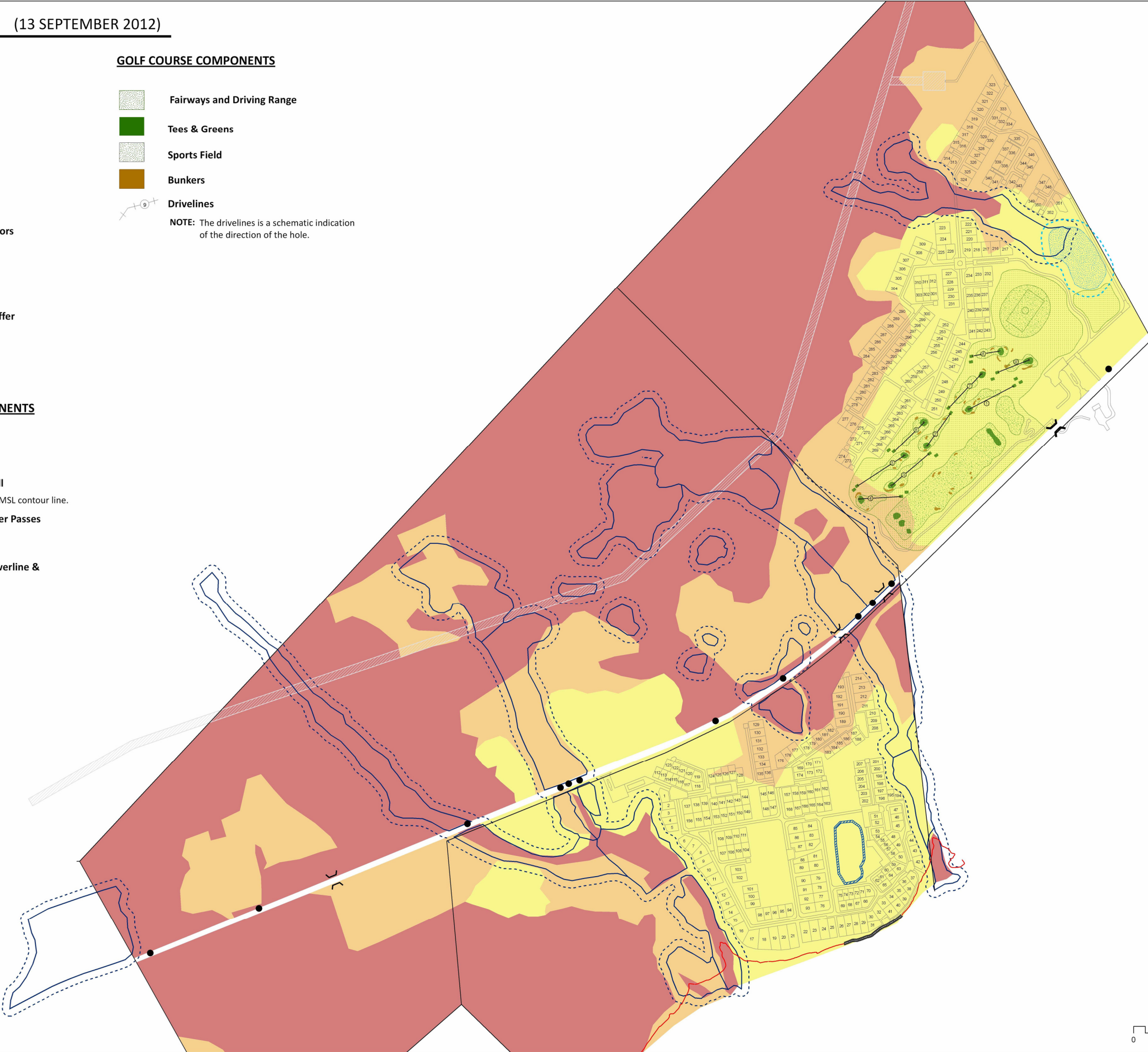
BUILT ENVIRONMENT COMPONENTS

- Roads and Boardwalks
- Erf Boundaries
- Proposed Retaining Wall
- Proposed Culverts/Under Passes
- Existing Culverts
- Overhead Electrical Powerline & Sub-Station

GOLF COURSE COMPONENTS

- Fairways and Driving Range
- Tees & Greens
- Sports Field
- Bunkers

- Drivelines
- NOTE: The drivelines is a schematic indication of the direction of the hole.



ANNEXURE B2

MITIGATION REPORT

1 INTRODUCTION

This Mitigation Plan was prepared in terms of Section 34 of the National Environmental Management Act (NEMA, Act 107 of 1998) which stipulates that *a draft environmental management plan must include information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified...*

The scope of the mitigation plan describes how effect will be given to each mitigation measure by indicating the following:

- What specific actions are required to give effect to the proposed mitigation;
- Who would be responsible for implementing the actions;
- Who would be responsible for auditing the implementation of the actions;
- The timeframe for implementation of the actions, (as it relates to the overall programme for construction and operation);

This Mitigation Report should be read together with the:

- a) Environmental Impact Report (EIR) dated October 2010.
- b) Integrated ISO14001 *Environmental Management System* for the estate as a whole (To be Completed).
- c) Environmental Management Plan for Arabella Phase 2 (This document).
- d) Broad Based Black Economic Empowerment Agreement (BBBEE) dated September 2005.
- e) Environmental Management Specifications for Arabella Phase 2 (Environmental Management Plan, Section B).
- f) Architectural and Design Guidelines for Arabella Phase 2 (Environmental Management Plan, Section B, Annexure B4).
- g) Landscaping Plan (Environmental Management Plan, Section B, Annexure B5).
- h) Environmental Rehabilitation and Management Plan (Environmental Management Plan, Section B, Annexure B10).
- i) Water Management Plan (To be Completed).
- j) Stormwater and Flood Run-Off Management Plan (To be Completed).
- k) Sewage and Solid Waste Management Plan (To be Completed).
- l) Fire Management Plan (Environmental Management Plan, Section B, Annexure B3).

2 DOCUMENT STRUCTURE

The document addresses the mitigation measures proposed by the various specialists in their respective reports compiled during the EIA process. The document was drafted in tabular format, consisting of the following headings:

- a) **MITIGATION REF. NO.:** Reference number assigned to a particular mitigation.
- b) **MITIGATION MEASURE** proposed.
- c) **REFERENCE IN SPECIALIST REPORT:** This refers the reader to the paragraph and page number where the specific recommendation and/or mitigation measure has been stated in the particular specialist report.
- d) **IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTION:** The mitigation measure and/or activity to be implemented in order to address the condition of authorisation and recommendations are addressed here.
- e) **RESPONSE:** The institution and/or specialist responsible for drafting and/or initiating the mitigation measure and/or activity are listed here.
- f) **EXECUTE:** The institution and/or specialist responsible for implementing the mitigation measure and/or activity are listed here.
- g) **AUDIT:** The institution and/or specialist responsible for auditing the correct implementation of the mitigation measure and/or activity are listed here.
- h) **PHASE:** The phase in which the mitigation measure and/or activity must be started and maintained are listed here.
- i) **CROSS REFERENCE:** Any mitigation measures and/or activities which are continuously repeated are listed here.

The following acronym or abbreviations are used in the column *PHASE*:

TITLE	ACRONYM OR ABBREVIATION
Pre Construction Phase	PCP
Construction Phase	CP
Pre Operational Phase	POP
Operational Phase	OP

3 PROJECT TEAM

The various project team members (together with an abbreviation or acronym for their respective titles) that individually or collectively responsible for the implementation of the stipulated mitigation measures are listed below.

FUNCTION	TITLE	ACRONYM OR ABBREVIATION
Arabella	Arabella Country Estate	ACE
Architects		ARC
Consulting Engineers		CE
Contractor		CR
Environmental Control Officer		ECO
Auditing Committee		AC
Planning Consultants	Dennis Moss Partnership	DMP
Landscape Architect		LA
Project Managers		PM
Site Engineer		SE
Specialist Consultant		SC
Estate Manager		EM

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
4 INVENTORY								

Mitigation Ref. No..	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
Fauna								
(JAH Environmental Consultancy, Arabella Phase 2, Kleinmond: Revised Impact Assessment: Fauna, Seventh Draft, November 2012)								
1	<i>Mitigation of destruction of natural habitats and populations.</i>	11.1 (p64)	/	/	/	/	/	/
1.1	<i>Design of roads across ecological corridors: ... need to be designed so as to minimize damage to the habitats of the corridors and reduce the likelihood of animal road mortalities. Raise these crossings on bridges to allow for continuity of all corridor habitats beneath the bridges. Consult a fauna specialist at the design stage.</i> <i>Other road crossings over minor ecological corridors occur at four points in the development plan. These should be mitigated by means of short (at least 10m) raised stretches of road, under which free movement of small fauna is possible. Consult the fauna specialist at the design stage.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE/SC	CR	EC	PCP	/
1.2	<i>Paths for golf carts: There are two places where paths for golf carts would need to cross ecological corridors. The impact of these paths needs to be reduced to a minimum by (i) using grass blocks where relatively dry habitats are crossed, and (ii) using raised bridges where the paths cross wet habitats.</i>	/	Detailed specifications and management guidelines addressed in the Landscaping Plan.	LA/CE/SC	CR	CE	PCP	/
1.3	<i>Include footpaths and nature trails in the development plan: Footpaths with numerous access points help to prevent the creation of informal paths and desire lines by residents and staff. Such informal</i>	/	Detailed specifications and management guidelines addressed in the Landscaping Plan.	LA/CE/SC	CR	CR	PCP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>paths degrade habitats. Paths relatively close to residential areas and the golf course, if well maintained, could also be used for jogging and cycling. The lack of planned pedestrian access to Botrivierlei and the mountainside is presently a concern. This study predicts that informal access to such natural attractions will be created by local residents and that this will lead to habitat degradation. A system of well-designed hiking trails through conservation areas is appropriate and compatible with ecotourism and environmental education. Consult the fauna specialist at the design stage.</i>							
1.4	<i>Use low-impact methods of excavation. Where pipes and cables for bulk services need to cross ecological corridors, the trenches must be excavated by hand wherever possible. Heavy machinery should be used only where the substrate does not permit an alternative. Regardless of the method of excavation, trenches should be left open for as short a time period as possible, and soil must be replaced in a manner that ensures that topsoil is returned to a surface position. Alternatively, pipelines and cables can be raised off the ground where, for example, a bridge is available for attachment.</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 8.10 – 1.	DMP	CR	SE/ECO	CP	17.7/20.9
1.5	<i>Preserve and buffer rocky outcrops. Although rocky outcrops are common at higher altitudes on the mountain slopes, they are relatively rare at lower attitudes in the vicinity of Arabella. They provide essential habitat for a variety of animals, especially reptiles. All rocky outcrops should be preserved and buffered by 10m of undisturbed fynbos. Some of these outcrops are presently obscured by</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 8.10 – 5.	DMP	CR	SE/ECO	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>thickets of alien vegetation which need to be removed before the outcrops can be mapped.</i>							
1.6	<i>Where possible, some copses of tall alien trees (pines and gums) should be retained for their value as perches and nesting sites for raptorial birds, such as Fish Eagles, Black Sparrow-hawks and Spotted Eagle Owls. Such copses should be located in the developed portions of the property, i.e., the residential and golf-course portions, not in the nature areas and ecological corridors. Copses of trees will be more sustainable than individual, isolated trees, because of the prevailing strong winds.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	DMP	CR	SE/ECO/AC	CP	/
1.7	<i>Restrict development and construction activities to planned areas. Areas outside of the development footprints must be seen as “no-go” areas, especially if they are reserved for conservation. Note that these no-go areas should not be used for any on-site buildings, installations or laydowns, including areas for storage of excavated overburden. All construction-related activities must be restricted to the planned footprint. There are disturbed areas on site that would be suitable for laydowns.</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 6.01 – 1, 7.01 – 1a, 8.01, 8.03, 8.04, 8.05 – 1, 2, 3, 8.10 – 1, 2, 3, 4, 5.	DMP	CR	SE/ECO	CP	/
1.8	<i>Create laydowns in previously disturbed areas. Avoid creating laydowns and storage areas for overburden in areas of high quality habitat. Areas that have been previously disturbed and degraded are preferable because their biodiversity will already have been depressed and there will be less nett loss of biodiversity.</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 6.01 – 1, 7.01 – 1a, 8.01, 8.03, 8.04, 8.05 – 1, 2, 3, 8.06, 8.10 – 1, 2, 3, 4, 5.	DMP	CR	SE/ECO	CP	/
1.9	<i>Mark off affected areas. During construction, the footprint area of each</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 6.01 – 1, 7.01 – 1a,	DMP	CR	SE/ECO	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>construction site must be demarcated with stakes and hazard tape prior to site clearance, and should remain marked out during construction. The area impacted by construction activities must not be allowed to spread beyond the demarcated area.</i>		8.01, 8.03, 8.04, 8.05 – 1, 2, 3, 8.06, 8.10 – 1, 2, 3, 4, 5.					
1.10	<i>Manage functional areas appropriately. For example, within road verges, where high vegetation cannot be allowed, natural vegetation should also be encouraged, but be kept low by regular mowing. This will allow many indigenous species, such as fossorial reptiles and mammals, and invertebrates, to use these managed habitats. Planting with alien grasses, or allowing alien grasses to take over such areas, must be avoided at all costs. An appropriate management policy at Arabella will encourage the growth of locally indigenous annuals, bulbs and shrubs in landscaped areas, creating attractive displays of flowers which will also be beneficial to local fauna.</i>	/	Refer to Draft EMP, Section E, the Environmental Rehabilitation and Management Plan and the Landscaping Plan to be completed.	LA	CR	AC	PCP/CP/OP	/
1.11	<i>Compensate for loss of habitats.</i>	/	Refer to the Environmental Rehabilitation and Management Plan to be completed.	ACE	ACE	AC	PCP/CP/OP	/
2	<i>Mitigation of fragmentation of natural habitats and patterns of animal movement.</i>	11.2 (P66)						/
2.1	<i>Make provision for, and manage, ecological corridors. Ecological corridors are “passages” of natural habitat between larger areas of natural habitat at either end of the corridor. Ecological corridors also need to be managed such that the habitats in them are restored to, and maintained in, a natural state according to the provisions of the EMP. The</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 8.10. and the Environmental Rehabilitation and Management Plan to be completed.	DMP	EM	AC	CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>effectiveness of ecological corridors is largely dependent on the quality of the habitats within them.</i>							
2.2	<i>Create underpasses under the R44. There are currently twelve culverts under the stretch of the R44 that crosses Arabella 1 and 2. Most of these have the potential to be upgraded so that they can function as underpasses for animals. It is important that at least the five that have high priority should be upgraded as per specifications given in Table 3. Note that this would constitute a significant offset mitigation. Some of these upgraded underpasses could serve a dual purpose by also providing a connection between parts of the golf course, i.e., roads for golf carts could also pass through them. Consult the fauna specialist at the design stage.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.21.	DMP/CE	CE	AC	PCP/CP	2.3/20.11/22.18
2.3	<i>Upgrade the approaches to all R44 culverts, whether upgraded or not. The approaches to culverts are critical to their suitability as underpasses for animals. At present, the approaches to the culverts are overgrown and inappropriately fenced. Fences need to be moved so that they do not obstruct the approaches to the culverts and vegetation needs to be cut back for the same reason.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.21.	DMP/CE	CE	AC	PCP/CP	/
2.4	<i>Leave interior of ecological corridors unfenced. Within ecological corridors there should be no fences, or, where security barriers are essential, such fences should be of a type that is permeable to the majority of wild animals.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	CP/OP	/
2.5	<i>Realign western fences. The western boundary/security fences, both to the north and south of, and perpendicular to,</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>the R44, are inappropriately aligned according to the current development plan. These fences should be erected adjacent to the relevant developments, thus leaving the maximum amount of natural habitat unobstructed for free faunal movement. This is an important mitigation action. Consult the fauna specialist at the design stage.</i>							
2.6	<i>Use recommended types of security fencing. Suitable types of fencing can greatly improve the permeability of boundaries for small animals. Palisade fencing generally has a lower negative impact than mesh fencing.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	CP/OP	/
2.7	<i>Create continuity with neighbouring properties. Wherever possible, connections between the Arabella 2 conservation areas and similarly conserved areas on neighbouring properties should be maintained or improved by removal of fencing or the use of appropriate boundary fencing.</i>	/	/	ACE	ACE	AC	OP	/
2.8	<i>Create "soft" crossings over ecological corridors. Where roads cross ecological corridors, make these crossings as "soft" and natural as possible. Avoid any vertical edges at the curbs, and use grass blocks instead of tarmac. This recommendation is especially relevant to the outer parts of the riparian ecological corridors which comprise terrestrial buffer zones: these are important parts of the corridors for some animals.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	CP/OP	/
2.9	<i>Install underpasses. Use bridges, boardwalks or large box culverts to create underpasses for animals where roads or paths cross watercourses or marshy areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE	CR	AC	CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>This is definitely necessary for the access road to the north-eastern residential precinct.</i>							
2.10	<i>Place pipelines and cables underground, and rehabilitate. Underground pipelines do not present surface barriers, especially if topsoil is replaced and the surface is rehabilitated. Keep excavations and trenches as small as possible to minimize disturbance, and do not keep trenches open for longer than absolutely necessary. Alternatively, pipelines and cables can be raised off the ground where, for example, a bridge is available for attachment.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.10 - 1. Also detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	CE/EM	CR/EM	SE/ECO/EM	CP/PCP	/
2.11	<i>Use appropriate designs. All structures for drainage (e.g., gutters, drains, sumps, ditches) must be designed so that they do not act as pitfall traps for small creatures, i.e., they will either have gently sloping edges or they will be adequately covered to prevent animals from falling into them.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE	CR	AC	CP/OP	/
2.12	<i>Swimming pools must be of the beach type. These are much safer for children and for wildlife that may fall into them, because they are easy to climb out of. This requirement could be waived if a pool is surrounded by a wall that does not permit entry of small animals to the pool area.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural & Design Guidelines.	ARC	ARC	AC	PCP/OP	/
2.13	<i>Prevent creation of informal tracks. Roads and vehicle tracks are a major cause of fragmentation. No vehicle tracks other than the official roads should be allowed. Similarly for footpaths.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.06.	DMP	CR	SE/ECO	CP/OP	
2.14	<i>Use natural materials to surface footpaths in conservation areas. Footpaths through areas of natural habitat should not have hard surfaces. Where anti-erosion</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE	CR	AC	CP/PCP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>measures are needed, or where seasonal waterlogging occurs, install boardwalks or some low-impact method of stabilizing the ground. What must be avoided is long, unbroken stretches of hardened path which make it impossible for small fossorial animals to cross from one side of the path to the other.</i>							
3	<i>Mitigation of degradation of natural habitats</i>	11.3 (p69)						/
3.1	<i>Develop and implement a programme of controlled veld burning. This needs to form part of the operational-phase EMP and conservation plan, with the input of a botanical and faunal specialist. Burning is needed to maintain the quality and biodiversity of fynbos habitats. Planned fires should not have long-term negative impacts (Andersen & Muller 2000; Panzer 2002), provided that (a) fires are not too frequent (i.e., not less than 10-year intervals), and (b) a block-burning approach is adopted such that nearby unburnt veld can serve as a source area for re-colonization (Swengel 2001).</i>	/	Refer to the Fire Management Plan.	DMP/SC	CR/EM	AC	CP/OP	/
3.2	<i>Develop and implement a programme of habitat rehabilitation. Rehabilitate degraded habitats, especially wetlands and watercourses. Essential actions include:</i> <ul style="list-style-type: none"> <i>removal of all invasive alien vegetation, including Kikuyu Grass,</i> <i>ongoing, regular removal of alien regrowth and seedlings,</i> <i>stabilization of areas of erosion caused by tracks on steep slopes,</i> <i>closing off and rehabilitation of tracks across wetlands,</i> <i>removal and rehabilitation of</i> 	/	Refer to Draft EMP, Section E, the Landscaping Plan and the Environmental Rehabilitation and Management Plan to be completed. Refer to Draft EMP, Section D, 2.3.1 – f. Refer to Draft EMP, Section E, 1.3.	DMP/LA	CR/EM	CR/EM	AC	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<p>causeway across Lekkerwater stream,</p> <ul style="list-style-type: none"> ○ restoration of habitats in and around the Cape-Platanna ponds. • The EMP must include detailed plans for rehabilitation, including defined timeframes. • The roads to be developed adjacent to the frog reserve must have warning signage for the protection of frogs crossing the road and should have the design features recommended. • Alien trees and grasses in the vicinity of the ponds must be replaced with locally indigenous species. The present situation cannot be regarded as sustainable because alien plants are progressively degrading and choking the ponds. • The spread of existing indigenous plants should be encouraged. The process of alien removal will probably stimulate the germination of fynbos seeds in the soil. Such germination should be encouraged because it is likely to lead to a natural succession of locally indigenous species. However, ongoing weeding out of alien seedlings and Kikuyu stolons will be necessary. • New plantings should consist only of locally indigenous species, derived from the local fynbos. Restios and groundcovers will help to minimize runoff and siltation, and will also create suitable shelter for frogs. 							

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<ul style="list-style-type: none"> <i>In the process of removing alien plants and replanting with indigenous species, it is important that disturbance to the ponds be kept to an absolute minimum. Runoff of soil into the ponds has the potential to radically alter water chemistry, cause algal blooms, etc., and must be avoided. For this reason, clearance and replanting should proceed in stages with relatively small sections tackled at a time, and the whole process staggered over two or three years. Wholesale clearance of existing vegetation is likely to destroy populations of frog species that spend most of their time on the fringes of the ponds, hidden among vegetation or buried under the soil. Consult the fauna specialist at the planning stage.</i> <i>It is essential that no alien-clearance or horticultural activities within the frog reserve involve chemicals of any kind whatsoever, not even fertilizers. Glyphosate used in herbicides has the potential to be especially damaging. Even quite small amounts of chemical runoff into these small-volume ponds may be sufficient to directly impact on frogs and especially on tadpoles and spawn, and/or change the water chemistry and plant growths in the ponds. The only aids to horticulture that should be used are organic compost (not manure), organic</i> 							

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<p>peat, and organic mulch.</p> <ul style="list-style-type: none"> Disturbance of the ponds by horses (trampling and the deposition of dung) must be stopped with immediate effect. No direct aquatic connection between the two existing ponds should be created because their habitats are not identical and a connection may alter their respective habitats to the detriment of the frogs, especially those in the larger pond. For similar reasons, under no circumstances should any "hardening" or other alteration of the pond substrates be contemplated. Runoff from a built environment has the potential to be polluted in various ways and would therefore not be suitable for the ponds. It is essential that the oligotrophic (low in nutrients) nature of the pond waters be maintained. In fact, it is desirable that the nutrient levels in the ponds be reduced from their present levels because the presence of Typha indicates some degree of eutrophication. For this reason it is important that only local runoff and seepage from natural fynbos areas reach the ponds. Additionally, water that has been polished in bio-retention ponds or swales could be allowed to seep into the ponds. Areas which are completely transformed, such as the corral, can be used for the creation of 							

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<p>entirely new bio-retention ponds. Such additional "wetlands" would enrich the reserve area, provided that only locally indigenous plants were allowed to become established. Consult the fauna specialist at the planning stage.</p> <ul style="list-style-type: none"> Water levels must be allowed to fluctuate. In other words, water levels should subside in summer and rise with winter rains, because this will encourage a diversity of wetland-edge habitats and will stimulate frog breeding activity. Such a dynamic equilibrium is vital to the maintenance of a naturally functioning system. If winter water levels rise to the extent that some of the terrestrial habitat becomes flooded, this should be seen as a good, not a bad thing. Such temporarily flooded habitat is ideal for the breeding of many species of frog. Platannas are quite capable of surviving periods of drought by aestivating underground. Under no circumstances should fish, of any kind, be introduced into the ponds. Indigenous galaxias fish may become established naturally. The frog populations themselves will require a degree of hands-on management because the site is very small and isolated, and is currently degraded, and will be further affected by the rehabilitation process. 							

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<p><i>Interventions to improve the composition of the frog species community on the site are recommended.</i></p> <ul style="list-style-type: none"> <i>The Common Platanna Xenopus laevis is an aggressive colonizer of disturbed wetland habitats and it competes with the Cape Platanna for space and food. It is also likely to predate on the tadpoles and juveniles of the Cape Platanna (De Villiers 2004). Furthermore, it is known that hybridization between the Common and Cape platannas does occur (Picker 1985; Picker et al. 1996). For these reasons it is necessary that a programme of removal of Common Platannas be initiated. Such a programme would involve trapping at a frequency of about twice a year, until such time as Common Platannas are no longer found on site. The programme would have the additional benefit of allowing the population of Cape Platannas to be monitored.</i> <i>The population of Cape Platannas should be monitored by means of annual trapping, so that the effectiveness of management actions and policies can be gauged. Both this monitoring and the removal of Common Platannas should be done initially by an experienced herpetologist, who should train the resident Environmental Officer so that he can take over the task after a year or two.</i> 							

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	<ul style="list-style-type: none"> It may be advisable to introduce individuals from other local populations (e.g., those on Lamloch Farm) from time to time, if the population at Arabella 2 is too small to be genetically viable in the long term. Decisions in this regard will depend on the results of population monitoring, the advice of experts, and the necessary permission of CapeNature. The presence and approximate population sizes of other species should be monitored by means of auditory sampling of calling males. This can be done to coincide with the trapping of platannas. Such monitoring will help to inform management policies and may lead to recommendations for the introduction of certain locally occurring species, as habitat conditions allow. The frogs themselves, together with the wetland habitats, provide an opportunity for environmental education and interpretation. For example, the protected area could be traversed by a raised boardwalk and interpreted by means of informative signage. The area has the potential to become a favourite night-time stroll by virtue of its variety of frog calls. Consult the fauna specialist at the planning stage. 							
3.2	Restrict plantings to locally indigenous	/	Detailed specifications and	LA/SC	CR	AC	CP/OP	/

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	<i>species. Those erven and landscaped areas to be developed adjacent to conservation areas and the major ecological corridors (the watercourses) must be required to use locally indigenous species only for gardens and landscaping. A suitable list of species must be prepared by a qualified botanist and this list must form part of the EMP and home-owner regulations. (It is especially important that only indigenous grasses be used for lawns, because alien grasses, such as Kikuyu Grass Pennisetum clandestinum, are highly invasive and cause serious degradation of wetlands, in particular.) This measure will provide additional faunal habitat and, importantly, will prevent the spread of alien species into adjacent sensitive habitats. (It is desirable, but not essential, that the same provisions apply to all erven and landscaped areas on the estate.)</i>		management guidelines to be addressed in the Landscaping Plan.					
3.3	<i>Under no circumstances should Kikuyu be used at Arabella 2. The choice of grass needs to be well researched to select strains that are not invasive and that do not have high water requirements.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	CP/OP	/
3.4	<i>Monitor sources of new infestations. New infestations of invasive alien vegetation often begin at points of disturbance, e.g., new roads and earthworks, and imported gravel used to surface roads. Such areas must be carefully monitored and any new alien growth removed promptly. Dumps for garden refuse are also sources of infestation which need to be monitored and carefully contained.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	DMP/SC	EM	AC	OP	/
3.5	<i>Include footpaths and nature trails in the development plan. Footpaths with</i>	/	Detailed specifications and management guidelines to be	DMP/LA	CR	CA	PCP/CP	

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	<i>numerous access points help to prevent the creation of informal paths and desire lines by residents and staff. Such informal paths degrade habitats. The lack of planned pedestrian access to Botrivierlei and the mountainside is presently a concern. This study predicts that informal access to such natural attractions will be created by local residents and that this will lead to habitat degradation.</i>		addressed in the Landscaping Plan.					
3.6	<i>If recreational activities other than hiking (e.g., water-sports, fishing, horse-riding, mountain-biking) are planned for Arabella 2, either now or later, the relevant specialists should be consulted in defining the appropriate zones, routes and management requirements. (It would be sufficient for it to be specified in the ROD that the relevant specialists should have input into the planning of such activities, prior to their implementation.)</i>	/		ACE				/
3.7	<i>Manage stormwater runoff appropriately.</i>	/	Detailed specifications and management guidelines to be addressed in the Stormwater and Flood Run-off Management Plan.	CE	CE	AC	PCP	/
3.8	<i>Prevent pollution of soil and water.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 6.01, 7, 8.09, 8.22, 8.38 – 4, 8.39.	CR/EM	CR/EM	SE/ECO/AC	CP/PCP/OP	/
3.9	<i>Draft, implement and audit an operational-phase EMP.</i>	/	Refer to Draft EMP, Draft 3.	ACE		AC	PC	/
4	<i>Mitigation of ongoing decline in populations of Threatened and other species</i>	11.4 (p73)						/
4.1	<i>Design an EMP for the construction phase. This EMP must include a comprehensive set of regulations aimed at achieving</i>	/	Refer to Draft EMP, Draft 3. Refer to Draft EMP, Section C,	DMP/ACE	EM	EM	PC	/

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	<i>protection and good management of the conservation areas of the estate. Conservation areas should be strictly out-of-bounds to all construction-related activities and personnel. Implementation to be monitored by an on-site ECO.</i>		Functions and Implimentation Procedures. Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.					
4.2	<i>Design an EMP for the operational phase. This EMP must include a comprehensive set of regulations aimed at achieving protection and good management of the conservation areas of the estate. The input of biodiversity specialists is essential. Implementation to be monitored by an on-site ECO.</i>	/	Refer to Draft EMP, Draft 3. Refer to Draft EMP, Section C, Functions and Implimentation Procedures.	DMP/ACE				/
4.3	<i>Commission faunal surveys. Such surveys are needed to confirm which species occur on Arabella so that appropriate management programmes can be put in place. For example, if it were found that the Western Leopard Toad (Endangered) breeds on Arabella 2, this would have implications for the planning and implementation of a veld-burning regime and the management of key wetlands. The presence of other Red Listed species could have different implications for the management of conservation areas. (Note that detailed surveys of the vertebrate fauna, which are time-consuming, were not possible during the EIA process; of necessity the emphasis was on faunal habitats. The ideal timing of such surveys would be prior to and during construction because bush-clearing and excavations for creation of the golf course and other parts of the development would provide good opportunities for sampling of fauna that are otherwise difficult to find.)</i>	/	Detailed specifications and management guidelines to be addressed in the Enviropnmental Rehabilitation and Management Plan.	EM/SC	EM	AC	OP	/

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4.4	<i>Revise the Operational-Phase EMP in light of the results of detailed fauna surveys. The recommended surveys should be followed up by a revision of the EMP to ensure that the management plan is appropriate for sensitive species that are present.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM/SC	EM	AC	OP	/
4.5	<i>Isolate incompatible land uses from each other. For example, residential development and golfing are not compatible with nature conservation, therefore these types of land use should be spatially isolated from conservation areas, and vice versa. Human-dominated environments and activities must not spill over into and negatively impact areas where natural processes are intended to hold sway. For this reason, conservation areas must be adequately buffered. In addition, where human and/or domestic animal intrusion into conservation areas is likely to occur, fencing should be erected to prevent such intrusion. Note that this recommendation does not preclude walking trails through the conservation areas, but does prescribe that such trails are well planned and laid out, and are accessed only from suitable, designated points of entry.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping and the Environmental Rehabilitation and Management Plan.	LA/SC	CR	AC	CP	/
4.6	<i>Restrict the keeping of pets on site and control their behaviour. Pets interact negatively with wildlife and are highly undesirable in conservation areas. However, it is not practical to enforce a complete ban on pets in a residential area, therefore the following measures are recommended:</i> <ul style="list-style-type: none"> ○ <i>Enforce a complete ban on cats and all other free-range pets, including pigeons, chickens, ducks and peacocks.</i> 	/		ACE				/

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	<ul style="list-style-type: none"> ○ Restrict the number of dogs per household to two. ○ Restrict the size of dogs to less than 15 kg. ○ Require that dogs be kept indoors or within a fenced/walled yard. ○ Require that dogs be kept on a leash when taken for walks on the estate. ○ Restrict the walking of dogs to certain routes on the estate, and keep others out-of-bounds to dogs, so that wild animals do not feel threatened in those areas. Such out-of-bounds paths should include all of the trails through designated conservation areas. In other words, dogs should be walked within residential and landscaped areas, not in conservation areas. 							
4.7	Implement awareness programmes for local and neighbouring communities. The cooperation of local residents, staff and visitors, of all socio-economic classes, will be essential in managing conservation areas effectively. Various approaches to raising and sustaining awareness of conservation-related actions and regulations are needed.	/		ACE				/
4.8	Enforce all regulations. The terms of sale of properties must include an agreement to comply with the provisions of the EMP and estate regulations. The Environmental Control Officer (ECO) on site must monitor and enforce compliance with all relevant regulations.	/	Refer to the Arabella Country Estate Phase 2 EMP.	ACE				/
4.9	Institute a monitoring and auditing programme.	/	Refer to the Arabella Country Estate Phase 2 EMP.				ACE	/
5	Mitigation of road mortality	11.5 (p75)						/

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5.1	<i>Install box culverts in the recommended places. These culverts provide animals with an alternative to crossing the roads and endangering their lives. Consult the fauna specialist at the design stage.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
5.2	<i>Restrict speed on roads. Enforce a speed limit of no more than 40 kph on roads within the estate. Erect speed humps at either end of stretches that cross ecological corridors.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
5.3	<i>Place warning signage in appropriate places. In places where roadkills frequently occur, warning signage should be erected.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
5.4	<i>Use appropriate curb designs. Curbs and roadside gutters should have low, sloping profiles without any vertical surfaces. Appropriate designs facilitate the movements of small animals such as frogs, lizards and mice. Consult the fauna specialist at the design stage.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
6	<i>Mitigation of dust pollution beyond the building sites</i>	11.6 (p75)						/
6.1	<i>Apply standard mitigation measures. Apply standard measures for the reduction of airborne dust at construction sites, e.g., damping down with freshwater, use of cloth or brush-barrier fences, covering dumps with plastic sheeting, etc. Appropriate measures must also be applied on all dirt roads that service the construction sites.</i>	/	Refer to Draft EMP, Section B, EMSpecs Sections 7.06.	CR	CR	SE/ECO	CP/PCP	/
6.2	<i>Apply hardtop to roads with high traffic loads. Main access roads on the estate should be tarred.</i>	/						/

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7	<i>Mitigation of pollution of soil and water beyond the building sites</i>	11.7 (p75)						/
7.1	<p><i>Apply standard mitigation measures. Apply standard measures for avoiding spills and mitigating those that occur at construction sites. For example:</i></p> <ul style="list-style-type: none"> <i>○ The site office, toilets and storage areas for building materials should be at least 50 m away from wetlands and ecological corridors, and the storage areas bunded so that there will be no runoff from these areas towards wetlands or ecological corridors.</i> <i>○ All building materials must be removed from the site after construction.</i> <i>○ Spoil material must not be dumped on, or within 50 m of, wetlands or ecological corridors.</i> <i>○ Construction activities near wetlands or ecological corridors should take place during the dry season, if possible, to reduce risks of contamination through runoff.</i> <i>○ Runoff from the site should not flow directly into the wetlands or watercourses, but should first be captured in a detention pond for settlement.</i> <i>○ A stormwater system for the proposed development must be established as a priority, such that all runoff is led to the site-drainage system. Essentially, all natural waterbodies should be isolated from all artificial drainage systems.</i> <i>○ Areas where machinery and vehicles are stored and used must be bunded to prevent pollutants (e.g., fuel and oil) from accidentally entering the wetlands or watercourses.</i> <i>○ If construction areas are to be pumped of water (e.g. groundwater, or after</i> 	/	Refer to Draft EMP, Section B, EMSpecs Sections 6, 7, 8.	DMP	CR	SE/ECO	CP	/

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	<p>rains), this water must be pumped into an appropriate settlement area, and not allowed to flow directly into the wetlands or watercourses.</p> <ul style="list-style-type: none"> Vehicle and machinery should not be washed within 50 m of wetlands or watercourses. No discharge of effluents or polluted water shall be allowed into wetlands or watercourses. Carry out all servicing and refuelling of construction vehicles on a concrete platform with run-off "traps" and containment. Attend to waste-disposal practices during construction; ensure that contaminants are not placed directly on top of the ground surface. Soil and water polluted with chemical (e.g., fuel or cement) should not be left in situ, and should not be stockpiled or dumped on site, but should be removed from the site to a designated dump site. 							
7.2	Remove all polluted soil and water from site. Polluted soil and water should not be left in situ, and should not be stockpiled or dumped on site, but should be removed from the site and, where necessary, to a designated hazardous-waste dump.	/	Refer to Draft EMP, Section B, EMSpecs Sections 6.01, 7.05, 8.09.	DMP	CR	SE/ECO	CP	/
7.3	Dispose of sewage in a sustainable manner. This would entail the connection of an on-site sewerage reticulation to an existing off-site system, or to a purpose-built on-site sewage-treatment plant. Under no circumstances should raw or treated sewage be allowed to contaminate streams, wetlands, estuaries (Botrivierlei) or groundwater. Even treated sewage effluent will cause	/		CE/CR				/

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	<i>damaging eutrophication of watercourses and wetlands and should therefore have most of its nutrients removed by biological and/or chemical filters, prior to release into natural systems. Treated effluent can be recycled by using it for irrigation of the golf course and landscaped areas.</i>							
7.4	<i>Prevent contamination of natural areas with agrochemicals. The proximity of the golf course and erven to watercourses creates the likelihood that both pesticides and fertilizers could contaminate natural habitats, via the air or water, and cause direct and indirect negative impacts on local fauna and their habitats. Flow of contaminated water into Botrivierlei could have additional negative impacts there. Runoff from the golf course, in particular, must not enter watercourses directly but must first be treated to remove contaminants. Aerial spraying of pesticides must not be allowed because of the danger of drifting, airborne chemicals. When pesticides are used they should be applied in strict accordance with the manufacturer's specifications, and under the strict and constant supervision of a trained and responsible manager. All toxic substances must be stored securely and not be available for casual, unsupervised or illegal use. Pesticides must be used with the greatest circumspection and only as a last-resort solution to serious and intractable problems on the golf course; in other areas, nature should be allowed to take its course.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management, and Landscaping Plan.	LA/SC	CR/EM	AC	CP	/
7.5	<i>Educate residents and staff, under the operational-phase EMP, to the effect that no pesticides whatsoever may be used in natural areas to, for example, control</i>	/		ACE				/

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	<i>mosquitoes.</i>							
7.6	<i>Refer to the recommendations of the freshwater ecologist, especially with regard to seepage of irrigation water on the golf course.</i>	/						/
8	<i>Mitigation of light pollution beyond the building sites</i>	11.8 (76)						/
8.1	<i>Reduce exterior lighting to the minimum necessary for essential functions. This should be explicit in architectural guidelines and property-owners' regulations. Street lighting should be avoided. Where street lighting is essential, it should be of the "bollard" type which illuminates only a small area and light is not cast broadly.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the Landscaping Plan.	ARC/LA/SC	CR	AC	CP/PCP	/
8.2	<i>Use only long-wavelength lights (red or orange) for exterior lighting or the "warm light" models of energy-saving lights. Long wavelengths are less attractive to insects.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the Landscaping Plan.	ARC/LA/SC	CR	AC	CP	/
8.3	<i>Use light sources of the lowest intensity (wattage) adequate for the purpose, because the lower the intensity of the light, the less attractive it is to insects.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the Landscaping Plan.	ARC/LA/SC	CR	AC	CP	/
8.4	<i>Position lights as low down as possible to reduce their visibility from a distance.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the Landscaping Plan.	ARC/LA/SC	CR	AC	CP	/
8.5	<i>Use directional fittings for exterior lights. Fit lights with shades to direct light only to where it is needed, and to prevent it from spreading over a wide area.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the	ARC/LA/SC	CR	AC	CP	/

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			Landscaping Plan.					
8.6	<i>Use only sealed light fittings so that insects cannot reach the light source. Insects that get close to the light source are usually killed by the heat.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines and the Landscaping Plan.	ARC/LA/SC				/
8.7	<i>Position lights so that they do not cast a pool of light on surfaces that take traffic. In such places, insects that fall to, or settle on, the ground, and the predators that are attracted to them, are likely to become roadkill.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
8.8	<i>Control outdoor lighting with timers so that lights do not stay on all night. Limit lighting to the periods of greatest human activity.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	AC	CP	/
8.9	<i>Strictly prohibit installation of “bug zappers” outdoors. This should be explicit in architectural guidelines and property-owners’ regulations.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines.	ARC	EM	EM	CA	/
8.10	<i>Encourage the screening of interior lighting with blinds, curtains, etc, to prevent exterior light pollution, especially on erven adjacent to nature areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Architectural and Design Guidelines.	ARC	EM	EM	CA	/
8.11	<i>The small “frog reserve” (central precinct), in particular, needs to be well protected from artificial lights so that breeding of the Cape Platanna (Endangered) is not adversely affected.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan and the Environmental Rehabilitation and Management Plan.	LA/SC/EM	CR/EM	AC	PCP/CP/OP	/
8.12	<i>These specifications must be included in the EMP and be applicable to all residences on the estate.</i>	/	Refer to the Arabella Country Estate Phase 2 Draft EMP.					/
9	<i>Mitigation of alteration of surface and groundwater levels and flows, and knock-</i>	11.9 (p77)						/

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	<i>on effects on local wetlands</i>							
9.1	<i>If groundwater is used, ensure that boreholes do not leak and are not a source of mineral pollution. For example, some existing boreholes on the property are leaking and showing clear signs of being the source of iron-oxide pollution.</i>	/		ACE	EM	AC	PCP/CP/OP	/
9.2	<i>Obtain professional geohydrological opinion on any structures with foundations that extend to the water table. Structures should not reduce seepage into wetlands.</i>	/		ACE	EM	AC	PCP/CP/OP	/
9.3	<i>Manage stormwater runoff in a manner that minimizes impacts on local habitats. Erosion, siltation and eutrophication must be avoided by means of stormwater retention ponds, etc. (The development plan includes appropriate provisions.)</i>	/	Detailed specifications and management guidelines to be addressed in the Stormwater and Flood run-off management Plan.	CE	CR/EM	AC	PCP/CP/OP	/
9.4	<i>Manage seepage of irrigation water. Nutrient-rich water arising from irrigated fairways and greens must not seep into wetlands, streams or Botrivierlei. Seepage should be collected and treated before release into the environment. (The development plan includes appropriate provisions.)</i>	/	Detailed specifications and management guidelines to be addressed in the Stormwater and Flood run-off management Plan.	CE	CR/EM	AC	PCP/CP/OP	/
10	<i>Mitigation of poaching of local wildlife</i>	11.10 (p77)						/
10.1	<i>An Environmental Control Officer (ECO) must be appointed to monitor poaching, among other duties.</i>	/		ACE	EM	AC	OP	/
10.2	<i>Educate workers. All workers, at all levels of responsibility, need to be informed and actively educated as to the high conservation status of the fauna and flora around the construction sites. Everyone must be made to understand that exploitation of wildlife resources is not</i>	/	Refer to the Arabella Country Estate Phase 2 EMP Section F, Environmental Awareness Training.	CR	CR	SE/ECO	PCP	/

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	<i>permitted and will not be tolerated.</i>							
10.3	<i>Patrol the area. The on-site ECO must patrol areas where snares and traps are likely to be set. Efforts should be made to apprehend perpetrators and apply penalties.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE	EM	AC	OP	/
10.4	<i>Control materials. Access to materials that can be used to create snares and traps, such as wire and poisons, should be strictly controlled at stores and laydowns.</i>	/						/
10.5	<i>Control after-hours access. Access to construction sites after hours, especially at night, is likely to lead to poaching and should not be allowed.</i>	/	Refer to the Arabella Country Estate Phase 2 Draft EMP, EMSpecifications Section 8.16.	CR	CR	SE/ECO	PCP	/
10.6	<i>Control access to non-construction areas. Access to areas of the site that are not involved in construction should be controlled. Roads/tracks that provide such access should be gated and locked.</i>	/	Refer to the Arabella Country Estate Phase 2 Draft EMP, EMSpecifications Section 8.16.	CR	CR	SE/ECO	PCP	/
10.7	<i>Engage with local communities. Local communities could, potentially, be a source of poaching activity. Environmental education and ecotourism should be promoted at Arabella 2, so that local support for conservation can develop. Such engagement with local communities should also form part of the operational-phase EMP.</i>	/		ACE				/
11	<i>Mitigation of problem-animal scenarios</i>	11.11 (p79)						/
11.1	<i>Do not allow feeding of wild animals. Feeding should be strongly discouraged by both educational information and enforcement of estate regulations.</i>	/		ACE	EM			/
11.2	<i>Keep attractive resources out of reach. It is</i>	/		ACE	EM			/

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	<i>of utmost importance that all artificial sources of food, including refuse, be kept completely out of reach of wild animals. This may require inventive and quite extreme measures because some animals, e.g., baboons, are dextrous and intelligent.</i>							
11.3	<i>Exercise rigorous control of edible refuse. Refuse must not be dumped or stored on site, but be completely removed from site at frequent and regular intervals.</i>	/		ACE	EM			/
11.4	<i>Use professional help. If specific individual animals become problematic (e.g., a venomous snake in a resident's garden), the ECO or CapeNature or other suitably experienced persons, should be called in to deal with the problem in a professional manner, preferably without having to kill the animal.</i>	/		ACE	EM			/
11.5	<i>Specify appropriate methods for the control of problem animals, such as rats, moles and mole rats, in the operational-phase EMP. The methods used should not jeopardize owls and other predators.</i>	/		ACE	EM			/
12	<i>Mitigation of invasion of alien animals</i>	11.12 (p79)						/
12.1	<i>Exercise rigorous control of edible refuse. Refuse must not be dumped or stored on site, but be properly contained and completely removed from site at frequent and regular intervals.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
12.2	<i>Restrict the keeping of pets on site and control their behaviour, including a complete ban on cats and all other free-range pets (e.g., pigeons, chickens, ducks and peacocks). Pets interact negatively with wildlife and are highly undesirable in protected nature areas.</i>	/		ACE	EM			

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12.3	<i>Eliminate any feral cats and dogs. Feral cats and dogs are a serious threat to wildlife and the problem must be aggressively dealt with by the ECO wherever such animals enter conservation areas. It is necessary to promote awareness of this problem, and remedies for it, among the residents and staff of the estate.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
12.4	<i>Adhere to a nodal design of housing development. This is likely to have a lesser impact than if houses are spread throughout the site.</i>	/						/
12.5	<i>Keep peripheral developments to a minimum and as close to planned development nodes as possible (e.g., visitor centres, lapas, camp sites, stables, etc, etc). Such "informal" or temporary developments must not happen without following a proper EIA process.</i>	/						/
12.6	<i>No artificial plantings – indigenous or otherwise – within wilderness/nature areas, because the Argentine Ant may be spread by means of nursery plants. This will also help to avoid introduction of plant-disease organisms.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
13	<i>Mitigation of cumulative impacts</i>	11.13 (p79)						/
13.1	<i>Cumulative impacts cannot be completely avoided because many of the impacts will have an ongoing effect during the operational phase. Also, the development as a whole will have a cumulative impact as an additional development on the shores of Botrivierlei. However, cumulative impacts can and should be significantly reduced by means of diligent</i>	/						/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<p>implementation of all recommended mitigation measures (above) and implementation of EMPs for both the construction and operational phases. The recommended mitigations that will contribute most to the reduction of cumulative impacts are:</p> <ul style="list-style-type: none"> • rehabilitation of degraded areas, post construction • use of a suitable design for boundary fences • use of suitable exterior lighting • enforcement of restrictions on pets • measures to reduce road mortality • measures to reduce pollution • measures to control poaching • ongoing commitment to appropriate management of conservation areas • regular audits to evaluate the implementation and effectiveness of EMPs. 							
14	Mitigation/offset of impacts through improved conservation of undeveloped land	11.14 (80)	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE	EM	AC	PCP/CP/OP	/
14.1	Put in place Environmental Management Plans (EMPs) for the construction and operational phases.	/	Refer to the Arabella Phase 2 Draft EMP.					/
14.2	Appoint an ECO on a permanent basis to ensure implementation of the EMPs and to manage and monitor the conservation areas and carry out other environmental duties.	/	Refer to the Arabella Phase 2 Draft EMP, Section C, Functions and Implementation Procedures.					/
14.3	Elevate the legal status of the conservation areas, including riparian corridors, to that of a private nature reserve, or a land stewardship area, recognized by CapeNature.	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE	EM	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
14.4	<i>Institute an ongoing programme to remove all invasive alien plants, including Kikuyu Grass, in terms of the Operational Phase EMP. It is especially important to remove alien growth from watercourses.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
14.5	<i>Rehabilitate areas covered by alien vegetation and other degraded areas. It is likely that some nature areas will be impacted by construction activities, either accidentally or through neglect. Such areas need to be identified and rehabilitated by the ECO.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
14.6	<i>Commence management of sensitive localities. Eight years have lapsed since recommendations were made for the management of the ponds where Cape Platannas (Endangered) were found (Harrison 2004b). In that time, the habitats of the locality have deteriorated, as predicted, because of ongoing inappropriate use of the site and a lack of conservation management. The management that was recommended then has not occurred in the interim. It is essential that management commence without delay so that the Cape Platanna population can be protected at the site. Similarly, environmental degradation caused by the spread of alien vegetation along the northern edge of the old plantation, and along watercourses, needs to be halted by an urgent programme of weeding.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
14.7	<i>Develop collaborative relationships with neighbouring property owners so that a common understanding is reached on appropriate environmental management for the area. This mitigation is especially</i>	/		ACE			OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>relevant at Arabella 2 where the Rooisands and Kogelberg nature reserves are neighbours and Arabella 2 provides a link between the two.</i>							
14.8	<i>Compile a database of animals that occur on site, including amphibians, reptiles, birds, mammals and invertebrates, to provide the ECO with information relevant to the management of the conservation areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
14.9	<i>Make provision for eco-education and ecotourism on site. The recommended nature trails on Arabella 2 will provide opportunities for environmental education and low-key ecotourism, such as birding. These opportunities can be valuable to local residents and visitors, and especially to children from local communities. Such provisions are among the appropriate methods of creating sustainable job opportunities on the estate which will also, in the long term, add value to the investment in nature conservation on the estate.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
15	<i>Recommended monitoring and evaluation programme</i>	11.15 (p81)	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
15.1	<i>Institute regular audits of the EMP during the construction phase, at monthly intervals. To be carried out by the ECO.</i>	/	Refer to the Arabella Phase 2 Draft EMP, Section C, Functions and Implementation Procedures.	ECO/EM	ECO/EM	AC	PCP/CP/OP	/
15.2	<i>Institute regular audits of the EMP for the operational phase, at two-yearly intervals. To be carried out by independent consultants.</i>	/		ACE		AC	OP	/
15.3	<i>Set up a monitoring programme in terms</i>	/	Detailed specifications and	EM	EM	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>of the operational-phase EMP, to be carried out by the ECO. This programme should have as its objective the documentation of the condition of the conservation areas, including the occurrence of plant and animal species.</i>		management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.					
15.4	<i>Carry out surveys of fauna.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
15.5	<i>Create an environmental advisory committee. Such a committee should comprise the ECO, representatives of the property owners, representatives of the developers, and suitably qualified and interested local members of the public who are prepared to assist in management of the estate. The committee should meet regularly (e.g., monthly) and assist in formulating policy and taking management decisions for the environmental management of the estate.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan. Refer to the Arabella Country Estate Phase 2, Section G, Public Involvement.	ACE	ACE	AC	PCP	/
Flora (Nick Helme Botanical Surveys, Arabella Golf Estate (Kleinmond) Phase 2: Revised Environmental Impact Assessment: Vegetation. January 2013)								
16	<i>Planning phase mitigation</i>	P41						/
16.1	<i>All non-development areas (i.e. those areas outside the development footprints) with more than 25% natural vegetation cover (thus whether partly degraded or not) must be considered formal conservation areas and managed as such.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	CR/EM	SE/ECO/EM	AC	PCP/CP/OP	/
16.2	<i>The approximately 340ha referred to in the previous bullet (or whatever is deemed a practicable portion thereof by CapeNature) should be rezoned as Open Space 3 and should be registered as a formal Conservation Area, preferably with</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE	EM	AC	PCP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>the Stewardship Program of CapeNature (provided that they have capacity in this area). Contract Reserve status is recommended, given the Endangered and Critically Endangered status of the vegetation concerned, but this is subject to a decision by CapeNature.</i>							
16.3	<i>These formal conservation areas must be registered as such within one year of any approval of the current application, irrespective of whether the actual development has been initiated or not.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE	EM	AC	PCP	/
16.4	<i>All costs associated with registration and rezoning in terms of the above must be borne by the applicant.</i>	/		ACE				/
16.5	<i>The management of these areas will be supervised and overseen by CapeNature as part of the Stewardship Program contract, and will be according to a management plan that CapeNature helps to draw up. The management plan will presumably be based partly partly on the EMP for the current study area.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE/EM	EM	AC	PCP/CP/OP	/
16.6	<i>The proposed stormwater rising main cutting across a High sensitivity area immediately south of the R44 should be relocated some 100m east so that it falls within the bulk services corridor indicated by the green arrow. This is necessary in order to minimise disturbance to the sensitive area (a Critically Endangered vegetation type).</i>	/		CE	CE/CR	AC	PCP	/
17	<i>Construction phase mitigation</i>	P42						/
17.1	<i>An ECO should be on site during the construction phase of the sports facilities, golf course and associated facilities, and</i>	/	Refer to the Arabella Phase 2 Draft EMP, Section B, EMSpecifications and Section C, Functions and					/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>obviously throughout the installation of all bulk services. He/she must ensure that no damage occurs to the adjacent conservation areas, and must enforce all other requirements of the construction phase EMP which should be drawn up.</i>		Implementation Procedures.					
17.2	<i>The exact boundaries of all development footprints within Medium and High sensitivity botanical areas (including all roads, golf course and associated infrastructure, and all pipelines not within the roads) must be surveyed before any construction starts on the site, with the help of a land surveyor. The boundary of the development footprints must then be pegged, and a temporary 1.5m high wire mesh fence put in place along this boundary before any construction commences. Printed notices should be placed on this fence every 20m, saying that the (conservation) areas (beyond) are No Go areas for all contractors and vehicles. This fence should be removed only once all relevant bulk services and the golf course infrastructure and earthworks are in place.</i>	/	Refer to the Arabella Country Estate Phase 2 Draft EMP, Section B, EMSpecifications.	CR	CR	SE/ECO	PCP/CP	/
17.3	<i>Potential buyers and owners in the development must be made aware of the mandated requirement for controlled fires in the nearby or adjacent conservation areas every 12 -15 years. This is in order to minimise possible legal challenges later on against such necessary management.</i>	/		ACE				/
17.4	<i>No dumping or temporary storage of any construction related materials or fill should be allowed in any conservation areas.</i>	/	Refer to the Arabella Phase 2 Draft EMP, Section B, EMSpecifications Section 6.	CR	CR	AC	PCP/CP	/
17.5	<i>No new roads or tweespoor tracks may be</i>	/	Refer to the Arabella Phase 2 Draft	CR/EM	CR/EM	AC/SE/	PCP/CP/OP	/

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	<i>constructed within the conservation areas on site, other than those indicated as formal roads on the final layout plan, access roads for golf course maintenance and golf cart tracks. Wherever possible golf course maintenance tracks and cart tracks should be on the same alignment.</i>		EMP, Section B, EMSpecifications and the Environmental Rehabilitation and Management Plan.			ECO		
17.6	<i>All pipeline excavation through High sensitivity areas, rocky areas, and wetlands (where these lie outside the approved Alternative 4 development footprint) should be by hand. All pipeline trenches should be closed up as soon as possible after excavation, and may not stand open for more than 72hrs. Pipeline excavation within approved development footprints and within Low sensitivity areas may be done by machinery.</i>	/	Refer to the Arabella Phase 2 Draft EMP, Section B, EMSpecifications Section 8.10.	CR	CR	SE/ECO	CP	1.5/20.9
17.7	<i>The final landscaping plan for the conservation and rehabilitation areas should be reviewed and approved by the botanist before implementation.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	LA	AC	PCP/CP	/
17.8	<i>The developers have undertaken to use Paspalum vaginatum (seashore paspalum) as the primary golf course grass, and there is now a wide body of literature that shows that this species is not invasive, is remarkably salt tolerant, and is relatively water efficient (Duncan 2004).</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	PCP/CP/OP	/
18	<i>Operational Phase mitigation:</i>	P44						/
18.1	<i>No alien invasive vegetation (as per CARA legislation; Amendment 30 March 2001) may be used, cultivated or maintained anywhere on the site, with the exception of a few large (>15m tall), existing specimen trees of certain species, that are identified as important by the faunal</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping and Environmental Rehabilitation and Management Plan.	LA	CR/EM	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>specialist for bird roosts or nest sites.</i>							
18.2	<i>Invasive kikuyu grass (Pennisetum clandestinum) may not be planted or maintained anywhere within 100m of a conservation (see Figure 3a) or rehabilitation area, but could potentially be used without significant danger on erven or facility areas that meet these restrictions. Suggested indigenous alternative lawn grasses include Cynodon dactylon (fynkweek), Stenotaphrum secundatum (buffalo grass), or Paspalum vaginatum, as per the 2005 Policy Guidelines for Golf Course and Polo Field Development.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping and Environmental Rehabilitation and Management Plan.	CR	CR/EM	AC	PCP/CP/OP	/
18.3	<i>All lawn cutting and garden refuse dumps must be located at least 30m from any natural Fynbos vegetation, and should be restricted to designated dump areas that have 10m wide buffers (no vegetation) around them.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Management Plan.	CR	CR	AC	PCP/CP/OP	/
18.4	<i>Specific mention is made of three highly invasive, exotic species (often used in horticulture and landscaping) that may not be planted or maintained anywhere on site – Cortaderia species (pampas grass), Metrosideros excelsa (New Zealand Christmas tree) and Schinus terebinthifolius (Brazilian pepper tree).</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	CR	CR	AC	PCP/CP/OP	/
18.5	<i>No formal gardening may be undertaken within designated conservation areas, and this also means that no irrigation of these areas should take place, unless there is a specific reason to do so and this is approved beforehand, in writing, by an independent botanist.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and Landscaping Plan.	LA/EM	CR	AC	PCP/CP/OP	/
18.6	<i>All landscaping in private and public open</i>	/	Detailed specifications and	LA	CR	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>spaces (POS; other than the conservation areas) should be planted with a selection of suitable, waterwise and locally indigenous Fynbos plant species approved, in writing, by the botanist. This replanting of natural vegetation will help increase biodiversity in the Low and Medium sensitivity areas, and will help reduce ecological fragmentation of the site.</i>		management guidelines to be addressed in the Landscaping Plan.					
18.7	<i>The appointed landscaper should liaise with the botanical specialist in order to check the appropriateness of the species to be used. There are relatively few locally indigenous tree species that are likely to enjoy the site, and thus the following list includes some species from further afield in South Africa: Note that none of these should be planted in natural (conservation) areas; they are only for rehabilitation and landscaping purposes: Sideroxylon inerme (milkwood), Kiggelaria africana (wild peach), Tarchonanthus africanus (camphor, vaalbos; wind tolerant), Maytenus oleoides (kliphout), Pterocelastrus tricuspidatus (kershout), Halleria lucida (tree fuchsia; damp or shaded areas), Celtis africana (white stinkwood), Rhus pendulina (karee; wetter areas), Cunonia capensis (butterspoon/rooiels; wet areas), Syzygium cordatum (water berry; wet areas); Rhus crenata (dune crowberry; a large shrub or hedge for dry sandy and windy areas), Grewia occidentalis (cross berry, shrub to 3m), Virgilia oroboides (keurboom, sheltered areas), Rapanea melanophloeos (Cape beech; more sheltered areas), and Harpephyllum caffrum and Ekebergia capensis (wild plum and essenhout; sheltered areas on better soils).</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	PCP/CP/OP	/

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18.8	<i>Annual alien clearing must be undertaken within all the conservation areas, starting with the lowest density invasions and working up to the densest areas. This must be undertaken by experienced personnel who practise Dept. of Water Affairs approved alien clearing methodology, and it should be noted that no heavy machinery may be used for this purpose, which would be likely to disturb the soil surface and further encourage alien invasion. There are likely to be various trained teams living in the Hermanus - Botriver – Hawston area. All alien clearing must be undertaken in the period November – April (outside the main flowering season) in order to minimise impact on the indigenous species). Particular care should be taken to remove alien invasive grasses such as Lolium (ryegrass), Avena (wild oats), Hyparrhenia hirta (thatching grass), and Pennisetum clandestinum (kikuyu) in the areas fringing the development.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE/EM	EM	AC	PCP/CP/OP	/
18.9	<i>Within three years of any authorisation of this project all parts of the site outside the actual development footprint should be at least 95% clear of alien invasive vegetation, such that any one patch (continuous area of 1-50ha in extent) of habitat supports less than 2% total alien vegetation cover (as determined by audit by independent botanist), and within five years no area should have more than a 1% alien cover. Alien clearing should be undertaken using DWA approved methodology, and annual follow-up alien clearing must be undertaken in all conservation areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	ACE/EM	EM	AC	PCP/CP/OP	/

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18.10	<i>No spraying of herbicides or pesticides should be allowed anywhere within the conservation areas, due to the significant risk of collateral damage to non-target species. The appropriate herbicides (such as Garlon, Chopper or Timbrel, or similar triclopyr; mixed with a suitable dye to show which stems have been treated) must however be used on the cut stumps of all woody alien invasive species, and these must be hand painted onto the cut stumps within 5 minutes of the stems being cut, and not during or just before rain. All cut alien plant material from areas within 200m of any access track or road should be removed from the conservation areas to a designated organic dump, where it should be chipped and turned into compost. In areas where alien clearing is undertaken further than 200m from any access track the cut alien material must be neatly stacked into cones, with cut ends facing up.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and Landscaping Plan.	LA/EM	CR/ME	AC	PCP/CP/OP	/
18.11	<i>No livestock grazing may take place anywhere within conservation areas on site once this application has been approved.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
18.12	<i>No hospitality tents or any other temporary infrastructure or parking required for events may be erected or prepared anywhere within mapped High sensitivity areas that do not fall within the proposed development footprint, at any stage.</i>	/		ACE				/
18.13	<i>All conservation areas (excluding small riverine or wetland patches and thicket areas on rocky outcrops, and excluding the firebreaks) will need to be burnt on a cycle of once every 12 -15 years. The controlled</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and Fire Management Plan.	ACE/EM	EM	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>fires must take place in the optimum ecological period of February – early April. The EMP must include detailed guidelines for fire management, which will have to be conducted in partnership with CapeNature and the local authorities. If it is not deemed possible to burn certain areas due to extreme fire danger (such as those very close to infrastructure) then these areas must instead be bushcut at a similar interval (every 12 -15yrs), preferably in late summer. This will partly simulate the effects of a fire, without the fire danger, but ecologically it is not the preferred option. It will stimulate many, but not all species to resprout or flower. The bushcut material should be removed two months after cutting, and mulched at the organic dump. At least 90% of the total 310ha conservation area should be burned, rather than being bushcut.</i>							
18.14	<i>Firebreaks will need to be maintained along the northern and western edges of the northern development sector (north of the R44) and along the western edge of the southern development sector (south of the R44). The firebreaks should be a total of 10m wide (5m either side of any boundary fence). All firebreaks should be bushcut every two years, in late October.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and Fire Management Plan.	EM	EM	AC	PCP/CP/OP	/
18.15	<i>All the initial and ongoing requirements of the EMP must be funded by an Environmental Management Fund. This fund must be set up either by the applicant or derived from a levy on the homeowners, or a combination thereof. Funding requirements are likely to be substantial, especially for alien vegetation management.</i>	/		ACE				/

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18.16	<i>No alien invasive grasses may be used in any rehabilitation or seed mix anywhere on site that is within 100m of any designated conservation area supporting natural vegetation or vegetation in need of rehabilitation.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and Landscaping Plan.	LA/EM/CR	EM/CR	AC	PCP/CP/OP	/
18.17	<i>The ecological management of the site, and especially of the conservation areas in the vicinity of the golf course and residential areas, should be audited every year by a person with extensive experience and understanding of Fynbos management. The auditor must assess the degree to which the applicant and their managers are complying with the requirements of any ROD in terms of ecological management of the site. The auditor must compile a report that is submitted to the site managers, who must in turn act on the recommendations with three months (90 days) of the date of the audit report. Failure to act within this period, to the satisfaction of the auditor, should result in a fine of not less than R10 000 being paid by the applicant into the Environmental Management Fund.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
18.18	<i>Management of conservation areas and POS should be in accordance with an operational phase EMP prepared with inputs from all specialists, and incorporating all management requirements listed in this report.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
<p style="text-align: center;">Freshwater (Freshwater Consulting Group, Arabella Golf Estate Phase 2: Revised Freshwater Ecological Input to the Environmental Impact Assessment, December 2012)</p>								
20	<i>Development layout</i>	P26						/
20.1	<i>The design of the golf estate should aim to minimise the loss of wetland habitat. This includes the bed and the banks of any</i>	/						/

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	<i>channels flowing within the wetlands. NOTE: alterations to the location of erven are not considered an implementable mitigation measure for any of the alternatives, as this may or may not threaten the financial viability of the project.</i>							
20.2	<i>Where encroachment into sensitive areas is unavoidable, areas of past disturbance must be used in preference to pristine areas.</i>	/						/
20.3	<i>Rehabilitate the donga downstream of the restio wetland patches at site 27, to enhance its corridor function. Rehabilitation would probably involve the strategic placing of small weirs (possibly wooden structures) to attenuate flow, thereby maximising local infiltration and reducing the high energy flows that are responsible for donga formation. Rehabilitation would also involve the removal of the remaining pine trees and replanting with indigenous riparian vegetation.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
20.4	<i>The design of the golf estate should aim to minimize the loss of wetland habitat. This includes the bed and the banks of any channels flowing within the wetlands. NOTE: alterations to the development layout is not considered an implementable mitigation measure for Alternatives 1 and 2, but there is scope for further layout changes for Alternative 3, as this alternative has a "golf course subdivisional area" within which the golfing greens, roughs etc can be shifted.</i>	/		DMP				/
20.5	<i>The location of fairways and greens should avoid the river and wetland, and</i>	/		DMP				/

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	<i>should, if possible, avoid the recommended buffers around these ecosystems – 20 m from the edge of each ecosystem.</i>							
20.6	<i>Where encroachment into sensitive areas is unavoidable, areas of past disturbance must be used in preference to pristine areas.</i>	/		DMP				/
20.7	<i>The detailed design of crossings over the streams and / or wetlands must be done with input from a river ecologist, and must attempt to disturb the river beds and banks as little as possible.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE/SC	CR	EC	PCP	/
20.8	<i>Bridges across the river must aim to span the active channel, if possible, and not require support structures to be placed in the stream channels or wetlands. Crossings may not be in the form of causeways.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE/SC	CR	EC	PCP	/
20.9	<i>The laying of pipes in and around streams and wetlands must be done by hand, and the construction footprint rehabilitated.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.10 - 1.	CR	CR	SE/ECO	CP	1.5/20.9
20.10	<i>The causeway crossing the Lekkerwater stream must be rehabilitated.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
20.11	<i>The culverts under the R44 must be upgraded, as recommended by Harrison (2010). This will improve connectivity between the upper and lower catchments of the Lekkerwater and Laughing Waters systems.</i>	/	Refer to Draft EMP, Section B, EMSpecs Section 8.21.	DMP/CE	CE	AC	PCP/CP	2.2/2.3/22.18
20.12	<i>Bridges should be supported on piles and should not be box culverts, wherever possible.</i>	/						/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
20.13	<i>Erosion control measures in the vicinity of bridges and culverts must be designed with input from a river ecologist.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/SC	CR	CR	PCP	/
20.14	<i>Ensure that the wetland buffers – 20 m from the edge of each ecosystem - are established and properly managed (through a detailed operational environmental management plan, programme or system), thereby providing for an ecologically viable corridor for the movement of flora and fauna.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
20.15	<i>Fencing must be designed as recommended by Harrison (2010).</i>	/						/
21	<i>Construction impacts</i>	P31						/
21.1	<i>Ensure that all building materials are stored at least 50m away from the edges of the wetlands or streams, as demarcated prior to construction.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 6.	CR	CR	SE/ECO	PCP/CP	/
21.2	<i>Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind, to prevent spread of fine materials across the site.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 6.01.	CR	CR	SE/ECO	CP	/
21.3	<i>Sensitive areas that are impacted by the dumping of materials must be ripped and re-planted after construction is complete.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
21.4	<i>Construction close to sensitive areas should take place during the dry season, to reduce the risks of contamination of the ecosystems through rainfall and runoff.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications.	CR	CR	SE/ECO	CP	/
21.5	<i>Machinery prone to oil or fuel leakage must be located at least 50m away from any freshwater ecosystem, and the area</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications.	CR	CR	SE/ECO	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>adequately bunded in order to contain leakages.</i>							
21.6	<i>Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications 7.08.	CR	CR	SE/ECO	CP	/
21.7	<i>Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications 7.03 and 7.05.	CR	CR	SE/ECO	CP	/
21.8	<i>Pathways and access roads must be routed around the wetlands and streams.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.06 and 8.10.	CR	CR	SE/ECO	CP	/
21.9	<i>The sensitive areas (i.e. the edges of the buffers around the ecological corridors) must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.05.	CR	CR	SE/ECO	CP	/
21.10	<i>Stream crossings for construction vehicles and personnel must be kept to a minimum, and should be located where the stream channels are naturally narrower.</i>	/						/
21.11	<i>Affected areas must be ripped and re-planted after construction, to the satisfaction of the ECO.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	ECO/AC	PCP/CP/OP	/
21.12	<i>Excavation and infilling of the streams or wetlands, or land in the vicinity of these ecosystems, must be restricted to areas where this is necessary, such as for rehabilitation and for road/track/pathway</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.10 - 1.	CR	CR	SE/ECO	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>construction.</i>							
21.13	<i>Indigenous plants in the ecological corridors must be retained for re-planting after construction.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management and the Landscaping Plan.	LA/EM	CR/EM	ECO/AC	PCP/CP/OP	/
21.14	<i>Any such work must be done during the dry season, to minimise impacts on the freshwater fauna and flora.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	ECO/AC	PCP/CP/OP	/
21.15	<i>The sensitive areas (i.e. the edges of the buffers around the ecological corridors) must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.05.	CR	CR	SE/ECO	CP	/
21.16	<i>Flow diversion structures must be removed from the stream channels as soon as possible, and the area rehabilitated to the satisfaction of the ECO.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.10 - 1.	CR	CR	SE/ECO	CP	/
21.17	<i>The design of crossings over the stream channels must be done with input from a river ecologist, and must attempt to disturb the river beds and banks as little as possible.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA/CE	CR	CR	PCP	/
21.18	<i>Affected areas must be rehabilitated after construction.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	ECO/AC	PCP/CP/OP	/
21.19	<i>The construction site, and pathways must avoid sensitive areas. If lights are used, these must be directed away from all sensitive areas.</i>	/						/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
21.20	<i>The sensitive areas (i.e. the edges of the buffers around the ecological corridors) must clearly be demarcated and fenced off (using temporary fencing) before any construction work or site preparation begins. These are no-go areas during the construction process.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 8.05.	CR	CR	SE/ECO	PCP	/
21.21	<i>Construction close to the streams and wetlands should preferably take place during the dry season, to reduce the risks of contamination through rainfall, runoff and erosion. If work must be done in the stream channels during the wetter months, the streams must be diverted during construction, using sandbags or pipes, and all diversion measures removed as soon as possible. The stream channels and affected wetlands must then be rehabilitated to the satisfaction of the ECO.</i>	/						/
21.22	<i>Special care should be taken around storm and heavy rain events. The site should be inspected for erosion damage at these times.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications.	CR	CR	SE/ECO	CP	/
21.23	<i>Construction work on the steep slopes of the site (e.g. around the Lekkerwater streams) must attempt to retain sediment-laden water on the construction site, and not allow it to flow into the streams or wetlands. This can be achieved through the use of settlement ponds close to the actual construction sites.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications.	CR	CR	SE/ECO	CP	/
21.24	<i>All soils and top material must be bought from reliable sources, and must be free of alien seeds or grass runners.</i>	/	Refer to the Arabella Country Estate Phase 2 EMP, Section B, EMSpecifications Section 6.	CR	CR	SE/ECO	CP	/
21.25	<i>Constant monitoring of the construction</i>	/	Refer to the Arabella Country Estate	CR	CR	SE/ECO	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>site must occur, and all alien plant species removed from or destroyed on the site.</i>		Phase 2 EMP, Section B, EMP specifications.					
22	<i>Operation phase impacts</i>	P34						/
22.1	<i>Stormwater should not be conveyed directly into the seeps or streams, but rather into detention ponds, bioswales and/or constructed wetlands, before entering any sensitive receiving environment. These attenuating structures can be located within the ecological buffers.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CE	AC	CP	/
22.2	<i>The detailed design of the stormwater and irrigation return flow system must be passed by a freshwater and estuarine ecologist.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CE	AC	CP	/
22.3	<i>Hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bioretention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and improving the quality of runoff.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	PCP/CP	/
22.4	<i>All detention ponds should be fitted with litter traps to prevent litter from entering any natural areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan and the Environmental Rehabilitation and	LA/CR	CR	AC	PCP/CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
			Management Plan.					
22.5	<i>Where golfing greens and fairways are located on an impermeable sub-layer, they must be drained by cutoff drains, placed at the lowest point in order to prevent seepage of polluted water into the streams or wetlands. These cutoff drains should convey water to the detention ponds, or into bioswales.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CE	AC	PCP/CP	/
22.6	<i>Water quality in all of the dams, the detention ponds and irrigation holdings ponds must be monitored, in order to ensure that water finding its way into the wetlands or vleis is of acceptable quality.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
22.7	<i>Water entering any of the natural areas should meet DWA's Special Limits, and not merely General Limits. However, if this does at any stage match the Resource Quality Objectives for the Botrivierlei and its catchment, then these Limits must be revised.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CE/EM	AC	CP	/
22.8	<i>Regular cleanup operations must be carried out, and the entire site inspected on a regular basis.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
22.9	<i>Public areas must be supplied with baboon and other animal proof bins, that must be cleared regularly.</i>	/		EM	EM	AC	OP	/
22.10	<i>Stormwater should not be conveyed directly into the streams or wetlands, but rather into detention ponds, bioswales and/or constructed wetlands, before entering any sensitive receiving environment. These attenuating structures can be located within the ecological buffers.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CR	CR	AC	CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
22.11	<i>Water from the attenuating structures should only be allowed to overflow into the streams, wetlands or vleis during high rainfall events.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CR	CR	AC	PCP	/
22.12	<i>Hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bioretention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and improving the quality of runoff.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan and the Environmental Rehabilitation and Management Plan.	CR	CR	AC	PCP/CP	/
22.13	<i>Where golfing greens and fairways are located on an impermeable sub-layer, they must be drained by cutoff drains, placed at the lowest point in order to reduce runoff into the rivers and wetland. These cutoff drains should convey water to the detention ponds, or into bioswales.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CE/EM	AC	PCP/CP	/
22.14	<i>Heavily eroded portions of the Lekkerwater and Laughing Waters systems must be rehabilitated to the satisfaction of a river ecologist. This will include grading and reshaping of stream banks, and replanting of substantial portions of these systems. Rehabilitation must be guided by a detailed rehabilitation plan.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
22.15	<i>The actual placement of bulk services pipelines must be done in such a way as to minimise the number of crossings over sensitive areas. For instance, pipes can be carried on bridges, or follow golfing roughs, etc.</i>	/		CE	CE			/
22.16	<i>Pipe maintenance must be done in such a way as minimise damage to sensitive areas.</i>	/						/
22.17	<i>Erosion control measures in the vicinity of bridges and culverts must be designed with input from a river ecologist.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR	AC	PCP/CP	/
22.18	<i>The culverts under the R44 must be upgraded according to the recommendations of Harrison (2010), in order to improve the connectivity between the upper and lower catchments of the Lekkerwater and Laughing Waters systems.</i>	/	Refer to Draft EMP, Section B, EMSpecifications Section 8.21.	DMP/CE	CE	AC	PCP/CP	2.2/2.3/20.11
22.19	<i>Abstraction from any surface water resource shall only take place during winter months.</i>	/		ACE				/
22.20	<i>Abstraction shall not detrimentally affect the flow regimes of any of the affected ecosystems.</i>	/		ACE				/
22.21	<i>The impact of ground- and surface water abstraction must be continually monitored, not only by measuring water levels, but also by monitoring the viability of ecosystems potentially affected by abstraction. A detailed monitoring programme must be developed and implemented, and the results of the monitoring programme must be submitted to CapeNature.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
22.22	<i>The leaking borehole (borehole 9) and associated infrastructure must be fixed and the area rehabilitated.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/
22.23	<i>Where possible, runoff from natural areas must be allowed to flow unhindered across the site.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CR	AC	PCP	/
22.24	<i>The provision of a buffer – 20 m from the edge of each ecosystem – will allow for some natural runoff to enter the ecosystems.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/
22.25	<i>Residential and road lights should be directed away from natural areas.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR/EM	AC	PCP/CP	/
22.26	<i>A suitable buffer around these ecosystems – 20 m from the edge of each ecosystem - would provide some protection for the fauna and flora.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/
22.27	<i>Fencing must be designed according to the recommendations of the faunal specialist, Harrison (2010).</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR/EM	AC	PCP/CP	/
22.28	<i>The recommended buffer areas should be planted with appropriate indigenous vegetation, and a barrier provided between landscaped areas (gardens or golf course) and the buffer (e.g. a golfcart track or pathway).</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR/EM	AC	PCP/CP/OP	/
22.29	<i>Kikuyu grass will not be allowed on the site, and alternatives (e.g. <i>Stenotaphrum secundatum</i>, <i>Paspalum vaginatum</i> and <i>Cynodon dactylon</i>) sought for the golfing greens and fairways.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR/EM	AC	PCP/CP	/
22.30	<i>The spread of alien plant species into the</i>	/	Detailed specifications and	EM	EM	AC	PCP/CP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>natural areas must be prevented and monitored.</i>		management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.					
22.31	<i>Ensure that landowners are required to plant indigenous gardens so as to reduce the need for pesticides and fertilizers and thus address the source of some nutrient enrichment in the system. These measures could be stipulated in the title deeds for residential erven.</i>	/	Detailed specifications and management guidelines to be addressed in the Landscaping Plan.	LA	CR/EM	AC	PCP/CP	/
Estuary (CSIR, Adesktop assessment of the potential impacts of the Arabella Golf Estate Phase 2- Alternative 4 on the Botriver Estuary, 2013)								
23	<i>Design recommendations</i>	p35						/
23.1	<i>Bot/Kleinmond Estuary is included in the priority list of estuaries that needs to be protected to meet biodiversity targets in South Africa as stipulated in regional conservation plan for the cool and warm temperate estuaries.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP	/
23.2	<i>No water can be abstracted from any of the rivers flowing into the Bot River Estuary.</i>	/		ACE				/
23.3	<i>Current information indicates that the groundwater abstraction would have a negligible impact on the estuary, but this should be verified through continuous monitoring to ensure the ecological integrity of the system.</i>	/		ACE				/
23.4	<i>No nutrient rich sub-surface flow or fresh water from irrigation may reach the Bot River Estuary from the fairways. It is also strongly recommended that the potential sub-surface flows to the Bot River Estuary from the Arabella Country Estate Phase 1 development be investigated. If nutrient-rich sub-surface flows are reaching the estuary, it is of vital importance that this</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CR	AC	PCP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>aspect be addressed in the construction of Phase II and the Environmental Management Plan for the development.</i>							
23.5	<i>No wastewater should be discharged from the retention pond(s) to the Bot River Estuary.</i>	/	Refer to the Stormwater and Flood-runoff management Plan.	CE	CR	AC	PCP	/
23.6	<i>No development/modification of habitat should occur below the 5 m MSL contour.</i>	/	Refer to the Site Development Plan.					/
23.7	<i>No sediment should wash into the estuary during the construction phase of the development.</i>	/						/
23.8	<i>It is once again recommended that the Arabella Country Estate approaches the DWA to assist in co-funding such a Ecological Water Requirement study in order to fast track the process of determining priority areas for future reserve studies.</i>	/		ACE				/
24	<i>Recommendations for the Environmental Management Plan</i>	P38						/
24.1	<i>Conduct a detail investigation into the interaction between the Bot and Kleinmond estuaries, in order to successfully balance the various ecological needs of the two estuaries and the Rooisand area. This can then be used to draft management objectives focussing on the environmental needs, but accommodating other factors (e.g. economic or social needs) where possible.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
24.2	<i>Manage the Bot and Kleinmond estuaries as an interconnected system, as Branch et al (1985) have recommended. The joint management plan should account for the needs of both systems to ensure the</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>survival of dependent species.</i>							
24.3	<i>Regardless of the success of the Phase 2 development, the Environmental Management Plan drafted for Arabella Estate should include specific reference to the acceptance of the high degree of variability of the natural system and a policy of no interference. Developers, such as Arabella, should be encouraged to market the uniqueness of South African estuaries, with their high degree of natural variability, in contrast to the open, heavily impacted, systems in Europe.</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	/
24.4	<i>It is important that Arabella Estate becomes more active and involved in the Bot River Estuary Management Forum (as required by in the Bot/Kleinmond Estuary Management Plan). This include co-funding the development and implementation of a Bot/Kleinmond Estuary Monitoring Plan for the system, e.g. water quality samples along the system and a video camera.</i>	/		ACE				/
24.5	<i>With regards to the compliance monitoring as stipulated in the current Environmental Management Plan for Arabella Country Estate Phase I it is recommended that monitoring of subsurface flows into the estuary near Phase I development be included in the current programme. In addition, all analyses of water samples taken in and around the estuary (salinity > 1 ppt) should be validated for saline water (i.e. using a salt water method, standardising results against seawater standards) with laboratory detection limits of less than 10 µg/l for inorganic nitrogen and phosphate. If these result needs to be legally</i>	/	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.	EM	EM	AC	PCP/CP/OP	Detailed specifications and management guidelines to be addressed in the Environmental Rehabilitation and Management Plan.

Mitigation Ref No	Mitigation	REFERENCE IN SPECIALIST REPORT	IMPLEMENTATION OF MITIGATION & MANAGEMENT PRESCRIPTIONS	RESPONSE	EXECUTE	AUDIT	PHASE	CROSS REFERENCE
	<i>defensible, it is also recommended that the tests be done by a accredited laboratory.</i>							
24.6	<i>Cooperate with other role players in the region to addressing water quality problems in the Bot and Kleinmond Estuaries caused by agricultural pollution, return flow from the golf estate, dairy farms, sewage overflow and leaking septic tanks.</i>	/		ACE				/

ANNEXURE B3

FIRE MANAGEMENT PLAN

FIRE MANAGEMENT PLAN

1. INTRODUCTION

This Fire Management Plan has been prepared as part of the Arabella Country Estate Phase 2 EMP.

The primary purpose of the Fire Management Plan is to provide rules, regulations and procedures to be used in case of a fire, accidental or controlled, so that all personnel will be fully aware of their responsibilities. It aims to eliminate loss of life, human injury, economic and environmental losses as a result of veld fires while promoting the useful role of veld fires. It also aims to ensure that Arabella comply with legal requirements as it pertains to fire management.

1.1 SITE LOCATION AND CHARACTERISTICS

The Arabella Country Estate Phase 2 site (also referred to as the project site) is situated within the Overstrand Municipality, approximately 8 km east of Kleinmond on the R44 (refer to Figure 1).

The project site is located within the Cape Floristic Region and contains areas of pristine Kogelberg Sandstone Fynbos and Hangklip Sand Fynbos (Helme 2010¹). The project site has been lying fallow for a considerable period of time. Large portions of the site is covered with dense infestations of alien plants such as myrtle (*Leptospermum laevigatum*), Port Jackson (*Acacia saligna*), long leave wattle (*A. longifolia*), golden wattle (*A. pycnantha*), *Pinus* and *Eucalyptus*.

The climate of the region in which the project site is located is characterised by warm (temperatures ranging from 24 - 35°C), dry, windy summers and mild, moist winters. Due to the conditions experienced during summer months, there is the potential of runaway veld fires.

Fire season is predominately during the months of November to April when the fire risk is at its highest.

¹ Nick Helme Botanical Surveys. Supplementary environmental impact assessment of the proposed Arabella Country Estate, Kleinmond: vegetation, 2010.

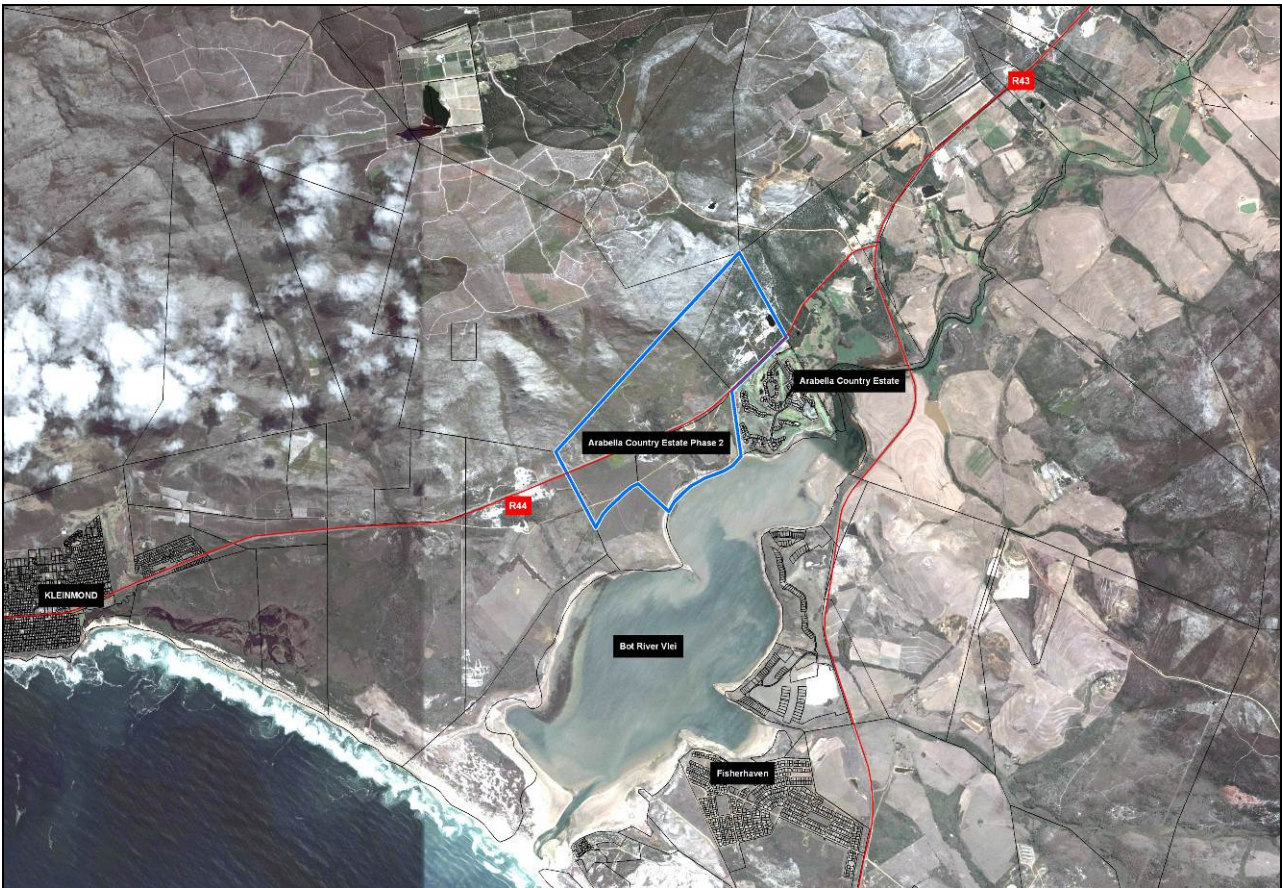


Figure 1: Location of Arabella Country Estate Phase 2 project site.

1.2 PROJECT SITE'S ADJOINING PROPERTIES

The project site is located within an area characterized by severe development impacts and degradation. The surrounding land units include:

- The Kogelberg Nature Reserve (former Highlands State Forest) forming the northern boundary. Most of this area is under pine plantations designated to be removed.
- Farm No. 545, Lekker Water (western boundary), currently used for harvesting of wildflowers and is degraded due to alien plant infestation.
- Farm No. 542/2 (eastern boundary), used for limited harvesting of wildflowers.
- The Bot River Vlei (State land) which forms the southern boundary of the property. The Bot River Vlei is utilized for conservation and low-impact recreation.
- The Rooisand Provincial Nature Reserve forms the south-western boundary of the project site. Most of the nature reserve has been severely degraded due to alien plant infestation.

2 APPLICABLE LEGISLATION

The following legislation places a responsibility on Arabella for proper veld fire management:

- The Constitution of the Republic of South Africa (Act 108 of 1996)
- National Environmental Management Act (Act 107 of 1998)
- National Veld and Forest Fire Act (Act 101 of 1998)

2.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA (ACT 108 OF 1996)

Section 24 of the Constitution provides that *everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) (ACT 107 OF 1998)

Section 28 of NEMA creates a general duty of care on every person to *take reasonable measures to prevent significant pollution or degradation of the environment from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.*

2.3 NATIONAL VELD AND FOREST FIRE ACT (ACT 101 OF 1998)

Veld fires in South Africa are dealt with under the National Veld and Forest Fire Act (Act 101 of 1998). The purpose of the National Veld and Forest Fire Act is *to prevent and combat veld, forest and mountain fires throughout the Republic.*

The Act places the duty on land owners to make provision for the management of veld fires on their own land. Failure to do so may result in penalties being enforced (refer to Section 24 and 25

of the above Act) and claims lodged against a landowner if the above Act's requirements were not met.

In terms of the National Veld and Forest Fire Act the following responsibilities apply to landowners:

- *The landowner on whose land a fire may start, or from whose land it may spread across boundaries, must have in place:*
 - *Such equipment, protective clothing and trained personnel required to extinguishing such fire as may occur as prescribed in the FPA (Fire Protection Association) regulations.*
 - *If there are no regulations applicable, then as reasonably required in the circumstances.*
 - *Take all reasonable steps to notify the Fire Protection Officer (FPO) of the local FPA should a fire break out.*
 - *Do everything in their reasonable power to stop the spread of the fire.*
 - *The Act also requires that should the owner be absent, a known and identified other person responsible needs to be present on or near this land to:*
 - *Extinguish a fire if one breaks out, or assist or instruct others to do so.*
 - *Take all reasonable steps to alert the neighbours and the FPO.*
 - *The owner may appoint an agent to act on his or her behalf to perform these duties.*

3 OBJECTIVES

The overarching fire management goals (italics) and objectives (bulleted) as it pertains to the Arabella Country Estate Phase 2 are the following:

Protect people and property.

- Minimise all extreme fire risks.
- Provide for the safety of residents, visitors, firefighters and staff.
- Directly protect real and personal property from the effects of fire.
- Achieve full compliance with the National Veld and Forest Fire Act.
- Reduce fuels with prescribed fire and thinning in places where wildfire is a threat to people and property.
- Implement programs to prevent unplanned human-caused ignitions and reduce human-caused wildfires.

- Ensure organized, professional and coordinated response to fires.
- Strive to meet health and safety standards that relate to fire, particularly for air quality and on-the-job safety (e.g. National Occupational Health Safety Act (Act 85 of 1993)).

Protect natural and cultural resources from undesirable effects of fire and suppression.

- Reduce fuels with prescribed fire and thinning in places where fire would adversely affect estate resources.
- Avoid negative effects to sensitive areas.
- Employ minimum impact suppression tactics, particularly in ecologically sensitive areas.

Suppress unwanted fire.

- Ensure Arabella is adequately prepared to suppress unwanted wildfires.
- Suppress all human-caused fire.
- Prevent unwanted fire from spreading onto neighbouring land.

Allow fire to assume its natural role in ecosystems.

- Determine fire-related data needs relative to natural resources.
- Attempt to determine range of natural variation related to fire (in time, space and intensity), role of fire and fire effects.
- Search for scientific results relative to data needs and apply to a fire program.
- Promote research relative to data needs and apply results to a fire program.
- Monitor fire effects and incorporate results into a fire program.
- Determine desired conditions before allowing or introducing fire.

Use prescribed fire for resource management purposes.

- Return fire to fire-dependent ecosystems.
- Specify and aim for desired conditions.
- Keep fire use within the natural range of variation (in time, space and intensity).
- Reduce fuels in places where fire would adversely affect resources.
- Look for opportunities to use fire to restore and maintain cultural landscapes.

Manage fire cooperatively with neighboring agencies and private land owners as well as other stakeholders.

- Maintain open lines of communication.
- Collaboratively plan and implement fire operations.
- Improve fire awareness amongst Arabella Country Estate Phase 2 staff, residence and visitors.

4 APPROACH & MANAGEMENT

It is important to understand the basics of fire before preparation can be made for efficient control thereof. It is essential to note that three environmental components are required for a fire to occur. These are oxygen, heat and fuel (refer to Figure 2). Whilst the atmosphere contains 21% oxygen, only 16% oxygen needs to be in the air for a fire to start. Fuel is any living or dead material that will burn. If ignition occurs in the situation or environment where all three elements are present combustion will result and a fire will continue to burn until one of the three elements are removed.

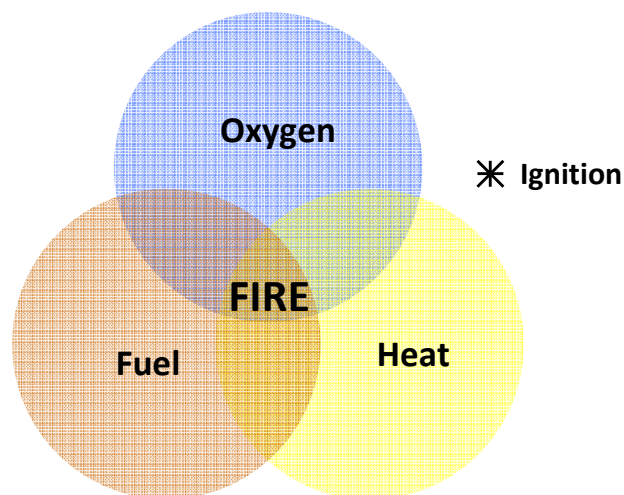


Figure 2: Basic elements of fire.

It is impossible to exclude oxygen from fires. Heat is considered a constant. However, a reduction in fuel will reduce the total energy output (refer to Figure 3). Fuel or more specifically the amount of fuel is the only aspect that can be influenced. It therefore become the most important factor in the prevention and control of fire.

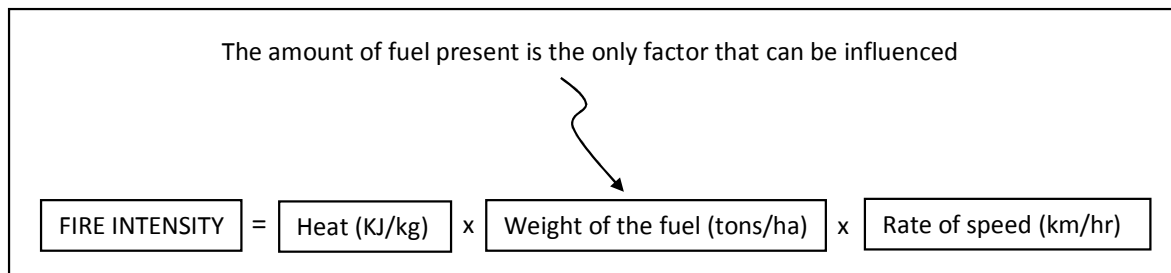


Figure 3: The factors determining the intensity of fire.

In order to fulfil this objective listed under Section 3 above the Fire Management Plan makes provision for the following four components in the approach to the occurrence of fire:

a) Awareness

The majority of unwanted fires are caused by human intervention. Proper training and education will promote awareness of risks and the ability to be to make the right decisions in situations that demand quick and efficient response.

It is essential for both staff, residents and visitors to the Arabella Country Estate Phase 2 to know where danger areas are, which season present the biggest risks and understand the local conditions (veld density and types, weather etc.) which are conducive to fire inception and spread. It is essential for residence to be aware of what is going on around their property and in their immediate vicinity.

Education of staff and local communities on fire awareness, the causes and prevention thereof therefore plays an important role in fire management as well as educating residence and guests of the phenomenon and how they can assist in prevention of unwanted wildfires.

b) Prevention

Prevention is always better than the cure. After awareness, prevention and control are the secondary steps in wildfire management. This Fire Management Plan and the measures addressed in the Arabella Country Estate Phase 2 Environmental Management Plan is essential to effectively achieve the objectives of fire prevention.

c) Preparedness

Nature is in a constant state of flux and is significantly influenced by fluctuating and variable rainfall cycles. Whilst proper prevention techniques will significantly reduce the likelihood of spreading veld fires it needs to be accepted that, despite any effort made, we will never be able to control natural forces to the extent we may wish to. It is therefore equally necessary to be prepared for the inevitable in this regard.

Arabella will be covering all the possible bases to be in a complete state of preparedness at all times. In this regard Arabella is committed to complying with the provisions of the National Veld and Forest Fire Act, i.e. being sufficiently prepared to react to fire, creating and maintaining adequate fire breaks, clearing the property of excess plant material that might fuel a fire, replacing dense flammable plants with succulent fire resistant plants, removing invasive alien plants, etc.

d) Response

All fires start small, thus, detection at the earliest possible stage is critical and is therefore also regarded as being as important a part of preparedness as it is for ensuring an appropriate response.

The management approach as it relates to of risk involved with veld fires is summarized in the table below.

Table 1: List of specific risk management options

Management options	Descriptors
Avoid the risk	By deciding not to proceed with the activity likely to generate the veld fire risk. For example, prohibiting certain types of actions in areas prone to wildfires.
Reduce the hazard and the likelihood of exposure	Programs to reduce the level of fuel available to burn in a veld fire and improve the degree to which assets are protected. For example, prescribed burning, the preparation of firebreaks or manual clearing of fire hazards as well as regular inspections.
Reduce ignitions	Programs to reduce the number of deliberate and accidental ignitions of human origin. For example, education and awareness programmes, fire bans, reduction in activities during high-risk season or periods, arson investigation programs, and issuing of

	permits to burn during the veld fire danger season. These measures are captured in fire prevention plans, which would also provide for education and enforcement.
Reduce consequences	This option includes various measures to reduce the consequence of wildfires, such as preparedness and contingency plans, wildfire recovery plans, community education programs for self-protection (lives and property), and building restrictions and standards for areas prone to veld fires.

5 FIRE MANAGEMENT ZONES

For the purpose of this fire management plan the Arabella Country Estate Phase 2 site has been divided into two zones namely the built-up area (Zone 1) and the natural area (Zone 2) (refer to Figure 4 below). These zones were defined according to the broad fire management approaches that will apply to each.

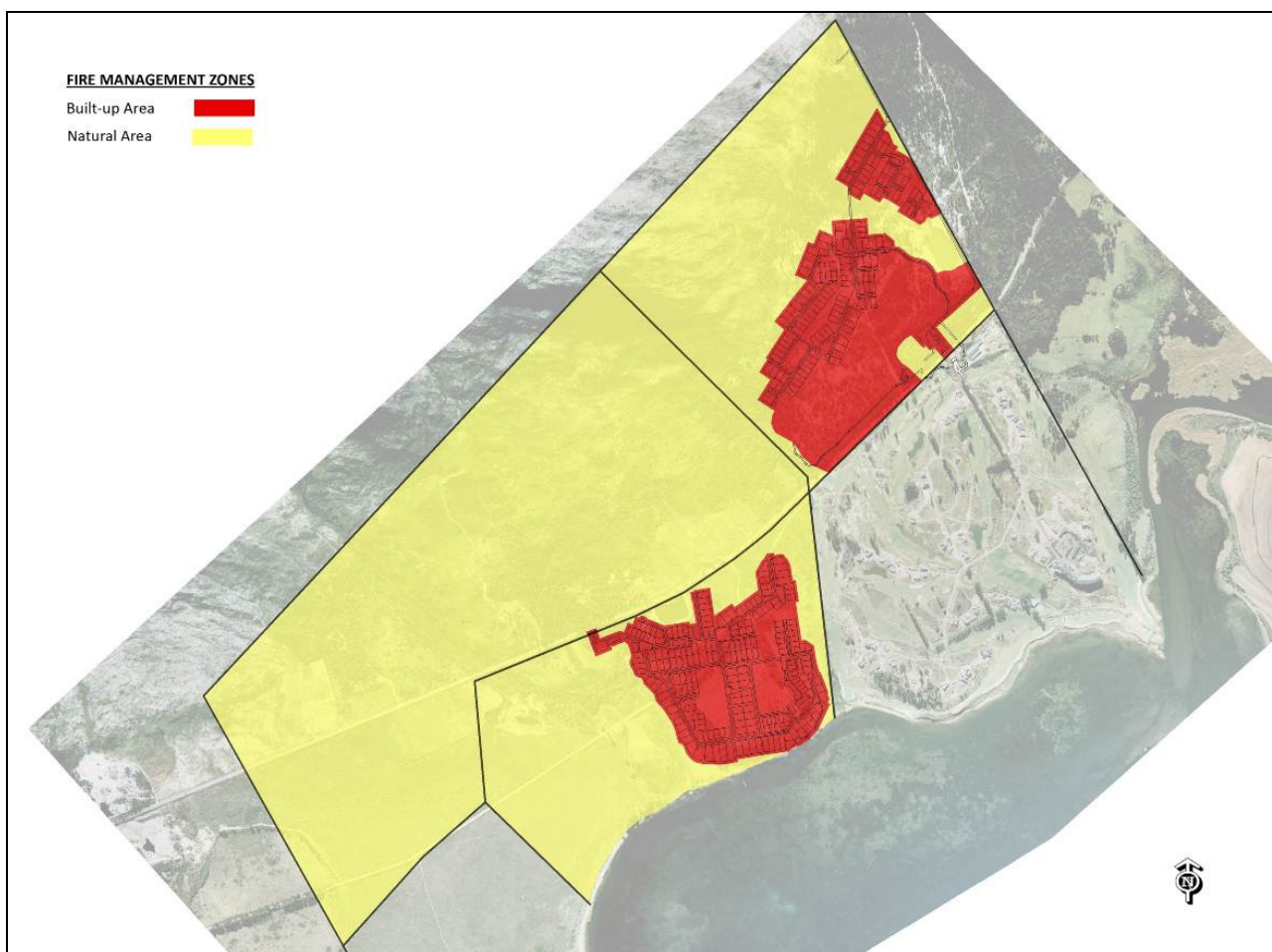


Figure 4: Fire management zones.

Zone 1 is a fire exclusion zone. Personnel responding to a fire in built-up areas will look to suppress the spread of fire. In the remaining two zones fire will be managed and fuel loads kept in check.

Throughout this document reference will be made to the fire management zones indicated in Figure 4 above.

6 ACCIDENTAL & CONTROLLED FIRES

As previously mentioned, the project site is located within the Cape Floristic Region, which is one of six floristic regions in the world and the only one confined to a single country. While it supports almost half of the plant species in South Africa, about 9000 species, it is the smallest of the six floristic regions, covering 0.01% of the world's land surface.

Fire is a natural and an essential part of fynbos. It creates space and increases the availability of nutrients, light and water that otherwise limit regeneration in mature fynbos. Fire acts as a mineralizing agent, returning elements held in living plants and litter to the soil. Recurring fires over millions of years have led to the evolution of many life-history features in fynbos plants. These include the stimulation by fire of seed released from cones held on the plant, seed germination and flowering. Various species of fynbos are killed by fire and rely entirely on seeds for reproduction. Others survive fires and re-sprout from beneath fire resistant bark or from below ground.

This Fire Management Plan recognises the need to maintain the fynbos fire regime by making provision for natural or controlled fires. These natural or controlled fires typically occur seasonally. From a species diversity perspective, the more random the fire regime (veld age, time of year, weather, etc) the more likely the fire is to maintain the biodiversity of the indigenous flora and fauna.

Unnatural fire, on the other hand, results from the intervention of humans and purposeful or accidental ignitions are becoming increasingly frequent, leading to land degradation and loss of biodiversity. These types of wildfires are the most damaging and cause widespread destruction.

Unnatural fires can, furthermore, be split into unwanted, unmanaged wildfires and managed, prescribed fires, but for the purpose of this Fire Management Plan, fires are classified as either a) accidental and b) natural or controlled fires.

This classification is mainly made according to the primary objective or response thereto. The primary objective to an accidental fire is that of prevention while the objective with regards to a natural or controlled fire is that of management (refer to Figure 5).

During the construction phase of the development, all construction activities will be strictly controlled in accordance with the EMP which will comply with ISO14001 standards and will include strict monitoring and environmental auditing prescriptions.

In terms of the EMP, in particular the Environmental Management Specifications, the appointed contractor will be responsible for the prevention of wildfires as it relates to his/her contractual responsibilities and works on site.

The management of fire as it relates to the estate as a whole both during the construction and operational phase of the development will be the responsibility of the Estate Manager, acting on behalf of the Arabella Country Estate Phase 2 Home Owners Association (HOA) in accordance with the EMP (refer to Figure 5).

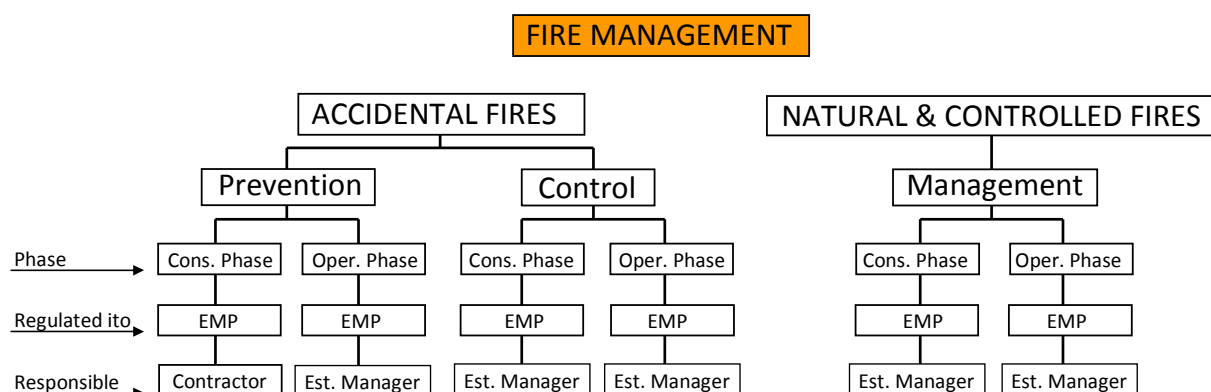


Figure 5: Fire management responsibilities.

6.1 ACCIDENTAL FIRES

6.1.1 ACCIDENTAL FIRES FIRE MANAGEMENT OBJECTIVES

The primary accidental fires fire management objectives are:

- To prevent the occurrence of human-induced wildfires.
- To protect persons and property on or adjacent to the project-site from wildfires that might be caused by project activities.
- To effectively react and suppress unplanned or accidental fires.

6.1.2 FIRE MANAGEMENT STRATEGIES

In response to the legal obligations for fire management, the following fire management strategies are proposed:

- During the construction phase of the development the Contractor shall take all reasonable and active steps to avoid increasing the risk of fire through his/her activities on site.
 - No fires may be lit except at places approved by the Environmental Control Officer (ECO).
 - On the construction site, the Contractor shall make provision for and ensure that the basic fire-fighting and emergency equipment is in good condition and inspected on a weekly basis.
 - Fire and 'hot work' shall be restricted to a site approved by the Site Engineer (SE).
 - A braai facility may be considered at the discretion of the SE. The area shall be away from flammable stores. All events shall be under management supervision and a fire extinguisher shall be immediately available.
 - Cooking shall be restricted to bottled gas facilities under strict control and supervision.
 - The Contractor shall take precautions when working with welding or grinding equipment near potential sources of combustion. Such precautions include having a suitable, tested and approved fire extinguisher immediately at hand and the use of welding curtains.

- The contractor must ensure that there is a staff member on-site with the necessary training to lead a team of workers in the event of a fire.
- The Estate Manager shall take all reasonable and active steps to avoid increasing the risk of fire through his/her activities on site.
 - The Estate Manager shall make provision for and ensure that the Estate's basic fire-fighting equipment is in good condition and inspected on a weekly basis.
 - Fire and 'hot work' shall be restricted to a site approved by the Estate Manager.
 - Fire-watch radio networks have to be established and maintained, especially during the fire season.
 - Fires within natural areas are prohibited.
 - Have in place a properly equipped and trained fire crew to assist in the suppression or containment of wildfires and to maintain fire mitigation measures.
 - Identify areas of high fire risk/hazards.
 - Identify activities in the project that could lead to the ignition of a fire and determine and then implement mitigatory measures.
 - Fire breaks should be prepared (as per Section 6.1.5.4 below) and maintained.
 - Suitable water points should be maintained for the provision of water to fire management teams.
 - The Estate Manager must ensure that there is a staff member on-site at all times with the necessary training to lead a team of workers in the event of a fire.

6.1.3 FIRE PROHIBITION

Further to the strategies listed under Section 6.1.2 above the following is proposed with regard to open air fires:

- No person shall make a fire in the open air, or if such a fire has been made, allow it to continue to burn or add fuel thereto, otherwise than:
 - Fires made within a demarcated area designated for such purpose, but only at places within such a demarcated area as have been specifically prepared and maintained for that purpose;
 - Fires for the preparation of food on residential stands which are adequately protected against fire;

- Fires made on residential and industrial stands in proclaimed townships which are adequately protected against fire.

6.1.4 FIRE MANAGEMENT CAPACITY

According to the Fire Brigade Services Act (Act 99 of 1987) the Chief Fire Officer of the District Municipalities Fire Brigade Services are responsible for any fire fighting operations within its area irrespective of fire fighting operations conducted by other organisations. Arabella Country Estate Phase 2 will rely on district and local authority fire management services in the event of a fire, however, the on-site minimum fire fighting requirements will be met by Arabella at all times.

Arabella will ensure that on-site personnel are trained in fire fighting to an acceptable standard prescribed by the Department of Water Affairs and Forestry. Personnel should preferably be trained by accredited institutions and trainers. Arabella will at all times comply with the provisions of the Occupational Health and Safety Act.

A standby schedules for each fire fighting team at the beginning of the fire season must be established. Throughout the fire season, the standby crew should be maintained after hours.

The equipment listed in Table 2 will be in place and kept in good working order. This equipment will be checked as per a checklist on a weekly basis or after it has been used. Inspections will be recorded.

Fire extinguishers will be serviced annually or after it has been used.

The dedicated fire fighting vehicle(s) must be equip with basic fire tools so that staff can respond immediately. These vehicles must be checked and serviced before the beginning of the fire season. During the fire season fire fighting vehicles must be fuelled before each weekend and repair work done after a fire event.

Table 2: Equipment and protective clothing for fire fighting teams.

DESCRIPTION	QUANTITY	DESCRIPTION	QUANTITY
HAND TOOLS		PROTECTIVE CLOTHING	
Rake Hoes		Fire resistant trousers	1/person
Fire beaters		Fire resistant shirts	1/person
Spades		Anti flash hoods	1/person
Slashers		Boots	1/person
Chain saws		Gloves	1/person
Fire extinguishers		Goggles	1/person
OTHER EQUIPMENT		Breathing masks	1/person
Spotlight		Hard hats	1/person
Torches		Chainsaw hat and pants	1/operator
Bolt cutters		WATER RELATED TOOLS	
First Aid kit		Back-pack sprayers / Knapsacks	
Maps		WATER TANKS AND PUMPS	
FUEL		1000ℓ Water trailer with 5.5kw pump.	
RADIOS			

6.1.5 PROACTIVE WILDFIRE MANAGEMENT MEASURES

6.1.5.1 Access maintenance

Roads must be inspected regularly to:

- Remove obstacles such as fallen trees.
- Make sure roads can accommodate fire tenders.
- Key locks alike and ensure that vehicles carry tools (e.g. bolt cutters and saws).

6.1.5.2 Fire detection

The Estate Manager and/or contractor will have to rely on its staff members, sub contractors, neighbours, residents and visitors for fire detection. Emergency telephone numbers must be boldly displayed in strategic positions across the projects site.

6.1.5.3 The development of a fire danger rating system

The Minister prepares and maintains a fire danger rating system for the entire country in consultation with:

- The South African Weather Bureau; and the
- Fire protection associations.

The country is divided into separate regions which have a uniform fire danger rating system. The Minister must communicate the rating to the fire protection associations in the region and must publish warnings when the fire danger rating is high in any region. This must be published in newspapers and television channels. When the minister has published a warning, no person may light, use or maintain a fire in the open air in the region where the fire danger is high.

The Contractor, in collaboration with the Site Engineer and Estate Manager, is responsible for the collation of the fire danger index daily rating, and any other local/regional fire danger ratings and to communicate danger ratings to staff. A simple, but effective fire danger rating should be applied to the project (refer to Table 3). Fire danger ratings must be assessed daily during the fire season. The fire danger rating system must take into account the following factors:

- (i) topography,
- (ii) type of vegetation in the area,
- (iii) seasonal climatic cycle,
- (iv) typical weather conditions,
- (v) recent weather conditions,
- (vi) current weather conditions,
- (vii) forecasted weather conditions, and
- (viii) any other relevant matter.

The fire danger rating system must show the rating in a clear format identifying what activities are dangerous and what precautions should be taken for each rating.

Table 3: Fire Danger Index

<i>Fire Danger Index</i>	<i>Fire Conditions</i>	<i>Fire management preparation</i>
	Safe	<ul style="list-style-type: none"> • Basic minimum fire fighting preparedness apply
	Moderate to safe	<ul style="list-style-type: none"> • Standby operational on a roster basis • Proactive fire management measures undertaken as planned
	Moderate to high	<ul style="list-style-type: none"> • Standby operational on a roster basis • Limited/no proactive burning interventions • Open fires only permitted in authorised fireplaces
	High	<ul style="list-style-type: none"> • Standby operational on a roster basis • Open fires only permitted in authorised fireplaces • Designated management staff available for wildfire response
	Very high to extreme	<ul style="list-style-type: none"> • Standby fully operational • No open fires • Fire response team (proto-team) working close to fire-fighting equipment • Test fire-fighting equipment • Deploy field staff in safe areas only

6.1.5.4 The preparation and maintenance of firebreaks

Fire breaks are cleared paths which will prevent the spread of fire by removing the fuel from the fire path.

Section 12 of the National Veld and Forest Fire Act *stipulates that every owner on whose land a veldfire may start or burn or from whose land it may spread must prepare and maintain a firebreak on his or her boundary between his or her land and any adjoining land.*

In terms of Section 13 of the Act above *a landowner is obliged to prepare and maintain a firebreak, with due regard to the weather, climate, terrain and vegetation.* The firebreak must:

1. *be wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading to or from the neighbouring land,*
2. *not cause soil erosion, and must*
3. *be reasonably free of inflammable material capable of carrying a veldfire across it.*

A fire break is a means of access for personnel and equipment, to serve as a control line and to serve as a line from where a fire can be attacked from, for example by setting a backburn. The firebreaks are to be linked to access roads, thereby reducing the areas requiring preparation and increasing accessibility to the various sites.

Fire breaks are required to be put in place along the perimeter of built-up areas, the Arabella Country Estate Phase 2 property boundary, the construction camps and offices and, if required, around working areas and hot works areas. Preparation of firebreaks must be done between September and November.

As per the National Veld and Forest Fire Act, the following apply with regards to the preparation and maintenance of firebreaks:

- If Arabella intends to prepare or maintain firebreaks by burning it must notify owners of adjoining land and relevant authorities.
- If Arabella intends to prepare and maintain a firebreak by burning, it must determine a mutually agreeable date or dates with the owners of adjoining land for doing so, and inform the fire protection association in the area.
- The necessary approval must be obtained.
- If agreement cannot be reached, Arabella must give to the owners of adjoining land and the fire protection association for the area at least 14 days written notice of the day or days during which he or she intends burning firebreaks, fire danger permitting.
- Arabella will prepare and maintain a firebreak with due regard to the weather, climate, particular terrain and vegetation. Arabella may not burn a firebreak if the fire protection association objects to the proposed burning; or a warning has been published because the fire danger is high in the region; or the conditions are not conducive to the burning of firebreaks.
- Arabella will inform the owners of adjoining land and the fire protection association if burning cannot be done on the agreed day.
- For a firebreak to be wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, a area of at least five (5) meters wide inside the boundary fence is proposed.

- Mitigation measures must be put in place to ensure that firebreaks do not cause soil erosion.
- Firebreaks will be kept reasonably clean of inflammable material.

6.1.5.4.1 Preparation and positioning of firebreaks

Locations where firebreaks are required vary. Individual circumstances will determine what type, width and length will be applicable.

When constructing firebreaks it is important that all vegetation cover is removed and that only rocks and soil (minerals) are exposed. A fire can travel very slowly through the grass roots or decayed vegetation and great care must be taken to ensure that mineral earth is exposed throughout the length and width of the break.

The following factors must be taken into account with the construction of firebreaks.

- Access
The placement of firebreaks on a slope must be determined by access to the break.
- Slope
Slope is the steepness of the land and has the greatest influence on fire behaviour. The steepness of the slope affects both the rate and direction of the fire spread. Fires usually move faster uphill than downhill and the steeper the slope, the faster the fire will move. This is because:
 - on the uphill side, the flames are closer to the fuel;
 - the fuels become drier and ignite more quickly than if on the level ground;
 - wind currents are normally uphill and this tends to push heat flames into new fuels;
 - convected heat rises along the slope causes a draft which further increases the rate of spread; and
 - burning embers and chunks of fuel may roll downhill into unburned fuels, increasing spread and starting new fires.
- Aspect
Aspect is the direction the land faces - north, south, east or west. The aspect of a slope influences a fire's behaviour in several ways:

- southern aspects receive more direct heat from the sun, drying both the soil and the vegetation;
- fuels are usually drier and less dense on southern slopes than fuels on northern slopes;
- heating by the sun also causes earlier and stronger slope winds; and
- on south-facing slopes, there will normally be higher temperatures, stronger winds, lower humidities, and lower fuel moistures.

These are all the conditions needed for quick starts and a rapid rate of fire spread.

- **Terrain**

Terrain or special land features may control wind flow in a relatively large area. Wind flows like water in a stream and will try to follow the path of least resistance. Ridges, trees, and rocks may alter wind flow and cause turbulence or eddies to form on the windward side of obstructions. Also, when wind flows through a restriction, such as a narrow canyon, it increases in strength. Wind movement can be critical in chutes or steep v-drainages. These terrain features create a chimney effect, causing a forced draft, as in a stove chimney. Fires in these chutes or drainages spread quickly and are very dangerous.

- Elevation.
- Vegetation type.
- Moisture content.
- Size and shape of material.
- Volume and area covered.
- Fuel content (breaks alignment should avoid heavy fuel concentrations and be situated in areas with the lightest fuels possible).
- Wind direction (internal belts should as far as possible run parallel with the prevailing winds).
- Conservancy aspects.
- Scarce/endangered species.
- Spotting distance.
- Firebreaks should be anchored, either to a natural barrier, road or another firebreak.
- Natural or existing barriers like roads, paths, streams, lakes, vleis, rivers, rock outcrops, or any other break in fuel should be utilise as far as possible.

6.1.5.4.2 Preparation methods

There are four methods of preparing a firebreak and proper consideration should be given to each before commencing the preparation of a firebreak. If, for example, it is not possible to burn areas due to extreme fire danger (such as those close to Zone 1, the built-up area) then these areas must instead be bushcut at a interval of every 12 -15 years.

The following firebreak preparation methods exist:

1. Manual

Preparing a firebreak manually involves the utilisation of a team of workers working in a planned manner using manual tools.

2. Burning

After deciding where the belt is to go, an adequate tracer is cut around the entire belt, and then the belt itself is burnt. This is the most common form of preparing a firebreak.

3. Ploughing/brushcutting

Ploughing/brushcutting with a tractor is a common method of constructing breaks where the vegetation is low or has been previously removed. The positive thing with brushcutting is that the roots are not destroyed and this will assist in reducing erosion on these breaks.

Bushcut material should be removed two months after cutting, and mulched at a organic dump.

4. Application of herbicide

With this method herbicide is used to kill off all the plant growth in the firebreak. The indiscriminate use of herbicides can cause long-term environmental damage.

6.1.5.4.3 Firebreak maintenance

Firebreaks need to be prepared annually before the start of the fire season.

6.1.5.5 The identification of hazard points

Prior to each fire season, the Estate Manager is responsible for updating a fire hazard map, additional to the maps referred to in Section 6.1.6 below. Areas that are a fire risk/hazard will need to be managed accordingly.

Fire risk areas can be divided into two separate groups, namely industrial fires and veld fires. Both these risks require different management and reaction strategies. It is essential that all the requirements stipulated in the Environmental Management Specifications contained in the Arabella Country Estate Phase 2 Environmental Management Plan, Section B, are strictly adhered to.

Table 4: Lists and description of the main fire hazards on the project site.

Hazard	Description
Fynbos & natural veld	Some areas of fynbos on the project site have not burnt for more than 15 years (Helme 2010). Although fynbos will generally benefit from a fire, it is at the same time a potential hazard if a fire occurs in high-risk weather conditions. The hazard of such a fire extends to areas of fynbos that have recently burnt. Serious damage might be done to species in such areas, should fire occur too frequently. Apart from possible loss of rare species it could also cause potential erosion damage as well as siltation of dams and reservoirs. Above ground biomass may range from 10 tons/ha after eight years to about 40 tons/ha in veld older than 15 years.
Invasive alien plants	Invasive alien plants are a constant threat. Fires in invaded areas burn with extreme intensity because of the high fuel load. Apart from the direct threat of fire, the occurrence of fire in areas infested with invasive alien plants has several other consequences. a) After a fire erosion and germination of seedbeds become a financial and operational headache, b) the increased intensity of such fires destroys the natural veld and possible future rejuvenation from limited existing seed banks, thereby causing species loss as well as depleting the environment of food for fauna.
Residence and guests	The network of walking tracks planned on the project site will always be a point of concern. Residence and guests must be educated and made aware of the dangers and risks of veld fires.
Construction activities	Even though the construction phase and the handling of flammable material are strictly regulated, any construction activity and the presence of flammable fuels present a fire risk to the surrounding area.

Overgrown road reserves/verges	Road verges or shoulders are a potential hazard if they are overgrown with grass, invasive alien plants and/or fynbos. With the continual movement of people along the roads, for example the R44, it is a matter of time before someone flicks a cigarette butt into dry enough material to start a serious fire. The fuel load along the road verges needs to be managed as much as possible to decrease the possibility of someone starting a fire in these areas.
Overgrown power lines	The areas beneath power lines and supporting infrastructure are a potential hazard if they are overgrown with grass, invasive alien plants and/or natural veld. The fuel load beneath power lines and supporting infrastructure needs to be managed as much as possible to decrease the possibility of someone starting a fire in these areas or to reduce the spread of electrical fires originating from these structures.

6.1.6 MAPS

The Estate Manager is responsible for the completion and updating of maps on a regular basis. These maps must indicate neighbouring landowners, firebreaks, roads, points of abstraction, buildings and other infrastructure. Copies of these maps must be available on-site at all times.

6.1.7 WILDFIRE RESPONSE

The fire response to a wildfire is related to both the situation immediately after ignition and to the potential size and controllability of the fire. The contactor will use the following classification system for fires:

Table 5: Active wildfire management response

<i>Fire class</i>	<i>Description</i>	<i>Command structure</i>
Class C	Small fire that can be controlled by the first response team.	The local foreman and team takes initial command of the fire – report to local authority fire services.
Class B	Medium-sized fire that is manageable with existing resources, although additional resources may be required for mopping up.	The designated individual takes command of the fire and alternates this responsibility with his second in charge – report to local authority fire services.
Class A	Large, uncontrollable fire in which additional resources will need to be	The Fire Chief or the Fire Protection Officer of the FPA will take command

	deployed.	of the fire.
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6.1.8 PROCEDURES TO BE UNDERTAKEN IN THE EVENT OF A FIRE

1. The person who has discovered the fire must immediately report the fire at the main gate security or alternatively to his/her supervisor who must in turn inform the main gate security.
2. The main gate security must notify the Estate Manager and the Site Engineer of the fire who will investigate the report. The Estate Manager/Site Engineer or Fire Marshall (if appointed) will be take charge from this point.
3. Once the report has been confirmed the Estate Manager makes the decision depending on the location and size of the fire whether additional resources are required. The Estate Manager/Site Engineer or person in charge will assess whether there is reason to believe that the reported fire on the site or the land of an adjoining owner may endanger life, property or the environment. If it is concluded that this is the case the Estate Manager/Site Engineer must immediately take all reasonable steps to notify the:
 - (i) fire protection officer or, failing him or her, any member of the executive committee of the fire protection association, if one exists for the area; and
 - (ii) owners of adjoining land.
4. As per 3 above, the following persons must be contacted (refer to Section 8 for the Emergency Contact List):
 - a) Kleinmond Fire Brigade
 - b) Hermanus Fire Brigade (if no reply at Kleinmond Fire Brigade)
 - c) Bredasdorp Control Centre (if no reply at Hermanus Fire Brigade)
 - d) Ambulance (if injuries or casualties have been reported)
 - f) CapeNature
 - g) Neighbouring farms
5. The following information must be transferred to the relevant authority.
 - Name of the caller
 - Location of the fire
 - Type of fire
 - Seriousness of fire
 - Injuries or casualties

6. Raise the fire alarm by activating the fire alarm siren. If the fire is during the day, the telephone operator must notify key personnel.
7. Rapid deployment of fire fighting resources within the structure of pre-planned Emergency Procedures.
8. Shut off all air and power (fuel supplies).
9. Depending on where the fire is, evacuate building immediately.
10. When the Fire Brigade arrives, they are to be briefed on the location and seriousness of the fire, whether there are casualties and they are to be provided with a map of the area.
11. An escort must be organized for the Fire Brigade to the location of the fire if the area is unknown to them.
12. Emergency medical resources should be placed on stand by.

At the same time the following internal procedures are to take place:

1. Depending on where the fire is (within or in the vicinity of Zone 1, Zone 2), staff and guests are to be alerted and marshalled to a safe assembly or evacuation point.
2. A head count should be made and reconciled with guests and staff records.
3. Evacuation vehicles on standby in a separate safe area to evacuate guests if necessary.
4. The team respond to fire with fire-fighting equipment (trailer unit, fire-beaters and rake-hoes) and communicate response of fire to the Estate Manager.
5. Where a fire involves multiple land owners/managers, a joint operations centre is established to co-ordinate the strategic deployment of resources and

After a fire:

1. Suppressed fires should be observed for re-ignition.
2. Post fire equipment maintenance must be performed.
3. Supplies must be restocked.
4. The burnt area must be mapped.
5. Compilation of a fire report.
6. Review of events.

General rules to remember in case of a fire:

- Do not panic and stay calm at all times.
- Do not run, but move quickly.

- Do not obstruct the way to the fire scene.
- Assist those who need help.
- If necessary evacuate the area immediately.
- The safety of lives, take precedence over saving property.
- Ensure that the fire fighting does not endanger any lives.
- Do not go sightseeing at the scene of the fire.
- When the fire team or fire brigade arrive at the scene evacuate the area immediately unless instructed differently.
- Adhere to instructions given to you by the fire team or the fire brigade personnel.
- Attack the fire with the fire equipment available, but do not place yourself at risk.
- Ensure that the correct fire equipment is used.
- Assess the seriousness, size and type of fire and whether its source has been shut down (e.g electrical and gas fires).

6.1.9 OFF-SITE RESOURCES AND LOCAL AUTHORITIES

As already mentioned, the Contractor and the Arabella Country Estate Phase 2 HOA will make use of and be dependent on the District Municipal Fire Services to assist in the control of wildfires. Arabella, the contractor, local land owners and the local District Municipal Fire Services will act with mutual interest to combat fires that may pose a threat to the joint properties.

6.1.10 WATER SUPPLY

Water supply for fire fighting will be in accordance with the contractor's water abstraction methods. Water bowzers will be used to replenish fire fighting vehicles to prevent disengagement during fire attack.

6.1.11 FIRE DRILL PROCEDURES

Fire drill procedures play an important role in fire awareness and preparedness. Fire drills will be conducted on command of the Estate Manager as a safety measure. Fire drills must be performed at least once a year before the fire season.

7.2. NATURAL FIRES

7.2.1 NATURAL FIRES FIRE MANAGEMENT OBJECTIVES

Natural fires are associated with the area within Zone 2 and certain areas within Zone 2.

The primary fire management objective with regard to natural or controlled fires is to effectively manage natural or controlled fires.

The primary importance of natural or controlled fires is to maintain viable populations of fynbos by breaking up large tracts of old vegetation into a mosaic of different ages. Additionally, it plays an important role in the reduction of fuel load to prevent unmanageable wildfires, the control of invasive alien plants and the safeguarding of property and infrastructure.

7.2.2 FYNBOS AND FIRE

When it comes to fynbos, the management of fire is done in accordance of three factors namely, frequency, intensity and season.

7.2.2.1 FREQUENCY

Although it is suggested that fynbos should be burnt at a frequency of between 12 and 15 years, interval between fires should be determined by the growth rate of existing plants. Fire should be permitted in fynbos until at least 50% of the population of the slowest-maturing species in an area have flowered for at least three successive seasons. Similarly, a fire is probably not necessary unless a third or more of the plants of these slow-maturing species are dying or no longer producing flowers and seeds.

7.2.2.2 INTENSITY

The intensity of a fire is influenced by the fuel load, fuel moisture, relative humidity and wind speed. The intensity can be manipulated by either reducing the fuel load (i.e. burning more often)

or by selecting conditions that will lead to the desired type of fire. Most fynbos species require high intensity fires for survival, however low intensity burns are often favoured for safety reasons. Alien plants impact significantly on intensity (and consequently frequency) due to their flammable oils and the greater biomass created by the density of invasion.

7.2.2.3 SEASON

Due to the area's climate accidental fires occur mainly in summer but can occur at any time under suitable weather conditions. Controlled fires must take place in the optimum ecological period of February to early April (Helme 2010²). Prescribed burning in the summer months (November – February) is seldom advised due to the risk of runaway fires. The season for prescribed burns in the Western Cape is 15 January to 15 May (Cape Town Metropolitan Council, 1995) although, following consultation with CapeNature and the relevant District Council Fire Chief, prescribed burns may be carried out after these dates.

Additional factors that need to be taken into account when implementing a programme of deliberate prescribed burning is that any plan to implement prescribed burning over a period of decades will most probably be upset by the occasional unplanned wildfire that will necessitate re-planning. A very flexible approach to the adoption of prescribed burning is therefore essential. It is also important to recognise that burning on a fixed rotation is undesirable and variation in the intervals between fires is necessary to promote biodiversity.

In this regard it is recommended that a block-burning approach is adopted. An efficiently implemented block-burning approach ensures that nearby unburnt veld serve as a source area for burnt areas re-colonization.

7.2.3 USE OF FIRE FOR ALIEN PLANT CONTROL

Felling and clearing of dense stands of alien plants can result in the accumulation of large quantities of dead brush. If planned fires are not carefully executed, the intense fire can sterilise the soil and will result in poor fynbos recovery. Dense brush should be burnt under moderate conditions, and preferably after allowing the fuel to decay for one or two years.

² Supplementary environmental impact assessment of the Arabella Country Estate, Kleinmond: Vegetation, 2010.

Control operations need to be planned to ensure that the fynbos is mature enough to burn by the time that fires are needed as part of the sequence of control treatments. The controlled fire planning needs to take into account the ecology and biology of particular invaders, e.g. the longevity of the alien plant seedbanks.

7.2.4 FIRE MANAGEMENT STRATEGIES

The following fire management strategies are proposed:

- The Estate manager shall ensure that the basic fire-fighting equipment is in good condition and inspected on a weekly basis.
- Have in place a properly equipped and trained fire crew to assist in the management of natural or controlled fires.
- Identify areas of high fire risk/hazards.
- Compile a burning implementation plan, including a contingency plan.
- Fire breaks should be prepared (as per Section 6.1.5.4 above) and maintained to act as pre-ignition boundaries for back burning when unplanned fire threatens the property.
- The fire breaks should be prepared in a manner that is least damaging to the environment and aesthetics of the property. To this end, where possible, current management roads and tracks will be utilised.
- Suitable water points should be maintained for the provision of water to fire management teams.
- The Estate Manager must ensure that there is a staff member on-site at all time with the necessary training to lead a team of workers in the event of a fire.
- Potential hazards should be identified and plans developed to deal with an emergency, should one occur.
- Similar to the preparation of firebreaks, Arabella must contact adjoining land owners and the fire protection unit to notify them of its intention to implement a controlled fire association for the area.
- Notification of the intent to burn must be done at least 14 days in advance.
- Arabella will implement controlled fires with due regard to the weather, climate, and terrain. Arabella may not burn a firebreak if the fire protection association objects to the proposed

burning, or a warning has been published because the fire danger is high in the region; or the conditions are not conducive to the burning of firebreaks.

- Accurate records must be kept of fires, using a map of veld age as a basis. Note the date and time of ignition, weather conditions, etc.
- In order to undertake a burn during the prescribed season, a permit must be obtained from the local Fire Protection Association (if operational).
- A permit for any burn must be obtained from the National Department of Agriculture.
- Other relevant authorities, such as the District Council Fire Chief and CapeNature, should also be notified.

8. EMERGENCY CONTACT LIST

POLICE

Kleinmond:	028 271 8200
	028 271 8219

Caledon:	028 214 3900
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Emergency nr:	10111
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MUNICIPALITY

Kleinmond:	028 271 8400
	028 271 4010

FIRE BRIGADE

Overstrand (Hermanus):	028 312 2400
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Bredasdorp Control Centre:	10177
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AMBULANCE

Kleinmond:	086 106 3342
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NATURE CONSERVATION

Kogelberg Nature Reserve office: 028 271 5138

Mark Johns (Kogelberg Nature Reserve Manager): 082 783 8585

ANNEXURE B4

ARCHITECTURAL AND DESIGN GUIDELINES

ARCHITECTURAL & DESIGN GUIDELINES

Once a positive Environmental Authorisation (EA) has been issued a comprehensive set of architectural and design guidelines for the proposed Arabella Country Estate Phase 2 will be completed.

The Arabella Country Estate Phase 2 architectural and design guidelines will be drafted in terms of the follow key aspects summarised below.

1 APPROACH

Arabella supports a holistic approach towards promoting environmental integrity, referring to both the natural and human-made environment. In respect of conserving the natural environment and its resources, the aim is to reconcile the existing and proposed physical developments with the requirements of biodiversity conservation and to minimize damage to sensitive and/or scenic landscapes.

The rationale behind the planning, design and construction approach proposed for the development is to create a specific character and atmosphere, which people will instinctively and intuitively recognize as qualitative and unique and which will instil a sense of pride, belonging and identity.

In respect of the built environment, the aim is to ensure that such development is of a high quality and conform to general standard set by the Phase 1 development. The planning and design of the Phase 2 development are subject to existing policy and associated guidelines.

2 CRITICAL REGIONALISM

As such, the planning and design of the proposed Phase 2 development will give effect to the concept of 'critical regionalism' as contemplated in the Arabella Country Estate Phase 2 Development Framework (2003) and promoted in the Heritage Impact Assessment of Aikman Associates (Aikman 2010).

Critical regionalism promotes a return to the development of high-quality settlements that comply with the definition of *a unique sustainable man-made environment which is in harmony with the natural environment that 'contains' it and which demonstrates the five guiding principles of 'critical regionalism* (PGWC 2003¹). Such a quality is often dependent upon a specific 'sense of togetherness' and character that requires a specific scale and density. 'Critical regionalism' constitutes a sensory understanding and appreciation of the environment and its component 'things'. It is based on five basic principles that guide the planning, design and management of the development, namely (PGWC 2003; Kelbaugh, 1997²):

a) Sense of Place

'Sense of place' is described as the *'degree to which a place can be clearly perceived and mentally differentiated and structured in time and space by its residents, and the degree to which that mental structure connects with their values and concepts'* (Lynch, 1998)³.

In evaluating a sense of place, one needs to recognise that there are various 'components of sense' that, together, provide a particular environmental quality for the observer. 'Sense of place' is based upon the *sensed quality* of the unique 'components of sense' of a particular place, including its identity, character, structure, local climate, topography, vegetation, building materials, building practices, and local authenticity.

In practice, in the preparation and consideration of development applications (including architecture and placement of new infrastructure), it is important to ensure that the above 'components of sense' are incorporated into the planning and design. For example, this implies that any development within the natural environment should *inter alia* reflect elements of the traditional vernacular of the area, make use of local natural building materials, and reflect a strong sense of local authenticity.

¹ PGWC, 2003. *Manual for Bioregional Planning and Management in the Western Cape*. Cape Town.

² Kelbaugh, D. 1997. *Common Place: Toward neighbourhood and regional design*. Washington Press, Seattle.

³ Lynch, K. 1960. *The image of the City*. Massachusetts: MIT Press.

b) Sense of History

Historical precedents are a good point of departure when planning, designing and rehabilitating new places and existing areas (Kelbaugh, 1997). It is imperative that the local history, traditions and values be thoroughly studied as part of any planning process and that the planning and design of both the cultural and the natural environment should reflect these dimensions.

The people of the Cape have a very rich history that needs to form the basis of development and land-use in the area. Developments should reflect an appreciation for the history, culture and traditions of the local people and build on the historical precedents presented by existing high quality settlements.

In this regard, it is noted that any architectural type that has stood the test of time must be doing something right in terms of responding to climate, social and cultural needs, tradition, and economy, and should, therefore, be worth copying (Kelbaugh, 1997).

c) Sense of Craft

Critical regionalism builds upon a return to craftsmanship and avoids construction types, which have become less sustainable and less appropriate over most of the past century (Kelbaugh, 1997).

The architecture and settlement structure that characterise traditional settlements in the Overberg area, are some of its most unique features. These characteristics and the craftsmanship of the local people evolved in response to the challenges of nature and the needs of the historic people of the area. In order to create *places* where humans can live with dignity and pride, it will be necessary to revive and retain the traditional craftsmanship and to ensure that an appropriate 'sense of craft' is reflected in all development.

d) Sense of Nature

Nature is a good model for design because it holds the key to vitality and sustainability. It is recognised that architects, landscape planners, and urban planners can learn from the

sophistication of ecological systems and that these can fulfil a meaningful role to protect ecosystems, natural processes, and the symbiosis between organisms and their environment (Kelbaugh, 1997). This can be achieved through appropriate study and developing an appreciation for the unique environmental value of a place before any planning, design and development is undertaken. Any development is to reflect an appreciation for the unique natural attributes of the environment and respond to the dominant local forces of nature.

This implies that in the development there should be presumption in favour of conservation and that a premium will be placed on the conservation of natural resources, wildlife and landscape. Materials for new development should, for example, be obtained from sustainable sources, and in the design of buildings the use of energy consumption should be minimised. In addition, the following principles should be incorporated into the planning and management of any development:

- (i) Minimise use of the four generic resources, namely energy, water, land and materials.
- (ii) Maximise resource re-use and/or recycling.
- (iii) Use renewable resources in preference to non-renewable resources.
- (iv) Minimise air, land and water pollution.
- (v) Create a healthy, non-toxic environment.
- (vi) Maintain and restore the earth's vitality and ecological diversity.
- (vii) Minimise damage to sensitive landscapes, including scenic, cultural, historical, and architectural aspects.

e) Sense of Limits

There is a need for physical and temporal boundaries to frame and limit human places and activities. There is also a need for human scale in the built environment. Kelbaugh (1997) states that *'the sense of limits also pertains to a need for psychological boundaries – ones that make life more understandable and negotiable'*.

The scale and density of the proposed development should therefore be determined by the *ability of the natural environment* to sustain the development and the associated human land-use.

3 DESIGN

The architectural design of the buildings in Phase 2 will not be considered in isolation but as one of the components of coherent urban design that would ensure the establishment of a high-quality urban environment with a unique atmosphere and *genius loci* (spirit of place). The design will be strictly in accordance with the principles of 'critical regionalism' referred to above.

The building height on the residential cluster will be mixed, with some additional roof space permitted for houses on the lower elevations. The overall height will not exceed two storeys or 8 m measured from the finished floor level to the soffit of the roof.

Buildings will, as far as possible, be designed and constructed in accordance with energy-efficient and place-specific planning and design. All efforts will be made to ensure that the design of the buildings embraces the natural attributes and 'spirit' of the surrounding natural environment. Natural materials and locally-manufactured materials will as far as possible be used while full use will be made of available technologies aimed at ensuring environmental sustainability.

The design of buildings will resonate with both the historical vernacular qualities and characteristics of buildings in the region as well as the buildings located within Phase 1. In this regard, it is envisaged that, whilst the dark gray colour of the roofs and the ochre/earth colours of the external walls of the Phase 1 houses will be retained, the structure of buildings will be more in keeping with traditional building form. In this regard, it is suggested that the design of buildings will draw from traditional building dimensions and footprint.

A detailed set of architectural design guidelines will be formulated for the Phase 2 development. These guidelines will include aspects such as building form, maximum allowable building height, exterior walls, windows and doors, external lighting etc.



Photo 1: Typical use of material and building form used in the Phase 1 development.

4 DESIGNING ENVIRONMENTAL FRIENDLY BUILDINGS

The following sustainable design principles will be incorporated in the Arabella Country Estate Phase 2 architectural design guidelines:

- 1) **Apply good passive design principles to ensure optimal building orientation, form, layout and design to optimize buildings thermal performance, i.e.** orientate building(s) in the Cape region with the longest sides facing north south on the east west axis to maximise on solar gain in winter and to avoid it in summer.
- 2) **Use sustainable Building Materials.**
- 3) **Water & Solid Waste Management** – Minimise water consumption, i.e. specify low-water-consumption fittings, e.g. dual-flush toilets and water saving devices for taps, showers, baths, irrigation, and pools. Harvest rainwater for re-use. Provide for recycling of waste water and waste composting facilities (refer to Annexure B7).
- 4) **Minimise Energy Consumption:**
 - **Use renewable energy**, e.g. solar power , photovoltaic (PV) panels and solar water heating options to reduce energy consumption. Use energy efficient water heaters and insulate well (e.g. vertical cylinders are more energy efficient than horizontal).
 - **Ventilation and cooling** – Apply good passive design principles to avoid the use of mechanical ventilation. Maximise natural ventilation, e.g. keep windows closed during the daytime and open at night.

- **Heating** - Apply good passive design principles to maximise on solar gain in winter and to avoid it in summer. Walls should be designed to have enough thermal mass to absorb solar radiation during the day and radiate it through the walls in the early evening. Roofs should be well insulated to prevent upward heat loss. Avoid condensation in winter.
- **Insulation** - Insulate walls and roof well (use thermal mass as far as possible) to take advantage that night cooling is not lost.
- **Lighting**- Minimise energy consumption. Rely predominantly on day lighting and specify energy efficient lighting such as compact fluorescents. Employ day lighting controls.

ANNEXURE B5

LANDSCAPING PLAN

LANDSCAPING PLAN

Once a positive Environmental Authorisation (EA) has been issued a comprehensive Landscaping Plan for the proposed Arabella Country Estate Phase 2 will be completed.

The above Landscaping Plan will be submitted to the relevant authority for approval before the construction phase of the development. The Landscaping Plan will be completed in conjunction with the relevant environmental specialists.

The Arabella Country Estate Phase 2 Landscaping Plan will be drafted in terms of the follow key aspects summarised below.

MEASURES TO FORM PART OF THE ARABELLA COUNTRY ESTATE PHASE 2 LANDSCAPING PLAN

1. A plant list will be compiled consisting of strictly indigenous plants only.
2. Landscaping of private and public open spaces should be planted with a selection of suitable, waterwise and locally indigenous fynbos species (Nick Helme Botanical Surveys 2013¹).
3. Trees that may be planted for rehabilitation and landscaping purposes (not in natural or conservation areas) are: *Sideroxylon inerme* (milkwood), *Kiggelaria africana* (wild peach), *Tarchonanthus africanus* (camphor, vaalbos; wind tolerant), *Maytenus oleoides* (kliphout), *Pterocelastrus tricuspidatus* (kershout), *Halleria lucida* (tree fuchsia; damp or shaded areas), *Celtis africana* (white stinkwood), *Rhus pendulina* (karee; wetter areas), *Cunonia capensis* (butterspoon/rooiels; wet areas), *Syzygium cordatum* (water berry; wet areas); *Rhus crenata* (dune crowberry; a large shrub or hedge for dry sandy and windy areas), *Grewia occidentalis* (cross berry, shrub to 3m), *Virgilia oroboides* (keurboom, sheltered areas), *Rapanea melanophloeos* (Cape beech; more sheltered areas), and *Harpephyllum caffrum* and

¹ Supplementary Environmental Impact Assessment of the proposed Arabella Country Estate, Kleinmond: Vegetation, 2013.

Ekebergia capensis (wild plum and essenhout; sheltered areas on better soils) (Nick Helme Botanical Surveys 2013).

4. No formal gardening will be permitted in designated conservation areas (Nick Helme Botanical Surveys 2013).
5. Where roads crosses ecological corridors, the design of the crossings must be of such a nature as to minimize the damage to the habitats of the corridor (JAH Environmental Consultancy 2010²). If possible, bridges must span active water or wetland channels (Freshwater Consulting Group 2012³).
6. Crossings over corridors must be designed to minimize animal road mortalities (JAH Environmental Consultancy 2012). Additionally, speed limit of 40km/h must be enforced on the Estate (speed humps must be constructed on either end of stretches that cross ecological corridors and warning signage must be place at high risk areas).
7. The impact of pathways for golf carts must be minimized using:
 - grass blocks where relatively dry habitats are crossed,
 - raised bridges where the paths cross wet habitats (JAH Environmental Consultancy 2012).
8. The Landscaping will include a system of well-designed formal footpaths as well as hiking trails through appropriate conservation areas (JAH Environmental Consultancy 2012).
9. Footpaths through areas of natural habitat should not have hard surfaces. Where anti erosion measures are required or seasonal waterlogging occur boardwalks or some low-impact method to stabilise the ground must be constructed (JAH Environmental Consultancy 2012).
10. The R44 presents the most destructive environmental impact in the area. It has a detrimental impact in respect of habitat fragmentation as well as a negative impact on the

² Arabella Phase 2, Kleinmond: Revised Impact Assessment: Fauna, Second Draft, 2012.

³ Arabella Golf Estate Phase 2: Revised Freshwater Ecological input to Environmental Impact Assessment, 2012.

social environment, causing serious noise pollution, a safety and security risk. A primary of the Landscaping Plan will be to mitigate the effects of the R44 through the following:

- Providing for the continuation of ecological corridors from the core conservation areas all the way down to the Bot River Vlei. This will be achieved through the construction of appropriate underpasses and the modification up of existing culverts (as per the recommendations from JAH Environmental Consultancy [2012]).
- Undertaking appropriate landscaping alongside the R44 in order to alleviate the noise factor and generally create an area of high aesthetic quality.

11. Fencing within and across corridors should be kept to the minimum. Where security fencing is essential such fences should be of a type that is permeable to the majority of wild animals (JAH Environmental Consultancy 2012).
12. Roads cross ecological corridors at certain areas. These crossings will be made as “soft” as possible by avoiding vertical edges at curbs and by using grass block in stead of tarmac (JAH Environmental Consultancy 2012).
13. Areas where “soft” level crossings over watercourses or ecological corridors are not possible, bridges, boardwalks or large box culverts must be used to create underpasses for animals (JAH Environmental Consultancy 2012). Where possible, bridges should be supported by piles (Freshwater Consulting Group 2012).
14. Attention must be given to the design of all structures for drainage so they do not act as pitfall traps for small creatures. They must either have gentle slopes or be adequately covered (JAH Environmental Consultancy 2012).
15. *Paspalum vaginatum* (seashore paspalum) will be used as primary golf course grass. Other include *Cynodon dactylon* (fynkweek), *Stenotaphrum secundatum* (buffalo grass) (Freshwater Consulting Group 2012).
16. Lawn to be used on erven include *Cynodon dactylon* (fynkweek), *Stenotaphrum secundatum* (buffalo grass) or *Paspalum vaginatum* (Nick Helme Botanical Surveys 2012).

17. Kikuyu grass will be removed as far as possible along with other alien vegetation (JAH Environmental Consultancy 2012).
18. Areas with erosion caused by tracks on steep slopes must be stabilised (JAH Environmental Consultancy 2012), along with other areas prone to erosion.
20. Tracks across wetlands indicated by the faunal specialist must be closed off and rehabilitated (JAH Environmental Consultancy 2012).
21. The causeway across the Lekkerwater stream must be removed and rehabilitated (JAH Environmental Consultancy 2012).
22. Habitats in and around the Cape-Platanna ponds, as indicated by the faunal specialist, must be must be rehabilitated and managed as per the recommendations of the above specialist (JAH Environmental Consultancy 2012).
23. Curbs and roadside gutters should have low, sloping profiles without any vertical surfaces. Appropriate designs facilitate the movements of small animals such as frogs, lizards and mice (JAH Environmental Consultancy 2012).
24. The contamination of natural areas with agrochemicals must be prevented. The proximity of the golf course to conservation areas creates the likelihood that both pesticides and fertilizers could contaminate natural habitats, via the air or water, and cause direct and indirect negative impacts on local fauna and their habitats. Conservation areas need to be surrounded by buffer zones that minimize the risks of pollution. Aerial spraying of pesticides should not be allowed. When pesticides are used they should be applied in strict accordance with the manufacturer's specifications, and under the strict and constant supervision of a trained and responsible manager. All toxic substances must be stored securely and not be available for casual, unsupervised or illegal use. Pesticides must be used with the greatest circumspection and only as a last-resort solution to serious and intractable problems on the golf course; in other areas, nature should be allowed to take its course (JAH Environmental Consultancy 2012).

25. Exterior lighting must be reduced to the minimum necessary for essential functions. Where streetlights are essential it should be the “bollard” type which illuminates only a small area (JAH Environmental Consultancy 2012).
26. Long-wavelength lights must be used (red and orange) for exterior lighting or the “warm light” models of energy-saving lights (JAH Environmental Consultancy 2012).
27. Light sources of the lowest intensity (wattage) adequate for the purpose must be used (JAH Environmental Consultancy 2012).
38. Light must be positioned as low down as possible (JAH Environmental Consultancy 2012).
39. Directional fittings must be used for exterior lights. Where necessary lights must be fitted with shades to direct light only to where it is needed (JAH Environmental Consultancy 2012).
30. Light with sealed light fittings must be used (JAH Environmental Consultancy 2012).
31. Lights must not be positioned to cast a pool of light over surface that takes traffic. In such places, insects that fall to, or settle on, the ground, and the predators that are attracted to them, are likely to become roadkill (JAH Environmental Consultancy 2012).
32. Outdoor lighting must be controlled with timers so that lights do not stay on all night. Lighting must be limited to the periods of greatest human activity.
33. The small “frog reserve” identified by the faunal specialist in the central precinct needs to be well protected from artificial lights so that breeding of the Cape Platanna is not adversely affected.
34. The donga downstream of the restio wetland patches at site 27 (as indicated by the freshwater ecologist) must be rehabilitate, to enhance its corridor function. Rehabilitation would probably involve the strategic placing of small weirs (possibly wooden structures) to attenuate flow, thereby maximising local infiltration and reducing the high energy flows that are responsible for donga formation. Rehabilitation would also involve the removal of the

remaining pine trees and replanting with indigenous riparian vegetation (Freshwater Consulting Group 2012).

35. Pathways and access must be routed around wetlands and streams (Freshwater Consulting Group 2012).
36. The design of crossings over the stream channels must be done with input from a river ecologist, and must attempt to disturb the river beds and banks as little as possible.
37. Hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bioretention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and improving the quality of runoff (Freshwater Consulting Group 2012).

All efforts will be made to mitigate any potential detrimental impacts associated with the development. In this regard, the tremendous potential of environmental landscaping in respect of rehabilitating degraded areas, beautifying the surroundings, and mitigating negative development impacts, will be fully utilized. The aim of the landscaping plan will be the establishment of an 'integrated green system', comprising of landscaped open spaces and a number of water features that will be effectively linked, or integrated, with the natural areas through ecological corridors. An integral part of the landscaping will, therefore, be the restoration of the existing ecological corridors and the establishment of additional corridors. The gardens within the development will continue and consolidate this place-specific theme and integrate the human-made environment with the golf course and, ultimately, the pristine natural areas on the high-lying portions of the property.

ANNEXURE B6

CONSTRUCTION CAMP PLAN

CONSTRUCTION CAMP PLAN

The Arabella Country Estate Phase 2 EMP will form part of the tender documentation for the construction phase of the development. An appointed ECO, in collaboration with the relevant Site Engineer (SE) (refer to the EMP Section C, Functions and Implementation Procedures), will monitor, review and verify compliance with the EMP by the Contractor.

In terms of Section C of the Arabella Country Estate Phase 2 EMP the Contractor is required to submit various required Method Statements before the commencement of any works on site. The method statement shall cover applicable details with regard to:

- a) Location of site offices.
- b) Construction procedures.
- c) Materials and equipment to be used.
- d) Getting the equipment to and from site.
- e) How the equipment/ material will be moved while on site.
- f) How and where material will be stored.
- g) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur.
- h) Timing and location of activities.
- i) Compliance/ non-compliance with the Environmental Management Specifications.
- j) Any other information deemed necessary by the Site Engineer.

The Contractor shall abide by these approved method statements. An activity covered by a method statement shall not commence until the SE has approved of such method.

The consideration of the above Method Statements will be done with due regard of the EMP, in particular the:

1. Environmental Constraints Plan and the,
2. Environmental Management Specifications.

Specifications relevant to the location and outlay of the Construction Camp as contemplated in the Environmental Management Specifications include:

- The Contractor shall prepare and submit a site plan of the construction camp to the Site Engineer for approval.
- The construction camp shall be located at an easily accessible point and within an area of low environmental sensitivity. The location shall be identified in consultation with the ECO.
- The construction camp must be situated more than 50 m away from wetlands or ecological corridors.
- The ECO shall be consulted on the area that the Contractor intends using for the storage of fuel.
- The fuel storage area shall be shown on the construction camp plan.
- Fuel storage tanks are to be installed and managed in accordance with the relevant Oil Industry Standards and SANS codes.
- Areas for storage of fuels and other flammable materials shall comply with standard fire safety regulations and may require the approval of the Municipal Fire Prevention Officer.
- Fuel storage tanks shall be erected at least 3.5m from buildings, boundaries and any other combustible or flammable materials.
- The Contractor shall indicate the eating areas on the construction camp plan.
- Provision shall be made for employee facilities including shelter, toilets and washing facilities.
- The exact location of the toilets shall be approved by the ECO prior to establishment.
- Sanitation facilities shall be located within 100 m from any point of work and not closer than 50 m to any water body. Toilets shall be within the Contractor's Camp and at work areas more than 50 m from the Contractor's Camp.
- Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 30 workers (preferred 1:15). Combinations of urinal and pan type units shall be carefully considered.
- The Contractor shall ensure that the entrances to toilets are adequately screened from public view.
- Refuse screens and oil traps shall be installed at runoff concentration points from large parking facilities, wash bays, stormwater outlets, inlets to detention ponds, workshop forecourt drainage points, ablution and eating areas. These facilities shall be serviced and monitored at the discretion of the ECO.

- Runoff from fuel depots/workshops/truck washing areas and concrete swills shall be directed into a conservancy tank and disposed off at a site approved by the ECO and relevant municipality.
- The contaminated water, contaminated run-off, or effluent may also require analysis prior to disposal. The relevant South African Water Quality Guidelines implemented by DWAF apply.
- Washing areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas, which include groundwater, are not polluted.
- Washing areas will be no closer than 50 m from wetlands or watercourses.
- A Method Statement shall be required for all wash areas where hydrocarbon and hazardous materials, and pollutants are expected to be used. This includes, but is not limited to, vehicle washing, workshop wash bays, paint wash and cleaning.
- Wash areas for domestic use shall ensure that the disposal of contaminated 'grey' water is sanctioned by the ECO.

ANNEXURE B7

SEWAGE AND SOLID WASTE MANEGEMENT PLAN

TO BE COMPLETED

ANNEXURE B8

STORMWATER AND FLOOD RUN-OFF MANAGEMENT PLAN

TO BE COMPLETED

ANNEXURE B9

WATER MANAGEMENT PLAN

TO BE COMPLETED

ANNEXURE B10

ENVIRONMENTAL REHABILITATION AND MANAGEMENT PLAN

ENVIRONMENTAL REHABILITATION AND MANAGEMENT PLAN

Once a positive Environmental Authorisation (EA) has been issued a comprehensive Environmental Rehabilitation and Management Plan for the proposed Arabella Country Estate Phase 2 will be completed.

The Environmental Rehabilitation and Management Plan will be completed in conjunction with the relevant environmental specialists.

The Environmental Rehabilitation and Management Plan will be drafted in terms of the follow key aspects summarised below and must be read together with Section D, Site Clearance, and Section E, Revegetation and Rehabilitation, of the Arabella Country Estate Phase 2 Environmental Management Plan.

OBJECTIVES

The purpose of the Arabella Country Estate Phase 2 Environmental Rehabilitation and Management Plan will be to guide Arabella in their effort to:

1. clear the project site of all alien vegetation,
2. rehabilitate wetland, riverine and other areas that have been degraded or disturbed and
3. the long-term management of the natural environment of the project site.

ISSUES RAISED / MEASURES PROPOSED DURING THE EIA PHASE

The site is situated in an environmental sensitive area which contains conservation worthy vegetation and a wide range of fauna, some of which are considered to be endangered.

Alien plant invasion on project site has been identified during the environmental impact assessment process as the greatest threat to the ecology and biodiversity in the area. Additionally, large areas have been disturbed by past agricultural practices, quarrying and development.

Botanical study

There is a significant threat of alien invasive vegetation increasing in density on at least 75% of the High sensitivity vegetation on site, and on almost 100% of the Medium sensitivity area (Helme 2013¹). The invasive plants are mostly various *Acacia* species, pines and gum trees. About 30% of the project site has been heavily disturbed by a long term history of agriculture, quarrying (for sand, koffiekliip and gravel), plantations and alien infestation. The original disturbance has in many cases totally destroyed the natural vegetation and its seedbank (and thus also much of its rehabilitation potential), especially where the disturbance involved quarrying or agriculture. These areas represent approximately 23% of the project site (Nick Helme Botanical Surveys 2013).

Alien densities in much of the high sensitivity area are currently at very manageable levels, where appropriate and timeous intervention could make a big long term difference. Thus essentially all medium and high sensitivity areas are considered rehabilitable in terms of the alien vegetation cover that may be present in these areas.

Helme (2013) has found that about 50% of the site has been burnt in the last ten years. Large areas have not seen fire for over fifteen years (Nick Helme Botanical Surveys 2010). Fire being one of the key economic drivers of a functioning fynbos system it is important that a proper fire regime is established and managed on the project site (refer to the Fire Management Plan for Arabella Country Estate Phase 2).

As development mitigation measure Helme (2013) proposed that:

- Formal conservation areas must be registered as such within one year of the approval of the application.
- Management of the conservation areas must be supervised by CapeNature as part of a Stewardship Program. Arabella will enter into a Stewardship Program Agreement (Level 3) with CapeNature. This will entail that the land is utilised consistent to the provisions of Protected Areas Legislation.

¹ Supplementary Environmental Impact Assessment of the proposed Arabella Country Estate, Kleinmond: Vegetation, 2013.

- Annual alien clearing on the project site be undertaken within all the conservation areas, starting with the lowest density invasions and working up to the densest areas. This must be undertaken by experienced personnel who practise Department. of Water Affairs approved alien clearing methodology.
- No heavy machinery may be used for the purpose of alien clearing, which would be likely to disturb the soil surface and further encourage alien invasion.
- All alien clearing must be undertaken in the period November – April (outside the main flowering season) in order to minimise impact on the indigenous species).
- Particular care should be taken to remove alien invasive grasses such as *Lolium* (ryegrass), *Avena* (wild oats), *Hyparrhenia hirta* (thatching grass), and *Pennisetum clandestinum* (kikuyu) in the areas fringing the development.
- Within three years of the authorisation of this project all parts of the site outside the development footprint should be at least 95% clear of alien invasive vegetation, such that any one patch (continuous area of 1-50ha in extent) of habitat supports less than 2% total alien vegetation cover (as determined by audit by independent botanist), and within five years no area should have more than a 1% alien cover.
- Alien clearing should be undertaken using Department of Water Affairs approved methodology, and annual follow-up alien clearing must be undertaken in all conservation areas.
- No spraying of herbicides or pesticides should be allowed anywhere within the conservation areas, due to the significant risk of collateral damage to non-target species. The appropriate herbicides (such as Garlon, Chopper or Timbrel, or similar triclopyr; mixed with a suitable dye to show which stems have been treated) must however be used on the cut stumps of all woody alien invasive species, and these must be hand painted onto the cut stumps within 5 minutes of the stems being cut, and not during or just before rain.
- All cut alien plant material from areas within 200m of any access track or road should be removed from the conservation areas to a designated organic dump, where it should be chipped and turned into compost. In areas where alien clearing is undertaken further than 200m from any access track the cut alien material must be neatly stacked into cones, with cut ends facing up.
- Search and rescue of all bulbs and succulents and any translocatable species of conservation concern within the development footprints in mapped high sensitivity areas should be undertaken before these are cleared for development.

- Rescued material should be translocated to the areas that require rehabilitation, or stored and maintained in a designated greenhouse until such time that they are required for rehabilitation. This work must be undertaken by an experienced, local horticulturist.
- Replanting must take place only in the appropriate season, *i.e.* the start of winter, after the first winter rains.
- The ecological management of the site, and especially of the conservation areas in the vicinity of the golf course and residential areas, should be audited every year by a person with extensive experience and understanding of fynbos management. The auditor must assess the degree to which the applicant and their managers are complying with the requirements of any ROD in terms of ecological management of the site. The auditor must compile a report that is submitted to the site managers, who must in turn act on the recommendations with three months (90 days) of the date of the audit report. Failure to act within this period, to the satisfaction of the auditor, should result in a fine of not less than R10 000 being paid by the applicant into the Environmental Management Fund.

Faunal study

According to James Harrison (JAH Environmental Consultancy 2012²) the Arabella Country Estate Phase 2 project site has the potential to be an asset to Kogelberg Biosphere Reserve. Its position as a link between a lowland and an upland nature reserve is especially important to the ecology of KBR. However, the property currently has major ecological problems. Large input of effort and money is required to remove alien vegetation and to keep it free of invasive plants into the future. It will also need expert and dedicated conservation management to ensure that the local ecology becomes fully functional and habitats do not degrade over time.

The rehabilitation of wetlands, riverine and other areas indicated by James Harrison (JAH Environmental Consultancy, 2012) that have been degraded or disturbed will form a central part of the Environmental Rehabilitation and Management Plan. The rehabilitation and management have widespread advantages for the fauna that occurs in the area as indicated by the faunal specialist (JAH Environmental Consultancy 2010).

² Arabella Phase 2, Kleinmond: Revised impact assessment: Fauna, Second draft, 2012.

It is recommended by Harrison (JAH Environmental Consultancy 2010) that buffers be created and maintained between wetlands and watercourses. A buffer of at least 20 are proposed.

As development mitigation measure Harrison (2012) proposed that:

- Provision must be made for the management of ecological corridors. Habitats in ecological corridors must be restored to, and maintained in, a natural state. The effectiveness of ecological corridors is largely dependent on the quality of the habitats within them (reference is made to the recommendations by Harrison [JAH Environmental Consultancy 2012] regarding the creation of underpasses and upgrading of culverts under the R44 as means to maintain continuity of ecological corridors).
- A program of controlled veld burning must be developed and implemented (refer to the Arabella Country Estate Phase 2 Fire Management Plan).
- A programme of habitat rehabilitation must be develop and implement. Degraded habitats must be rehabilitated, especially wetlands and watercourses. Essential actions include:
 - removal of invasive alien vegetation, including Kikuyu Grass,
 - ongoing, regular removal of alien regrowth and seedlings,
 - stabilization of areas of erosion caused by tracks on steep slopes,
 - closing off and rehabilitation of tracks across wetlands,
 - removal and rehabilitation of causeway across Lekkerwater stream,
 - restoration of habitats in and around the Cape-Platanna ponds.
- The EMP must include detailed plans for rehabilitation, including clearly defined timeframes
- The specific rehabilitation actions required in the “frog reserve” (central precinct) are:
 - Alien trees and grasses in the vicinity of the ponds must be replaced with locally indigenous species.
 - The spread of existing indigenous plants should be encouraged.
 - New plantings should consist only of locally indigenous species, derived from the local fynbos. Restios and groundcovers will help to minimize runoff and siltation, and will also create suitable shelter for frogs.
 - In the process of removing alien plants and replanting with indigenous species, it is important that disturbance to the ponds be kept to an absolute minimum. Runoff of soil into the ponds has the potential to radically alter water chemistry, cause algal blooms, etc., and must be avoided. For this reason, clearance and replanting

should proceed in stages with relatively small sections tackled at a time, and the whole process staggered over two or three years. Wholesale clearance of existing vegetation is likely to destroy populations of frog species that spend most of their time on the fringes of the ponds, hidden among vegetation or buried under the soil.

- No alien-clearance or horticultural activities within the frog reserve should involve chemicals of any kind whatsoever, not even fertilizers. The only aids to horticulture that should be used are organic compost (not manure), organic peat, and organic mulch.
- Water levels must be allowed to fluctuate. In other words, water levels should subside in summer and rise with winter rains, because this will encourage a diversity of wetland-edge habitats and will stimulate frog breeding activity. Such a dynamic equilibrium is vital to the maintenance of a naturally functioning system. If winter water levels rise to the extent that some of the terrestrial habitat becomes flooded, this should be seen as a good, not a bad thing. Such temporarily flooded habitat is ideal for the breeding of many species of frog. Platannas are quite capable of surviving periods of drought by aestivating underground.
- Under no circumstances should fish, of any kind, be introduced into the ponds.
- The frog populations themselves will require hands-on management because the site is very small and isolated, and is currently degraded, and will be further affected by the rehabilitation process.
- The Common Platanna *Xenopus laevis* is an aggressive colonizer of disturbed wetland habitats and it competes with the Cape Platanna for space and food. It is also likely to predate on the tadpoles and juveniles of the Cape Platanna (De Villiers 2004). Furthermore, it is known that hybridization between the Common and Cape platannas does occur (Picker 1985; Picker et al. 1996). For these reasons it is necessary that a programme of removal of Common Platannas be initiated. Such a programme would involve trapping at a frequency of about twice a year, until such time as Common Platannas are no longer found on site. The programme would have the additional benefit of allowing the population of Cape Platannas to be monitored.
- The population of Cape Platannas should be monitored by means of annual trapping, so that the effectiveness of management actions and policies can be gauged. Both this monitoring and the removal of Common Platannas should be

done initially by an experienced herpetologist, who should train the resident Environmental Officer so that he can take over the task after a year or two.

- It may be advisable to introduce individuals from other local populations (e.g., those on Lamloch Farm) from time to time, if the population at Arabella 2 is too small to be genetically viable in the long term. Decisions in this regard will depend on the results of population monitoring, the advice of experts, and the necessary permission of CapeNature.
- The presence and approximate population sizes of other species should be monitored by means of auditory sampling of calling males. This can be done to coincide with the trapping of platannas. Such monitoring will help to inform management policies and may lead to recommendations for the introduction of certain locally occurring species, as habitat conditions allow.
- Private and public landscaping and garden plantings should be done with indigenous plants. The definition of “indigenous” should be limited to the south-western Cape, not the whole of South Africa. Only indigenous grasses must be used for lawns.
- Use non-invasive grasses for fairways and greens (refer to Arabella Country Estate Phase 2 Landscaping Plan).
- Monitor sources of new infestations. New infestations of invasive alien vegetation often begin at points of disturbance, e.g., new roads and earthworks, and imported gravel used to surface roads. Such areas must be carefully monitored and any new alien growth removed promptly. Dumps for garden refuse are also sources of infestation which need to be monitored and carefully contained.
- Include footpaths and nature trails in the development plan. Footpaths with numerous access points help to prevent the creation of informal paths and desire lines by residents and staff. Such informal paths degrade habitats. The lack of planned pedestrian access to Botrivierlei and the mountainside is presently a concern. This study predicts that informal access to such natural attractions will be created by local residents and that this will lead to habitat degradation.
- Manage stormwater runoff appropriately.
- Prevent pollution of soil and water.
- Draft, implement and audit an operational-phase EMP.
- The ongoing decline in populations of threatened and other species should be mitigated. Faunal surveys must be commissioned. Such surveys are needed to confirm which species

occur on Arabella so that appropriate management programmes can be put in place. For example, if it were found that the Western Leopard Toad (Endangered) breeds on Arabella 2, this would have implications for the planning and implementation of a veld-burning regime and the management of key wetlands. The presence of other Red Listed species could have different implications for the management of conservation areas. The Operational Phase Environmental Management Plan must be revised based on the results of the faunal surveys.

- Incompatible landuses must be isolated from each other.
- The keeping of pets on site must be restricted and their behaviour controlled. Pets interact negatively with wildlife and are highly undesirable in conservation areas. However, it is not practical to enforce a complete ban on pets in a residential area, therefore the following measures are recommended:
 - Enforce a complete ban on cats and all other free-range pets, including pigeons, chickens, ducks and peacocks.
 - Restrict the number of dogs per household to two.
 - Restrict the size of dogs to less than 20kg.
 - Require that dogs be kept indoors or within a fenced/walled yard.
 - Require that dogs be kept on a leash when taken for walks on the estate.
 - Restrict the walking of dogs to certain routes on the estate, and keep others out-of-bounds to dogs, so that wild animals do not feel threatened in those areas. Such out-of-bounds paths should include all of the trails through designated conservation areas. In other words, dogs should be walked within residential and landscaped areas, not in conservation areas.
- Implement awareness programmes for local and neighbouring communities. The cooperation of local residents, staff and visitors, of all socio-economic classes, will be essential in managing conservation areas effectively.
- Prevent contamination of natural areas with agrochemicals. The proximity of the golf course to conservation areas creates the likelihood that both pesticides and fertilizers could contaminate natural habitats, via the air or water, and cause direct and indirect negative impacts on local fauna and their habitats. Conservation areas need to be surrounded by buffer zones that minimize the risks of pollution. Aerial spraying of pesticides should not be allowed because of the danger of drifting, airborne chemicals. When pesticides are used they should be applied in strict accordance with the manufacturer's specifications, and under the strict and constant supervision of a trained

and responsible manager. All toxic substances must be stored securely and not be available for casual, unsupervised or illegal use. Pesticides must be used with the greatest circumspection and only as a last-resort solution to serious and intractable problems on the golf course; in other areas, nature should be allowed to take its course.

- Mitigate the pollution of soils and water beyond the building sites (refer to the Arabella Country Estate Phase 2 Environmental Management Specifications).
- Mitigate light pollution beyond the building sites (refer to the Arabella Country Estate Phase 2 Landscaping Plan).
- Mitigation of alteration of surface and groundwater levels and flows, and knock-on effects on local wetlands.
 - Ensure that boreholes do not leak and are not a source of mineral pollution. For example, some existing boreholes on the property are leaking and showing clear signs of being the source of iron-oxide pollution.
 - Manage stormwater runoff in a manner that minimizes impacts on local habitats. Erosion, siltation and eutrophication must be avoided by means of stormwater retention ponds, etc..
 - Manage seepage of irrigation water. Nutrient-rich water arising from irrigated fairways and greens must not seep into wetlands, streams or Botrivierlei. Seepage should be collected and treated before release into the environment.
- The poaching of animals must be prohibited.
- Problem animal scenarios must be mitigated.
 - No feeding of wild animals.
 - Keep attractive resources out of reach. It is of utmost importance that all artificial sources of food, including refuse, be kept completely out of reach of wild animals. This may require inventive and quite extreme measures because some animals, e.g., baboons, are dextrous and intelligent.
 - Exercise rigorous control of edible refuse. Refuse must not be dumped or stored on site, but be completely removed from site at frequent and regular intervals.
 - Use professional help. If specific individual animals become problematic (e.g., a venomous snake in a resident's garden), the ECO or CapeNature or other suitably experienced persons, should be called in to deal with the problem in a professional manner, preferably without having to kill the animal.

- Specify appropriate methods for the control of problem animals, such as rats, moles and mole rats, in the operational-phase EMP. The methods used should not jeopardize owls and other predators.
- Mitigation of invasion of alien animals
 - Exercise rigorous control of edible refuse. Refuse must not be dumped or stored on site, but be properly contained and completely removed from site at frequent and regular intervals.
 - Restrict the keeping of pets on site and control their behaviour, including a complete ban on cats and all other free-range pets (e.g., pigeons, chickens, ducks and peacocks). Pets interact negatively with wildlife and are highly undesirable in protected nature areas.
 - Eliminate any feral cats and dogs. Feral cats and dogs are a serious threat to wildlife and the problem must be aggressively dealt with by the ECO wherever such animals enter conservation areas. It is necessary to promote awareness of this problem, and remedies for it, among the residents and staff of the estate.
 - Adhere to a nodal design of housing development. This is likely to have a lesser impact than if houses are spread throughout the site.
 - Keep peripheral developments to a minimum and as close to planned development nodes as possible (e.g., visitor centres, lapas, camp sites, stables, etc, etc). Such “informal” or temporary developments must not happen without following a proper EIA process.
 - No artificial plantings – indigenous or otherwise – within wilderness/nature areas, because the Argentine Ant may be spread by means of nursery plants. This will also help to avoid introduction of plant-disease organisms.

Furthermore, the following is proposed:

- Impacts must be mitigated through improved conservation of undeveloped land. Recommended actions are:
 - Put in place Environmental Management Plans (EMPs) for the construction and operational phases (refer to the Arabella Country Estate Phase 2 Construction Phase Environmental Management Plan).

- Appoint an ECO on a permanent basis to ensure implementation of the EMPs and to manage and monitor the conservation areas and carry out other environmental duties.
- Elevate the legal status of the conservation areas, including riparian corridors, to that of a private nature reserve, or a land stewardship area, recognized by CapeNature. Institute an ongoing programme to remove all invasive alien plants, including Kikuyu Grass, in terms of the Operational Phase EMP. It is especially important to remove alien growth from watercourses.
- Develop collaborative relationships with neighbouring property owners so that a common understanding is reached on appropriate environmental management for the area. This mitigation is especially relevant at Arabella 2 where the Rooisands and Kogelberg nature reserves are neighbours and Arabella 2 provides a link between the two. If a collaborative agreement between Arabella and CapeNature could go further, such that the currently neglected Rooisands Nature Reserve could benefit from improved management, there could be further significant benefits for conservation and the biosphere reserve, constituting off-site offsets for development at Arabella 2.
- Make provision for eco-education and ecotourism on site.

Freshwater study

A number of wetlands and seasonal streams were identified in the study area (Snaddon 2012³). Most of the freshwater ecosystems encountered on the site are considered to be high ecological importance and sensitivity, and thus of high conservation importance. These ecosystems are important in terms of the provision of aquatic and semi-aquatic habitat, attenuation of floodwaters, and as refugia for flora and fauna. These systems are sensitive to changes in water quantity and quality due to their relatively unimpacted state, but also due to their seasonal nature. Any change in inundation or flow regime will lead to a sometimes irreversible change in the nature of these systems.

Various seep areas were in degraded conditions largely due to the heavy infestation of alien trees, primarily *Acacia* spp. These trees have the effect of:

³ Arabella Golf Estate, Phase 2: Revised Freshwater Ecological input to the Environmental Impact Assessment, 2012.

- Increasing erosion of the stream bed and banks, leading to steep, unstable banks and an incised channel;
- Outcompeting the natural riparian vegetation and so leading to a loss of plant biodiversity and aquatic and semi-aquatic habitat;
- Shading the streambed and so reducing productivity;
- Altering the food source (i.e. leaves) required by aquatic invertebrates;
- Altering the flow of water into and along the stream channel – the stream should resemble the more natural stretches of these systems, which are typical hillslope seeps, and not the incised channels that they now are.

As development mitigation measure Snaddon (2012) proposed that:

- The donga downstream of the restio wetland patches at site 27 as indicated in the study (FCG 2012) must be rehabilitated, to enhance its corridor function. Rehabilitation would probably involve the strategic placing of small weirs (possibly wooden structures) to attenuate flow, thereby maximising local infiltration and reducing the high energy flows that are responsible for donga formation. Rehabilitation would also involve the removal of the remaining pine trees and replanting with indigenous riparian vegetation.
- Sensitive areas that are impacted by the dumping of materials must be ripped and re-planted after construction is complete.
- Construction close to sensitive areas should take place during the dry season, to reduce the risks of contamination of the ecosystems through rainfall and runoff.
- Indigenous plants in the ecological corridors must be retained for re-planting after construction.
- The sensitive areas (i.e. the edges of the buffers around the ecological corridors) must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process.
- Special care should be taken around storm and heavy rain events. The site should be inspected for erosion damage at these times.
- Construction work on the steep slopes of the site (e.g. around the Lekkerwater streams) must attempt to retain sediment-laden water on the construction site, and not allow it to

flow into the streams or wetlands. This can be achieved through the use of settlement ponds close to the actual construction sites.

- Introduction and spread of alien invasives – top material brought onto the site, for filling and landscaping (e.g. for golfing greens, tees or roughs, and for gardens and roads) can lead to the introduction of alien or invasive seedbanks. All soils and top material must be bought from reliable sources, and must be free of alien seeds or grass runners. Constant monitoring of the construction site must occur, and all alien plant species removed from or destroyed on the site.
- Pollution of streams and wetlands from stormwater/irrigation runoff must be prevented
 - Stormwater should not be conveyed directly into the seeps or streams, but rather into detention ponds, bioswales and/or constructed wetlands, before entering any sensitive receiving environment. These attenuating structures can be located within the ecological buffers.
 - The detailed design of the stormwater and irrigation return flow system must be passed by a freshwater and estuarine ecologist.
 - Hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bioretention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and improving the quality of runoff.
 - All detention ponds should be fitted with litter traps to prevent litter from entering any natural areas.
 - Where golfing greens and fairways are located on an impermeable sub-layer, they must be drained by cutoff drains, placed at the lowest point in order to prevent seepage of polluted water into the streams or wetlands. These cutoff drains should convey water to the detention ponds, or into bioswales.
 - Water quality in all of the dams, the detention ponds and irrigation holdings ponds must be monitored, in order to ensure that water finding its way into the wetlands or vleis is of acceptable quality.

- Water entering any of the natural areas should meet DWA's Special Limits, and not merely General Limits. However, if this does at any stage match the Resource Quality Objectives for the Botrivierlei and its catchment, then these Limits must be revised.
- Increased quantities of litter – an increased number of residents of the estate, users of the golf course, spectators at golfing events and other visitors will lead to an increase in litter on the estate.
 - Regular cleanup operations must be carried out, and the entire site inspected on a regular basis.
 - Public areas must be supplied with baboon and other animal proof bins, that must be cleared regularly.
- The development will result in an increased volumes of stormwater runoff
 - Stormwater should not be conveyed directly into the streams or wetlands, but rather into detention ponds, bioswales and/or constructed wetlands, before entering any sensitive receiving environment. These attenuating structures can be located within the ecological buffers.
 - Water from the attenuating structures should only be allowed to overflow into the streams, wetlands or vleis during high rainfall events.
 - Hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bioretention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and improving the quality of runoff.
 - Where golfing greens and fairways are located on an impermeable sub-layer, they must be drained by cutoff drains, placed at the lowest point in order to reduce runoff into the rivers and wetland. These cutoff drains should convey water to the detention ponds, or into bioswales.
 - Heavily eroded portions of the Lekkerwater and Laughing Waters systems must be rehabilitated to the satisfaction of a river ecologist. This will include grading and

reshaping of stream banks, and replanting of substantial portions of these systems. Rehabilitation must be guided by a detailed rehabilitation plan.

- Abstraction of water for use on the estate must be done with care
 - Abstraction from any surface water resource shall only take place during winter months.
 - Abstraction shall not detrimentally affect the flow regimes of any of the affected ecosystems.
 - The impact of ground- and surface water abstraction must be continually monitored, not only by measuring water levels, but also by monitoring the viability of ecosystems potentially affected by abstraction. A detailed monitoring programme must be developed and implemented, and the results of the monitoring programme must be submitted to CapeNature.
 - The leaking borehole (borehole 9) and associated infrastructure must be fixed and the area rehabilitated.
- There is a risk that the dry summer season can be extended as a result of the diversion of natural surface and subsurface runoff away from the wetlands and streams, through the construction of swales and cut-off drains that direct all runoff to the monitoring ponds. This would effectively lead to desiccation of the wetland habitat and concomitant loss of ecological functioning.
 - Where possible, runoff from natural areas must be allowed to flow unhindered across the site.
 - The provision of a buffer – 20 m from the edge of each ecosystem – will allow for some natural runoff to enter the ecosystems.
- Spread of alien invasives must be controlled
 - The recommended buffer areas should be planted with appropriate indigenous vegetation, and a barrier provided between landscaped areas (gardens or golf course) and the buffer (e.g. a golf cart track or pathway).
 - Kikuyu grass will not be allowed on the site, and alternatives (e.g. *Stenotaphrum secundatum*, *Paspalum vaginatum* and *Cynodon dactylon*) sought for the golfing
- All alien and invasive plant species that inhabit the site must be removed.

ANNEXURE B11

START-UP MEETING REPORT

TO BE COMPLETED

SECTION C

FUNCTIONS & IMPLEMENTATION PROCEDURES

SECTION C - CONTENT

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LIST OF ANNEXURES

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SECTION C: ROLE-PLAYER FUNCTIONS AND IMPLEMENTATION PROCEDURES

SECTION SYNOPSIS

This section describes the functions of the key role-players (i.e. the Environmental Control Officer, the Site Engineer and the Contractor) and puts forward guidelines and mechanisms for the implementation of the Environmental Management Specifications.

1 INTRODUCTION

The EMP illustrates Arabella's support for best construction practice, which includes ensuring that environmental damage during construction is minimised.

Before the start of any works on site an ECO has to be appointed for the project. The ECO shall be responsible for monitoring compliance with the EMP.

The purpose of this section is to:

- a) Describe the role of the ECO, the Site Engineer and the Contractor with respect to the implementation of the EMP for this project.
- b) Explain the relationship between the Site Engineer and the ECO.
- c) Highlight the salient features of the EMP.
- d) Clarify and streamline the implementation of the EMP.
- e) Indicate environmental issues covered in the Tender Document and other relevant legislation, other than in the EMP specifications, which are deemed to form part of the EMP.

2 COMMUNICATION STRUCTURE

Figure 1 on the following page defines the communication lines between the various role-players involved in the project. All instructions and official communications regarding environmental matters will follow these lines of communication.

The Site Engineer and the ECO are expected to develop a close working relationship and to stay in contact with each other. The Site Engineer issues site instructions to the Contractor and all requests and communications between the ECO and Contractor are via the Site Engineer. The EMP will be an item of the monthly site meetings and the ECO will attend these meetings in order to provide input with respect to compliance with the EMP. If at any time the ECO is uncertain in any way with regard to an environmentally related issue or any specification in the EMP, he will consult with the CEO.

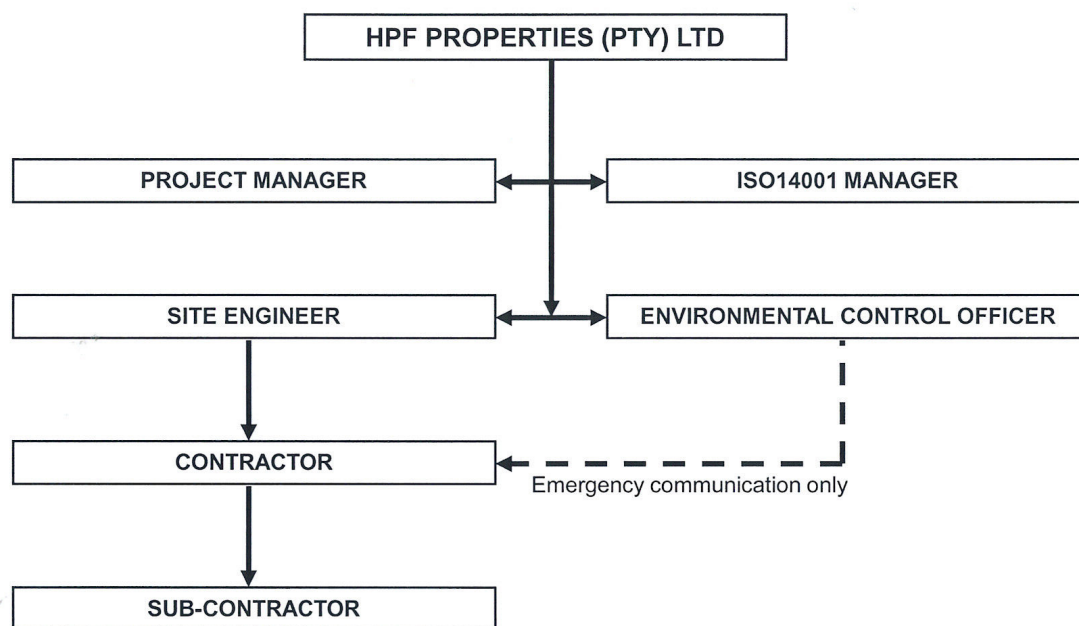


Figure 1: Communication structure for the project.

3 FUNCTIONS AND RESPONSIBILITIES

3.1 ENVIRONMENTAL CONTROL OFFICER

The ECO will be appointed by Arabella before the start of construction for the duration of the construction phase. The ECO will have the following qualifications and competency:

- Registered with the South African Council for Natural Scientific Professions as a Professional Natural Scientist.
- Knowledge and experience of the environmental management process and impact mitigation in terms of the Environment Conservation Act (Act 73 of 1989) and the National Environmental Management Act (Act 107 of 1998).

- Knowledge and experience of the rezoning process and associated guidelines and requirements in terms of the Land Use Planning Ordinance (No. 15 of 1985).
- Proven experience of ECO work undertaken in similar projects.

The ECO will be responsible for monitoring, reviewing and verifying compliance with the EMP by the Contractor. The ECO's duties in this regard will include the following:

- a) Assisting Arabella in ensuring that the necessary environmental authorizations and permits have been obtained.
- b) Monitoring and verifying that the EMP is adhered to at all times and taking action if the specifications are not followed.
- c) Monitoring and verifying that environmental impacts are kept to a minimum.
- d) Reviewing and approving construction method statements together with the Site Engineer (Annexure C2 provides guidelines for the preparation and implementation of method statements).
- e) Assisting the Contractor in finding environmentally responsible solutions to problems.
- f) Giving a report back on the environmental issues at the monthly site meetings and other meetings that may be called regarding environmental matters.
- g) Keeping records of all activities/ incidents on site in the Site Diary concerning the environment.
- h) Inspecting the Site and surrounding areas regularly with regard to compliance with the EMP.
- i) Keeping a register of complaints in the Site Office and recording and dealing with any community comments or issues.
- j) Monitoring the undertaking by the Contractor of environmental awareness training for all new personnel coming onto site.
- k) Ordering the removal of, or issuing spot fines for, person(s) and/or equipment not complying with the specifications (undertaken via the Site Engineer).
- l) Ensuring that activities on site comply with other relevant environmental legislation.
- m) Issuing of penalties, via the Site Engineer, for contraventions of the EMP (e.g. damage to 'no go' areas).
- n) Completing start-up, weekly, monthly and site closure checklists.
- o) Keeping a photographic record of progress on site from an environmental perspective.

- p) Undertaking a continual internal review of the EMP and submitting a report to Arabella at the end of the project.
- q) Site visits to be undertaken once every twice a week depending on the status and intensity of operations.
- r) An environmental audit will be undertaken every sixth month. An audit report will be submitted to the Auditing Committee (AC) and the Home Owners Association (HOA), after which it will be submitted to DEA&DP.

Except in an emergency situation (defined as a situation requiring immediate action and where failure to implement appropriate actions timeously may result in serious environmental damage), where instructions may be given directly to the Contractor, all instructions given by the ECO shall go through the Site Engineer, who will then convey these to the Contractor.

3.2 SITE ENGINEER

The Site Engineer will be responsible for monitoring, reviewing and verifying compliance with the EMP by the Contractor. The Site Engineer's duties in this regard will include the following:

- a) Monitoring and verifying that the EMP is adhered to at all times and taking action if the specifications are not followed.
- b) Monitoring and verifying that environmental impacts are kept to a minimum.
- c) Reviewing and approving construction method statements.
- d) Conducting pre-building inspections.
- e) Assisting the Contractor in finding environmentally responsible solutions to problems.
- f) Reporting back on the environmental issues at the monthly site meetings and other meetings that may be called regarding environmental matters.
- g) Keeping records of all activities/ incidents on site in the site diary.
- h) Inspecting the site and surrounding areas regularly with regard to compliance with the EMP.
- i) Keeping a register of complaints in the site office and recording and dealing with any community comments or issues.
- j) Monitoring the undertaking by the contractor of environmental awareness training for all new personnel coming onto site.
- k) Ensuring that activities on site comply with other relevant environmental legislation.

- l) Ordering the removal of, or issuing spot fines for, person(s) and/or equipment not complying with the specifications.
- m) Issuing of penalties for contraventions of the EMP (e.g. damage to 'no go' areas).
- n) Completing start-up, weekly, monthly and site closure checklists.
- o) Keeping a photographic record of progress on site from an environmental perspective.

3.3 CONTRACTOR

The Contractor must ensure that all of its sub-contractors, employees, suppliers, agents, etc., are fully aware of the environmental specifications detailed in the site EMP. The Contractor must liaise closely with the Site Engineer must ensure that the works on site are conducted in an environmentally sensitive manner and fully in accordance with the requirements of the EMP.

All contractors working on site must have proper and competent contractor supervision during their time of contract. If more than one contractor work on the site simultaneously then the responsibility lies on each contractor to adhere to the conditions of the EMP and related documents.

All Contractors / Sub-contractors must sign the Declaration of Understanding (refer to Annexure C1) before construction commences.

The main actions required by the Contractor, before construction, at initial start up and during construction are listed below. The ECO and Site Engineer must ensure that all of these actions are undertaken timeously and in accordance with the EMP.

It must be noted that the list below does not necessarily includes all the functions of the Contractor. The list rather serves as a guide as to where definite actions are required before certain activities can commence.

3.3.1 PRIOR TO COMMENCEMENT

a) Method Statements

A method statement is a written submission by the Contractor setting out the plant, materials, labour and method the Contractor proposes to use in order to carry out an activity, in such detail that the Engineer would be able to assess whether the Contractor's proposal is in accordance with the Environmental Management Specifications and/ or will produce results in accordance with the Specifications.

Where relevant, method statements shall be provided by the Contractor within 14 days after appointment. All activities which require method statements may only commence once the method statements have been approved by the Site Engineer.

The method statement shall cover applicable details with regard to:

- a) Construction procedures.
- b) Materials and equipment to be used.
- c) Getting the equipment to and from site.
- d) How the equipment/ material will be moved while on site.
- e) How and where material will be stored.
- f) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur.
- g) Timing and location of activities.
- h) Compliance/ non-compliance with the Environmental Management Specifications.
- i) Any other information deemed necessary by the Site Engineer.

The Contractor shall abide by these approved method statements. An activity covered by a method statement shall not commence until the Site Engineer has approved of such method.

b) Preparation for Environmental Awareness Course

The Contractor shall organise and finalise the logistics and date of the environmental awareness course with the engineer before the commencement date.

3.3.2 INITIAL TWO WEEKS AFTER COMMENCEMENT**a) Demarcation of the site**

Where required, one of the first actions to be undertaken by the Contractor shall be to erect and maintain a temporary fence along the boundaries of the site, and around any no-go areas, to the satisfaction of the engineer.

b) Undertaking environmental awareness course

The contractor shall ensure that all management staff attend the awareness course to be held in or before the first week after the commencement date.

c) Follow-on from the environmental awareness course

The Contractor shall be responsible for ensuring that the information presented at the course along with the requirements in the EMP are presented to the rest of his staff including all labour and mechanical staff as well as to sub-contractors and their staff. During construction, the Contractor shall be responsible for providing awareness training to all new staff coming onto site, thus ensuring that these personnel are aware of the Environmental Management Specifications on site.

d) Method statement awareness

Where applicable, the Contractor shall provide job-specific training on an *ad hoc* basis when workers are engaged in activities which require method statements.

3.3.3 DURING THE CONSTRUCTION PERIOD

a) Familiarisation of the EMP

A copy of the EMP shall be available on site, and the Contractor shall ensure that all the personnel on site (including sub-contractors and their staff) as well as suppliers are familiar with and understand the specifications contained in the EMP.

b) Method statements

Other method statements which are required during construction must be submitted to the engineer for approval 14 days prior to the proposed commencement of the activity. This may include emergency construction method statements.

c) Watchmen

Where applicable, the contractor shall ensure that a watchman is present on site during all non-working hours, including public holidays.

d) Handling, use and storage of materials

The Contractor shall ensure that any materials delivery drivers are informed of all procedures and restrictions (e.g. which access roads to use, no go areas, speed limits, noise, etc) required by the EMP before they arrive at site and off load any materials.

3.3.4 AFTER COMPLETION OF CONSTRUCTION

a) Site clean-up

The Contractor shall clear and clean the site and ensure that everything not forming part of the permanent works is removed from site.

b) Revegetation and rehabilitation

The Contractor shall be responsible for rehabilitating and revegetating all areas to the satisfaction of the engineer as detailed in the revegetation specification and project specifications.

3.4 SUMMARY OF IMPLEMENTATION ACTIONS

Table 1 below summarises the actions required by the various organisations to ensure that the EMP is implemented correctly from the start of the project.

Table 1: Actions required by the various role-players to ensure that the EMP is implemented correctly from the start of the project.

SITE ENGINEER	CONTRACTOR	ENVIRONMENTAL CONTROL OFFICER
		Provide input in the EMP as part of the Tender Document
Attend EMP education course run by the ECO		Inform/educate the Contract Engineer and Site Engineer regarding their responsibilities towards the EMP
Sign and commit to the 'Site Engineer and ECO Guideline' document		Sign and commit to the 'ECO Guideline' document
Put project out to tender with EMP as part of the Tender Document		
Assess Tenders and identify preferred Contractor		Assess Tenders and assist in identification of preferred Contractor
	Submit method statements required in	

	terms of the EMP	
Review method statements in consultation with the ECO		Review method statements in consultation with the Site Engineer
	Make required changes to method statements and re-submit	
Approve method statements and verify commencement date		Approve method statements in consultation with Site Engineer and develop a Management environmental awareness course
Attend the environmental awareness course for managers	Attend environmental awareness course for managers	Present environmental awareness course for managers
Oversee initial site establishment and the contract		Oversee initial site establishment and develop the labour force environmental awareness course
	Commence project with demarcation of the site and organisation for the environmental awareness course	
Attend the labour force environmental education course and get attendance register	Undertake the labour force environmental awareness course	Attend the labour force environmental education course
Monitor, review and verify compliance with the EMP	Comply with the EMP	Oversee implementation of the EMP by attending monthly meetings and providing <i>ad hoc</i> input

4 CONTRACTOR'S ENVIRONMENTAL SITE OFFICER

In terms of the Environmental Management Specification Section 8.02, the Contractor shall appoint an Environmental Site Officer. The Environmental Site Officer's responsibilities will be to undertake a daily site inspection to monitor compliance with the EMP. The Contractor shall forward the name of the Environmental Site Officer to the Site Engineer for his approval, prior to the onset of the Environmental Awareness Course.

A daily checklist has been included in Annexure C2 to facilitate the daily site inspection by the Environmental Site Officer. These completed checklists must be submitted to the ECO at the end of each week.

5 RECORD OF ACTIVITIES, NON-COMPLIANCE AND CORRECTIVE ACTION

The ECO will keep a record of all activities on site, meetings attended, method statements received and approved, issues arising on site, cases of non-compliance with the EMP together with corrective action taken and penalties issued. This information will be recorded in an appropriate manner by the ECO in a site diary, registers, issues/ warning book, etc (the Site Engineer should also keep a record). The ECO will undertake weekly and monthly checks on Site in order to ensure compliance with the EMP. At the end of each month, a monthly compliance certificate would be completed and submitted to the CEO (the weekly and month end checklists need to be attached to the compliance certificate).

6 PHOTOGRAPHIC RECORD

The ECO will keep a photographic record of progress on site and an *ad hoc* record of all environmental incidents or events on site. Such photographs shall be properly dated. This will include a photographic record of all major stages of construction, of all working and construction camp areas before and after the start of construction and at any time during construction if there are any deviations from or transgressions of the EMP that can be recorded on film. This record can be used, where applicable, in disputes with the Contractor regarding environmental matters, and for the review process after completion of construction.

7 SPOT FINES

The Site Engineer, at the request of the ECO or of to his own discretion, can impose spot fines on the Contractor for any contraventions of the EMP. By imposing spot fines on individuals guilty of contravening the EMP, the ECO will be able to ensure that the requirements of the EMP are taken seriously not only by the management personnel on site, but also by labour.

Environmental Management Specifications Section 9.01 puts forward a range of spot fines for different contraventions of the EMP. The Site Engineer and ECO should use these as a guide and use their own discretion in determining the severity of the contravention and thus the value of the spot fine (it is recommended that the Site Engineer and ECO agree on the fine prior to issuing it to the Contractor).

The Site Engineer and ECO will not collect the fines from individuals, but rather the Site Engineer will inform the Contractor of the contravention, the individual's identity and the amount of the fine. The fine will be deducted from the Contractors' monthly certificate, or the Site Engineer will issue a variation order, to the value of the fine, for the Contractor to undertake activities that would in some way enhance the state of the environment or the site. It will be the Contractor's responsibility to reclaim such fines from the guilty individuals.

8 PENALTIES, REMOVAL FROM SITE, AND SUSPENSION OF WORKS

Non-compliance with the conditions of the EMP constitutes a breach of Contract for which the Contractor may be liable to pay penalties. These penalties imposed will be per incident. The amount of the penalty will depend on the seriousness of the contravention, and thus the ECO and Site Engineer must use their judgement in determining the amount of the penalty. Again, it is recommended that the Site Engineer and ECO agree on the penalty prior to issuing it to the Contractor. The Contractor is deemed not to have complied with the EMP if:

- a) there is evidence of contravention of the specification within the boundaries of the site, site extensions and haul/ access roads,
- b) construction related activities taking place outside the defined boundaries of the site,
- c) environmental damage ensues due to negligence,

- d) the Contractor fails to comply with corrective or other instructions issued by the Engineer within a specific time,
- e) the Contractor fails to respond adequately to complaints from the public.

In addition to penalties, the Site Engineer, at the request of the ECO or of his own conviction, has the power to remove from site any person who is in contravention of the EMP, and if necessary, the Site Engineer can suspend the part or all of the works, as required.

9 INTERNAL REVIEW

An internal review procedure will be established by the ECO to monitor the progress and implementation of the EMP, and any modifications to the EMP will be issued as variation orders by the Site Engineer and registered in the records of both the Site Engineer and ECO. At the end of the project, a report outlining the implementation of the EMP and highlighting any problems or issues that arose during the construction period will be compiled by the ECO (with input from the Site Engineer where necessary) and submitted to Arabella. This report will indicate where future EMPs can be improved or changed.

10 COMPLIANCE WITH LEGISLATION

Annexure C4 provides a list of the legislation that may be of relevance to the project. The purpose of the annexure is to make the ECO aware of environmental legislation and that compliance is ensured.

CHIEF EXECUTIVE OFFICER

HPF PROPERTIES (PTY) LTD

ANNEXURE C1

DECLARATION OF UNDERSTANDING

DECLARATION OF UNDERSTANDING

I,,
representing,
declare that the conditions of the Environmental Authorisation has been brought under my
attention and that I have read and understand the contents of the Environmental Management Plan.

SITE

Arabella Country Estate Phase 2, Portion 1 and Remainder Portion 3 of Farm Hermanus River No.
542, Kleinmond, Division Caledon.

ENVIRONMENTAL AUTHORISATION REF.

.....

I declare that I understand my responsibilities in terms of enforcing and implementing the
Environmental Specifications as set out in the various documents for the above site. I undertake to
inform all persons under my supervision of such specifications and contents of the documents.

SIGNED AT **THIS** **DAY OF** **20...**

.....

NAME.....

.....

WITNESS

ANNEXURE C2

GUIDELINES FOR THE PREPARATION AND IMPLEMENTATION OF METHOD STATEMENTS

PREPARATION OF METHOD STATEMENTS

Method Statements are to be completed by the person undertaking the work (i.e. the contractor). The method statement will enable the potential negative environmental impacts associated with the proposed activity to be assessed. The method statement can only be implemented once approved by the ECO and Site Engineer.

The contractor (and, where relevant, any sub-contractors) must also sign the method statement, thereby indicating that the works will be carried out according to the methodology contained in the approved method statement.

The ECO will use the method statement to audit compliance by the contractor with the requirements of the approved method statement.

Changes to the way the works are to be carried out must be reflected by amendments to the original approved method statement; amendments require the signature of the ECO and the Site Engineer, denoting that the changed methodology or works are necessary for the successful completion of the works, and are environmentally acceptable. The contractor will also be required to sign the amended method statement thereby committing him/herself to the amended method statement. This method statement must contain sufficient information and detail to enable the Site Engineer and ECO to apply their minds to the potential impacts of the works on the environment. The contractor will also need to thoroughly understand what is required of him/her in order to undertake the works.

The time taken to provide a thorough, detailed method statement is time well spent. Insufficient detail will result in delays to the works while the method statement is rewritten to the satisfaction of the Site Engineer and ECO. A *pro forma* method statement is provided below. It is important to note that a method statement needs to be prepared for each activity requiring a method statement in terms of the EMP.

METHOD STATEMENT

CONTRACT:.....DATE:.....

PROPOSED ACTIVITY (title of method statement and reference number from the EMP):

--

WORK TO BE UNDERTAKEN (brief description of the works):

--

WHERE ARE THE WORKS TO BE UNDERTAKEN (plan and a full description of the extent of the works):

--

START AND END DATE OF THE WORKS FOR WHICH THE METHOD STATEMENT IS REQUIRED:

Start Date:

End Date:

HOW ARE THE WORKS TO BE UNDERTAKEN (including sketches and plans):

DECLARATIONS

1) ENVIRONMENTAL CONTROL OFFICER

The work described in this Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm:

Signature_____

Date_____

2) PERSON UNDERTAKING THE WORKS

I understand the contents of this Method Statement and the scope of the works required of me. I further understand that this Method Statement may be amended on application to other signatories and that the ECO and Site Engineer will audit my compliance with the contents of this Method Statement

Signature_____

Date_____

3) APPROVING AUTHORITY (Site Engineer)

The works described in this Method Statement are approved.

Signature_____

Date_____

ANNEXURE C3

CHECKLISTS FOR SITE INSPECTION

CHECKLISTS

1 ENVIRONMENTAL CONTROL OFFICER: DAILY CHECKLIST

ENVIRONMENTAL ASPECT	YES/ NO (✓ or X)	COMMENTS
All new personnel on site are aware of the contents of the EMP and have been through the environmental awareness course.		
Contractor's camp is neat and tidy and the labourers' facilities are of an acceptable standard.		
Sufficient and appropriate fire fighting equipment is visible and readily available in the appropriate places, <i>e.g.</i> next to the fuel depot or where 'hot work' is underway.		
Waste control and removal system is being maintained.		
Boundary and other fences are being maintained.		
Drip trays are being utilised where there is a risk of incidental spillage		
Bunds/ drip trays are being emptied on a regular basis (especially after rain).		
No leakages are visible from construction vehicles		
Refuelling of vehicles occurs within the workshop or, if outside the workshop, drip trays are being used.		
No go areas, natural features and trees have not been damaged.		
Dust control measures (if necessary) are in place and are effectively controlling dust.		
Noise control measures (if necessary) are in place and are working effectively.		

Erosion control measures (if necessary) are in place and are effective in controlling erosion.		
Stockpiles of topsoil are located within the boundary of the site, do not exceed 2 m in height and are protected from erosion.		
Spoil stockpiles are located within the boundary of the site, do not exceed 2 m in height and are protected from erosion.		

Completed by.....

Signature.....

Date.....

2 SITE ENGINEER CHECKLISTS & CERTIFICATES

The attached checklists are to serve as mechanisms, which will aid the Site Engineer in the implementation and enforcement of the EMP. Four different types of checklists have been attached, namely:

- a) **Start-up Checklist**
- b) **Weekly Checklist**
- c) **Monthly Checklist**
- d) **Site Closure Checklist**

It is imperative that the Site Engineer undertakes to fill in the checklists on a weekly and monthly basis in order to ensure that the EMP is effectively implemented.

2.1 MONTHLY COMPLIANCE CERTIFICATE

The Site Engineer has to fill in a Monthly Compliance Certificate and keep the latter as a record of compliance and non-compliance during the contract. The relevant weekly and monthly checklists should be attached to this Certificate as supporting documentation. The ISO14001 monitoring officer may request these certificates at any stage during the contract.

PROJECT START-UP CHECKLIST

ENVIRONMENTAL ASPECT	YES/ NO (√ or X)	COMMENTS
All environmental method statements required before commencement of the works have been submitted and approved.		
A copy of the contract document is on site.		
Environmental Awareness education course has been given to everyone on site and an attendance register given to the Site Engineer.		

Telephone numbers of emergency services are available on site.		
List of hazardous materials on site with storage, handling and disposal procedures.		
Location and type of boundary fencing has been erected and complies with the specification.		
Solid waste management system has been established.		
Wastewater management system has been established.		
Location of construction camp and working area infrastructure comply with specifications.		
All necessary fire-fighting equipment is on site and in good working order.		

Completed by.....

Signature.....

Date.....

WEEKLY CHECKLIST

ENVIRONMENTAL ASPECT	YES/ NO (√ or X)	COMMENTS
Contractor's camp is neat and tidy and the labourers facilities are of an acceptable standard.		
Waste control and removal system is being maintained.		
Sufficient fire-fighting equipment is available on site and is in good working order.		
Wastewater control system is being maintained.		
Boundary and other fences are being maintained.		
Bunds/ drip trays are being emptied on a regular basis (especially after rain).		
All construction vehicles are in good working order and no leakages are visible.		
Refuelling of vehicles is in accordance with the EMP specifications.		
No go areas, remaining natural features and trees have not been damaged.		
Dust control measures (if necessary) are in place and are effectively controlling dust.		
Noise control measures (if necessary) are in place and are working effectively.		
Erosion control measures (if necessary) are in place and are effective in controlling erosion.		
Stockpiles of topsoil are located within the boundary of the site and do not exceed 1.5 m in height.		

Any spot fines, penalties have been recorded in the site diary.		
---	--	--

Completed by.....

Signature.....

Date.....

MONTHLY CHECKLIST

ENVIRONMENTAL ASPECT	YES/ NO (√ or X)	COMMENTS
The EMP is an item on the monthly site meeting agenda.		
The Contractor has made staff numbers report available.		
All new personnel on site are aware of the contents of the EMP and have been through the environmental awareness course.		
Construction activities are being undertaken according to approved method statements.		
Fuel and flammable material storage areas comply with general fire safety requirements.		
Public complaints have been recorded and dealt with in a satisfactory manner.		
Monthly Compliance Certificate has been completed.		

Completed by.....

Signature.....

Date.....

SITE CLOSURE CHECKLIST

ENVIRONMENTAL ASPECT	YES/ NO (√ or X)	COMMENTS
Contractor has cleared everything not forming part of the permanent works.		
Environmental 'Snag List' has been compiled.		
Revegetation and rehabilitation has been satisfactorily completed and in accordance with the revegetation and rehabilitation specification.		
All areas disturbed by the contractor have been rehabilitated in accordance with the revegetation and rehabilitation specification.		
Outstanding fines have been deducted from the Final Payment Certificate.		

Completed by.....

Signature.....

Date.....

MONTHLY COMPLIANCE CERTIFICATE

SITE ENGINEER:

ENVIRONMENTAL CONTROL OFFICER:

FOR THE PERIOD..... TO

Date of Submission: _____

Key activities on site during the month:

NON-CONFORMANCE

Area of activity: _____

Reason: _____

Responsible Party: _____

Results:

Corrective action taken:

Intended follow-up:

GOOD PERFORMANCE

Description of activity or action in which contract went beyond compliance towards responsible care for the environment:

ADDITIONAL COMMENTS

ANNEXURE C4

LEGISLATION RELEVANT TO PHASE 2 PROJECT

APPLICABLE LEGISLATION

The following legislation are of relevance to the project and shall be complied with:

ACT OR ORDINANCE	AREA OF APPLICATION	RESPONSIBLE AUTHORITY
Atmospheric Pollution Prevention Act No. 45 of 1965	Control of noxious and offensive gases, smoke, dust and vehicular emissions.	Department of Environmental Affairs and Tourism
Conservation of Agricultural Resources Act No. 43 of 1983	Control of the utilisation and protection of wetlands, soil conservation, control and prevention of veld fires, control of weeds and invader plants.	Department of Agriculture
Environment Conservation Act No. 73 of 1989 National Environmental Management, Act No. 107 of 1998	Control/prevention of pollution; combating of noise; activities which may have a detrimental effect on the environment, preparation and contents of environmental impact reports.	Department of Environmental Affairs and Tourism
Nature Conservation Ordinance No. 74 of 1979	Private Nature Reserves, Conservancies, Biosphere Reserves	Cape Nature
Fencing Act No. 31 of 1963	Clearing of bushes for border fencing, Access to property for fencing.	Department of Agriculture
Land Use Planning. Ordinance No. 85 of 1985 (Western Cape Act on Planning and Development No. 7 of 1999)	Land use and zoning.	Department of Environmental Affairs and Development Planning
Forest Act No. 122 of 1984 (National Act on Forests, Act No. 84 of 1998)	Control over encroaching, protection of trees on private land, prevention an extinction of fire hazards.	Department of Water Affairs and Forestry
National Act on Veld and Forest Fires, Act No.101 of 1998	Fire Protection Associations. Building of fire breaks.	Department of Water Affairs and Forestry

ACT OR ORDINANCE	AREA OF APPLICATION	RESPONSIBLE AUTHORITY
National Environmental Management Act No. 107 of 1998.	Biodiversity conservation and impact mitigation.	Department of Environmental Affairs and Tourism
National Environmental Management; Biodiversity Act No. 10 of 2004.	Biodiversity conservation and impact mitigation.	Department of Environmental Affairs and Tourism
National Environmental Management Act: Protected Areas Act 57 of 2003.	Biodiversity conservation and impact mitigation.	Department of Environmental Affairs and Tourism
National Water Act No. 36 of 1998.	Diversion or impoundment of rivers. Conservation and use of water.	Department of Water Affairs and Forestry
Water Services Act No. 108 of 1997.	Treatment and disposal of waste, wastewater and effluent; Pollution and pollution emergencies; Water Users Associations Dam safety. Registration of boreholes.	Department Of Water Affairs And Forestry
Health Act No. 63 of 1977	Control of solid, liquid and gaseous wastes that may pose a health hazard.	Department of Health and Local Authorities
Occupational Health and Safety Act No. 85 of 1993.	Controls the exposure of employees and the public to dangerous and toxic substances or activities.	Department of Labour Affairs
National Heritage Resources Act No. 25 of 1999.	Conservation of national heritage and archaeological material.	South African Heritage Resources Agency.
Constitution Act No. 108 of 1996.	The Constitution of South Africa.	National, Provincial and Local Government
National Road Traffic Act No. 93 of 1996.	Provides for road traffic matters which applies uniformly throughout South Africa.	Department of Transport
Advertising on Roads and Ribbon Development Act No. 24 of 1940.	Regulates the display of adverts at places visible from public roads. Also controls the depositing of machinery or refuse, and the construction or lying of structures, near public roads.	Provincial Authorities

ACT OR ORDINANCE	AREA OF APPLICATION	RESPONSIBLE AUTHORITY
Hazardous Substances Act No. 15 of 1973.	Provides for the control of substances which may cause injury or ill health to, or the death of human beings.	National Department of Health. Local Authorities may be authorized
Road Transportation Act No. 74 of 1977.	Construction of roads.	Department of Transport
National Building Regulations and Standards Act 103 of 1977 (SABS 0400).		
Waste Act No. 59 of 2008.	Waste management.	Department of Environmental Affairs and Development Planning.
Integrated Coastal Management Act No. 24 of 2008.	Coastal and estuarine management.	Department of Environmental Affairs and Development Planning.

SECTION D

SITE CLEARANCE

SECTION D: CONTENT

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SECTION D: SITE CLEARANCE

SECTION SYNOPSIS

This section puts forward procedural guidelines for the clearance of the site as the first step of the Construction Phase after the demarcation of sensitive areas.

1 PREPARATION FOR SITE CLEARANCE

1.1 PLANT SEARCH AND RESCUE

- a) Plant search and rescue (i.e. the location and removal of specified plants, or their seeds, species without unnecessary damage and the transfer of these plants to a specified location) shall be undertaken by the Contractor prior to the commencement of any site clearing operations.
- b) The source location of all rescued plant material shall be recorded on a grid system and the original habitat type shall be recorded.
- c) Where possible, direct transplantation of rescued plant material, into areas earmarked and prepared for revegetation, shall occur.
- d) Where direct transplantation is not feasible, plant material shall be moved to a holding area on site, where it shall be placed in bags on open ground, or alternatively relocated to an off-site nursery for transplantation once the permanent revegetation areas become available.
- e) Rescued plants which are to be stockpiled at a temporary holding area or nursery shall be stored under damp shade cloth / hessian until they are transported to these sites. They shall be dipped into a moisture-retaining agent and bagged in the topsoil from the area.
- f) Transport of rescued plants to the storage site/ nursery shall occur regularly during each working day.
- g) Geophytes (or bulbs) shall be collected and either planted out in seed trays or in bags, depending on size or where appropriate, as determined by the Site Engineer, they shall be stored under cool dry conditions, at the storage site/ nursery.
- h) During plant search and rescue, as much seed as possible shall be removed from all seeding indigenous plants in the affected area. Seed shall be:

- (i) Stored in waterproof containers free of insects and away from rodents in a cool area;
 - (ii) Sown directly into the desired area to allow for self-germination as the seasons dictate; or
 - (iii) Sown at the storage site/ nursery.
- i) Were possible, the seed collection programme shall be ongoing to allow for the sowing of seed directly into the newly prepared soil in the revegetation areas as and when these areas are ready to receive seed.
- j) Geophytes seeds shall be sown directly into seed trays at the storage site/ nursery.
- k) Wetland areas shall not be disturbed.
- l) Wetland material from the existing wetlands on site shall be rescued, and used to plant new wetland areas. Large sods of material bearing both plant material and soil adhering to the root systems shall be transplanted.
- m) Appropriate Wetland species shall be taken to the nursery for storage and multiplication.

2 VEGETATION CLEARANCE

2.1 SITE CLEARANCE

- a) Before any area is cleared of vegetation a Method Statement shall be provided.
- b) All cleared areas shall be stabilised as soon as possible. Areas that are, in the reasonable opinion of the Site Engineer, less stable, shall be stabilized immediately following vegetation clearance.
- c) The disposal of vegetation by burying or burning is prohibited in terms of the National Environmental Management Act (Act 107 of 1998) and various Local Authority bylaws. Cleared vegetative material shall (where applicable) be treated as follows:
 - (i) Removed from site and disposed of at an approved disposal site.
 - (ii) Chipped and mulched, where suitable.
- d) Indigenous vegetation from different topsoil types shall be stockpiled separately, each to be returned to its respective parent topsoil type. Stockpile sites shall be identified by the Contractor and approved by the Site Engineer.

- e) Where necessary, as directed by the Site Engineer, the vegetation within the buffer zones surrounding any sensitive feature, to be retained or protected on site, shall be cleared by hand.
- f) Vegetation, apart from trees identified for retention on site, shall be cleared mechanically. Care shall be taken to minimise the disturbance to topsoil during this process.
- g) During site clearance, any old concrete, rubble or refuse shall be removed from the site, or stockpiled for disposal at an approved disposal site. All stockpiles shall be managed so as to avoid damage to vegetation. Where stockpiles are located in the vicinity of trees, they shall be located outside of the trees' drip line.
- h) Where practical, indigenous plant material shall be kept separate from alien material. The vegetative material shall be reduced either by mechanically means (chipper) or by hand axing to sticks no longer than 100 mm.
- i) All indigenous vegetation cleared from the site shall be collected for later use. Where appropriate, with permission from the Site Engineer, the indigenous material shall be collected simultaneously with the topsoil.
- j) Indigenous mulch shall be harvested with a tractor-drawn harvester in such a manner that loss of seed and biomass shall be at a minimum. Unless the Site Engineer allows a longer period, the mulch shall be harvested not more than two days before use.
- k) Contractor shall store the mulched vegetation in bags. The bags shall be approved by the Site Engineer and shall allow air to pass through the enclosed material. Mulch shall be protected from wetting.
- l) Subject to the approval of the Site Engineer, seed-free material from exotic invasive plants shall be chipped and used to prepare mulch.
- m) The Contractor shall wet the soil in unstabilised areas in order to control wind-blown dust and sand.

2.2 VEGETATION REMOVAL AND TRIMMING IN WATERCOURSES

- a) No heavy machinery shall be permitted within watercourses for any purpose, except emergency procedures, without the prior approval of the Site Engineer. Clearing of vegetation shall be conducted by hand.
- b) All cleared and trimmed vegetation shall be removed from the watercourse to prevent flooding/snagging hazards being created.

2.3 CLEARING OF ALIEN VEGETATION

- a) Alien control measures within wetlands and river and stream watercourses require an approved method statement.
- b) No bio-remediation control measures may be used prior to a method statement being approved by the Site Engineer. A permit is required to implement bio remediation programmes.
- c) Comprehensive methods for the control of specific alien/ invasive plant species are detailed below.

2.3.1 TREATMENT OF SPECIFIC SPECIES

a) **Spidergum (*Eucalyptus lehmanii*)**

- (i) Trees shall be cut as low as possible and the cut surface, bark and root crown of the stump shall be painted or sprayed immediately with a mixture of Garlon (Triclopyr) and diesel to suppliers specification.
- (ii) Dye shall be added into the chemical mixture to identify sprayed areas.
- (iii) Stumps shall be monitored for coppice. Coppice shall be sprayed when actively growing and approximately 1m tall with Garlon and Actipron (or similar wetting agent) in water to suppliers specification.

b) **Poplars**

- (i) Large trees shall be cut and painted with 0,5% Garlon in diesel.
- (ii) The uncut stems of young trees shall be painted with 0,5% Garlon in diesel.

c) **Port Jackson (*Acacia saligna*)**

- (i) Large trees shall be cut as close to the ground as possible.
- (ii) Young growth and coppice shall be sprayed in winter and when plants are approximately 1 m tall and growing vigorously, with Garlon and Actipron or Roundup in water to suppliers specification (*if the Contract takes place during summer, young growth and coppice shall be sprayed at the end of the contract period*).

d) Rooikrans (*Acacia cyclops*)

- (i) Large trees shall be cut as close to the ground as possible.
- (ii) New growth shall not be brushcut under any circumstances.
- (iii) Young growth and coppice shall be sprayed in winter and when plants are approximately 1 m tall and growing vigorously, with Garlon and Actipron or Roundup in water to suppliers specification.

e) Long leafed wattle (*Acacia longifolia*)

- (i) Large trees shall be cut as close to the ground as possible.
- (ii) New growth shall be brushcut, or treated with a mixture of Garlon and Actipron or Roundup in water to suppliers specification.
- (iii) Spraying shall occur in winter and when plants are approximately 1 m tall and growing vigorously.

f) Kikuyu (*Pennisetum clandestinum*)

- (i) Where control/ eradication is required, kikuyu shall be sprayed with 1,5% Roundup in water.

g) Bramble (*Rubus sp*)

- (i) Bramble plants shall be sprayed with 1,5% Garlon in diesel.

3 TOPSOIL**3.1 REMOVAL AND STOCKPILING**

- a) Prior to site establishment the Contractor shall strip and stockpile all topsoil within the works area and construction camp for subsequent use in the rehabilitation and revegetation of the site.
- b) Prior to commencement of any earthmoving operations, all topsoil shall be stripped and stockpiled.
- c) All topsoil shall be stripped and stockpiled separately from subsoil for subsequent use during rehabilitation and revegetation.

- d) Soil shall be stripped in a phased manner, so as to retain vegetation cover for as long as possible.
- e) The top 150 mm of topsoil shall be stripped unless otherwise stipulated by the Site Engineer.
- f) Topsoil from different soil types shall be stockpiled separately and replaced in the same areas from which they were taken.
- g) The Site Engineer will identify a suitable site for stockpiling
- h) Topsoil shall be treated with care and precautions shall be taken to prevent unnecessary handling and compaction. In particular, topsoil shall not be subject to compaction greater than 1 500 kg/m² and shall not be pushed by a bulldozer for more than 50 m. Trucks may not be driven over the stockpiles.
- i) Unless otherwise instructed, topsoil shall not be mixed with any other type of material, nor contaminated with machine oils or any other pollutant.
- j) The Contractor shall ensure that the material does not blow or wash away. If the topsoil is in danger of being washed or blown away, the Contractor shall cover it with a suitable material, such as mulch and/or seed it with a fast-growing annual grass.
- k) Topsoil areas shall be demarcated in order to ensure the safekeeping of topsoil and to separate different stockpile types.
- l) Soil shall be stockpiled for as short a period as possible.
- m) Where possible a rotational system shall be implemented to reduce storage time. For short term stockpiling (for 1 - 2 months), temporary erosion measures shall be implemented, by securely covering the material (e.g., using a perforated tarpaulin or hessian). If stockpiles stand for between 3 to 6 months, a cover of rye grass (*Lolium perenne*) or *Cynodon dactylon* (kweek) shall be established around the slopes to reduce the effects of erosion washes.
- n) Stockpiles shall be monitored at weekly intervals to identify invasive plants, which shall be removed when they germinate, to prevent contamination of the seed bank.
- o) Stockpiles shall not be covered with materials, such as plastic, that may cause it to compost, or kill any seeds.
- p) Soil infested with kikuyu shall not be used for revegetation purposes. Kikuyu shall be controlled by means of spraying with Roundup, or any other comparable herbicide approved by the Site Engineer, on at least 2 occasions, at least 2 months apart, before any site clearing and stockpiling of materials takes place. Kikuyu shall be sprayed according to

the manufacturer's recommendations and then removed to a site approved by the Site Engineer.

- q) The Contractor, before indigenous vegetation clearing or soil removal for stockpiling begins, shall remove alien invasive weeds present within the construction area (*see section on alien vegetation removal*).

3.2 SPOIL MATERIAL

- a) The location of spoil stockpiles sites shall be agreed upon by the Site Engineer prior to the onset of any operations which will generate spoil materials.
- b) No spoil material shall be dumped outside the defined site unless it is being removed from the site, as approved by the Site Engineer.
- c) The Contractor shall ensure that the material does not blow or wash away. If the spoil material is in danger of being washed or blown away, the Contractor shall cover it with a suitable material, such as hessian or plastic.

CHIEF EXECUTIVE OFFICER

HPF PROPERTIES (PTY) LTD

SECTION E

REVEGETATION & REHABILITATION

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SECTION E: REVEGETATION AND REHABILITATION

SECTION SYNOPSIS

This section provides guidance pertaining to the revegetation and rehabilitation of important ecosystems and habitats on the site and the creation of an environment that enhances the physical, social and economic well-being of its residents and visitors.

Arabella is committed to the restoration/rehabilitation of all aspects of the natural environment and its community supporting natural processes, and the creation of an environment that enhances the physical, social and economic well-being of its residents and visitors.

In this regard, the focus will be on creating an integrated 'green system' of eco-corridors as an essential development intervention that can significantly contribute to enhancing the quality of life of the residents of the estate. Throughout the developments appropriately landscaped 'green areas' will be linked, or integrated, with ecological corridors. The proposed botanical conservancies will form part of the system of 'green areas' (refer to the Site Development Plan, Section A, Annexure A1).

The environmental restoration projects will focus on, *inter alia*, the clearing of alien vegetation and the implementation of management interventions that will promote biodiversity conservation.

This document provides guidelines for the revegetation and rehabilitation to be undertaken on the estate. These guidelines should be read together with Annexure E1, Manual for revegetation and rehabilitation.

1 PLANT MATERIAL

1.1 RECOMMENDED PLANT SPECIES

Only indigenous and endemic plant species will be used for the revegetation and rehabilitation of eco-corridors and for the establishment of ecological conservancies (refer to Landscaping Plan, Section B, Annexure B5).

1.1.1 SHRUBS AND TREES

- a) All plant material will be obtained either from nurseries, from the site prior to clearing or from an area in close proximity to and of the same veld type as the Site, as indicated by the ECO.
- b) Indigenous plants will be obtained either from the site prior to clearing or from an area in close proximity to and of the same veld type as the Site, as indicated by the ECO.
- c) Plants will be obtained from nurseries. Nursery plants will be grown from locally obtained seed unless approved by the ECO. The Contractor will inform the ECO of the source of his plants
- d) Plants will be obtained from their natural habitat.
- e) The Contractor will ensure that each plant is handled and packed in the approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on site in a proper condition for successful growth.
- f) Trucks used for transporting plants will be equipped with covers to protect the plants from windburn. Containers will be in a good condition. Plants will be protected from wind during the transportation thereof.
- g) No plants or plants with exposed roots will be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force-feeding at any time after purchase.
- h) The Contractor will ensure that the plants are in a good condition and free from plant diseases and pests. The Contractor will immediately remove plants containing any diseases and/ or pests from the Site.

- i) All plants supplied by the Contractor will be healthy, well formed, and well rooted. Roots will not show any evidence of having been restricted or deformed at any time. The potting materials used will be weed free.
- j) There will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist.

1.1.2 GRASS: SODS AND RUNNERS

- a) Grass sods will be clean of invasive plants or weeds.
- b) Sods will be obtained from a source approved by the ECO. Sods rejected by the ECO will be removed from the site immediately.
- c) Grass will have been grown specifically for sod purposes, mown regularly and cared for to provide an approved uniformity to the satisfaction of the ECO. It will be harvested by special machines manufactured for this purpose to ensure an even depth of cut with sufficient root material and soil.
- d) Sods will be delivered in healthy conditions and be free from weeds and disease.
- e) Sods will be obtained from an approved nursery. Nursery sods will have been maintained regularly to the required quality. Nursery grass sods will have at least a 30 mm layer of topsoil.
- f) Sods will be obtained directly from the veld. Veld sods will contain at least a 50 mm topsoil layer and the roots will be minimally disturbed. They will be obtained from the near vicinity of the site from an area selected by the ECO. The soil will be compatible with that removed from the area to be revegetated and will not have been compacted by heavy machinery.
- g) Runners will be of an approved quality and free from disease or weeds.

1.1.3 BASIC REGRASSING SEED MIX

- a) Summer seed mixture:
 - (i) *Cynodon dactylon* (germinates in summer from end September onwards and is widespread)
 - (ii) *Hyparrhenia hirta* (well-drained stoney soils).

- a) Winter seed mixture:
 - (i) *Lolium multiflorum* (widespread, germinates in winter, grows until November/December. Don't sow after September since temperatures too high).
 - (ii) *Chaetobromus dregeanus* (well-drained sandy soils).

1.1.4 INDIGENOUS VEGETATION SODS

- a) Sods of indigenous vegetation (e.g. rushes, sedges and restios) will be obtained from areas approved by the ECO, within or near the site.
- b) The Contractor will identify suitable sods, as directed by the ECO.
- c) Sods rejected by the ECO will be removed from the site immediately.
- d) Indigenous vegetation sods will be clean of weeds or invasive plants in specified areas before planting.

1.1.5 SEED

- a) The seed mix quantities and purity levels will be specified and approved by the ECO.
- b) Seed will be utilised for the cultivation of material for revegetation.
- c) Seed will be utilised for direct sowing.
- d) Seed must be pre-dried then stored under cool, dry, insect free conditions until required either for cultivation in the nursery or in the rehabilitation process. Only viable, ripe seed will be used.
- e) A record of stock relevant to the project that is held in the nursery will be provided to the ECO on a monthly basis.
- f) Seed will be stored at the Contractor's expense.

a) Commercial seed

- (i) All seed used will be labelled in accordance with the Government Seed Act No. 28 of 1961 or amendment thereof. The Contractor will furnish the ECO with signed copies of a statement from the seed merchant certifying that each container of seed delivered is fully labelled in accordance with the Government Seed Act. This certification will appear on, or be submitted with, all copies of invoices for the seed.

- (ii) Commercial seed will only be used in previously disturbed areas.

b) Harvested seed

- (i) Indigenous seed will be harvested in areas which are free of alien/ invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites, as indicated by the ECO.
- (ii) Following harvesting, the seed will be dried under cool airy conditions. The seed will be insect free and will be stored in containers under cool conditions that are free of rodents or insects. No wet, mouldy or otherwise damaged seed is acceptable.
- (iii) Seed harvested by hand from selected species, should be treated and stored separately.
- (iv) Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs will be kept apart from individually harvested seed .
- (v) Harvested seed obtained by means of vacuum harvesting, will be free of excessive quantities of organic and/ or substrate material.

1.2 MULCH

1.2.1 BRUSH-CUT MULCH

- a) The stockpiled vegetation from the clearing operations will be reduced to mulch.
- b) Indigenous plant material will be kept separate from alien material. The vegetative material, will be reduced by either mechanically means (chipper) or by hand-axing to sticks no longer than 100 mm. The chipped material will be mixed with the topsoil at a ratio not exceeding 1:1.
- c) Mulch will be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants.
- d) No harvesting of vegetation outside the area to be disturbed by construction activities will occur.

- e) Mulch will be harvested from areas in close proximity to the site, as approved by the ECO. Any collection of indigenous material from nearby veld that will not be subject to complete denudation will only be done in mature vegetation in areas identified by the ECO.
- f) Harvesting will be performed in a chequer board fashion, cutting the indigenous vegetation down to ± 100 mm above the ground, in 2 m wide strips, leaving 2 m gaps of undisturbed vegetation in between.
- g) The Contractor will take every effort to ensure the retention of as much seed as possible in mulches made from indigenous vegetation. Mulches will be collected in such a manner as to restrict the loss of seed.
- h) Brush-cut mulch will be stored for as short a period as possible, and seed released from stockpiles will be collected for use in the rehabilitation process.
- i) Fynbos vegetation cleared from the site prior to construction activities, that is suitable for mulching, will be stockpiled for later use. The Contractor will ensure that no alien species are used to make indigenous vegetation brush cut mulch without the approval of the ECO.
- j) Natural topsoil will be mixed with fynbos.

1.2.2 PROCESSED COMMERCIAL MULCHES

- a) Processed commercial mulch, in the form of a 'roll-on blanket' or fibrous product will be utilised as mulch during revegetation and rehabilitation of the site.
- b) The mulch used will be weed free, of a reputable make and approved by the ECO.
- c) The packaged fibrous mulch will be processed in such a manner as to contain no growth or germination inhibiting factors. The mulch will remain in uniform suspension in water under agitation.
- d) When packaged fibrous mulch is used together with seed and fertiliser in a hydro-seeder, the Contractor will ensure that it blends with other constituents to form homogenous slurry.

1.2.3 WOOD CHIPS

- a) Wood chips (including bark) will be utilised as mulch during revegetation and rehabilitation of the site.

- b) The chips will be no longer than 50 mm in length or breadth and will be free of seed. The ECO will approve the source of chips.
- c) The wood will be chipped during winter
- d) Chips will not be made from wood treated with preservatives.
- e) Half-composted chips will be utilised in preference to non-composted chips
- f) Indigenous seed will always be added to wood chip mulches.

1.2.4 COMPOST

- a) Compost will be utilised as mulch during revegetation and rehabilitation of the site.
- b) The compost will be well decayed, friable and free from weed seeds, dust or any other undesirable materials.
- c) Seed free, half-composted material, such as mulled-bark, will be used as an additive to extend indigenous mulch. No more than 50% compost will be used under these circumstances.

1.2.5 ALTERNATIVE PRODUCTS

Molasses extract (Voermol)/ Aquasorb/ Stoscosorb/ Synpol H or other product approved by the ECO will be utilised as mulch during revegetation and rehabilitation of the site.

1.3 SLOPE STABILISERS AND ANTI-EROSION MEASURES

1.3.1 STABILISATION CYLINDERS

- a) Stabilisation cylinders will consist of cylindrical capsules approximately 125 mm in diameter by 1.5 m in length.
- b) Stabilisation cylinders will be manufactured from biodegradable material such as hessian or of extruded biodegradable plastic netting. The plastic material will be sufficiently robust to last for a period of not less than 3 years and not more than 10 years before disintegrating under normal service conditions.
- c) Stabilisation cylinders will be filled with shredded or partly compressed pine chips or similar material. Only material passing through a 31 mm sieve with round holes and

retained on a 5 mm sieve with square holes will be used. Wood chips will be treated with Tanalith C wood preservative. Splinters and flat chips are not acceptable.

- d) A seed approved by the ECO will be included in the cylinders.
- e) Cylinders will be anchored in position using biodegradable material.
- f) Cylinders will not be used to stabilise any rock faces.

1.3.2 BIODEGRADABLE NETTING / MATTING

- a) Biodegradable netting/matting will be made from jute, sisal, coir or similar material.
- b) A 1 m² sample of the geofabric, geogrid or nylon (biodegradable) fabric will be submitted to the ECO for approval prior to procurement.
- c) The netting/matting will be sufficiently robust to last for a period of not less than 5 years under normal service conditions.
- d) Holes in the netting/matting will have a minimum size of 400 mm² and a maximum size of 900 mm² and be made from at least 4-6 mm thick cord.

1.3.3 LOGS

- a) The Contractor will ensure that for slopes of less than 1:3, the Site will be stabilised by means of 'geojute' and continuous rows of logs, secured to the slope with timber pegs, parallel to the contour. Logs will be untreated pine (or gum) poles of not less than 150 mm with a taper of not more than 75 mm over its length. Timber pegs to be treated and not less than 400 mm in length. Timber pegs must be longer if thicker logs than the minimum are used.
- b) The slope will be covered with 'geojute' prior to placing the logs. The Contractor will install Kaytech Soil Saver 292 (or a similar product) as per the manufacturer's specifications except for the pegging that is replaced by the log stabilization.
- c) Logs will be secured to the slope in such a manner that they will not become dislodged during construction and/ or planting. Logs to be secured to the slope by means of a minimum of two pegs driven into the soil not less than 250 mm deep. For logs longer than 3 m, additional pegs will be required. Log ends to be butt-jointed and plugged with wood chips or similar to prevent water from washing through at the joint. Logs will be placed at

2 m intervals with a bottom row parallel to the edge of the road. Logging of the slope to start at the top of the slope to prevent the stretching of the 'geojute'.

1.3.4 HARD STRUCTURES

All hard structures used for slope stabilisation will have natural pebble face finishes.

1.4 SOIL STABILISERS

- a) Flobond/ Hydropam or other product approved by the ECO will be utilised as mulch during revegetation and rehabilitation of the site.
- b) Soil stabilisers will consist of an organic or inorganic material to bind soil particles together and will be a proven product able to suppress dust and form an encrustation.
- c) Soil stabilisers will be of such a quality that grass and indigenous seeds may germinate and penetrate the crust. Samples of the proposed material will be supplied to the ECO before any of the material is delivered to the Site.

1.5 FERTILISER

1.5.1 HYDRO-SEEDING

Organic compost, organic peat and organic mulch will be used as fertiliser in the vicinity of the two seasonal ponds located near the stables.

Liquid fertiliser will be used where fertiliser is applied during the hydro-seeding process (the fertilizer ratio would be dependant on the seed used during hydro-seeding).

a) Mountain and acid Sandplain Fynbos

The Contractor will use 3:1:1, 3:1:2, 4:1:1, 8:1:1, or similar in a solid form and 4:1:1 (19) Phosan, or similar, in a liquid form, as approved by the ECO.

b) Granite soils

The Contractor will use 3:1:0 and 4:1:0, or similar as approved by the ECO.

c) Basic regrassing

The Contractor will use 2:3:2 and super-phosphate.

1.6 BOULDERS AND ROCKS

- a) Boulders or rocks used in rehabilitation will come from comparable geomorphological units to those that they are being utilised to rehabilitated.
- b) Where possible, boulders and rocks utilised during rehabilitation, will be collected from the Site and stockpiled prior to the commencement of construction activities on Site.

2 PLANTING**2.1 HYDRO-SEEDER**

- a) The hydro-seeder will be capable of pumping the specified seed mix, fertiliser, soil stabiliser, aqueous smoke solution, mulch and wetting-agent (mixed in water) at specified rates over the areas to be seeded.
- b) The hydro-seeder will have an agitation system, which will be sufficient to agitate, suspend and homogeneously mix the specified slurry.
- c) The slurry distribution lines will be large enough to prevent stoppage. The discharge line will be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.
- d) The slurry tank will be mounted on a travelling unit, either self-propelled or drawn by a separate unit. The travelling unit will be capable of placing the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.

2.2 SEED STORAGE

Facilities should be available to store seed, collected or required on-site, in rodent- and insect-free, cool (7 - 10 °C), dry, conditions.

2.3 SITE-SPECIFIC NURSERY

- a) On-site nursery facilities were erected for the holding of rescued plant material and the propagation of appropriate species for revegetation. The nursery was suitably located and constructed under the supervision of the ECO.
- b) The nursery will be utilised for the cultivation and maintenance of the stocks of living plant material required for the revegetation and rehabilitation of the Site.
- c) The nursery, including irrigation, water will be free of Phytophthora.
- d) Irrigation water will be de-chlorinated.
- e) Soil used to cultivate or grow plants will be weed free.
- f) The area where plants are stored will be kept free of weeds.
- g) A record of stock relevant to the project that is held in the nursery will be provided to the ECO on a monthly basis.

2.4 IRRIGATION

- a) The design and layout of the irrigation will be indicated on a plan and approved by the ECO prior to its installation.
- b) The 100 mm uPVC sleeves connecting the planters will be installed by others, but the Contractor will insure that all sleeves are in the correct position prior to the installation of paving. The irrigation system will meet the following requirements:
 - (i) It will be connected to an appropriate water supply with a water meter.
 - (ii) The system will be semi-automatic.
 - (iii) Six drippers per tree will be required (underneath mulch level)
 - (iv) The system will be operated by means of a hand-operated stopcock in a lockable metal box.

3 RECOMMENDED PROCEDURES

3.1 PREPARATION OF GROUND SURFACES

- a) Prior to the application of topsoil, the ground surface will be ripped or scarified with a mechanical ripper to a depth of approximately 150 mm.
- b) Prior to the application of topsoil, the ground surface will be ripped or scarified by hand tilling to a depth of approximately 150 mm (this specification will be used on small sites).
- c) Compacted soil will be ripped to a depth of greater than 250 mm. The ripped area will be hand-trimmed.
- d) The subsoil will be thoroughly tilled to a depth of at least 100 mm by means of a plough, disc, harrow or any other approved method until the condition of the soil is acceptable, as approved by the ECO.
- e) Where tilling is difficult, the Contractor will use rotary tillage machinery until no clods or lumps larger than 40 mm in size remain, and the mixing of soil is acceptable to the ECO.
- f) In road cuttings, a weed-free gravel / sand / organic mix will be utilised as a sub-surface layer.
- g) Topsoil will be applied (give such details as are required additional to SABS 1200D Cl 5.2.4.2).
- h) Subsequent to the addition of the sub-soil, topsoil will be spread evenly over the ripped or tilled surface to a depth of 75-150 mm on flat ground or to a minimum depth of 75 mm on slopes of 1:3 or steeper or as specified in this specification.
- i) The final prepared surface will not be smooth but furrowed to follow the natural contours of the land, with scattered rocks of varying sizes according to the natural condition of the area.
- j) Where sodding is required slight scarification will be carried out to contain the sods. The soil will be uniformly moist to a depth of 150 mm prior to planting or seeding. If this condition is not met by rainfall, the Contractor, as directed by the ECO, will carry out irrigation.
- k) In artificial wetland areas, topsoil will be removed to a depth of approximately 200 mm, the wetlands excavated, and topsoil replaced. Wetland areas are then to be selectively

composted, as determined by the ECO, and permanent irrigation systems installed where necessary.

- l) Prior to any site clearance, the wetland areas, along with 10 m buffer zones, as indicated on the Revegetation Plan (refer to **Plan 3**) are to be effectively fenced off to prevent any damage to wetland material on sites prior to transplanting.

3.2 MULCHING

3.2.1 BASIC REGRASSING

Aquasorb, Stoscosorb, Synpol H are a similar product approved by the ECO, will be applied at a rate of 24 kg/ha. The mulch will be worked into the soil prior to seeding.

3.3 SOIL STABILISATION

3.3.1 STRAW STABILISATION

- a) Straw will be utilised as a binding material in areas with deep sand.
- b) Baled straw will be placed on the cleared area, opened and spread evenly by hand or machine at a coverage rate of 1 bale per 10 m² over the area to be stabilised. It will then immediately be rotovated into the upper 100 mm layer of soil. This operation will not be attempted when the wind strength is such as to remove the straw before it can be rotovated into the sand.

3.3.2 MULCH STABILISATION

- a) Mulch will be applied by hand to achieve a layer of uniform thickness. The mulch will then be lightly worked into the topsoil layer so that it mixes with the soil and serves to bind it.
- b) The mulch will be spread at a coverage rate of 100 kg per 250 m² or 4 t/ha.
- c) Where brush-cut material is to be utilised as mulch, this material will be evenly spread across the area to a uniform depth of 25 mm. The mulch will then immediately be rotovated into the upper 100 mm layer of soil. This operation will not be attempted when the wind strength is such as to remove the mulch before it can be rotovated in.

- d) In very rocky areas a layer of mulch will be added prior to adding the top-material. The mulch must then be worked into the top-material to bind it.
- e) Alien vegetation mulch will be in a non-seed bearing state and will be chipped prior to application. The preparation of alien vegetation mulch will be done at source.
- f) The Contractor will cut bush to a height of 400 mm above ground level from designated areas. This vegetation will then be passed through the chipping machine as above, and be stockpiled for later use as mulch.
- g) If the area is exposed to strong wind the mulch stockpile will be covered with a fine nylon net with 100 mm × 100 mm openings.

3.3.3 COMPOST STABILISATION

The soil will be stabilised by placing and lightly compacting a 75 mm layer of compost over the designated areas or by working a 75 mm layer of compost into the ground to a depth of 150 mm.

3.3.4 GRAVEL STABILISATION

- a) The soil will be stabilised by the placing of a 50 mm layer of gravel wearing course quality material complying with the physical properties specified in subclause 3.2.2 of SABS 1200 ME.
- b) The material will be placed, spread, trimmed and compacted by means of 3 passes of the same compaction equipment used for the bulk earthworks.

3.3.5 STABILISATION OF STEEP SLOPES

- a) The Contractor will take measures to protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. The Contractor will take any other measures that may be necessary to prevent surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
- b) If runnels or erosion channels develop, they will be back-filled and compacted, and the areas restored to a proper condition. The Contractor will not allow erosion to develop on a large scale before effecting repairs.

- c) Where artificial slope stabilisers are used, these will be applied to the slope, preferably before topsoiling, but according to the detailed construction plan and as specified in this specification.
- d) Near vertical slopes (1:1 to 1:2) will be stabilised using hard structures following specifications.
- e) Where the slopes are 1:3 to 1:6 they will be logged or otherwise stepped (using stabilisation cylinders or similar) in order to prevent soil erosion. Logs/ cylinders must be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope. These logs/ cylinders must be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.
- f) In areas where slopes are less than 1:6, horizontal grooves, willow steps or ledges parallel to contours will be made on the cut slopes. They will be made at random to appear natural.
- g) In areas where slopes are less than 1:6 these slopes will be stabilised by using logs in parallel rows, or stabilisation cylinders fastened randomly into position or using biodegradable netting. These structures will hold the top-material on the slopes and serve as erosion prevention structures.
- h) Willow slopes will be stabilised using commercial available and approved anti-erosion compounds.
- i) Cut and fill slopes will be shaped and trimmed to approximate the natural condition and contours as closely as possible and be undulating. Levels, incongruous to the surrounding landscape, will be reshaped using a grader and other earthmoving equipment.
- j) All cut and fill slopes will be left as rough as possible, and will contain ledges to facilitate the accumulation of topsoil. The ledges will be dug at random to appear natural. Furthermore, the Contractor will ensure that any embedded rocks that will not pose a danger to traffic, remain on the slopes.
- k) Boulders / rocks, collected on the site before disturbance, will be scattered at a predetermined density approved by the ECO.
- l) Any eroded areas deeper than 50 mm will be either trimmed down by back cutting the slope face or repaired to the satisfaction of the ECO with boulders and soil or any other approved method.
- m) Catchwater drains will be installed above the cut slopes.
- n) Where cut slopes are greater than 4 m in height, the Contractor will construct berms at regular intervals.

- o) Natural water flow paths will be identified and subsurface drains (using riprap or superfluous rock material) or surface drains and chutes (*use water speed control structures where necessary*), preferably using cemented natural rock, will be constructed along the flow paths.

3.4 FERTILISATION

3.4.1 TREES AND SHRUBS

One third of the fertiliser will be scattered at the bottom of the hole, one third dug into the topsoil to be replaced in the hole and the remainder watered into the soil at surface level.

3.5 TIMING OF PLANTING

- a) Reseeding will occur in late Summer to Autumn (January to March).
- b) Replanting will occur during April / June.
- c) Wetland preparation will occur during Autumn and planting will occur during early Winter after the first rains (May to June). If planting occurs in a dry late Autumn (end March) or early Winter (April to June) season it will be necessary to irrigate plants to ensure their successful establishment.
- d) Plant material will be planted into the ground within a maximum period of 5 days after delivery to the Site, unless otherwise specified by the ECO.

3.6 PLANTING GUIDELINES

3.6.1 RESEEDING

- a) Aqueous smoke solution (= smoke water) treatment will occur after the first Early Winter rains following sowing.
- b) If mulching is done at the end of autumn to early winter, aqueous smoke solution (= smoke water) will be applied as part of the hydro-mulch mixture.
- c) For natural areas a 1 delbs solution of aqueous smoke will be diluted in a ratio of 1:150.
- d) Seed will not be left exposed to smoke water.

- e) Hydro-seeding machines will be thoroughly cleaned after each operation and before different seed mixes of different origins are introduced into it. The mixture will be kept uniform during the seeding operation by means of a power-driven agitator.
- f) The following components will be added to the hydro-seeding slurry:
 - (i) Compost.
 - (ii) Fertiliser.
 - (iii) Soil binding agents (e.g. Surfisol).
 - (iv) Wetting agents (e.g. Aqua-gro).
 - (v) Seed and growth stimulants.
 - (vi) Micro-organisms.
 - (vii) Anti-erosion compounds.
- g) Where broadcast seeding is carried out, the seed will be sown evenly over the designated area. During sowing half the seed will be sown by the sower moving in one direction and the remainder by the sower moving at right angles to the first sowing.
- h) In confined areas the seed will be covered by means of rakes or other approved hand tools. Broadcast seeding will not be done under windy conditions.
- i) Drill seeding will be done in rows not more than 0.25 m apart. The seeding will be done with an approved grain drill with fine seed attachment or a combination grass planter and land packer or pulveriser. A combine grain and fertiliser drill may be used where appropriate, as directed by the ECO.
- j) Reseeding will only occur during a period approved by the ECO.
- k) The Contractor will demonstrate to the ECO in a trial section that the application of the materials required can be made at the rates specified in this specification.

3.6.2 REGRASSING

Grass seed will be applied at the following rates (*specify applicable grass mix depending on season and nature of soils*):

a)	Summer mix -	<i>Cyndon dactylon</i>	20 kg/ha
		<i>Eragrostis tef</i>	10 kg/ha
		<i>Hyparrhenia hirta</i>	5kg/ha
b)	Winter mix -	<i>Lolium multiflorum</i>	10kg/ha
		<i>Ehrharta villosa</i>	5kg/ha

Chaetobromus dregeanus 5 kg/ha

3.6.3 GRASS RUNNERS

- a) The runners will be planted within 30 hours of being harvested. Storage in the interim period will be in aerated bags under cool dry conditions. The runners will be planted at even spacing, by hand or mechanically.
- b) Only fresh runners that are in good condition and have not dried out, will be accepted. These runners will be planted in trenches not less than 50 mm deep with leafy ends, and not roots, exposed.
- c) The runners will be well watered after planting and rolled with a light agricultural roller when the soil has dried sufficiently, as directed by the ECO.

3.6.4 SODDING

- a) Prior to sodding, the area will be re-innocolated with microbes contained within natural veld sods. Veld sods of restios or grasses will be collected, as directed by the ECO, and replanted in willow hollows for this purpose.
- b) Re-innocolation will occur during or immediately after a rain event. Innocolation sods will be watered lightly after placement.
- c) Revegetation sods will be planted in strips to reduce erosion.
- d) Sodding will take place on moist, rock free topsoil that has been scarified.
- e) Sods, once harvested or delivered from a nursery, will not be allowed to dry out and will be planted within 30 hours of being removed from the soil or growing medium. If necessary, they will be lightly watered prior to planting.
- f) Sods will be planted so they abut tightly against one another. The first row will be in a straight line with subsequent rows planted so that the joints are staggered. Any gaps will either be planted with a sod reduced to the gap size or filled with topsoil.
- g) Where grass sods are planted on slopes steeper than 1:2, wooden stakes of 500 mm diameter will be used to anchor the sods in position.
- h) In the absence of rain, sods will be well watered after planting and not be allowed to deteriorate through a lack of moisture.

- i) Where grass sods are planted in the floodplain, wooden stakes of 500 mm in diameter will be used to anchor the sods in position.

3.6.5 TREES, SHRUBS AND HERBS

- a) The Contractor will be provided with an approved planting/landscaping plan.
- b) Where planting is not direct, the plants must be brought to an approved holding area in the intended planting area where they will be suitably maintained. The Contractor, as directed by the ECO, will provide sufficient shade and water. The operation of relocation from the nursery to the planting site must occur on the same day so as to minimise losses through death and to maintain or improve their condition at delivery.
- c) During transplanting of indigenous plants care will be taken to ensure that they are not exposed to the sun. The roots as well as the leaves will be covered with wet hessian to limit transpiration during transportation and storage. Plants will be kept in this state for as short a time as is reasonably possible.
- d) Planting will occur as specified in this specification or planting/ landscaping plan.

3.6.6 PLANTING GUIDELINES

- a) The size of holes will be sufficiently large to ensure that the entire root system is well covered with topsoil, without having to be compressed. The soil around the roots of the plants being transplanted will not be disturbed. Topsoil and subsoil from the hole will be stored nearby to be replaced to the same depth intervals from which it was originally removed.
- b) Individual spacing between trees will be 2-3 m and clumps will consist of 6-12 trees. The trees in the clumps will be planted in staggered rows of 5 trees per 6 m² with low to medium tall shrubs planted between the clumps. The clumps will be spaced at about 8-12 m distance.
- c) In the case of transplanted trees up to 3 m tall, the hole size will be 2 500 mm × 2 500 mm in width and 1 800 mm deep
- d) Shrubs will be planted 1-2 m apart around the trees and in the intervening areas between the clumps or as circumstances dictate.
- e) Plugs of herbs will be planted at densities of up to 12 per 1 m².

- f) Bulbous plants will be planted as features in selected areas and will be protected from moles and baboons using rock linings to the holes and surface soil.
- g) Before the placement of the plant specimens into prepared holes, the holes will be watered substantially.
- h) One to two handfuls of bone meal will be added to the hole before planting.
- i) Plants will be carefully transplanted into holes.
- j) Plant holes will be back-filled using a mixture of two-thirds loamy to sandy topsoil to one-third compost. Where the natural soil is very clayey or heavy, sand will be added at a ratio of one-third soil, one-third compost and one-third sand. The soil and compost / sand additives will be well mixed to the satisfaction of the ECO.
- k) The topsoil will be replaced at the same depth intervals at which it was excavated. The soil will be lightly compacted and well watered.
- l) Care will be taken to keep root damage to a minimum when transplanting seedlings. Where plants have a taproot this will not be cut. Excess foliage, flowers and side branches will be pruned as directed by the ECO.
- m) Coarsely chipped bark from pine trees will be supplied and placed in a 75 mm deep layer at the bases of the trees following planting.
- n) Large rocks will be placed around the base of planted trees in fire-prone environments.
- o) Plants planted at the waters edge in wetlands and rivers will be planted as follows:
 - (i) Wetland material harvested from existing wetland areas will be transplanted directly to the newly created wetland area, along with as much soil, and surrounding material as possible.
 - (ii) Indigenous shrubs and small trees will be planted 3 m apart
 - (iii) Palmiet will be planted 1- 2 m apart
 - (iv) Bulrushes, reeds, sedges and herbs will be planted in sods 0.4-0.5 m apart or as circumstances dictate.
- p) Plants will be watered immediately after transplanting to ensure that the soil is wet around the plants. If necessary additional soil must be added after initial watering to fill any subsidence back up to ground level.

3.7 MAINTENANCE

3.7.1 IRRIGATION

- a) The Contractor will be responsible for maintaining the desired level of moisture necessary to maintain vigorous and healthy growth. The quantity of water applied at one time will be sufficient to penetrate the soil to a minimum depth of 800 mm, where appropriate, and at a rate that will prevent saturation of the soil.
- b) Water used for the irrigation of revegetated areas will be free of chlorine and other pollutants that will have a detrimental effect on the plants.
- c) All seeded, planted or sodded grass areas and all shrubs or trees planted will be irrigated regularly at the specified intervals.
- d) Grassed areas will require irrigation coverage of 100% and a permanent watering programme. The watering programme will be modifiable to accommodate natural climatic variations.
- e) Revegetated areas will require irrigation coverage of 100% and a modifiable watering programme.
- f) Were an irrigation system is required, the Contractor will be responsible for its installation and maintenance.
- g) In the event of a delay between the planting programme and installation of the irrigation system, a water truck will be utilised for watering, according to a programme approved by the ECO.
- h) Every effort will be made to reduce irrigation overspray onto natural patches.
- i) The Contractor will water the planted areas as necessary, using a suitable fine spray which will not disturb the vegetation and which will not cause any erosion.
- j) The Contractor will ensure that the planted area receives 25 mm of irrigation water, including rain, per week applied uniformly over the whole area.
- k) The Contractor will supply all water required and will provide all pipework, pumps, irrigation equipment and other plant necessary.

3.7.2 FERTILISATION

- a) The Contractor will strictly control the use of fertilisers.
- b) Care will be exercised strict control when using such materials near sensitive natural areas, so as to avoided contamination of these areas.
- c) The Contractor will manage the fertilisation programme for different areas of planting.
- d) Additional fertiliser will be applied at the intervals specified with due regard to favourable climatic conditions and the state of growth of the vegetation. Application will be by hand or approved mechanical spreader and will provide uniform distribution.
- e) Fertilisers will be suitably sealed and stored in a location approved by the ECO.

3.7.3 WEEDING AND MOWING

- a) The Contractor will be responsible for controlling all woody alien/ invasive species including kikuyu grass or other invasive species. The Contractor will ensure that all weeds and alien/ invasive species are removed as specified.
- b) The Contractor will be responsible for ensuring that the site remains free of kikuyu during the contract and establishment period.
- c) Where seedlings occur sparsely, they should be removed manually.
- d) Where dense stands of seedlings are present a foliar spray of Garlon (0.5% concentration in water with a wetting agent such as Actipron, and a blue dye to indicate area applied) will be utilised.
- e) Larger individuals of alien/ invasive species will be controlled by cutting or loping and treating the cut stumps with herbicide to prevent regrowth (e.g. a 2% Garlon solution in diesel oil coloured with a red dye to indicate which stumps have been treated).
- f) Alien/ invasive plants and weeds will not be stockpiled, they should be removed from the site and dumped at an approved site.
- g) If, during the establishment period, any noxious or excessive weed growth occurs or other undesirable vegetation threatens to smother the planted species in the seeded or planted areas, such vegetation will be removed.
- h) The Contractor will mow the grass in specified grassed areas or on road verges at intervals ordered by the ECO. Grass cuttings will be collected and disposed of as directed by the

ECO. The grass will be mown at regular intervals to stimulate lateral growth. The first cutting will take place when the grass is 50 mm high and thereafter the height will be maintained at between 30 and 50 mm.

- i) If during the establishment period, non-indigenous weeds or other non-indigenous plants are present in the planted areas, such vegetation will be removed by hand.

3.7.4 DISEASE AND PEST CONTROL

The Contractor will inspect all plant materials at least once a month to locate any diseased or insect pest infestation. Once the nature and species of disease/ pest has been identified the Contractor will submit a method statement outlining the proposed method of control to the Site Engineer for approval, prior to application of proposed control measure.

3.7.5 PRUNING

- a) All plant material will be kept free from dead wood, broken branches, dead flower heads or otherwise harmful or objectionable branches or twigs. All other pruning will be done only as directed by the ECO.
- b) All pruning wounds greater than 12 mm diameter will be painted with an approved tree wound paint.
- c) Cutting equipment will be kept sterilised to avoid spreading fungal infestations.

3.7.6 TREE MAINTENANCE

- a) Trees should be watered three times weekly in summer and once weekly in winter unless sufficient rain occurs.
- b) All tree guards will be maintained in good condition. This includes ensuring that tree ties remain taut and the replacement of all such accessories when required. Where the tree ties damage the trees, this will be rectified immediately.
- c) Trees that die or become unhealthy from any cause or appear to be in a badly impaired condition will be promptly removed and replaced, or as soon as the weather permits, as directed by the ECO. All replacements will be trees of the same kind and quality as those originally planted.

4 QUALITY CONTROL ON PLANT MATERIAL

4.1 SEED

4.1.1 COMMERCIAL SEED

- a) Each lot of commercial seed will be subject to sampling and testing at the discretion of the ECO.
- b) Sampling and testing will be in accordance with the latest Rules and Regulations under the Government Seed Act.

4.1.2 HARVESTED SEED

- a) Purification will be to an agreed standard
- b) The quantities and quality of bulk harvested seed will be assessed according to seed to volume ratios.

CHIEF EXECUTIVE OFFICER

HPF PROPERTIES (PTY) LTD

ANNEXURE E1

REVEGETATION AND REHABILITATION MANUAL

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1 INTRODUCTION

The ECO would at all times obtain advice from specialists regarding different aspects of the rehabilitation procedures. The establishment of an Environmental Advisory Team can help to avoid costly environmental mistakes. Regular education of temporary and permanent construction staff to create environmental awareness will be beneficial to the project and to the community at large.

The personnel on site should at all times be made aware that the fynbos environment is a valuable national asset that is sensitive to disturbance, pollution and fire. All activities should be undertaken with due consideration for potential deleterious consequences.

Where required, the Contractor will revegetate all areas disturbed as a result of construction and associated activities to the satisfaction of the ECO. The Contractor will monitor and ensure the success of the rehabilitation process to the satisfaction of the ECO.

The revegetation project is to be undertaken on a habitat-specific basis. This is to ensure that appropriate plant material is used in the various revegetation sites. For example, seeds that are harvested from indigenous plants occurring on a specific soil type will be used to revegetate an area with the same soil type. Distinction will be made in the treatment of different habitat types.

As a general principle only plant material collected from the specific environment being rehabilitated should be used to avoid the introduction of genetic material from elsewhere. Subsequently, only appropriate indigenous plant species that have occurred historically on the site will be chosen for restoration purposes.

2 SCOPE

The aim of revegetation is to establish, upon completion of the contract, indigenous vegetation or other appropriate plant cover in an aesthetically pleasing manner, and thereby to enhance the ecological integrity of the area.

This manual intends to assist in providing information for quality control and the evaluation of the results of various stages throughout the revegetation process. The ECO must appoint a suitably qualified consultant to advise him/her on the revegetation aspects of the contract.

This document covers specifications and procedures for the establishment and maintenance of vegetation on slopes, fills, cuts, borrow pits, road reserves or any other area where specified or ordered by the ECO that such vegetation is required and procedures related to the establishment and maintenance of this vegetation.

3 MATERIALS

3.1 PLANT MATERIAL

3.1.1 SHRUBS AND TREES

The Contractor will supply all plants according to the complete and approved Plant List. Plants will be obtained either from nurseries or from their natural habitat. Nursery plants will be grown from locally obtained seed unless approved by the ECO. The Contractor will inform the ECO of the source of his plants. Indigenous plants will only be obtained from sources approved by the ECO.

Highly disturbed environments (including those heavily invaded by exotic invasive plants) may require the sourcing of soil or plant material from outside the immediate habitat, due to the lack of suitable material in the immediate area. Such translocation of soil or species will be planned in accordance with the general guidelines given in this manual (see introduction for basic principles).

The Contractor will take full responsibility for the transportation of the plants. Each plant will be handled and packed in the approved manner for that species or variety, and all the necessary precautions will be taken to ensure that the plants arrive at the site of the works in a proper condition for successful growth. Trucks used for transporting plants will be equipped with covers to protect the plants from windburn. Containers will be in a good condition. Plants must be protected from wind during the transportation thereof. No plants or plants with exposed roots will be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force feeding at any time after purchase. The plant material will be planted into the ground within

a maximum period of 5 days after delivery to the site or for an appropriate period as determined by the ECO.

The Contractor will ensure that the plants are in a good condition and free from plant diseases and pests, such as Argentine ants. Plants containing these diseases and pests will be rejected and immediately removed from the site by the Contractor. Furthermore, all plants supplied by the Contractor will be healthy, well formed, and well rooted. Roots will not show any evidence of having been restricted or deformed at any time. The potting materials used will be weed free. The ECO may reject plants notably smaller or of a less quality than those specified.

Prior to planting, all plant material must be placed on site for inspection by the ECO for quality and position. The Contractor must therefore inform the ECO when planting is commencing to facilitate the above-mentioned inspection. The Contractor must replace any plant that does not comply with the Project Specification and the ECO's approval. Deviations in quantities or of species will only take place after written approval has been obtained from the ECO.

There will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist.

Under no circumstance will any unauthorised substitution of plant material (both in quantity or number) be allowed unless prior written application to and approval from the ECO has been obtained. The ECO will consult with the appropriate specialists about changes proposed prior to their acceptance.

3.1.2 GRASS SODS AND RUNNERS

Grass sods or runners (stolons) will be of the species specified in the Project Specification. Sods and runners of various indigenous grasses (such as, buffalo grass (*Stenotaphrum secundatum*) and kweek (*Cynodon dactylon*)). No kikuyu (*Pennisetum clandestinum*) or other invasive grasses or other species may be used in areas that adjoin natural vegetation. Sods will be clean of invasive plants (or living parts of these plants) in specified areas before planting. Sods will be obtained from a source approved by the ECO. This implies that the ECO has the right to inspect material at

source and can accept or reject the material either before, on or after delivery. Sods rejected by the ECO will be removed from the site promptly. Sods will only be used where specified by the ECO.

Grass will have been grown specifically for sod purposes, mown regularly and cared for to provide an approved uniformity to the satisfaction of the ECO. It will be harvested by special machines manufactured for this purpose to ensure an even depth of cut with sufficient root material and soil.

Sods will be delivered in healthy conditions and be free from noxious weeds and disease. Sods may be obtained either from a nursery or directly from the veld as specified in the Project Specification. Veld sods will contain a 50 mm topsoil layer and the roots will be minimally disturbed. They will be obtained from the near vicinity of the site from an area selected by the ECO. The soil will be compatible with that removed from the area to be revegetated and will not have been compacted by heavy machinery. Nursery sods will have been maintained regularly to the required quality. A 30 mm layer of topsoil will be acceptable for nursery grass sods.

3.1.3 INDIGENOUS VEGETATION SODS

These sods (e.g., rushes, sedges and restios) may be obtained from areas approved by the ECO, within or near the site where a suitable type and density of vegetation and type of soil are found. The Contractor will identify suitable sods, as directed by the ECO. Conditions applicable to quality of sods will be as specified for grass sods.

3.1.4 SEED

All necessary permits, and written consent, to collect this seed from sites must be obtained prior to commencement of the contract.

Variation in quantities or species collected must be through written mutual assent. The seed is to be used for cultivation of material for rehabilitation or for direct sowing.

Seed must be pre-dried then stored under cool, dry, insect free conditions until required either for cultivation in the nursery or in the rehabilitation process.

A record of stock relevant to the project that is held in the nursery will be provided to the ECO on a monthly basis. The ECO has the right to inspect the nursery and relevant stocks held therein periodically at mutually agreed times.

Where seed requires aqueous smoke solution (= smoke water) to stimulate germination, then the concentration of the smoke solution must be stipulated prior to use or to any claims being submitted for the cost thereof.

Excess seed or plants not required for rehabilitation may be sold or otherwise disposed of at the end of the contract, preferably to inhabitants living near to the area being restored.

The introduction of annual pioneer seed of local, similar or non-invasive exotic origin can be used under specified conditions. This will include annual non-invasive grass available from commercial sources. The selection criteria should include the evaluation of the following:

- a) Effectiveness of the species.
- b) Persistence of the species.
- c) Time of sowing (summer or winter sowing will benefit different grass species).
- d) Cost and aesthetic impact of the species.
- e) Vegetation type of the area under consideration.

Local species (particularly of woody shrubs or trees) are used to augment the soil borne seed to enhance the process of revegetation. Seed from a nearby local natural environment is generally better suited to survive than that from further away. They serve both an aesthetic function as well as to bind the soil and to create a suitable microclimate for other species.

The seed of pioneer species tend to germinate rapidly under favourable conditions, while species of later successional stages tend to take longer to appear after sowing. *Erica* seedlings, for instance, generally only become visible after 2-3 years.

a) Commercial Seed

All seed used will be labelled in accordance with the Government Seed Act No. 28 of 1961 or amendment thereof. The Contractor will furnish the ECO with duplicate signed copies of a statement from the seed merchant certifying that each container of seed delivered is fully labelled in accordance with the Government Seed Act, and is at least equal to the requirements as specified in the Project Specification. This certification will appear on, or be submitted with, all copies of invoices for the seed.

Each lot of commercial seed will be subject to sampling and testing at the discretion of the ECO. Sampling and testing will be in accordance with the latest Rules and Regulations under the Government Seed Act.

Commercial seed should only be used in previously disturbed areas.

b) Harvested seed

Where seed, which is indigenous to the area but not available commercially, is specified, the seed will be hand harvested from selected species and treated and stored separately. Seed will be harvested in an alien-free environment either at the site prior to clearance or from suitable neighbouring sites, indicated by the ECO.

After harvesting, the seed will be dried under cool airy conditions. Purification must be to an agreed standard. Quantities are determined by mass according to the relevant species. Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs will be kept apart from individually harvested seed and quantities and quality assessed according to seed to volume ratios. The seed will be insect free and will be stored in containers under cool conditions that are free of rodents or insects. No wet, mouldy or otherwise damaged seed is acceptable. Germination tests are invaluable to determine whether the seed is of an acceptable standard.

3.2 MULCH

Mulch is used in rehabilitation to bind soil thereby reducing wind and water erosion. It serves to assist in the development of soil, to hold moisture and the breakdown products provide nutrients. Half-composted material is better than raw material as it retains more moisture and the raw material utilises more nitrogen from the soil than that which is half-composted. In a garden situation mulch is used as a cover to reduce weed growth and to reduce evaporation. In the natural situation a thick mulch cover inhibits regeneration of indigenous seed. It is usual to mix mulch into the top 100 mm layer of soil during restoration.

Inoculation of raw, uncomposted mulch with bacteria is essential to ensure that it starts breaking down rapidly enough in areas without natural topsoil.

Mulch material that contains viable seed of declared weeds, which through their invasive or other deleterious qualities are ecologically undesirable, or threatens adjacent areas, is unacceptable. Mulch obtained locally from indigenous weed-free vegetation should be used in preference to imported mulch, since there is a greater likelihood of viable indigenous species being present in it.

Straw tends to inhibit seed germination and should only be used where none of the alternatives listed below are available or under particular specified conditions (e.g., to bind loose disturbed dune sand) and only then when it has been suitably dried out and is partly decomposed. Wood cellulose mulch will also not be used in an unprocessed form (bark, for instance, should be mulled).

At least 5 days prior to the start of grassing, or similar rehabilitation works, the Contractor will notify the ECO of the source or sources from which mulch materials are to be obtained and indicate the quantities thereof to be supplied. Representative samples of the materials, proposed for usage, will be furnished for approval. One or more of the mulches specified in subclauses 3.2.1 to 3.2.4 will be used.

3.2.1 BRUSH-CUT MULCH

As much mulch as possible can be harvested from areas that are to be denuded of vegetation during construction activities, provided that it is clean of alien invasive plants carrying seed. Harvesting vegetation outside the area to be disturbed by construction activities is not desirable. Where there is insufficient indigenous vegetative material on the construction site, a mulch may be harvested from an area in close proximity to the site. Any collection of indigenous material from nearby veld will only be undertaken in mature vegetation in areas identified by the ECO, subject to evaluation by a qualified botanist.

Harvesting will be performed in a mosaic pattern, cutting the fynbos down to ± 100 mm above the ground, in 2 m wide strips, leaving 2 m gaps of undisturbed vegetation in between. This will have a short to medium term visual effect on the area, but will not impact the long-term growth or survival of the fynbos, as the rootstocks are left intact and sprouting takes place soon after cutting.

Every effort should be made to retain as much seed as possible in mulches made from indigenous vegetation. This implies that it should be collected when most of the dominant species are in seed, and in such a manner as to restrict the loss of seed, especially of wind-dispersed species. Furthermore that it should be stored for as short a period as possible, or that seed released from stockpiles is collected for use in the rehabilitation process. Mulch obtained from markedly different habitats should be stored separately and reapplied later to habitats similar to that from which it was obtained.

Fynbos vegetation cleared from the site prior to construction activities, that is suitable for mulching, can be stockpiled for later use. The Contractor will ensure that no alien species are used to make fynbos brush cut mulch without the written approval of the ECO. Note that mulch from alien invasive species that is free of seed and does not reproduce from vegetative pieces may be employed to good effect.

Fynbos mulch is generally reasonably cheap to obtain and contains seeds local to the area. Decomposition of this mulch type is improved if natural topsoil, containing bacteria from the area, is mixed in the mulch.

3.2.2 PROCESSED COMMERCIAL MULCHES

Processed commercial mulch may take the form of a 'roll-on blanket' or be a fibrous product (often in a bag). The mulch used must be weed free, of a reputable make and approved by the ECO. The 'roll-on blanket type' is of aspen wood fibres contained within a nylon or other synthetic mesh. The packaged fibrous mulch, usually of wood or natural plant fibre base, must be processed in such a manner as to contain no growth or germination inhibiting factors. The mulch should remain in uniform suspension in water under agitation. When used together with seed and fertiliser in a hydro-seeder, it should blend with other constituents to form a homogenous slurry. Commercial mulches are to be used when natural brush-cut mulches are not available.

3.2.3 WOOD CHIPS

Wood chips (including bark) may be of pine, wattle, vine or eucalypt origin. The chips will be no longer than 50 mm in length or breadth and will be free of seed. The source of chips will be approved by the ECO. The wood must be chipped at the right season to ensure that it is free of seed. Chips should not be made from wood treated with preservatives. Half-composted chips are preferable as they function far better in the development of soil. Eucalypt, pine and other wood chips rich in natural resins compost more slowly than those with low concentrations.

Wood chips can be used to extend indigenous mulches. They are also appropriate where no indigenous mulch is available and a fairly heavy soil is present. Indigenous seed must always be added when using these mulches. Inoculation with composting microbes, such as are present in topsoil from the surrounding area, hastens the breakdown of the chips and the development of topsoil.

3.2.4 COMPOST

Where compost is used as a mulch, the compost will be well decayed, friable and free from weed seeds, dust or any other undesirable materials. Compost will not be used in areas of pristine fynbos, unless otherwise directed by the ECO.

Compost can be used to extend indigenous mulches. It is also appropriate where no indigenous mulch is available and a fairly heavy soil is present. Indigenous seed must always be added when using this mulch type. It is usually a more expensive material to use to improve the topsoil but is more effective as the necessary composting microbes are present in the compost.

3.2.5 ALTERNATIVE PRODUCTS

Molasses extract (Voermol) or other product approved by the ECO may be used as a mulch, either independently or as a supplement to a brush-cut or processed mulch.

Molasses are biodegradable and are usually expensive. They are not commonly used in the Fynbos region. The soil must have indigenous seed in it.

3.3 STABILISATION CYLINDERS

Stabilisation cylinders are cylindrical capsules approximately 125 mm in diameter by 1.5 m in length. They will be manufactured from biodegradable material such as hessian or of extruded biodegradable plastic netting. The plastic material must be sufficiently robust to last for a period of not less than 3 years and not more than 10 years before disintegrating under normal service conditions.

Stabilisation cylinders must be filled with shredded or partly compressed pine chips or similar material. Only material passing through a 31 mm sieve with round holes and retained on a 5 mm sieve with square holes will be used. The wood chips will be treated with Tanalith C wood preservative to retard degradation. Splinters and flat chips are not acceptable.

Seed should be included in the cylinders to conceal their appearance. Cylinders are anchored in position using biodegradable material. These cylinders should not be used on rock faces as they dislodge easily under this situation.

These cylinders are primarily used to hold topsoil in position. They are inadequate as primary mulches to obtain a regular cover of vegetation

3.4 BIODEGRADABLE NETTING / MATTING

Biodegradable netting/matting made from jute, sisal, coir or similar material is acceptable. The netting/matting must be sufficiently robust to last for a period of not less than 5 years under normal service conditions. Holes in the netting/matting will have a minimum size of 400 mm² and a maximum size of 900 mm² and be made from at least 4-6 mm thick cord. Netting is held in place using biodegradable pegs. A 1 m² sample of the geofabric, geogrid or nylon (biodegradable) fabric will be submitted to the ECO for approval prior to procurement.

The netting is usually fastened over a suitably prepared loose substrate to stabilise it. It's use is inappropriate on rocky or very steep terrain, without considerable manipulation (cutting holes for rocks to protrude) or where remains of indigenous vegetation are present as it cannot be laid properly. It does not offer sufficient purchase to retain soil on relatively steep slopes. Fairly large holes are necessary to allow seed to germinate (small holes inhibits the germination of indigenous seed) and plants to grow through the mesh. A thick cord creates a superficial micro-habitat with relatively low wind velocity that protects the substrate from wind erosion, reduces evaporation and offers some protection to seedlings. This technique is suitable for fairly loose textured substrates. Topsoil with indigenous seed that is spread thinly over the netting on flat to gentle slopes is effectively held in place by the netting. The higher costs involved in the purchase of the netting are offset by the stability achieved in the topsoil.

3.5 BOULDERS AND ROCKS

Any boulders or rocks used in rehabilitation should come from the same geomorphological units they were removed from. Rounded boulders, for instance, are characteristic found in rivers.

Remove all boulders and large rocks prior to commencement of construction and stockpile these to one side of the construction working area.

Boulders and rocks create a natural effect to hide disturbances in rocky areas. They are effective in providing local shelters from wind and strong currents. Rocks are used to protect young trees from damage such as from fire. Smaller rocks are placed around bulbs to protect them from moles, for instance.

3.6 ROCK STAINS

A bitumen-based stain (viakote bitumen primer solution), for instance, can be applied to fresh rock cuts, as directed by the ECO, to assist in reducing the visual impact of freshly cut rock-faces and boulders. The stain will not inhibit plant growth.

The stain will be diluted 1:1 with either turpentine or paraffin and then applied at a rate of 1 litre per every 20-25 m² of rock face, or according to product specifications.

Stains are used to soften the light colours of newly cut rock faces. It should be applied so as to produce an uneven mottled, near-natural, appearance. It is often appropriate to test mixtures and application techniques to achieve an acceptable appearance.

An alternative staining and stabilising procedure is the use of a cement-based screed or grout that is sprayed onto rock faces. It is relatively easy to apply and the materials are relatively cheap. Application is limited by the reach of the application equipment. It provides some stability. Disadvantages are that a uniform colour results and the alkaline cement base suppresses regeneration of fynbos plants growing in an acid environment.

Note that the bitumen-based stain is not the same as a bitumen stabiliser. Bitumen has been used to spray over flat or slightly sloping soil to bind the soil and to restrict erosion. As it is biodegradable it breaks down in time and allows vegetation to penetrate through the layer. Sand particles also tend to stick to the bitumen thereby hiding the initial dark colour. This is relatively rapid to apply and is easily procured. Disadvantages are that it is unsightly in the first few months. It remains visible for up to at least 20 years after application. The dark colour absorbs heat in summer resulting initially in the natural selection of drought tolerant plants that are a bit stunted by the drier conditions.

3.7 SLOPE STABILISER

Where, in the opinion of the ECO, the slope is too steep to hold soil for any period without assistance, artificial stabilisers may be used according to particular requirements. The following are some materials that may be used:

- a) Vegetation cylinders
- b) Geogrids
- c) Logs
- d) Hard structures

The composition of vegetation cylinders is outlined above. Biodegradable, hessian based, netting covers are used to hold sandy slopes in place to reduce soil movement and to hold any materials spread on the slopes in position. Very dense netting (with small apertures) must be avoided as they inhibit germination. The fabric should be coarse so that it can provide a low wind speed at the soil surface.

Logs are used when they are available at low cost and where the substrate is relatively soft so that they can be partially embedded in the substrate. They are fastened in position (using biodegradable pegs) in parallel lines approximately one meter apart (closer with steep slopes) so that no openings are apparent beneath them once they are in place and so that they hold a reasonably quantity of topsoil in position. The topsoil is applied after they have been positioned. Logs are not appropriate in rocky undulating areas as they do not fold to conform to the changes in relief. Water tends to erode channels under the rocks on fairly steep, rocky areas.

Natural rock wall structures, using conventional building methods or in forms with slurry forced between the rocks and cleaning of the visible faces thereafter give a pleasing relatively natural appearance. These structures are expensive and are only used when the need justifies the cost. Concrete preformed shutters, preferably with pebble faces, are effective under certain circumstances. Hard stabilisation using stacked precast concrete retaining structures (preferably with natural pebble face finishes), such as 'terraforce or löffel' blocks, are used when the slopes are very steep. Soil and plants are placed in soil in the hollows to hide the unnatural contours. The incorporation of a watering system on north-facing slopes is sometimes necessary. Rock-filled

gabion baskets are less expensive to establish but require a wider 'footprint'. Soil-filled gaps in the baskets should be planned to accommodate plants suitable to the particular environment. Biodegradable material placed on top of the baskets on slopes will hold sufficient soil to accommodate drought resistant plants. These plants will soften the outlines of the baskets. In rivers, the plants reduce flows around the baskets and extend their lives.

3.8 FERTILISERS

Fertilisers must be uniform in composition, free-flowing and suitable for application with approved equipment. It will be delivered to the site in bags or other convenient containers, each of which will be fully labelled and bear a clear indication of the contents, the trade name or trade mark, the producer's name and a warranty about the contents by the producer. Liquid fertiliser is appropriate when applied in the hydroseeding process. Each lot of fertiliser will be subject to sampling and testing at the discretion of the ECO. Sampling and testing will be in accordance with the official methods used by the Department of Agriculture.

Fertilising in fynbos is specialised because the soils in which it grows are inherently low in nutrients. For this reason, any fertilisers used where fynbos is to be established must be determined by the particular circumstances. Fertilisers used in Mountain and Acid Sand Plain Fynbos in particular must be low in chloride, lime and phosphorous. The Contractor will use 3:1:1, 3:1:2, 4:1:1, 8:1:1, or similar in a solid form and 4:1:1 (19) Phosan, or similar, in a liquid form. In granitic soils, 3:1:0 and 4:1:0, or similar, may also be used. This does not apply to Dune and Strandveld vegetation. Renosterveld is a special intermediate vegetation between the above two types and requires specialist advice on the application of fertilisers. Where grass lawns are to be established, the Contractor may use 3:2:3, super-phosphate or similar. Before applying fertilisers, topsoil from each soil type must be tested to determine the type and quantity of fertiliser required.

3.9 MANURE

Manure will be pure kraal manure free from soil, noxious weed seed or other undesirable material. It will not contain any particles that will not pass through a 50 mm sieve and will be approved by the ECO before being delivered to the site. Manure will not be used in the fynbos

areas because it contains numerous weed seeds inappropriate to natural or restored natural vegetation.

3.10 TOPSOIL AND SUBSOIL

Topsoil (this term includes topsoil in some areas and the rock-filled top-material found in mountainous areas) from the work areas must be stockpiled for use in the rehabilitation process. The natural soil from an area is the most valuable material available for use in the revegetation process as it contains local seeds, bulbs and microbes. First priority must be given to saving as much of it as possible for use in the rehabilitation process.

Topsoil from different broad habitat types (e.g., wet, moist and dry areas, acid versus alkaline substrates, rocky versus sandy areas) should be stockpiled separately for later use in similar environments.

If weeds are present in the soil then herbicides must be used on at least two occasions prior to removal, with appropriate intervals between applications, to reduce the weed population to an extremely low level.

Except where this is contrary to the properties of topsoil in the habitat being rehabilitated, topsoil that is imported will be fertile, friable and preferably loamy in character with 10-50% organic matter. The topsoil will be free from refuse, roots, clay lumps, stones larger than 50 mm in size, weeds, noxious seed, propagules or other biotic materials (including flora and fauna), pathogens and any toxic or germination inhibiting substance. The topsoil must be approved by the ECO prior to delivery onto the site.

A chemical analysis of the topsoil and of the top exposed surface material in the area to be rehabilitated, to a depth of 150 mm will be carried out by the Contractor prior to treatment. The tests will be done by an approved laboratory and will determine the type and quality of nutrients to be added to the subsoil and topsoil respectively.

Topsoil contaminated with seed or plant material from invader species or weeds must under no circumstances be used for rehabilitation work, except in areas already infested as directed by the

ECO. If topsoil is in short supply, it may be supplemented with fynbos brush-cut mulch, wood chips and/or a suitable composted material in a ratio not exceeding 1:1.

3.11 SOIL STABILISERS

Where required, soil stabiliser or anti-erosion compounds will be of the type and be applied at the rate specified in the Project Specification. Soil stabilisers will consist of an organic or inorganic material to bind soil particles together and will be a proven product able to suppress dust and form an encrustation. The application rate must conform to the manufacturer's recommendations. The material used will be of such a quality that grass and fynbos seeds may germinate and penetrate the crust.

3.12 IRRIGATION

Water used should be free of chlorine and other pollutants that will have a detrimental effect on the plants. The irrigation system used, if any, will be appropriate to the particular planting area's characteristics. It will be designed and indicated on the Site Master Plan by the ECO, and supplied and installed by the Contractor. If delay between the planting programme and installation of the irrigation system is unavoidable then a water truck must be made available for watering according to a programme specified by the ECO.

Planting is best undertaken during rainfall events in winter. Grassed areas require irrigation coverage of 100% and a permanent watering programme. The watering programme should be modifiable to accommodate natural climatic variations. Revegetated areas require irrigation coverage of 100% and a modifiable watering programme. It is likely that the watering programme could be discontinued once full establishment has occurred. In most instances, and particularly after a drought, the early after-establishment watering will be a pre-requisite. Advice on this aspect is left to the discretion of the ECO.

Care must be taken that no irrigation be distributed over natural areas. In mixed revegetated / natural areas, careful monitoring of water demand will be required according to plant condition. Every effort should be made to reduce irrigation overspray onto natural patches. Once

established, watering must stop. In a drought, early after-establishment watering may be needed. This is left to the discretion of the ECO.

The 100 mm uPVC sleeves connecting the planters, will be installed by others, but the Contractor will insure that all sleeves are in the correct position prior to the installation of paving. The irrigation system will meet the following requirements:

- a) It will be connected to an appropriate water meter.
- b) The system will be semi-automatic.
- c) Six drippers per tree are required (underneath mulch level)
- d) The system will be operated by means of a hand-operated stopcock in a lockable metal box.

The Contractor will also provide construction drawings for the irrigation systems and will guarantee the system for a period of 1 year.

4 BASIC REQUIREMENTS FOR PLANT

4.1 GENERAL

Before commencing with the work, the equipment necessary for the proper handling and placing of all required materials will be on hand, in good condition and to a standard approved by the ECO.

4.2 HYDRO-SEEDER

The hydro-seeder will be capable of pumping a seed-cocktail (which may include shrub or grass seed, either commercial or harvested, as specified in the Project Specification, fertiliser, soil stabiliser, aqueous smoke solution or smoke-water, mulch and wetting-agent) mixed in water at specified rates over the areas to be seeded.

It will have an agitation system, which will be sufficient to agitate, suspend and homogeneously mix the slurry specified in the Project Specification. The slurry distribution lines will be large

enough to prevent stoppage. The discharge line will be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.

The slurry tank will be mounted on a travelling unit, which may be either self-propelled or drawn by a separate unit. The travelling unit will be capable of placing the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.

4.3 SEED STORE

Facilities should be available to store seed collected or required on-site in rodent- and insect-free, cool (7 - 10 °C), dry, conditions. Seed will be stored at the Contractors expense. The ECO is entitled to inspect the seed store at regular intervals.

4.4 NURSERY

On-site nursery facilities, or alternatively, an off-site nursery, must be made available for the holding of rescued plant material and the propagation of appropriate species for revegetation. The nursery must be suitably located under the supervision of a specialist (horticulturist). A site-specific nursery must cultivate and maintain mutually agreed upon stocks of living plant material required for the restoration project on hand. These are to include functional and special feature plants. Variation in numbers and species cultivated for and used in restoration of the area in question can only be made through mutual written agreement.

A cheaper alternative would be to establish significant numbers of suitable plants obtained from an indigenous plant nursery but, where appropriate (e.g., where natural vegetation is being returned), the plant material must be guaranteed endemic to the local area being rehabilitated (to prevent genetic mixing). In the case of a river, the material must have originated from the river in question. The plants should be cultivated and stored separately from other material in the nursery so that material from the surrounds of the area being revegetated remains genetically pure.

The nursery including water used should be free of *Phytophthora*. The water used for watering should not be chlorinated. Soil used to cultivate or grow plants must be weed free. The area where plants are stored should be kept free of weeds so that transplanted material does not become invested and thereby infest the cleared riparian areas where they are used in rehabilitation. The nursery area should be subjected to intermittent independent checks by a mutually accepted suitably experienced horticulturist or botanist to ensure that the material is being looked after under acceptable conditions and that the material is in a sound and healthy state.

A record of stock relevant to the project that is held in the nursery will be provided to the ECO on a monthly basis. The ECO has the right to inspect the nursery and relevant stocks held therein periodically at mutually agreed times.

5 ENVIRONMENTAL PREPARATIONS

5.1 SEARCH AND RESCUE

The ECO will ensure that the Contractor has obtained all the necessary permits from CapeNature and the written permission of the land-owner before he collects any material from the site or an area adjacent to the site. The ECO will identify, in consultation with an appropriately qualified specialist, any rare / threatened / special flora (or fauna) prior to removing and mulching the remainder of the vegetation. Special flora will be transferred to a nursery approved by the specialist for storage prior to replacement on site. Areas identified as no-go areas must be clearly marked off using coloured tape while individual plants that are not to be harmed in any way must also be clearly marked prior to any construction orientated activities taking place in the area.

The removal (or rescue) of plants and the collection of seed will be conducted by the ECO under supervision of an appropriately qualified specialist before clearing operations begin. The ECO will remove all suitable plant material, as identified by the specialist, from the site. In each instance, as much surrounding soil as possible will be removed with the plant material. The source location of all plant material will be recorded on a grid system. The original habitat type must be recorded.

Rescued plants will be stored under damp shade cloth / hessian until they are transported to the bagging site. They must then be dipped into a moisture-retaining agent and bagged in the topsoil from the area. These plants will be transported to the nursery regularly during each working day. Geophytes (or bulbs) will be collected and either planted out in seed trays or in bags, depending on size, or, where appropriate as determined by a specialist, they will be stored under cool dry conditions, at the nursery.

Seed collection will only be of appropriate species as indicated by a specialist. Seed collection should aim to provide a representative selection of all types of seed, from both pioneer species and from long-lived perennial plants. Remove as much seed as possible from all seeding indigenous plants in the affected area and store in waterproof containers free of insects and away from rodents in a cool area.

Fleshy seed from geophytes will be sown directly into seed trays at the nursery as they do not store well. Other seed will either be sown directly into the desired area, to allow for self-germination as the seasons dictate, or will be stored or sown at the nursery. The seed collection programme can also be ongoing to allow for the sowing of seed directly into the newly prepared soil in the revegetation areas as and when these areas are ready to receive seed.

Distinction should be made in the selection of plants to cultivate in the nursery. Sensitive material, such as red data book species, will be housed in a special section of the nursery (ICU) and be afforded maximum care. Feature long-lived plants are particularly important and are often slow-growing. They are a priority for cultivation in the nursery. Plants that are long-lived and form an integral part of the mature plant communities are also recommended for cultivation. The cultivation of pioneer plants is usually not necessary, except under special circumstances (for mass displays of some attractive annual species such as *Bokbaai vygies*). It is best to sow seed of pioneer species directly into the prepared soil in areas being revegetated.

Direct transplantation into areas earmarked and prepared for revegetation will ensure the best results. Should this, however, not be possible, plant material may be moved to a holding area on site, where it may be placed in bags on open ground, or alternatively relocated to an off-site nursery for transplantation once the permanent revegetation areas become available. Here, it will be maintained and watered on a regular basis.

Wetland material from the existing wetlands on site will be rescued, and used to plant new wetland areas. Prior to construction commencing, a thorough investigation of existing wetlands will be made by the specialist to determine if there are any particularly important or rich areas of existing wetlands. Where these are identified, large sods of material bearing both plant material and soil adhering to the root systems are to be transplanted in such a way as to inoculate the new wetlands created on site. Appropriate species can be taken to the nursery for storage and multiplication.

5.2 VEGETATION CLEARANCE

All fynbos vegetation cleared from the site will be collected for later use. Where appropriate, with permission from the ECO, the fynbos material can be collected simultaneously with the topsoil.

Fynbos mulch will be harvested with a tractor-drawn harvester in such a manner that loss of seed and biomass will be at a minimum (particular care must be taken when harvesting under windy conditions). Unless the ECO allows a longer period, the mulch will be harvested not more than two days before use.

Indigenous plant material should be kept separate from alien material, due to the possible spreading of alien seed. The vegetative material, will be reduced either by mechanically means (chipper) or by hand-axing to sticks no longer than 100 mm. The chipped material will be mixed with the topsoil at a ratio not exceeding 1:1. Note that if the mulch is cut using a brush-cutter then the material will already have been reduced to a correct size and further chipping is not necessary. Fynbos mulch that is chipped after harvesting is less acceptable as it loses much of the natural seed in it during the chipping process.

Stockpile sites will be identified by the Contractor and approved by the ECO. Where necessary, the advice of a specialist will be obtained with respect to the storage of mulched vegetation to ensure that seed in it remains viable until construction has been completed and it is used. Fynbos from different topsoil types will be stockpiled separately, each to be returned to its respective parent soil type. The Contractor may consider storing the mulched vegetation in bags to minimise

wastage. The bags will be approved by the ECO and will allow air to pass through the enclosed material. It must be protected from wetting.

Where necessary, as directed by the ECO, the vegetation within the buffer zones surrounding any sensitive feature to be retained or protected on site must be cleared by hand, to minimise the disturbance of the environment. All other vegetation can be cleared mechanically, apart from trees identified for retention on site. Care must be taken to minimise the disturbance to topsoil during this process.

Material from exotic invasive plants can be chipped and used to prepare mulch if it is free of seed. Alternative uses are as poles (but then the material must be dead), or can be sold as firewood. Avoid leaving piles of material in places where it can be a fire hazard. Composting plant material can combust from high temperatures generated in the piles.

5.3 TOPSOIL REMOVAL AND STOCKPILING

It is important to point out that the topsoil (also called top-material) is the most important element in the revegetation process. It is often called the 'gold' in restoration. Typically topsoil contains organic material, both alive (essential plant seed and micro-organisms) and dead (humus) as well as nutrients and an inorganic part. The complete complement of constituents forming fynbos soil cannot be manufactured artificially yet as our knowledge about all the elements is still inadequate.

Prior to commencement of earthmoving operations, all topsoil will be stripped and stockpiled separately from subsoil so as to provide the required quantities for revegetation as agreed with the ECO. Soil will be stripped in a phased manner, so as to retain vegetation cover for as long as possible. The ECO will agree on the extent of topsoil stripping required, usually the top 150 mm.

Topsoil from different soil types will be stockpiled separately to be replaced in the same areas from which it was taken. Topsoil will be handled twice only, i.e. for the first time to strip and stockpile, and for the second time to replace, level, shape and scarify.

The ECO will identify a suitable site for stockpiling that is:

- removed from the working area and sources of pollution, including alien seed;
- in a sheltered position and be protected from erosion, trampling or vehicular movement over it;
- removed from drainage courses to minimise the risk of wash-aways; and
- removed from the base of a bank so that runoff from the bank does not cause ponding of water along the stockpile.

Topsoil will be treated with care and precautions will be taken to prevent unnecessary handling and compaction. In particular, topsoil will not be subject to compaction greater than 1 500 kg/m² and will not be pushed by a bulldozer for more than 50 m. Trucks may not be driven over the stockpiles.

Unless otherwise instructed, topsoil will not be mixed with any other type of material, nor contaminated with machine oils or any other pollutant.

Topsoil stockpiles must be convex at the top to promote runoff and prevent water accumulation. The Contractor will ensure that the material does not blow or wash away. If the topsoil is in danger of being washed or blown away, the Contractor will cover it with a suitable material, such as mulch and/or seed it with a fast-growing annual grass.

Soil must be stockpiled for as short a period as possible. Where possible a rotational system must be implemented to reduce storage time. For short term stockpiling (for 1 - 2 months, temporary erosion measures can be implemented, depending on the season, by securely covering the material (e.g., using a perforated tarpaulin or hessian). If stockpiles stand for between 3 to 6 months, a cover of rye grass (*Lolium perenne*) or *Cynodon dactylon* (kweek) can be established around the slopes to reduce the effects of erosion washes. *Eragrostis tef* should not be used, as this plant is persistent and invasive in fynbos. Stockpiles must be checked weekly to identify weeds, which will be removed when they germinate, to prevent contamination of the seed bank. If stockpiling for more than 6 months cannot be avoided (only allowable in extreme cases), the stockpiles should be vegetated with an indigenous pioneer species. Topsoil may also be used for berms as long as it is protected from erosion. Stockpile areas need to be demarcated in order to ensure the safekeeping of topsoil and to separate different stockpile types.

Stockpiles may not be covered with materials, such as plastic, that may cause it to compost, or kill any seeds. The Contractor may also consider storing topsoil in bags to minimize wastage. The bags will be approved by the ECO and will allow air to enter into them but be kept under dry conditions where they are protected from the rain.

Soil infested with kikuyu will not be used for revegetation purposes. Kikuyu will be controlled by means of spraying with Roundup, or any other comparable herbicide approved by the ECO, on at least 2 occasions, at least 2 months apart, before any site clearing and stockpiling of materials takes place. Kikuyu will be sprayed according to the manufacturer's recommendations and then removed to a site approved by the ECO. This operation must be carried out by skilled personnel with suitable equipment and must not be undertaken in windy conditions. The site will be inspected by the ECO before any areas infested with kikuyu are cleared for construction to ensure that all kikuyu has been killed. The Contractor will also be responsible for ensuring that the site remains free of kikuyu during the contract and maintenance period. Additional spraying may be necessary to ensure this.

Alien invasive weeds present within the construction area will be removed by the Contractor before indigenous vegetation clearing or soil removal for stockpiling begins (see section on alien vegetation removal). The Contractor will not remove any indigenous plants that may occur amongst the alien plant growth, unless he has received permission from the ECO.

5.4 SLOPE MODIFICATION AND STABILISATION

Cut-slope preparation before the addition of topsoil is critical. Cut and fill slopes must be shaped and trimmed to approximate the natural condition and contours as closely as possible and be undulating. They should be made to blend into the natural topography of the area. Levels, incongruous to the surrounding landscape, will be reshaped using a grader and other earthmoving equipment.

Catch-water drains can be installed above the cut slopes to prevent later erosion gulleys developing through the cut slope. Where cut slopes are greater than 4 m in height, the ECO may order the construction of berms at intervals. Alternatively, natural water flow paths are identified and subsurface drains (using riprap or superfluous rock material) or surface drains and chutes (use

water speed control structures where necessary), preferably using cemented natural rock, are constructed along the flow paths.

Horizontal grooves and willow steps and ledges paralleling contours are made on the cut slopes. They must be made at random to appear natural. Alternatively, slope stabilisers, such as logs in parallel rows, or vegetation cylinders and trashbins fastened randomly into position are used. (Where slope stabilisers are required, these will be fixed according to the Project Specification.) These structures must hold the top-material on the slopes and serve as erosion prevention structures.

Borrow pits must be shaped to have undulating slopes and surfaces. Upon completion they should blend into the natural terrain.

Blasted areas must be as rough as possible, firstly to emulate the surroundings, and secondly to facilitate the collection of pockets of soil on the ledges and the subsequent establishment of vegetation. All cut and fill slopes must be left as rough as possible, and must contain ledges to facilitate the accumulation of topsoil. The ledges must be dug at random to appear natural. Furthermore, any embedded rocks that will not pose a danger to traffic must remain on the slopes. This is especially important in the boulder scree and colluvium landforms. Provision must be made for additional boulders to be placed on the slopes if these slopes do not appear natural enough.

Boulders / rocks, collected on the site before disturbance, will be scattered at a predetermined density approved by the ECO, to create an uneven surface and reduce wind and water erosion. Any eroded areas deeper than 50 mm will be either trimmed down by back cutting the slope face or repaired to the satisfaction of the ECO with boulders and soil or any other approved method.

Near vertical slopes (1:1 to 1:2) will be stabilised using hard structures following specifications, preferably with a 'natural' look and facilities for plants to grow in. All areas where the slopes are 1.3 to 1:6, will be logged or otherwise stepped (using revegetation cylinders, trash bins or similar) in order to prevent soil erosion. The logs must be laid in continuous lines following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope. These logs must

be secured by means of steel pegs and wire in rocky areas, and treated wooden pegs in other areas.

5.5 PREPARATION OF GROUND SURFACES

Remove all remnants of building materials, concrete foundations, timber and other foreign debris from the site. Before replacing the subsoil or topsoil, the Contractor will also remove all visible weeds.

Before topsoil application, the ground surface will be ripped or scarified with a mechanical ripper to a depth of approximately 150 mm to facilitate bonding between the soil layers or steep cut and fill slopes should be prepared as specified above. Compacted soil will be ripped to a depth of >250 mm to break up the clods to ensure proper drainage and water infiltration. The ripped area may also be hand-trimmed to ensure that it will meld and blend into the surrounding levels of the natural fynbos area.

Replace the subsoil and / or neatly contour the site to establish effective drainage patterns. The subsoil will, where possible, be thoroughly tilled to a depth of at least 100 mm by means of a plough, disc, harrow or any other approved method until the condition of the soil is acceptable. On sites where the soil conditions are such that high clay content causes difficulty in effectively pulverising clods and lumps, the Contractor will use rotary tillage machinery until no clods or lumps larger than 40 mm in size remain, and the mixing of soil is acceptable to the ECO. In road cuttings, a weed-free gravel / sand / organic mix can be used as a sub-surface layer. (Blue-chip gravel is saline and must not be used in acid fynbos areas.)

Topsoil will then be spread evenly over the ripped or tilled surface to a depth of 75-150 mm on flat ground or to a minimum depth of 75 mm on slopes of 1:3 or steeper. This will minimise the chances of the topsoil sliding down the slope. The final prepared surface will not be smooth but furrowed to follow the natural contours of the land, with scattered rocks of varying sizes according to the natural condition of the area as an aid to seed germination. Where sodding is required slight scarification will be carried out to contain the sods. The soil will be uniformly moist to a depth of 150 mm prior to planting or seeding. If this condition is not met by rainfall, irrigation will be carried out by the Contractor as directed by the ECO.

In artificial wetland areas, topsoil is to be removed to a depth of approximately 200 mm, the wetlands excavated, and topsoil replaced. Wetland areas are then to be selectively composted, as determined by the ECO, and permanent irrigation systems installed where necessary. Prior to any site clearance, the wetland areas, along with 10 m buffer zones, as indicated on the Revegetation Plan are to be effectively fenced off to prevent any damage to wetland material on sites prior to transplanting.

5.6 SOIL STABILISATION

In order to prevent loss of material from the completed areas, the Contractor will, after the areas have been completed and approved, immediately stabilise it in accordance with one of the subclauses below. Any costs resulting from a failure to prevent erosion will be borne by the Contractor.

All materials used for the stabilisation of such areas will be subject to the approval of the ECO.

5.6.1 STRAW STABILISATION

Straw is suitable as a binding material in areas with deep sand. Baled straw will be placed on the completed area, opened and spread evenly by hand or machine at a coverage rate of 1 bale per 20 m² over the area to be stabilised. It will then immediately be rotovated into the upper 100 mm layer of soil. This operation will not be attempted when the wind strength is such as to remove the straw before it can be rotovated into the sand. This requirement will mean that the Contractor will have to be in a position to take advantage of periods of calm at relatively short notice.

Straw usually contains some grain seed left in it. In some instances the grain may germinate to form a thick standing crop. This has been found to inhibit the regrowth of indigenous vegetation for a number of years. Straw should preferably not be used in natural areas, as it may introduce alien seed into the area, posing a further threat to the natural vegetation to be conserved on site. A covering of mulch must not be left lying loose on the surface as it inhibits germination of other species. Mulch obtained from the surrounding natural vegetation is an acceptable alternative

binding material. Raw or fresh mulch uses nitrogen from the soil during the decomposition process causing a shortage in the soil. This nutrient must then be added to stimulate better growth.

5.6.2 MULCH STABILISATION

Mulch should be applied by hand to achieve a layer of uniform thickness. The mulch should then be lightly worked into the topsoil layer so that it mixes with the soil and serves to bind it. Note that a layer of fynbos mulch must not be left covering the surface so that sunlight is largely excluded from penetrating to the soil. A thick layer of mulch inhibits the germination of seed. In some cases, such as in very rocky areas it may be necessary to first return a layer of fynbos mulch before adding the 75 - 150 mm of top-material. The top-material must then be worked (often by hand) into the mulch so that the mulch can bind it.

It is very important to use the fynbos mulch from the immediate area because fynbos species are often very localised in their distribution, because they are dependant on specific habitat, climatic and soil conditions. Any alien vegetation mulch to be used will be in a non-seed bearing state and must be chipped prior to application. (The preparation of alien vegetation mulch must be done at source.)

The mulch will be spread at a coverage rate of 100 kg per 250 m² or 4 t/ha. All areas to be mulched with brush-cut material will be evenly spread to a depth of 25 mm. It will then immediately be rotovated into the upper 100 mm layer of soil. This operation will not be attempted when the wind strength is such as to remove the mulch before it can be rotovated in. This requirement will mean that the Contractor will have to be in a position to take advantage of periods of calm at relatively short notice.

Should insufficient vegetation be available from site clearing operations for the volume of mulch required, the ECO may require the Contractor to cut bush to a height of 400 mm above ground level from designated areas. This vegetation will then be passed through the chipping machine as above, and be stockpiled for later use as mulch.

If the area is exposed to strong wind the mulch will be covered with a fine nylon net with 100 mm × 100 mm openings. Although the “roll-on” blanket type of commercial mulch may assist in slope stabilisation it will not be employed for this purpose on its own unless the tensile strength of the product is certified sufficient for the steepness of the slope to the satisfaction of the ECO. (Note that a continuous cover of mulch will slow the recovery of the vegetation.)

5.6.3 COMPOST STABILISATION

Seedfree, half-composted material, such as mulled-bark, may be used as an additive to extend indigenous mulch. No more than 50% compost may be used under these circumstances. In some cases, such as preparing for a *Cynodon dactylon* lawn, compost is a valuable additive to the soil as it improves the texture of the soil and its water-holding capacity as well as adding useful nutrients. Depending on circumstance, the soil can be stabilised by placing and lightly compacting a 75 mm layer of compost over the designated areas or the 75 mm layer of compost can be worked into the ground to a depth of 150 mm.

5.6.4 GRAVEL STABILISATION

The soil will be stabilised by the placing of a 50 mm layer of gravel wearing course quality material. The material will be placed, spread, trimmed and compacted by means of 3 passes of the same compaction equipment used for the bulk earthworks. Note that blue road chip gravel is saline and inhibits the growth of acid-loving fynbos species. Do not use this type of gravel through fynbos stands.

5.6.5 STABILISATION OF STEEP SLOPES

Steep slopes are susceptible to erosion, especially during periods of high rainfall. The Contractor will take measures to protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. The Contractor must also take any other measures that may be necessary to prevent surface water from being concentrated in streams and from scouring the slopes, banks or other areas. If runnels or erosion channels develop, they must be back-filled and compacted, and the areas restored to a proper condition. The Contractor must not allow erosion to develop on a large scale before effecting repairs.

Where artificial slope stabilisers are used, these will be supplied to the slope, preferably before topsoiling, but according to the detailed construction plan and as specified in the Project Specification. There are many slope stabilisers on the market. Some are biodegradable while others are more permanent. In natural areas, only biodegradable slope stabilisers should be allowed. These products should last at least 2 years but not more than 10 years to allow the slow-growing indigenous vegetation time to establish. Revegetation cylinders, biodegradable netting/matting, anti-erosion compounds, retaining walls and rock baskets may be used for this purpose. Note that gabions and rock baskets should last longer than 10 years, while anti-erosion compounds usually only last for 6 months.

5.7 FERTILISATION

The type and quantity of fertiliser to be applied will be determined through analyses by the ECO and according to the vegetation type being reinstated. Generally, the analysis will require that part of the fertiliser be added to the soil on seeding. The fertiliser will be incorporated uniformly into the subsoil or topsoil to a depth of at least 100 mm at the rate specified by the ECO on the basis of the soil analysis. The remainder of the fertiliser will be applied at the specified rate in conjunction with the seeding or planting operations, either as part of the hydro-seeded mix or by hand.

In the case of tree or shrub planting, one third of the fertiliser will be scattered at the bottom of the hole, one third dug into the topsoil to be replaced in the hole and the remainder watered into the soil at surface level.

6 PLANTING

6.1 TIMING OF REVEGETATION

The Contractor must not begin revegetation work until all construction activities in the area to be revegetated have been completed.

As far as possible, the Contractor must establish vegetation during periods of the year most likely to produce the best growing results, i.e. before or at the start of the winter rains, in contrast to reseeded which takes place in late Summer to Autumn (January to March). Therefore, the optimal planting season is April / June, which allows the young plants to benefit from natural irrigation from rainwater for the first season. Wetland preparation should take place during Autumn and planting should take place in early Winter after the first rains (May to June). In a dry Late Autumn (end March) or Early Winter (April to June) season it will be necessary to irrigate plants to ensure their successful establishment.

Shrubs should preferably be transplanted in late autumn (May to June). Bulbs should preferably be transplanted at the end of the flowering season (October to November).

6.2 SEEDING

Seed is an accepted source to result in the diversity of plants required as part of the rehabilitation process. A mix of species 5 years after reseeded should be within a 75% accuracy level in quantity and diversity of that agreed upon when the contract was accepted.

Seed collected in the area and stored, instead of being used in the nursery for the cultivation of feature plants, must be mixed with the hydro-seeding mix and sown during late Summer to Autumn (January to March) as part of the revegetation process. The quality and purity of the seed will be determined and agreed upon by mutual assent. Costs to prove viability and purity will be due to the supplier of the seed.

Many fynbos seeds germinate better when exposed to treated smoke or aqueous smoke solution (= smoke water). Smoke water treatment is best done after the first Early Winter rains following sowing. It can also be applied as part of the hydro-mulch mixture if this mulching is done at the end of Autumn to Early Winter. Do not leave seed exposed to smoke water as it is very acid and can damage unprotected seeds. Pre-treating seed is also not recommended for the same reason.

Studies have shown that seed from different species only shows germination enhancement within specific smoke solution concentration ranges. Therefore, when using smoke water it is essential to know the concentration you are using to ensure a good germination response. A highly

concentrated solution is easier to handle because smaller volumes are required, but can damage seed, if the seed are exposed directly to it. The cost effectiveness of smoke water purchased should be determined by its concentration. This is measured in 'delbs'. A standard established to measure smoke solution concentrations. The original smoke-water used by De Lange & Boucher (1997) to germinate the seed of *Audouinia capitata*, a rare and endangered fynbos species is equal to 1 delb. The assessment is done by means of a bioassay of Grand Rapids lettuce seed (Meets, in prep.). All other smoke solutions are measured against this standard and a delb value is awarded after comparison. The dilution of the Standard 1 delb solution for fynbos is 1:150. Other smoke solutions are diluted to an equivalent concentration, following their delb value. The determination of smoke solution concentrations and recommended dilution levels can be done at the Botany Department of the University of Stellenbosch.

Sowing can be done by hand, mechanically or hydraulically. Each of these applications has its specific benefits and these range from low cost to effectiveness under difficult conditions and improved germination as well as the ability to rapidly introduce material evenly and with additives.

Hydro-seeding, being fast and very effective, is best suited for large areas, with the exception of areas that are inaccessible to hydro-seeding machinery. In these instances, seeding may be done by hand-operated equipment or even by hand only. The latter instance has the advantage of giving employment to more people. Indigenous plant seed taken from different areas must be used in the local habitat from which it was collected. This means that the indigenous plant seeds in the hydro-seeding mix will vary according to the area in which the operation takes place. The hydro-seeding machines must therefore be thoroughly cleaned after each operation and before different seed mixes of different origins are introduced into it. The mixture will be kept uniform during the seeding operation by means of a power-driven agitator.

Additives can be added to the hydro-seeding slurry. Compost, fertiliser, soil binding agents (such as Surfasol), wetting agents (such as Aqua-gro), seed and growth stimulants as well as micro-organisms can be applied in one operation thus reducing compaction and application costs. On steep slopes, polymers must be added to the hydro-seed mix for added stability against erosion. Where any of these additives are specified in the Project Specification, they will be added to the hydro-seed mixture.

Where harvested seed is specified in terms of SABS 1200 D and obtained by means of vacuum harvesting, seed containing excessive quantities of organic material or of the substrate material (e.g., sand) may be considered unsuitable for hydro-seeding application. Payment for this material will be according to purity levels. It will either be scattered by hand or broadcast as specified below. The material will then be lightly raked into the topsoil.

Where broadcast seeding is carried out, the seed will be sown evenly over the designated area. During sowing half the seed will be sown by the sower moving in one direction and the remainder by the sower moving at right angles to the first sowing. In confined areas the seed will be covered by means of rakes or other approved hand tools. Broadcast seeding will not be done under windy conditions.

Drill seeding will be done in rows not more than 0.25 m apart. The seeding will be done with an approved grain drill with fine seed attachment or a combination grass planter and land packer or pulveriser which accomplishes seeding by pressing the seed about 6 mm into the ground in rows and compacting the soil all in one operation. A combine grain and fertiliser drill may be used where appropriate and directed.

Whatever method is used, the work will be performed only during a period approved by the ECO when beneficial results are likely to be obtained. When conditions are such that by reason of drought, excessive moisture or other factors, satisfactory results are not likely to be obtained, the work will stop on the order of the ECO and will be resumed only when directed. This will not apply where unfavourable conditions can be counteracted by methods specified in the Project Specification.

The Contractor will demonstrate to the ECO in a trial section that the application of the materials required can be made at the rates specified in the Project Specification.

6.3 PLANTING OF GRASS RUNNERS

The species of runners will be as specified in the Project Specification according to the biogeographic characteristics of the area. *Cynodon dactylon* (fyn kweek) is used in inland acid

situations, while *Stenotaphrum secundatum* (buffalo grass) is used in coast sands. The runners will be planted within 30 hours of being harvested. Storage in the interim period will be in aerated bags under cool dry conditions. The runners will be planted at even spacing, by hand or mechanically at a rate of at least 70 grain bags of runners per hectare. Only fresh runners, that are in good condition and have not dried out, will be accepted. These runners will be planted in trenches not less than 50 mm deep with leafy ends, and not roots, exposed. The runners will be well watered after planting and rolled with a light agricultural roller when the soil has dried sufficiently for the rolling to be beneficial.

6.4 SODDING

Sodding is the use of sods of plants, usually grasslike, to establish a broad band of cover such as for lawns. Sods of sedges and reeds or similar plants are usually planted during the revegetation of water features. Sods can also be planted in strips to reduce erosion. When the area being revegetated has had all its original top-material removed, or where there is very little to no soil available, it might sometimes be necessary to re-innoculate the area with microbes contained in veld sods. Veld sods of restios or grasses are sometimes simply pulled up and replanted in willow hollows for this purpose. Note that this should be done with circumspection to reduce damage to the adjacent vegetation. This process is best carried out during or immediately after a rain event. Where feasible they should be watered lightly after placement. Often there is a high mortality of the original plants but seeds in the sods soon grow as replacements in the soil caught in the sods.

Sodding will take place on moist, rock free topsoil that has been scarified. Sods, once harvested or delivered from a nursery, will not be allowed to dry out and will be planted within 30 hours of being removed from the soil or growing medium. If necessary, they will be lightly watered prior to planting.

Sods will be planted so they abut tightly against one another. The first row will be in a straight line with subsequent rows planted so that the joints are staggered. Any gaps will either be planted with a sod reduced to the gap size or filled with topsoil.

Where grass sods are planted on slopes steeper than 1:2, wooden stakes of 500 mm diameter will be used to anchor the sods in position. In the absence of rain, sods will be well watered after planting and not be allowed to deteriorate through a lack of moisture.

6.5 PLANTING TREES, SHRUBS AND HERBS

6.5.1 PREPARATIONS FOR PLANTING

When plants are supplied and delivered to the site by the Contractor, the ECO will give at least six week's advance notice of his requirements to the Contractor. Upon receipt of the plants, the ECO will ensure that the plants are in good condition and free from plant diseases and pests. Where planting is not direct, the plants must be brought to an approved holding area in the intended planting area where they will be suitably maintained. Sufficient shade and water must be provided by the Contractor on site, as directed by the ECO. The operation of relocation from the nursery to the planting site must occur on the same day so as to minimise losses through death and to maintain or improve their condition at delivery. The entire operation will be undertaken by informed personnel and under the supervision of the ECO.

It is best to use a planting plan drawn up by an experienced landscape architect. Holes will be dug as directed by the ECO. Planting holes will be dug according to specified dimensions and densities. The size of holes will vary according to the tree, shrub or herb to be used but will be sufficiently large to ensure that the entire root system is well covered with topsoil, without having to be compressed. The soil around the roots of the plants being transplanted will not be disturbed. Topsoil and subsoil from the hole will be stored nearby to be replaced to the same depth intervals from which it was originally removed. Nutrient supplementation will be as specified in section 5.7.

In the case of transplanted trees up to 3 m tall, the hole size must be 2 500 mm × 2 500 mm × 1 800 mm deep. The holes for plants will be back-filled using a mixture of two-thirds loamy to sandy topsoil to one-third compost. If the natural soil tends to be very clayey or heavy, then add sand to it as well in the ratio of one-third soil, one-third compost and one-third sand. The soil and compost / sand additives will be well mixed to the satisfaction of the ECO. Add one or two handfuls of bone meal to the hole before planting. Bone meal is organic and there is less risk to the plants using it in preference to super phosphates and other fertilisers. Indigenous trees tend

to grow too vigorously if fertilised and the young weak shoots that tend to develop are unable to withstand the strong winds and break of the Cape environment. Coarsely chipped bark from pine trees will be supplied and placed in a 75 mm deep layer at the bases of the trees to restrict competition from weeds and to reduce drying out. Some large rocks placed around the trees will reduce fire damage in fire-prone environments.

6.5.2 PLANTING GUIDELINES

Where possible, only locally indigenous species will be used. An attempt should be made not to change the character of an area, for example 'forest' trees are used in verge plantings only in forest areas, while 'dry scrub forest' trees that occur in fynbos communities are used in fynbos areas. Trees and shrubs will be planted in groupings rather than individually. Extensive use will be made of organic mulches to help the trees and shrubs become established.

The following generalized specifications for planting should be used as a guide to quantities. Detailed plans should be drawn-up by a Landscape Architect. Individual spacing between trees should be 2-3 m and clumps should consist of 6-12 trees. The trees in the clumps should be planted in staggered rows of 5 trees per 6 sq. m with low to medium tall shrubs planted between the clumps. The clumps should be spaced at about 8-12 m distance. Shrubs should be planted 1-2 m apart around the trees to offer the trees protection during early establishment phase and in the intervening areas between the clumps or as circumstances dictate. Plugs of herbs (often provided in flats) are planted at densities of up to 12 per m². Bulbous plants are planted as features in selected areas and should be protected from moles using rock linings to the holes.

Plants planted at the waters edge in wetlands and rivers should be planted as follows:- indigenous shrubs and small trees should be planted 3 m apart, palmiet 1- 2 m apart, while bulrushes, reeds, sedges and herbs planted should be planted in sods 0.4-0.5 m apart or as circumstances dictate.

Information about general species to use, where to plant them and other information about plants are given in the Appendix.

Wetland material harvested from existing wetland areas is to be transplanted directly to the newly created wetland area, along with as much soil, and surrounding material as possible, to ensure a transfer not only of the plants, but also fauna and micro-organisms associated with the wetland.

Before the placement of the plant specimens into prepared holes, the holes will be watered substantially. Plants will be carefully transplanted into holes. The topsoil will be replaced at the same depth intervals at which it was excavated. The soil will be lightly compacted and well watered. Care will be taken to keep root damage to a minimum when transplanting seedlings. Where plants have a taproot this will not be cut. Excess foliage, flowers and side branches will be pruned as directed by the ECO. During transplanting of veld plants care will be taken to ensure that they are not exposed to the sun. The roots as well as the leaves will be covered with wet hessian to limit transpiration during transportation and storage. Plants will be kept in this state for as short a time as is reasonably possible.

Holes for bulbous plants (e.g. *Watsonia*) require special attention. Rocks placed at the bottom of the holes and rocks or gravel placed around the planted bulbs protects them from moles. In some instances rocks need to be placed on the surface around the plants to protect them from baboons as well.

In fire-prone areas, it is advisable to place a few rocks around planted trees to protect the lower parts of the stems from the heat of fires. They can then resprout from the protected parts after a fire. The rocks also create a cooler local environment around the plants which is beneficial to them.

Plants will be watered immediately after transplanting to ensure that the soil is wet around the plants. If necessary additional soil must be added after initial watering to fill any subsidence back up to ground level.

The ECO will monitor the condition of the transplants and be satisfied that the plants are in healthy condition and show signs of growth. If, at any time before or during the maintenance period, any plant dies, it will be replaced at the Contractor's expense.

6.6 RESPONSIBILITY FOR ESTABLISHING AN ACCEPTABLE COVER

Upon completion of any of the operations a final check of the total quantities of individual materials used will be made with respect to the area treated. If the minimum rates of application have not been met, the ECO may require the distribution of additional quantities of the materials to make up the minimum application rates specified.

The plants must be watered immediately after seeding, sodding or planting and then on a regular basis until the onset of substantial winter rains. The site must be monitored frequently to determine if erosion has occurred, and to instigate erosion control measures if it has. Any alien plant seedlings must be removed on a quarterly basis.

Notwithstanding the fact that the ECO will determine the method of planting (seeding, sodding etc) and that the type of seed, grass or plant used, and the rate of application of seed or planting density may be specified or agreed to by the ECO, and that the frequency of mowing will be ordered by him/her, the Contractor will be solely responsible for establishing and maintaining an acceptable plant cover and for the cost of replanting or rehydro-seeding where acceptable cover is not obtained or maintained.

Where, however, in the opinion of the Contractor, it is doubtful at the outset whether it will be possible to establish or maintain an acceptable cover, he may inform the ECO of his reasons therefore and the ECO will, if he agrees, either adopt another method of planting or agree to accept whatever cover can be obtained, provided that all reasonable efforts are made to establish a good cover using the method proposed. Any such agreement will only be valid if given in writing by the ECO.

All planted areas will have an acceptable and stipulated cover in stages from the beginning to the end of the maintenance period. A mutually accepted method to determine plant cover will be established before a contract is awarded. It should be statistically acceptable and be defensible in the event of a dispute arising.

Where only indigenous seed, harvested from the site, has been used, acceptable cover will mean that:

- not less than 60% of the area seeded will be covered with acceptable plants; and
- there will be no bare patches greater than 800 mm in maximum dimension through the area, except where large rocks or boulders occur.

Where commercial grass seed is used, acceptable cover will mean that:

- not less than 75% of the area seeded will be covered with grass; and
- there will be no bare patches greater than 500 mm in maximum dimension.

In the case of sodding, acceptable cover will mean that the full area will be covered with live grass at the end of any period not less than three months after sodding. Where this cover is not achieved, the Contractor will, at his/her own expense, plant additional grass and tend it in a similar manner to the original planting until the acceptable cover is achieved.

6.7 TRAFFIC ON REVEGETATED AREAS

No construction equipment, vehicles or unauthorised personnel must be allowed onto areas that have been revegetated. Only persons or equipment required for the preparation of areas, application of fertiliser and spreading of topsoil must be allowed to operate on these areas. Should paths develop through unauthorised passage through the area by non-construction personnel, then it is often wise to formalise these routes into paths that are erosion resistant.

7 MAINTENANCE

The Contractor will accept full responsibility for maintaining the plants in a good condition throughout the contract and maintenance periods. The plants will be fully maintained and watered during this period and any losses of plants on account of disease or through lack of care during the contract and maintenance periods, will be replaced at the Contractor's own cost. Replacement will take place on a monthly basis unless otherwise instructed by the ECO.

During the maintenance period, any activities that may have detrimental impacts on the revegetated areas must be avoided. Secondary revegetated areas will be clearly marked and demarcated in the field and on the planting plans. No unauthorised access onto these areas will be permitted.

Maintenance will begin when the planting commences and will continue until provisional acceptance of all planting works. Following provisional acceptance, there will be a maintenance period of 24 months, which may be reduced at the request of the ECO and/or Client. Should there be any reduction, the Contractor will only be paid for the number of months that maintenance was undertaken at the monthly rate that will form part of the Tender.

Maintenance will consist of erosion control, watering, weeding, fertilising, disease and insect pest control, pruning, and any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous and healthy growth of the plant material on site. The Contractor will be responsible for the use of all materials, labour and equipment. Any injury to plants caused by the Contractors material, labour and / or equipment, will be corrected and repaired by the Contractor at no additional expense to the Client.

The survival rate of transplanted plant specimens will be monitored by the ECO. A programme in this respect will be drawn up by the ECO to monitor, on a weekly basis, the condition of the transplanted specimens. Assessment criteria for the programme will include plant species, transplantation / germination techniques, prevailing climatic conditions and survival rates of transplanted species. The Contractor will be responsible for on the ground monitoring and is to keep the ECO informed on a weekly basis.

The effects of irrigation, fertilisation and any other reactions resulting from the Constructors activities on adjacent natural areas will also be monitored. A monitoring brief in this regard will be prepared by the ECO. The Contractor will be responsible for on the ground monitoring and report any abnormalities to the ECO immediately. Visual monitoring of the relevant vegetation by a qualified expert, combined with monitoring of groundwater is accepted as an adequate indicator of change. The monitoring programme must make provision for appropriate amendments to be made to the causes of change if appropriate and for appropriate penalties to be applied, equivalent to the resulting costs should the contractor not meet his commitments in this regard.

7.1 IRRIGATION

The Contractor is responsible for maintaining the desired level of moisture necessary to maintain vigorous and healthy growth. The quantity of water applied at one time will be sufficient to penetrate the soil to a minimum depth of 800 mm, where appropriate, and at a rate that will prevent saturation of the soil.

All seeded, planted or sodded grass areas and all shrubs or trees planted will be irrigated regularly at the intervals specified in the specification on the basis of the climate of the area and the plant species concerned, in order to ensure adequate germination and growth of vegetation. Specific attention will be given to the management of irrigation systems at the interfaces between different planting areas in terms of their individual water requirements.

A regular maintenance check-up of pipes will be conducted by the Contractor. The entire routing of any particular irrigation system will be subject to inspection once every week. A reporting mechanism needs to be in place whereby the responsible contractor immediately informs the Contractor of any burst or leaking pipes or operational break-downs so that immediate emergency repairs can be effected by the relevant suitable party. Provision must also be made for any environmental or rehabilitation repair work to be effected as soon as possible.

7.2 FERTILISATION

The use of fertilisers, herbicides and pesticides will be strictly controlled by the Contractor. Care must be taken not to use excessive fertiliser to speed growth. Care needs to be exercised when using such material near sensitive natural areas, particularly as the fertiliser requirements of fynbos vegetation differs considerably from that required by lawns and gardens. The fertilisation programme for different areas of planting will be managed by the Contractor. Excess material will be stored for later use. Bags and containers of these materials will be suitably sealed and stored in a location approved by the ECO.

Additional fertiliser will be applied at the intervals specified in the specification with due regard to favourable climatic conditions and the state of growth of the vegetation. Application will be by

hand or approved mechanical spreader and will provide uniform distribution. The type and quantity of fertiliser will also be specified in the Project Specification.

7.3 WEEDING AND MOWING

Remove all weeds and invasive grass manually from plant surrounds, making sure to remove the roots as well. Regeneration of seedlings should be treated according to densities of regeneration and the situation involved. Pulling seedlings is very effective and least disruptive to the system. (A puller has recently been developed to remove slightly larger juveniles.) If dense stands of seedlings are present then a foliar spray of Garlon (0.5% concentration in water with a wetting agent such as Actipron, and a blue dye to indicate area applied) are used. Cutting (axe or hand saw) or loping (using special secateurs) larger (waist high) juveniles of exotics usually requires that the cut stump remains are treated with a herbicide (e.g. a 2% Garlon solution in diesel oil coloured with a red dye to indicate which stumps have been treated). Large plants must be cut (chain saw) by specially trained operators. The cut stumps should be treated to ensure no regrowth takes place.

Do not stockpile weeds, they should be placed directly into refuse bags and removed from the site and dumped on a lawful dumping site from which seed cannot escape. It is preferable not to leave cut material on the ground at the point of removal because this allows seed to be released *in situ* to reinfest the area and the debris inhibits the recovery of the natural vegetation and makes ground preparation for seeding and planting more difficult. The dead material becomes a fire hazard. Parts of the vegetative material from seedless exotics can be chipped for mulch or used to make compost. Burning remnant materials after utilisation, at a safe site away from the river, can be considered if the material cannot be utilised. In this instance great care should be taken that the spread of the exotics is not promoted during the actions.

Because of the danger of increasing the spread of invasive alien plants, as a result of the importation of building materials, special care must be taken to ensure that the work areas, and other areas disturbed by the Contractor, are kept free of these plants. The Contractor must be responsible for controlling all woody invasive alien weeds including kikuyu grass or other invasive species specified by the ECO. Woody invasives must be removed by hand pulling when the

seedlings are between 50 and 300 mm high. Kikuyu must be controlled by spraying on at least two occasions spaced two to three months apart.

If, during the maintenance period, any noxious or excessive weed growth occurs or other undesirable vegetation threatens to smother the planted species in the seeded or planted areas, such vegetation will be removed.

The Contractor will mow the grass in specified grassed areas or on road verges at intervals ordered by the ECO. Grass cuttings will be collected and disposed of as directed by the ECO.

7.4 DISEASE AND PEST CONTROL

Inspect all plant materials at least once a month to locate any diseased or insect pest infestation, identify the nature of species of the infestation (with specialist assistance if required), and submit the proposed method of control to the ECO for approval, prior to application of control measure. Pest control will be managed on a prevention basis. As much relatively harmless rapidly biodegradable measures must be taken as possible (e.g., Jeyes Fluid and Flower of Sulphur) before using pesticides / fungicides.

7.5 PRUNING

Keep all plant material free from dead wood, broken branches, dead flower heads or otherwise harmful or objectionable branches or twigs. All other pruning will be done only as directed by the ECO. All pruning wounds greater than 12 mm diameter will be painted with an approved tree wound paint. Secateurs and other cutting equipment will be kept sterilised to avoid spreading fungal infestations.

7.6 TREE MAINTENANCE

Trees should be watered three times weekly in summer and once weekly in winter unless sufficient rain occurs. Maintain all tree guards in good condition. This includes ensuring that tree ties remain taut and the replacement of all such accessories when required. Where the tree ties damage the trees, this will be rectified immediately.

Trees that die or become unhealthy from any cause or appear to be in a badly impaired condition will be promptly removed and replaced, or as soon as the weather permits, as directed by the ECO. All replacements will be trees of the same kind and quality as those originally planted.

7.7 EROSION CONTROL

Remedial work will be implemented immediately by the Contractor during incidents of surface wash-away or wind erosion under the direction and to the satisfaction of ECO or other relevant management authority. Pack erosion control trashbins, made of wooden poles and sticks, with vegetation so that soil is held by them.

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SECTION F

ENVIRONMENTAL AWARENESS TRAINING

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SECTION F: ENVIRONMENTAL AWARENESS TRAINING

SECTION SYNOPSIS

This section provides guidelines for establishing an appropriate level of environmental awareness with all the role-players involved in the envisaged construction activities, from the management and supervising level to the level of the labourer.

1 ENVIRONMENTAL AWARENESS COURSES

Two generic environmental awareness courses have been developed which will be used to educate management and workers on site pertaining to the environment and their responsibilities in terms of the environmental specifications. The Site Engineer will attend the course(s). The two courses are the following:

1.1 COURSE FOR THE CONTRACTOR'S MANAGEMENT STAFF

This course includes a hand-out that can be modified to include project-specific information (refer to Annexure F1). This course would be presented by the ECO will take the form of a discussion pertaining to the key environmental aspects of the project. The Development Framework will serve as a basis for this course.

1.2 COURSE FOR SITE STAFF AND LABOUR

The Contractor will present this course, with relevant input from the ECO. The course includes a hand-out (Annexure F2) and will take the form of a slide-show and the use of posters. The posters will be displayed at a suitable location on site (e.g. the eating area or office).

Due to its generic nature, the environmental education course could be modified for each presentation in order to ensure that it is site-specific and of relevance to the specific group.

The course will be presented in English and Afrikaans. The medium and language that will be used for the presentation will depend on the attendees.

Annexure F2 puts forward the key elements of the environmental awareness course for site staff and labour.

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ANNEXURE F1

MANAGEMENT STAFF HAND-OUT

IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

1 INTRODUCTION

Arabella subscribes to the philosophy of Integrated Environmental Management (IEM) which was designed to ensure that the environmental consequences of proposed projects are understood and adequately considered in the planning, implementation and management of development projects. It is intended to guide the development process and resolve or lessen any negative environmental impacts and enhance positive impacts of a development project.

Arabella supports a 'cradle to grave' approach, requiring environmental input from conceptualisation to decommissioning for all Phase 2 projects. Accordingly, the IEM guidelines aim to ensure upfront environmental input during planning and construction and subsequent input during operation and maintenance. The Environmental Management Plan (EMP) is a tool that would facilitate appropriate environmental input during the construction phase of the Phase 2 projects, and thus form a crucial component of the IEM process and the ultimate attainment of sound environmental practice during all phases of all projects undertaken on the estate.

WHAT IS THE ENVIRONMENT?

The environment comprises all living and non-living surroundings such as water, buildings, soil, plants, cars, air, humans and their interrelationships. It is important to realise that people form an integral part of the environment.

LEGAL REQUIREMENT FOR IMPLEMENTATION OF AN EMP

During 1998, government promulgated the National Environmental Management Act (NEMA) (Act 107 of 1998) in order to address potential impacts associated with a development project. This Act attempts to ensure that future developments are undertaken responsibly and with minimal impacts on the environment.

Any Phase 2 project that involves any of the activities specified in the Act must pass through the environmental impact assessment (EIA) process and be approved by the Provincial Authority, the

Environmental Impact Management Unit (EIMU) of the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP), before construction can start. DEA&DP decides whether or not the project can go ahead and issues a Record of Decision in which there may be certain conditions of approval of a project. A condition of approval of the project is that an Environmental Management Plan (EMP) must be implemented on site.

NOTE: The implementation of the EMP within the project is not an additional or 'add on' requirement. The EMP is legally binding, integral to the contract and as important as the engineering aspects of the contract.

WHO ENFORCES THE EMP?

The Environmental Control Officer (ECO) oversees the implementation of the EMP on site. All instructions to the Contractor are, as normal, issued through the Site Engineer.

METHOD STATEMENTS

Certain activities require method statements that have to be approved by the SE and the ECO prior to that activity commencing on site. For example, an explanation of the solid waste management system on site would be required including details of how often waste will be removed from site, where waste will be stored, how it will be stored, etc.

Method statements are defined in Section C of the EMP. A *pro forma* method statement form has been included which must be completed for all required method statements by the Contractor for approval by the SE and the ECO.

The purpose of method statements is to give the ER or ECO enough information to determine if the Contractor's actions in undertaking the activity will harm the environment. For example, will the solid waste removal system prevent cement bags and other rubbish from flying around the site?

FINES AND HOW THEY ARE COLLECTED

Failure to adhere to the specifications of the EMP may result in spot fines being issued to workers. These fines may range from R20 to R2000 and are deducted from the monthly payment certificate. Thereafter, it is the responsibility of the Contractor to collect the fines from the guilty individuals. If the EMP is still not being adhered to, guilty individuals may be refused entry to the site and construction may even be stopped.

YOUR INVOLVEMENT AS PART OF A TEAM

The keywords and actions that will determine the success of the EMP and the project are *Team Effort*. The old saying, 'a chain is as strong as the weakest link' holds true to the process. Only through co-operative management and empowerment by awareness education can we maintain and improve our environment. Please make every effort to assist us with this development requirement.

For the EMP to be successful, its contents must be communicated to everyone on site. For management (and foremen) this pamphlet serves as an introduction to EMPs. For the general labour force, this involves a short environmental education course that must be given before or soon after setting up on site.

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ANNEXURE F2

SITE STAFF AND LABOURER HAND-OUT

TAKING CARE OF THE ENVIRONMENT DURING CONSTRUCTION

On this project, an Environmental Management Plan (EMP) has been included in the contract. This EMP says what the Contractor may and may not do during construction. It will protect the environment during construction and prevent damage or nuisances (e.g. noise) to the environment.

What is the environment?

The environment is everything around you. It is made up of living things (e.g. people, plants & animals) and non-living things (e.g. soil, water, buildings & cars). People and man-made things are an important part of the environment. Protection of the environment means that all living and non-living things are protected.

All people on this site must know what is said in the EMP and how they can protect the environment. This will be explained to you in this environmental awareness course.

The person presenting the course will explain what you need to do to protect the environment. This list of do's and don'ts is only a summary of what you will be told in the course.

Everyone on site **must attend** the environmental awareness course. Please inform your supervisor or foreman if you have not attended a course. All new people must also attend the course.

There is a copy of the EMP at your Contractor's office or at the Site Engineer's office.

If you do not understand anything that is said to you during the course or anything in this handout, please ask your supervisor/ foreman.

DO'S AND DON'T'S



Workers & equipment must stay inside the site boundaries at all times



Do not swim in or drink from streams
Do not throw oil, petrol, diesel, concrete or rubbish in the stream
Do not work in the stream without direct instruction
Do not damage the banks or vegetation of the stream



Protect animals on the site
Ask your supervisor or Contract's Manager to remove animals found on site



Do not damage or cut down any trees or plants without permission
Do not pick flowers



Put cigarette butts in a rubbish bin
Do not smoke near gas, paints or petrol
Do not light any fires without permission
Know the positions of fire fighting equipment
Report all fires
Do not burn rubbish/ vegetation without permission



Work with petrol, oil & diesel in marked areas
Report any petrol, oil & diesel leaks or spills
Use a drip tray under vehicles & machinery
Empty drip trays after rain & throw away were instructed



Try to avoid producing dust - wet dry ground & soil



Do not make loud noises around the site, especially near schools and homes
Report or repair noisy vehicles



Use the toilets provided
Report full or leaking toilets



Only eat in demarcated eating areas
Never eat near a river or stream
Put packaging & leftover food into rubbish bins



Do not litter - put all rubbish (especially cement bags) into the bins provided
Report full bins to your supervisor
The responsible person should empty bins regularly



Always keep to the speed limit
Drivers - check & report leaks
Ensure loads are secure & do not spill



Know all the emergency phone numbers



Spot fines of between R20 and R2000
Removal from site
Construction may be stopped



Report any breaks, floods, fires, leaks and injuries to your supervisor
Ask questions!

ANNEXURE F3

COURSE MATERIAL AND POSTERS

ARABELLA PHASE 2

ENVIRONMENTAL AWARENESS COURSE

WHAT IS THE ENVIRONMENT?

- Soil
- Water
- Plants
- People
- Animals
- Air we breathe
- Buildings, cars and houses



WHY MUST WE LOOK AFTER THE ENVIRONMENT?

- It affects us all as well as future generations
- We have a right to a healthy environment
- A contract has been signed
- Disciplinary action (e.g. construction could be stopped or fines be issued)

HOW DO WE LOOK AFTER THE ENVIRONMENT?

- Report problems to your supervisor/ foreman
- Team work
- Follow the rules in the EMP



WORKING AREAS

Workers & equipment must
stay inside the site
boundaries at all times



RIVERS, STREAMS & LAGOON

- Do not swim in or drink from streams
- Do not throw oil, petrol, diesel, concrete or rubbish in the stream
- Do not work in the stream without direct instruction
- Do not damage the banks or vegetation of the stream



ANIMALS

- Do not injure or kill any animals on the site
- Ask your supervisor or Contract's Manager to remove animals found on site



TREES AND FLOWERS

- Do not damage or cut down any trees or plants without permission
- Do not pick flowers



SMOKING AND FIRE

- Put cigarette butts in a rubbish bin
- Do not smoke near gas, paints or petrol
- Do not light any fires without permission
- Know the positions of fire fighting equipment
- Report all fires
- Do not burn rubbish or vegetation without permission



PETROL, OIL AND DIESEL

- Work with petrol, oil & diesel in marked areas
- Report any petrol, oil & diesel leaks or spills to your supervisor
- Use a drip tray under vehicles & machinery
- Empty drip trays after rain & throw away where instructed



DUST

Try to avoid producing dust -
Use water to make ground &
soil wet



NOISE

- Do not make loud noises around the site, especially near schools and homes
- Report or repair noisy vehicles



TOILETS

- Use the toilets provided
- Report full or leaking toilets



EATING

- Only eat in demarcated eating areas
- Never eat near a river or stream
- Put packaging & leftover food into rubbish bins



RUBBISH

- Do not litter – put all rubbish (especially cement bags) into the bins provided
- Report full bins to your supervisor
- The responsible person should empty bins regularly



TRUCKS AND DRIVING

- Always keep to the speed limit
- Drivers - check & report leaks and vehicles that belch smoke
- Ensure loads are secure & do not spill



EMERGENCY PHONE NUMBERS

Know all the emergency phone numbers:

- Ambulance: 10177
- Fire: 808 8888
- Police: 10111



FINES AND PENALTIES

- Spot fines of between R20 and R2000
- Your company may be fined
- Removal from site
- Construction may be stopped



PROBLEMS - WHAT TO DO!

- Report any breaks, floods, fires, leaks and injuries to your supervisor
- Ask questions!



SECTION G

PUBLIC INVOLVEMENT

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SECTION G: PUBLIC INVOLVEMENT

SECTION SYNOPSIS

This section provides guidance regarding the involvement of I&APs in the project through a Liaison Committee.

1 LIAISON COMMITTEE

During the construction phase Interested and Affected Parties (I&APs) will be provided the opportunity to participate or be involved in the project through a Liaison Committee. The purpose of this committee is to serve as a forum for:

- a) Enabling the community to effectively participate in and monitor the environmental performance of the project.
- b) Discussing and addressing the concerns of the community regarding the project, especially those people living in the immediate vicinity.

The Liaison Committee will:

- Act as a representative of, and official means of communication, with the community and other stakeholders.
- Observe and monitor the impacts of the site on the environment.

2 MEMBERSHIP AND FUNCTIONS

Voluntary IAPs, including individuals and representatives of organisations and/or the interact groups will be appointed or selected onto the committee. When necessary, further IAPs can be elected or appointed.

The Liaison Committee has the following functions:

- a) Reviewing audit results and have it demonstrated that audit recommendations have been implemented within an agreed time frame.
- b) Reviewing monitoring results from ongoing monitoring programmes.
- c) Making recommendations to the developer.

- d) Meeting with local, provincial and national government officials, to discuss such issues as nuisances, complaints, conditions or permit compliance.
- e) Requiring that officials provide answers regarding actions taken to address identified problems.
- f) Holding meetings at which the developer and the I&APs can report back.
- g) Ensuring that report back meetings result in appropriate action.
- h) Requesting that special meetings be held for a specific purpose.
- i) Conducting site visits, at least twice a year, and participating in external audits.
- j) Conducting workshops for reporting back to community and re-election of members.

3 DUTIES OF THE LIAISON COMMITTEE

The duties of the Liaison Committee include the following:

- a) Formulate a Terms of Reference and Code of Conduct, under which the Committee can operate.
- b) Inform IAPs of the activities of the Liaison Committee.
- c) Hold public information meetings.
- d) Keep a record of proceedings and decisions.

4 ACCOUNTABILITY, RESPONSIBILITY AND LIABILITY

Members that have been elected by constituencies are accountable to the constituencies they represent, and are responsible for keeping them informed of proceedings. As part of ongoing public participation, regular meetings, site visits, workshops and information sessions should be held. These would be organised by the Committee.

Participation by a member in the proceedings of the Committee should not be interpreted as a waiver of such a person's right to challenge any issue pertaining to the site outside the forum of the Committee, unless such an issue had already been resolved by consensus on the Committee.

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