INKWAZI ESTATE DEVELOPMENT

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

19 March 2009

INTRODUCTION

1.1 Description of Proposal

The proposed development comprises predominantly sectional title type residential apartment units clustered together in villages / development sites. There are three affordability levels of housing proposed, namely approximately 100 units at maximum R440 000 each, approximately 100 upmarket Manor Units (R1.2 to R1.7million) and approximately 1300 middle income apartments (R800 000 to R1.2 million) – all at current prices, March 2009.

Each of these villages are connected by a system of movement links (roads and pedestrian pathways), and open spaces. Community facilities and recreational areas are provided in such a way that they are easily accessible from within each village. The recreational and community spaces are all linked with the road and pedestrian and open space movement systems.

Provision is also made for a school, a crèche, worship site, and other community related facilities such as club-house, picnic areas, parks and playgrounds. The development also provides for retail and mixed use facilities which will serve the immediately surrounding areas, including this development. The retail facilities will be provided in the mixed use zone in such a way that they are integrated with the development and without detracting from the general amenity of the area. To this extent it is important to note that buildings situated along the main P228 link road will be limited in height, and limitations will be placed on the use of the buildings.

1.2 Aim of this Document

In terms of Section 28 (1) of the National Environmental Management Act (108 of 1998) (NEMA):

"(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment in authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. (2)…the persons on whom subsection (1) imposes and obligation to take reasonable measures, including and owner or land, a person in control of land or premises, or a person who has a right to use the land or premises on which or in which – (a) any activity or process is or was performed or undertaken; or (b) any other situation exists, which causes or has caused or is likely to cause significant pollution or degradation of the environment. (3) The measures required in terms of subsection (1) may include measures to – (a) investigate, assess and evaluate the impact on the environment; (b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment; (c) cease, modify or control any act, activity or process causing pollution or degradation; (d) contain or prevent the movement of pollutants or the causes of degradation; (e) eliminate the source of the pollution or degradation; or (f) remedy the effects of the pollution or degradation…"

Thus, the aim of this Environmental Management Plan (EMP) is to identify and minimise, as far as possible, potential impacts that the construction of the proposed development may have on the surrounding biophysical and socio-economic environment.

The EMP will serve as the environmental input to the contractors tender to ensure that the contractor complies with all the necessary management actions and incorporate this cost into the tender budget.

The purpose of the EMP is to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
  - Minimise disturbance of the natural environment;
  - Prevent or minimise all forms of pollution;
  - Protect indigenous flora and fauna;
  - Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment; and,
  - Adopt the best practicable means available to prevent or minimise adverse environmental impacts.
- Develop waste management practices based on prevention, minimisation, recycling, treatment or disposal of wastes;
- Describe all monitoring procedures required to identify impacts on the environment; and,
- Train employees and contractors with regard to environmental obligations.

Focus

This EMP has been developed to outline measures that are to be implemented in order to minimise adverse environmental degradation associated with the proposed Inkwazi Estate. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the development period.

1.3 Terms of Reference

Metamorphosis Environmental Consultants were appointed by Chapman Enterprises to conduct the environmental scoping assessment and environmental impact assessment for the proposed Inkwazi Estate. The compilation of a comprehensive EMP with which all Contractor(s) must comply is a requirement of the EIA process. The EMP will require regular monitoring by an independent Environmental Control Officer (ECO) to ensure that the Contractor complies with all aspects of the EMP during the construction phase.

In terms of Section 28 (1) of NEMA, every person who may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring.

Metamorphosis has prepared specific and appropriate management guidelines to ensure that the construction site, particularly sensitive areas, is not damaged during construction.

1.4 Site description

1.4.1 Existing and Surrounding Landuse

The site is located approximately 3km to the north-west of the town of Sheffield Beach. The properties around the site are currently used for agricultural purposes although the residential/equestrian estate of Seaton Delaval is being developed adjacent to the south western property boundary. The equestrian estate component of the development is a low density, high income gated estate development. There is an 'animal farm' and farm labourers village to the north east of the property and a dolerite quarry on the northern property boundary (the mining lease area actually extends into the proposed development area). The proposed mining lease extension runs along the escarpment to the west of the property boundary. The property to the east of the site (across the MR228 which forms the eastern property boundary) is an agricultural property with sugar cane, lychees and macademia production.

There is significant development occurring in the area, with the extensive Royal Palm development located to the north east of the site.

Implications

The activities at the adjacent quarry will have to be considered in project planning, as these may have implications for the residents close to the quarry (noise, dust etc). The shared fenceline with the low density, high income Seaton Delaval development will have to be taken into account by the developers.

1.4.2 Topography

The site is located on a series of spurs and valleys which lead into the Mhlali River to the north of the site. Slopes vary from 1:10 to 1:5, with the steeper slopes occurring on the western side of the site. The highest point on the site is in the western corner at a height of 93m.The site slopes to the north east.

The buildings will be of varied height, with a combination of two and three storey units. They will be clustered to reduce the visual impact.

Implications

The site is not highly visible from the south or west. It is highly visible from the MR228 road and from properties to the north. There will be a significant amount of earthworks required due to the topography of the site.

1.4.3 Water Resources

The Mhlali River runs approximately 200m to the north of the site, at its closest point. There are two tributaries of the Mhlali River on the property, these run from south to north and join the Mhlali River just to the north of the site, adjacent to the existing quarry.

Implications

Whilst the drainage channels and wetland buffers will not be disturbed during construction and operation of the development, stormwater from the area will have to be managed within the site. Potentially contaminated stormwater may enter these channels during the construction phase of the project. Stormwater quantities will increase once the project has been completed due to the increase in hardened surfaces on the site.

1.4.4 Wetlands

A wetland delineation study was undertaken by Greg Mullins of Sivest, at the beginning of 2008. NB It should be noted that this study shows an area much larger than the study area which forms the south western portion of the area delineated. The study was undertaken in accordance with the DWAF guidelines for wetland delineation and a functional assessment was undertaken using the WET-EcoServices classification.

The wetlands were defined using soil and vegetation characteristics. A 20m buffer was added to all the wetlands defined and this was deemed sufficient due to the position and high level of disturbance of the wetlands. eKZNW requested an additional 10m no development zone and this has been accommodated over the majority of the site.

The wetland delineation study identified two Channelled Valley Bottom systems on the property. These were heavily incised along most of their length and are for the most part moderately to highly disturbed. Streamflow augmentation, erosion control, sediment trapping and flood attenuation within the systems on site are deemed to performed at an intermediate to moderately low level. The movement of water through these systems is generally fairly rapid given the alteration of the system between small areas of wetland and perennial streams. The increased velocity and canalised nature of the flow limits the ability of the system to slow flood water moving down the water course. In addition, the overall roughness of the systems is also reduced as a result of the heavy infestation of alien invasive plants within the water courses.

The wetlands on site have limited direct value with regards to direct resources such as crops and water, tourism and research. Their location, incised nature and heavy alien plant population limits the value of these systems to local communities. The location of these systems on private property also limits the access and utilisation of the site for direct resource collection and production.

Implications

The wetlands and their buffers have, in the main, been avoided in the project planning. A small area to the south east of the site has been proposed as a school and spiritual site and there is insufficient space beyond the wetland buffer. However, as a trade off, other linkages and areas of open space have been created to improve the viability of the systems, in areas which could be developed. It is proposed that once the wetlands are rehabilitated, access will be allowed to the wetland below the school and the rehabilitated quarry area for educational and resource collection uses.

1.4.5 Vegetation

The site falls into the Indian Ocean Coastal Belt (Mucina and Rutherford 2006). Land use in the area is primarily sugarcane farming (over 88% of the cultivated area - Camp 1999b). The coastline is highly developed with only small isolated occurrences of natural vegetation. About 39% of the area has been transformed with only approximately 7% of the coastal belt formally protected in reserves.

Cultivation and afforestation are the greatest threats to biodiversity in the region and alien invasive plants present an increasing problem in the area. Chromolaena odorata is the main problem plant.

The vegetation on the site would have been classified as Kwazulu Natal Coastal Belt (Mucina and Rutherford 2006), typical of the area at altitudes of between 20 – 450mamsl. The area is typified by highly dissected undulating coastal plains which would have been covered in various types of subtropical coastal forest. Trees occurring in the natural vegetation in the area include *Bridelia micrantha, Phoenix reclinata, Syzygium cordatum, Acacia natalia, Albizia adianthifolia* and *Antidesma venosum.*

There is a wide variety of grasses, herbs and shrubs associated with this vegetation type.

Alien vegetation constitutes a significant problem in the area with species such as *Chromolaena odorata, Lantana camara, Melia azedarach* and *Solanum mauritianum* occurring commonly in the area.

The site comprises mainly sugar cane (approximately 90%), with small pockets of indigenous vegetation in some of the drainage channels. However, even where there are isolated areas of natural vegetation, these are heavily infested with alien vegetation. There are therefore unlikely to be any faunal species of significance on the property.

Whilst there are significant wetlands on the site, these are predominantly occupied by sugar cane and there are very few indigenous species in these areas.

Implications

There will be no development in the drainage channels and associated buffers and therefore no impact on the existing natural vegetation in the area. Removal of alien vegetation and rehabilitation of the undeveloped areas will result in a significant improvement of the ecological status of the site.

1.6 Glossary of Terms and Abbreviations

1.6.1 Parties Involved

Contractor:
For the purposes of this EMP, the Contractor refers to the main contractor(s) appointed by the client for the construction of the Project, or portion of the Project. The main contractor(s) are required to adhere to the EMP and are responsible for ensuring that all sub-contractors, suppliers and staff appointed by them also adhere to the EMP.

All Staff:
The entire workforce. Workers employed by the contractor, persons involved with activities related to the Project, or persons present or visiting the construction area, including permanent, contract, or casual labour and informal traders.

Environmental Control Officer (ECO):
An individual nominated by the Client to act on behalf of a Contractor in matters concerning the day-to-day implementation of the EMP, and for liaison with the DAEA, the public and owners or managers of properties affected by construction.

Local Community:
People residing or present in the region and near the construction activities, including the owners and / or managers of land affected by construction, workers on the land, and people in nearby towns and villages.

Public:
Any individual or group concerned with or affected by the Project and its consequences, including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.

1.6.2 General

Access Roads and Tracks:
All existing and newly established roads and tracks, and areas cleared or driven over to provide access to / from the construction areas, and for the transportation of the workforce, equipment and materials.

Alternatives:
A possible course of action, in place of another, that would meet the same purpose and needs (of the proposal). Alternatives can refer to any of the following but are not limited thereto: alternative sites of development; alternative projects for a particular site, alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called 'no action' alternative may also require investigation in certain circumstances.

Assessment:
The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.

Construction Area:
The land on which the Project is to be located. It includes the site, construction campsite, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMP (particularly the specifications for rehabilitation) is relevant for all areas disturbed during construction.

Development:
The act of altering or modifying resources in order to obtain potential benefits.

Environment:
The surroundings within which people exist. The environment is made up of: the soil, water and atmosphere; fauna and flora; any part, combination or interrelationships among these; and all the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact:
The degree of change in an environment resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation's activities or may be indirectly caused by them.

Environmental Impact Assessment (EIA):
A process of examining the environmental effects of development.

Environmental Impact Report (EIR):
A report describing the process of examining the environmental effects of development proposal, the expected impacts and the proposed mitigation measures.

Environmental issue:
A concern felt by one or more parties about some existing, potential or perceived environmental impact.

Evaluation:
The process of weighing information, the act of making value judgements or ascribing values to data in order to reach a decision.

Fugitive Dust:
Natural and / or human-associated dust becoming airborne due to the forces of wind or human activity.

General Waste and Construction Rubble:
Includes waste paper, board, cardboard, benign organic and domestic waste and uncontaminated construction debris such as used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Hazardous Substances:
Substances that are potentially dangerous and may affect human and / or environmental health. This would be because of the substances' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste includes, but is not limited to: human excrement, the by-products and wastes associated will the use of hazardous substances (i.e. used fuel, oil, lubricants and solvents), as well as items such as spent batteries, old oil filters, light bulbs, tyres, circuit boards, etc. which requires special collection and handling.

When left abandoned, even substances such as scrap metal, wire, tins, broken glass and plastic could be harmful to people, wild and domestic animals, for example: plastic could be ingested by animals; people and animals could be injured by broken glass or metal objects; and animals could get trapped in drums, tins and bottles or get entangled in plastic or metal wiring. Even if buried, such objects may become exposed over time due to wind erosion, scavengers or future human activities. Because of the sensitive nature of the area, these substances are all regarded as 'hazardous waste' for the purposes of this EMP.

Heritage Sites:
Heritage sites and artefacts can be defined as any object or site of cultural, historical, archaeological or palaeontological significance found in or on the land. Historical objects are objects older than 50 years with architectural, historical, scientific, cultural, social, spiritual, linguistic, technological or aesthetic value, for example: buildings or parts thereof, graves or burial sites, milestones, numismatic objects (i.e. coins and beads), and military objects. Archaeological objects include material remains resulting from human activity which are older than 100 years and which are in a state of disuse, such as tools, artefacts, human and hominoid remains and artificial features and structures.

Hydrological Features:
Hydrological features include, but are not limited to:
- Wetlands and open water;
- Vegetated drainage channels;
- Subterranean water;
- Marine environments;
- Estuarine environments.

Independent consultant:
A consultant not in the permanent service of the applicant. In addition a consultant ceases to be independent if:
- Involved in any design or work of the same project;
- Earns more than 50% of his or her work from the same company;
- Payment depends on the successful authorisation of the applicant.

Consultants in the permanent service of the applicant are referred to as 'in-house' consultants.

Integrated Environmental Management (IEM):
IEM provides an integrated approach for environmental assessment, management, decision making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.

Interested and Affected Parties (I&AP's):
Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investigators, workforce, customers and consumers, environmental interest groups and the general public.

Irreversible impact:
When the character, diversity or reproductive capacity of an environment is permanently lost.

Land use:
The activities that take place within a given area or space.

Life Support Systems:
Life support systems include, but are not limited to:

- An ecological system in which its outputs are vital for sustaining specialised habitats;
- An ecological system in which its outputs are vital for sustaining human life (e.g. water purification).

List of activities:
Development actions that are likely to result in significant environmental impacts as identified by the Minister of Environmental Affairs and Tourism in terms of section 21 of the ECA.

Local Labour:
For the purposes of this EMP, local labour refers to people who live within the local Municipality.

Mitigation:
Measures designed to avoid, reduce or remedy adverse impacts.

Monitoring:
The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time to assess the efficiency of control measures.

Negative impact:
A change that reduces the quality of the environment (by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, property or by causing nuisances).

Positive impact:
A change that improves the quality of the environment (by increasing species diversity and the reproductive capacity of an ecosystem, by removing nuisances or improving amenities).

Relevant authority:
The environmental authority on national, provincial or local level entrusted in terms of the Constitution and in terms of the designation of powers in Notice No. R. 1184 of 5 September 1997 with the responsibility for granting approval to a proposal or allocating resources.

Scoping:
The process of identifying the significant issues, alternatives and decision points that should be addressed by a particular EIR, and may include a preliminary assessment of potential impacts.

Sensitive Sites:
Environmentally sensitive sites include, but are not limited to:

- Areas with high conservation value due to the presence of important plant specimens, pristine habitats, high biodiversity, important water resources or heritage features and artefacts;
- Areas particularly prone to erosion once disturbed (i.e. steep slopes);
- Vulnerable areas with low potential for rehabilitation / slow rate of recovery (i.e. rock outcrops, steep slopes); and
- Areas in close proximity of sensitive receptors, such as farm homesteads, viewpoints or tourist stopovers.

Significant impact:
An impact that, by its magnitude, duration or intensity alters an important aspect of the environment.

Specialised habitats:
Specialised habitats include, but are not limited to, areas which are:

- Priority breeding habitats;
- Refuge areas;
- Vital for species survival (important for part, or all, of its life cycle);
- Essential for species performance;
- Cryptic habitats, etc.

Value judgements:
A statement of opinion or belief, which is not capable of being falsified by comparison with fact.

1.7 Acronyms

DAEA	KZN Department of Agriculture and Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
ECA	Environmental Conservation Act (73 of 1989)
ECO	Environmental Control Officer
RE	Resident Engineer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
I&AP's	Interested and Affected Parties
KZN	KwaZulu-Natal
MSDS	Materials Safety Data Sheets
NEMA	National Environmental Management Act (107 of 1998)
KDM	KwaDukuza Municipality

2 ENVIRONMENTAL AWARENESS AND COMPLIANCE

2.1 Responsibilities for Environmental Management

An independent Environmental Consultant will arrange for an Environmental Control Officer (ECO) to undertake inspections of the construction activities and EMP implementation throughout the project. After each inspection, the ECO will produce a monitoring report that will be submitted to the KwaZulu-Natal Department of Agriculture and Environmental Affairs (DAEA) and KDM. Relevant sections of the minutes of customary site meetings will be attached to the monitoring report.

The Contractor and / or its agents will be responsible for environmental management on site during the construction period. A pre-construction meeting is recommended in order to reach agreement on specific roles of the various parties and penalties for non-compliances with the EMP. In addition surrounding residents, tenants or land owners must be notified in advance of any potentially disturbing activities.

2.2 Training and Induction of Employees

The Contractor has a responsibility to ensure that all those people involved in the project are aware of and familiar with the environmental requirements for the project. The EMP shall be part of the Terms of Reference (ToR) for all Contractors, Sub-contractors and Suppliers. All Contractors have to give some assurance that they understand the EMP and that they will undertake to comply with the conditions therein. All senior and supervisory staff members shall familiarise themselves with the full contents of the EMP. They shall know and understand the specifications of the EMP and be able to assist other staff members in matters relating to the EMP.

An environmental awareness training programme for all staff members shall be put in place by the contractor. Before commencing with any work, all staff members shall be appropriately briefed about the EMP and relevant occupational health and safety issues.

2.2.1 Content and Delivery of Environmental Training Session

The environmental training session will be carried out on site with all labourers and Contractors present. It will be delivered in English and translated into Zulu to ensure that the entire workforce fully understands the contents of the session.

The session covers the following topics:

- The Environmental Management Plan (EMP)
- What is the environment?
- What makes up the environment?
- Why is it so important to protect the environment?
- How can the environment be damaged?
- How can you protect the environment?

It describes ways of protecting the environment, namely fauna and flora, endangered species, water resources, soil resources and people.

The training session comprises a flip chart presentation with colourful posters and diagrams describing the above-mentioned issues. The information on the flipchart is presented in English and Zulu. The information on the flip chart is duplicated in hard copy hand-outs / brochures which are given to each member of the workforce to keep.

The session is interactive and questions and discussion from the workforce is encouraged.

2.3 Complaints Register and Environmental Incident Book

Any complaints received from the community must be registered and recorded by the contractor on site. The complaint must be brought to the attention of the site manager and ECO, who will respond accordingly. The following information will be recorded:

- Time, date and nature of the complaint;
- Response and investigation undertaken; and
- Actions taken and by whom.

All complaints received will be investigated and a response (even if pending further investigation) is to be given to the complainant within 7 days.

All environmental incidents occurring on the site will be recorded. The following information must be provided:

- Time, date, location and nature of the incident; as well as,
- Actions taken and by whom.

2.4 Environmental Monitoring

Environmental monitoring of the construction of the proposed development will be undertaken by the Environmental Control Officer (ECO) on a monthly basis. Monitoring will be undertaken to ensure compliance with all aspects of the EMP.

In order to facilitate communication between the ECO, Resident Engineer (RE) and Contractor, it is important that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the project team before being conveyed to the Contractor. In this way, penalties as a result of non-compliances with the EMP may be justified as failure to comply with instruction from the highest authority.

2.5 Non-Compliance with the EMP

Difficulties may be encountered with carrying out mitigation measures that could result in future non-compliance. The Contractor shall put in place procedures to motivate staff members to comply with the EMP, and to deal with acts of non-compliance, or malicious damage to the environment. Penalties for non-compliance need to be discussed with the Contractor at the earliest stage (during the Pre-Construction Meeting).

2.6 EMP Amendments / EMP Instructions

No EMP amendments (relaxation or revision of any mitigation measure) shall be allowed without approval from the relevant authority (DAEA AND KDM). Motivations for amendments to the EMP may be discussed with the ECO. The ECO may propose EMP amendments on behalf of the proponent or issue EMP instructions (corrective actions, remediation and rehabilitation). These amendments or instructions issued by the ECO shall be implemented within the specified time frame.

3 MACRO LEGISLATIVE FRAMEWORK

3.1 The Constitution of the Republic of South Africa Act (108 of 1996)

The Constitution of the Republic of South Africa is the legal source for all law, including environmental law, in South Africa. The Bill of Rights is fundamental to the Constitution of the Republic of South Africa and in, Section 24 states that:

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

3.2 National Environmental Management Act (107 of 1998)

NEMA is South Africa's overarching environmental legislation and has, as its primary objective to provide for co-operative governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state and to provide for matters connected therewith (Government Gazette, 1998)

The Act provides for the right to an environment that is not harmful to the health and well being of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks (Government Gazette, 1998). Section 30 (1, 3 and 4) of the NEMA states that:

(1) (a) "incident" means an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed. (b) "responsible person" includes any person who; (i) is responsible for the incident; (ii) owns any hazardous substance involved in the incident; or (iii) was in control of any hazardous substance involved in the incident at the time of the incident;

(3) The responsible person or, where the incident occurred in the course of that person's employment, his or her employer must forthwith after knowledge of the incident, report through the most effective means reasonably available (a) the nature of the incident; (b) any risks posed by the incident to public health, safety and property; (c) the toxicity of substances or by-products released by the incident; and (d) any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to; (i) the Director-General; (ii) the South African Police Services and the relevant fire prevention service; (iii) the relevant provincial head of department or municipality; and (iv) all persons whose health may be affected by the incident.

(4) The responsible person or, where the incident occurred in the course of that person's employment, his or her employer, must, as soon as reasonably practicable after knowledge of the incident; (a) take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons; (b) undertake clean-up procedures; (c) remedy the effects of the incident; (d) assess the immediate and long-term effects of the incident on the environment and public health.

The listed activities have been authorities by DAEA through the provisions of NEMA.

3.4 Sustainable Development

The principle of Sustainable Development has been established in the Constitution of the Republic of South Africa (108 of 1996) and given effect by NEMA and the ECA. Section 1 (29) of NEMA states that:

"1(29)…Sustainable development means the integration of social, economic and environmental factors into the planning, implementation and decision-making process so as to ensure that development serves present and future generations."

Similarly the guiding principles established in Section 2 (3) of NEMA state that:

"2(3) Development must be socially, environmentally and economically sustainable. (4) (a) Sustainable development requires the consideration of all relevant factors including the following: (i) That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied; (ii) that pollution and degradation of the environment are avoided, or where they cannot be altogether avoided, are minimised and remedied…(vii) that negative impacts on the environment and on peoples environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied."

Thus Sustainable Development requires that there is an integration of social, environmental and developmental concerns and that greater attention to each of these aspects of development will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future (United Nations Department of Economic and Social Affairs, Division for Sustainable Development, 1992).

4 MITIGATION MEASURES

4.1 Site Establishment and Preliminary Activities

Potential environmental impacts, impact sources and objectives are described, and environmental management mitigation measures to be implemented during construction are specified. The Contractor(s) shall adhere to these measures at all times.

<table>
<tr><th colspan="4">Site Establishment and Preliminary Activities</th></tr>
<tr><th>Routing
Routing should aim to circumvent sensitive ecological areas and cause as little disturbance to the surrounding areas as possible.</th><th>Responsibility</th><th>Timing</th><th>✓ / ×</th></tr>
<tr><td>• The location of all underground services and servitudes must be identified and confirmed.</td><td>RE</td><td>Prior to moving onto site.</td><td></td></tr>
<tr><td>• The choice of access routes should take into account minimum disturbances to residents and businesses neighbouring the site.</td><td>RE</td><td>Prior to moving onto site.</td><td></td></tr>
<tr><td>• The Contractor must make use of the designated entrance for the duration of the construction phase.</td><td>RE</td><td>Ongoing.</td><td></td></tr>
<tr><th>Haulage Roads</th><th>Responsibility</th><th>Timing</th><th>✓ / ×</th></tr>
<tr><td>• All temporary access roads must be planned and approved by the RE and ECO ahead of construction activities and must not be created on an ad hoc basis.</td><td>RE</td><td>Prior to moving onto site and during construction.</td><td></td></tr>
<tr><td>• Roads must have as little cut and fill as possible.</td><td>RE</td><td>Prior to moving onto site.</td><td></td></tr>
<tr><td>• No trees/shrubs/groundcover may be removed or vegetation stripped without the prior permission of the RE/ECO.</td><td>RE/ECO/KDM</td><td>Before and during construction.</td><td></td></tr>
<tr><td>• Contractors must construct formal drains on all temporary haulage roads in the form of side drains and mitre drains to prevent erosion and point source discharge of run-off.</td><td>RE</td><td>Prior to moving onto site.</td><td></td></tr>
<tr><td>• All roads must allow for the natural movement of water where required.</td><td>RE/ECO</td><td>During road establishment.</td><td></td></tr>
<tr><td>• Scour check walls must be constructed in the side drains as follows:
<table>
<tr><th>Gradient of Road</th><th>Scour Check Spacing.</th></tr>
<tr><td><4%</td><td>Not required</td></tr>
<tr><td>5%</td><td>20m</td></tr>
<tr><td>8%</td><td>10m</td></tr>
<tr><td>10%</td><td>5m</td></tr>
</table></td><td>RE</td><td>During road construction.</td><td></td></tr>
<tr><td>• Scour checks can be constructed from material available on site or using driven wooden pegs.</td><td>RE</td><td>During construction of temporary roads.</td><td></td></tr>
<tr><th>Survey points</th><th>Responsibility</th><th>Timing</th><th>✓ / ×</th></tr>
<tr><td>• Roads or trails that are cut to provide temporary access for survey work must be minimised.</td><td>RE</td><td>During surveys and preliminary site investigations.</td><td></td></tr>
<tr><td>• Marking of survey points must have the RE’s approval.</td><td>RE</td><td>During surveys and preliminary site</td><td></td></tr>
</table>

		investigations.	
• Vegetation clearing must be kept to a minimum during survey operations.	ECO	During surveys and preliminary site investigations.	
Layout **The location of the storage site must be done in conjunction with the ECO to ensure the least possible environmental impact.**	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor is to adhere to the following when selecting an alternative site for storage of equipment and materials:			
- Choose as level an area as possible (gradients must not exceed 1:3);	RE	During surveys and preliminary site investigations.	
- Avoid locating the site within 50m of a hydrological feature (Section 1 (24 and 29) National Water Act (36 of 1998));	RE	During surveys and preliminary site investigations.	
- Locate the storage site within an already disturbed area;	RE	During preliminary site investigations.	
• The site selected must be approved by the ECO. If the ECO is not satisfied with the proposed site, alternative sites must be proposed and discussed with the ECO until a compromise is reached that is mutually acceptable.	RE/ECO/KDM	During surveys and preliminary site investigations.	
• Where possible cut to fill must be avoided during the establishment of the storage site.	RE	During site establishment.	
• The storage site should not exceed an area of 0.5ha.	RE/ECO	During site establishment.	
• The extent of the storage site must be defined and fenced off and all activities must be confined within this area. The ECO must agree to any extension or change in location of the storage site.	RE/ECO/KDM	During preliminary site investigations.	
• The storage site is to be maintained in a neat and orderly state at all times.	RE	Before and during construction.	
• Provision must be made for adequate cooking and ablution facilities.	ECO	Ongoing.	
• Gas or electricity must be used for cooking purposes to avoid the use of fires and potential stripping of the surrounding vegetation for fuel.	ECO	Ongoing.	
• Adequate parking must be provided for site staff and visitors.	RE	During site establishment.	
Ablutions **Ablutions are required for use by all construction staff and it must be ensured that their location, maintenance and removal are done with minimal environmental impacts.**	**Responsibility**	**Timing**	**✓ / ×**
• Potable water must be available at all times at various points within the site.	ECO	Before and during construction.	
• Where waterborne sewerage is not available a reputable	ECO	During site	

company, approved by the RE, must provide portable chemical toilets. Such toilets must be available for all staff.		establishment.	
• Toilets must be no closer than 50m from any natural water body watercourses (Section 1 (24 and 29) National Water Act (36 of 1998)).	ECO	During site establishment.	
• The construction of long drop toilets is forbidden.	ECO	Ongoing.	
• Under no circumstances may open areas, wetlands, drainage lines or the surrounding area be used as a toilet facility.	ECO	Ongoing.	
Provision for Camp Waste Disposal **Wastes generated on site should be minimised and recycling / re-use of waste materials should be promoted. Wastes should be contained, controlled and disposed of in accordance with relevant waste management practices.**	**Responsibility**	**Timing**	**✓ / ×**
• An adequate number of waste receptacles must be available at strategic locations around the construction site for gathering all domestic refuse, and to minimise littering.	ECO	Ongoing.	
• Bins must be lined for efficient control and safe disposal of waste.	ECO	Ongoing.	
• Recycling and the provision of separate waste receptacles for different types of waste must be encouraged.	ECO	Ongoing.	
• The excavation and use of rubbish pits on site is forbidden.	ECO	Ongoing.	
• A fenced area must be allocated for waste sorting and disposal.	RE/ECO	During site establishment.	
• The burning of waste on site is not permitted.	RE/ECO	Ongoing.	
General Substances and Materials **The storage and use of substances on site has the potential to spill / leak and cause contamination of surface and groundwater resources.**	**Responsibility**	**Timing**	**✓ / ×**
• Choice of location for storage areas must take into account prevailing winds, distance from water bodies and general on-site topography.	ECO	During site establishment.	
• The proximity of houses, schools and businesses must be taken into account when locating the storage area.	RE	During preliminary site investigations.	
• Storage areas must be designated, demarcated and adequately fenced if necessary.	ECO	During site establishment.	
• A lockable, mobile structure must be erected on an impermeable surface for storing materials, equipment, chemicals, etc.	RE/ECO	During site establishment.	
• Fuel required for the construction phase should not be stored on site but should rather be brought to site from external sources. Only the required amount of fuel should be brought to site, and no excess.	RE/ECO	During site establishment.	
• A designated working area must be constructed and must be underlain by an impermeable surface (e.g. a concrete slab or plastic lining).	ECO	During site establishment.	
• All handling of potentially toxic or hazardous material, and the repair, maintenance and storage of vehicles and equipment must be undertaken on the impermeable	RE/ECO	Ongoing.	

working surface in accordance with the Materials Safety Data Sheets (MSDS). • Fire prevention facilities must be present and easily accessible at all storage facilities.	ECO	During site establishment.	
Fencing	**Responsibility**	**Timing**	**✓ / ×**
• The storage site must be adequately fenced with bonnox type fencing (approximately 2m high, topped with razor wire) to discourage the theft of materials and equipment from the construction site.	RE	During site establishment.	
Risks Associated with Materials on Site **Staff must be made aware of materials risks on site.**	**Responsibility**	**Timing**	**✓ / ×**
• Material stockpiles must be stable and well secured to avoid collapse and possible injury to workers / residents.	RE	Ongoing.	
• Flammable materials should be stored as far as possible from adjacent residential / commercial areas.	RE/ECO	During site establishment.	
• Fire fighting equipment is to be present on site at all times as per the Occupational Health and Safety Act (85 of 1993).	RE/ECO	During site establishment.	
• Obstruction to drivers' line of site as a result of stockpiles must be avoided, especially at intersections and on corners.	ECO	Ongoing.	
• Residents, tenants and land owners adjacent to the site are to be notified in advance of any known potential risks with the construction site and associated activities.	RE	Ongoing.	
Hazardous Substances and Materials **The uncontrolled release of chemicals to the environment must be prevented at all times. Contamination of land and water resources must be prevented or minimised and appropriate clean-up activities will be required in the event of a spill.**	**Responsibility**	**Timing**	**✓ / ×**
See Section 1.6 for a definition of hazardous substances and materials			
• Material Safety Data Sheets (MSDS's) shall be readily available on site for all chemicals / hazardous substances to be used on site. Where possible and available MSDS's should include additional information on ecological impacts and measures to minimise and mitigate against any negative environmental impacts in the result of an accidental spill.	RE	Before construction commences.	
• Hazardous storage and refuelling areas must be bunded with an impermeable liner to protect water quality. The Contractor shall submit a methods statement to the RE for approval.	RE/ECO	During site establishment.	
• Storage areas containing hazardous substances / materials must be clearly signed.	ECO	During site establishment.	
• Residents living adjacent to the construction site must be notified of the existence of the hazardous substances / materials storage area.	ECO	When moving onto site or when the relevant materials arrive on site.	
• Staff handling hazardous substances / materials must be aware of their potential impacts and follow appropriate safety measures.	ECO	During staff induction / Ongoing.	
• The Contractor must submit a method statement and plans for the storage of hazardous materials and	ECO/KDM	Prior to establishment	

emergency procedures.		of storage area.	
Materials Management **Adequate records of all materials on site must be maintained.**	**Responsibility**	**Timing**	**✓ / ×**
• Contractors shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone etc.) and submit these to the RE for approval prior to the commencement of any work. • A signed document from the supplier of natural materials must be obtained confirming that they have been obtained in a sustainable manner and in compliance with relevant legislation.	RE/ECO ECO	On award of contract. On receipt of natural materials.	
Environmental Education and Awareness **Ensure that all site personnel have a basic level of environmental awareness training.**	**Responsibility**	**Timing**	**✓ / ×**
The Contractor must submit a proposal for staff training to the ECO for approval. Topics covered should include: - What is meant by "environment"; - Why the environment needs to be protected and conserved; - How construction activities can impact on the environment; - What can be done to mitigate against such impacts; - Awareness of emergency spills response provisions; and - Social responsibility during construction (being considerate to residents etc.). It is the Contractors' responsibility to provide the site foreman with no less than 1 hour's environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff. • Translators are to be used if necessary. • The RE / ECO must be on hand to explain any technical issues and to answer questions. • Use should be made of environmental awareness posters on site. • The need for a 'clean site' policy needs to be explained to everyone working on site.	ECO/KDM ECO ECO ECO ECO	During staff induction / Ongoing. Prior to moving onto site. Ongoing. Ongoing. During staff induction, followed by ongoing monitoring.	
Worker Conduct on Site **A general regard for the social and ecological well being of the site and adjacent areas is expected of the site staff.**	**Responsibility**	**Timing**	**✓ / ×**
Workers need to be made aware of the following rules: • No alcohol / drugs to be allowed on site. • No firearms allowed on site or in vehicles transporting staff to / from the site. • Prevent excessive noise.	RE / ECO	During staff induction and continually monitored.	

• No harvesting of firewood or muthi plants from the site or from areas adjacent to it. • Construction staff are to make use of the facilities provided for them, as apposed to *ad hoc* alternatives. • Trespassing on private / commercial properties adjoining the site is forbidden. • Driving under the influence of alcohol is prohibited.			
Dust / Air Pollution **Dust / air pollution sources must be identified and the possibility of pollution from these sources must be prevented or reduced.**	**Responsibility**	**Timing**	**✓ / ×**
• Areas that have been stripped of vegetation must be dampened periodically to avoid excessive dust. • The Contractor must make alternative arrangements (other than fires) for cooking and / or heating requirements. LPG cookers may be used, provided that all safety regulations are followed.	ECO RE	Ongoing. Ongoing.	
Soil Erosion **Soil erosion and sediment transport from the site must be minimised at all times. Maximum use of soils on site should be undertaken for rehabilitation and landscaping purposes.**	**Responsibility**	**Timing**	**✓ / ×**
• Where possible the time that stripped areas are left exposed should be kept to a minimum. • Wind screening and stormwater control must be undertaken to prevent soil loss from the site.	RE/ECO RE/ECO	Throughout the project duration. During site establishment.	
Stormwater Management **Management of surface water must minimise sediments removed from site.**	**Responsibility**	**Timing**	**✓ / ×**
• To prevent stormwater damage, the increase in surface runoff as a result of construction activities needs to be calculated and an appropriately designed stormwater management system needs to be put in place. A drainage plan must be submitted to the RE for approval. • Temporary cut off drains and berms may be required to capture stormwater and promote infiltration. This may be enhanced with the addition of a series of small attenuation ponds.	RE ECO	During surveys and preliminary site investigations. During site establishment.	
Fauna and Flora **All activities musts be undertaken with the objective of having the least possible impact on flora, fauna and natural habitats.**	**Responsibility**	**Timing**	**✓ / ×**
• Vegetation not to be removed must be clearly marked beforehand with chevron tape. The ECO must be given time to identify vegetation that is not to be removed before the contractor begins clearing the site. • Care must be taken to avoid the introduction of invasive plant species to the site and surrounding areas. • The Contractor(s) and labourers must be confined to the site and may in no circumstance trespass onto adjacent properties.	RE/ECO ECO RE/ECO	During site establishment followed by ongoing monitoring. Ongoing. Ongoing.	

• The collection of muthi plants and hunting, snaring and disturbance of any plant or animal and their habitat is strictly forbidden. This must be strictly controlled and fines / prosecution should be enforced in this regard.	RE/ECO	Ongoing.	
Social Impacts: Visual and Noise **The quality of life of surrounding residents must be kept in mind during all construction activities.**	**Responsibility**	**Timing**	**✓ / ×**
Public Participation • During the initial phases of the project, the Contractor must make contact with those people who are interested in or affected by the project (I&AP's), as identified by the ECO.	RE	Prior to moving onto site.	
Noise Impacts • Construction vehicles are to be well maintained and fitted with silencers prior to the construction phase.	ECO	Prior to moving onto site.	
• Equipment should be fitted with noise reduction facilities and must be used as per operating instructions and maintained properly during operations.	ECO	Ongoing.	
Visual Impacts] • Storage facilities, elevated tanks and other temporary structures on site should be located in such a way that they have as little visual impact on local residents and businesses as possible.	RE/ECO	During surveys, preliminary site investigations and site establishment.	
• Special attention should be given to the screening of highly reflective materials on site.	ECO	During site establishment.	
General **Section 30 of NEMA makes provision that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.**	**Responsibility**	**Timing**	**✓ / ×**
• An earthen berm should be constructed along the upslope perimeter of the storage site to divert excess surface runoff away from potentially contaminated surfaces within the site.	RE/ECO	During site establishment.	
• An earthen berm must also be constructed along the down slope perimeter of the storage site, to contain any contaminated runoff.	RE/ECO	During site establishment.	
• The subsoil stripped from the camp can be used for creating the berm.	RE/ECO	During site establishment.	
• The berm must channel runoff to a vegetated settling pond. This will allow for a reduction in flow velocity thus decreasing potential for downstream erosion and also allowing for suspended solids to settle out.	RE/ECO	During site establishment.	
• All wastewater and contaminated runoff from the storage and working areas of the storage site must be channelled into an appropriately sized, designed and located collection sump.	ECO	During site establishment.	
• The sump must be adequately sized (capable of containing a storm event), properly managed and pumped out regularly to prevent overflows.	RE/ECO	Ongoing.	
• Contaminated liquids and sediments from the sump must be disposed of at an appropriate permitted disposal site.	ECO	Ongoing.	

Additional Notes:

4.2 Management of Construction Activities and Workforce

Most environmental impacts of developments occur in the construction phase of the project. As a result the regulation of construction activities and the general conduct of the workforce is an essential component of this EMP and must be carried out in conjunction with the ECO.

Management of Construction Activities and Workforce			
Site Access	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor is to ensure that all access roads are maintained in good working condition by attending to potholes, corrugations and storm water damage as soon as these develop.	RE	Weekly and after heavy rains.	
• If necessary staff must be employed to clean surfaced roads adjacent to construction sites where materials have been spilt.	ECO	When necessary.	
Maintenance of the Contractors Camp Surfaces	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor must monitor and manage site drainage to avoid standing water and soil erosion.	RE	Ongoing.	
• Run-off from the storage site must not discharge into adjacent properties.	RE	Ongoing.	
Waste Management Wastes generated on site should be minimised and recycling / re-use of waste materials should be promoted. Wastes should be contained, controlled and disposed of in accordance with relevant waste management practices.	**Responsibility**	**Timing**	**✓ / ×**
General			
• The Contractor must identify disposal sites for the various categories of waste likely to be generated on site and must provide the ECO with documented proof of the type and volume of waste disposed of at these sites.	ECO	Ongoing.	
• The general cleanliness of the site and compliance with the waste disposal requirements outlined will form part of the site inspections undertaken by the ECO.	ECO	Ongoing.	
• Where possible, waste must be collected for recycling programmes provided that the original contents of the containers were not hazardous.	ECO	Ongoing.	
Domestic Waste			
• The working areas and the storage site are to be cleared of litter on a daily basis.	RE	Ongoing.	
• Domestic waste is to be stored in watertight, scavenger-proof and wind proof waste receptacles at the camp.	ECO	During site establishment.	
• Domestic waste is to be cleared on a regular basis and transferred to a permitted domestic disposal site. No domestic waste is to be buried or burned on site.	RE	Ongoing.	
Scrap Metal and Hazardous Substance Containers			
• Scrap metal (components, sheet metal, nails, tins) must be stored in a designated scrap metal container (e.g. a skip) located at the storage site.	ECO	Ongoing.	
• All scrap metal is to be collected on the completion of a days work and transferred to the container.	RE	Daily.	

• When the scrap metal container is full, the scrap metal must either be collected by a scrap metal dealer or transferred to an appropriate disposal site.	ECO	Ongoing.	
• Hazardous substance containers, contaminated substrates and materials used in the clean-up of spillages must be stored in a designated, impermeable container (e.g. a skip) located at the storage site if it is not possible to remove them from the site immediately.	RE/ECO	When necessary.	
• The hazardous substance containers, contaminated soil, clean-up materials, etc. must be transferred to an appropriate disposal site on a regular basis.	ECO	Ongoing.	
Construction Debris			
• On completion of construction, all leftover construction materials are to be removed from the working area and storage site (sand, gravel, cement, cement bags, timber).	RE/ECO	On completion of project.	
• The materials must be disposed of at an appropriate site, sold / donated to the local inhabitants or taken to the Contractor's depot.	RE/ECO	On completion of project.	
• Construction debris is **not** to be buried on site.	RE/ECO	Ongoing.	
Ablution Facilities **Ablutions are required for use by all construction staff and it must be ensured that their location, maintenance and removal are done with minimal environmental impacts.**	**Responsibility**	**Timing**	**✓ / ×**
• An adequate number of self-contained chemical toilets must be established at the storage site and active working area. Contractors must supply toilet paper at all toilets, and will be responsible for their maintenance and servicing.	RE	During site establishment / Daily.	
• The ablution facilities should conform to any requirements stipulated by the Department of Health and the Local Authorities.	RE	Prior to moving ont site.	
• Toilets must be placed outside areas susceptible to standing or flowing water and siting must be done in consultation with the ECO.	RE/ECO	During site establishment.	
• The ablution facilities must be maintained in a clean and orderly state and are to be regularly cleared to prevent odour and pest problems.	ECO	Ongoing.	
• Contractors must ensure that no spillage occurs when chemical toilets are cleaned and cleared and that the contents is carefully stored and transported when removing off-site. All spills must be recorded in the Environmental Incident Record Book.	RE	When necessary.	
• **No** pit latrines are to be used.	RE/ECO	During site establishment.	
• Performing ablutions outside toilet facilities or in rivers / drainage lines will be strictly prohibited.	ECO	Ongoing.	
Provision of Water **Suitable water supply must be supplied for construction purposes to prevent *ad hoc* use of natural water resources.**	**Responsibility**	**Timing**	**✓ / ×**
• Potable water is to be sourced from an existing supply, and made available at various localities around the storage site.	RE	During site establishment / Ongoing.	

• A dedicated source of water for dust suppression purposes must be determined during site establishment and be approved by the ECO. • Ad hoc use of the nearby streams and wetlands for washing, bathing or as a toilet facility must be prohibited.	RE/ECO ECO	During site establishment. Ongoing	
Concrete Mixing **Such activities must be undertaken at suitable distance from drainage lines, whether flowing or not.**	**Responsibility**	**Timing**	**✓ / ×**
• If small volumes of concrete are to be mixed (manually), mixing is to be undertaken on a hard surface covered in plastic sheeting so that concrete waste and runoff can be contained. • If large volumes are generated, the following requirements must be met: - The mixing area must be underlain by an impermeable surface that is sufficient to trap spills; - Runoff from the concrete mixing area is to be contained and channelled into a sump. - All concrete waste is to be collected and removed from the site for disposal at an appropriate disposal site.	ECO ECO	Ongoing. Ongoing.	
Fauna and Flora All activities musts be undertaken with the objective of having the least possible impact on flora, fauna and natural habitats.	**Responsibility**	**Timing**	**✓ / ×**
• The following requirements must be met to ensure the protection of the vegetation: - Where possible, indigenous trees and plants on site are to be protected. - All staff members are required to attend the environmental awareness meeting; - Employees are subject to fines, should they be caught removing flora from the site or immediate surrounds. - No member of the construction team may harvest, damage or remove plants, especially those in designated 'out of bounds' areas. - Use only plant species endemic to the site for rehabilitation purposes. - Re-vegetate the disturbed area as quickly as possible. - The local Municipality is to ensure that follow-up work / monitoring is scheduled over a suitable time period (of the order of two years) to ensure that the planted vegetation establishes itself, that the natural re-colonisation by indigenous, pioneer plants is successful and that alien plants are controlled.	ECO	During staff induction / Ongoing.	

Removal of Vegetation **Unnecessary clearance must be minimised. Indigenous plant communities must be re-created as part of rehabilitation / landscaping.**	**Responsibility**	**Timing**	**✓ / ×**
• Site clearing activities should only be conducted immediately prior to construction, to reduce the amount of time topsoil is exposed, and thus the potential for erosion.	ECO	Ongoing.	
Weed Control **The introduction of new weeds onto the site must be prevented. Exiting weeds must be removed on an ongoing basis.**	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor is to control the spread of alien weeds during the project. The ECO will provide the Contractor with the most appropriate, species-specific methods for eradicating problem plants. • Alien plants that have been removed are not to be discarded but are to be collected and transferred to the storage site where they can be burned in a controlled manner.	ECO ECO	Ongoing. When required.	
Water Quality **The quality of natural water resources must be maintained at all times. Monitoring of water quality is strongly recommended.**	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor is to control and minimise the washing of soil into watercourses by implementing the following: - Appropriate soil management strategies; - Prompt rehabilitation to protect and stabilise exposed soil surfaces. - Follow the requirements for soil stockpiling and management. • The Contractor is to prevent the contamination of water by materials used during construction, ensure the following: - Implement measures to prevent seepage of liquid materials into ground where it could contaminate groundwater; - Ensure prompt cleaning up of accidental spillages (Section 20 of the National Water Act (36 of 1998)). • The Contractor is to prevent the contamination of hydrological features by diesel, grease, oil, etc. derived from the camp and working area by ensuring that: - The machinery / equipment is maintained in a good operating condition; - Specially designated areas for vehicle maintenance are created; - Accidental spillages are cleaned up promptly.	ECO ECO ECO	Weekly in summer Monthly in winter Ongoing Ongoing	
Stormwater Management **Management of surface water must minimise sediments removed from site.**	**Responsibility**	**Timing**	**✓ / ×**
General Principles • There is to be a periodic inspection of the sites drainage system to ensure that the flow of surface water in not obstructed.	RE/ECO	Monthly.	

• The use of high velocity stormwater pipelines is to be avoided and where possible open, high friction, semi-permeable channels are to be used.	RE/ECO	As directed by the RE.	
• A number of smaller stormwater outfall points are to be constructed as apposed to a few large outfall points.	RE/ECO	As directed by the RE.	
• Stormwater outfalls are to be designed to reduce flow velocity and avoid stream bank and soil erosion.	RE	As directed by the RE.	
Stormwater Attenuation Ponds			
• The existing dams on site are to be used for attenuation purposes however additional small ponds could be created to supplement this. Attenuation ponds should not obstruct the flow of surface water, rather they should encourage the unconfined flow of surface water, increase roughness and reduce flow velocity and ultimately direct the water into an existing drainage line.	ECO	Ongoing.	
• Stormwater discharge from the site is not to increase as a result of the development.	RE/ECO	Planned before the commencement of the project.	
Unchannelled Flow			
• During construction, unconfined surface flow must be contained to avoid soil erosion.	RE/ECO	As surfaces become exposed.	
Soil Erosion **Soil erosion and sediment transport from the site must be minimised at all times. Maximum use of soils on site should be undertaken for rehabilitation and landscaping purposes.**	**Responsibility**	**Timing**	**✓ / ×**
• Once the site has been cleared of vegetation, the top layer of soil (200mm) should be removed and stockpiled in a designated area.	ECO	Ongoing.	
• The entire site must not be cleared of vegetation before construction commences, ensuring that exposed areas are kept to a minimum, wherever possible.	RE/ECO	Ongoing.	
• Topsoiling and re-vegetation shall commence immediately after the completion of an activity.	ECO	On completion of each phase.	
• Stormwater management and wind screening must be undertaken to prevent soil loss from the site.	RE	Ongoing.	
• Side tipping of spoil and excavated materials shall not be permitted – all spoil material shall be deposited of as directed by the RE.	RE	Ongoing.	
• Battering of all banks shall be such that cut and fill embankments are no steeper than the previous natural slopes unless otherwise permitted by the RE. Cut and fill embankments steeper than the original ground levels are to be re-vegetated immediately on completion of trimming. Alternatively cut and fill embankments are to be protected against erosion using bioengineering stabilisation.	RE/ECO	As cut and fill activities are completed.	
• All embankments, unless otherwise directed by the RE shall be protected by a cut off drain to control surface flow and prevent erosion.	RE	Immediately after the creation of the embankment.	

Soil Handling **Alteration to soil structure and type must be prevented by minimising soil handling on site.**	**Responsibility**	**Timing**	**✓ / ×**
• Soil must not be handled when it is wet as this will result in unnecessary compaction.	RE	When necessary.	
• Repeated handling of soil must be avoided as this results in compaction and the loss of soil structure. Planning the soil stripping and stockpiling process and allocating formal stockpile areas will minimise the chance of repeated handling.	RE/ECO	Ongoing.	
• If the soil stockpiles are to remain unused for more than two months they need to be vegetated with a suitable grass / legume mix.	ECO	When necessary.	
• In order to minimise the risk of spillage / loss through wind erosion, trucks transporting soil must not be overloaded when conveying soil to, from and around the site.	RE	Ongoing.	
• Soils being transported long distances on vehicles must be covered with tarpaulins.	RE	Ongoing.	
Stockpile Management **Soil excavated on site should be suitably stored and covered for maximum use during rehabilitation activities.**	**Responsibility**	**Timing**	**✓ / ×**
General Guidelines			
• Stripped soil is to be stockpiled so that it can be used in the rehabilitation process.	RE/ECO	Ongoing.	
• Soil that is to be stockpiled for an extended period must be stored at: - A sheltered site where it will not be exposed to the effects of wind erosion; - Outside the working area where it will not be disturbed or contaminated; - Away from drainage lines so as to avoid the risk of erosion;	ECO	When necessary.	
• Topsoil (top 200 mm) is not to be mixed with subsoil.	ECO	When necessary.	
• Soil is not to be stockpiled against tree trunks as this will encourage ant infestations.	ECO	Locate as directed by the RE.	
• Topsoil is not to be used as a bedding material.	ECO	When necessary.	
Location of Soil Stockpiles			
• Stockpiles must not be situated such that they obstruct natural waterways and drainage lines.	RE/ECO	Locate as directed by the RE.	
• Soil is to be stockpiled in small manageable piles (Not to exceed 2m).	RE	Ongoing.	
Stockpile Maintenance			
• Stockpiles are to be protected from wind and water erosion: - Short-term stockpiling (less than 3 weeks) erosion control measures will not need to be implemented; however, limitations on the area to be cleared will apply. - Medium-term stockpiling (more than 3 weeks), stockpiles must be covered with biomatting. - Long-term stockpiling (more than 2 months), stockpiles must be re-vegetated by hydro-seeding or sowing with an appropriate grass / legume mix.	ECO	Ongoing.	

• The colonisation of stockpiles by invasive plants must be controlled by removing the plants when they germinate. The purpose of this is to reduce the risk of developing a seedbank of invasive species within the stockpiled soil.	ECO	Monthly.	
Spoil Use, Handling and Disposal	**Responsibility**	**Timing**	**✓ / ×**
• Excess material must first be used for: - Creation of rock gabions where required for slope protection and erosion control; - Rehabilitation of cuts; - Backfill for excavations.	RE/ECO	Ongoing.	
• Should the volume of spoil to be disposed of be too large or if the density of spoil stockpiles becomes too high, the spoil will have to be removed from the working area to an appropriate area.	RE	When necessary.	
Dust / Air Pollution Dust / air pollution sources must be identified and the possibility of pollution from these sources must be prevented or reduced.	**Responsibility**	**Timing**	**✓ / ×**
• Exposed surfaces must be re-vegetated as soon as possible.	RE/ECO	Ongoing.	
• Excavation, handling and transport of erodible materials must be avoided under high wind conditions or when a visible dust plume is present.	RE	Ongoing.	
• Soils must either be covered with a biomatting or re-vegetated, and stockpiles are to be located in sheltered areas where they will not be exposed to the erosive effects of the wind.	RE	Ongoing.	
• Appropriate dust suppression measures must be used when dust generation is unavoidable (dampening).	RE	Ongoing.	
• No fires are allowed on site, except for the burning of fire breaks and alien species.	RE	Ongoing.	
• Vehicles and machinery are to be kept in good working order and to meet manufacturers specifications for safety, fuel consumption etc.	ECO	Ongoing.	
• Should excessive emissions be observed, the Contractor is to have the equipment seen to as soon as possible.	RE	As directed by the RE.	
Hazardous Substances **The uncontrolled release of chemicals to the environment must be prevented at all times. Contamination of land and water resources must be prevented or minimised and appropriate clean-up activities will be required in the event of a spill.**	**Responsibility**	**Timing**	**✓ / ×**
• The handling and storage of hazardous materials must be in accordance with the MSDS and must be restricted to the storage site as the appropriate pollution control measures will need to be in place. If additional areas / sites are required for the storage or handling of hazardous substances, they must be assessed and approved by the ECO who will then instruct the Contractor to implement the appropriate controls.	RE/ECO	Before construction commences / As additional hazardous are required.	

Inventory of Substances • The Contractor must compile an inventory of all hazardous substances to be used and stored on the site, and must ensure that they know the effects of these substances on their staff and the environment. A copy of this inventory must be supplied to the RE and ECO.	RE/ECO	Before construction commences / As additional hazardous are required.	
Handling and Storage • The Contractor must ensure that the quantities of chemicals stored on site are appropriate for his / her requirements, and must ensure that they are appropriately stored and handled so as to minimise the risk of spills.	ECO	Ongoing.	
• All chemicals must be confined to specific and secured areas that have to be approved by the ECO.	ECO	During site establishment. / Ongoing.	
• Chemicals must be stored in a bunded area with an impermeable base (e.g. concrete or plastic lining).	ECO	Ongoing.	
Spills of Hazardous Substances • The accidental or negligent spillage of any potentially hazardous substances must be cleaned up immediately using the most appropriate methodologies, equipment and materials.	RE	When necessary.	
• The Contractor must ensure that the necessary materials, equipment and chemicals are available on the site to deal with spills of any hazardous materials (e.g. Drizit).	RE/ECO	During site establishment.	
• The Contractor must devise a procedure for dealing with spills, which has to be approved by the ECO. The procedure must distinguish between those spills that can be cleaned up by the Contractor and those that will require specialist input. The name and contact numbers of various clean up companies must be posted and visible at the camp office. This procedure must also include a provision to notify the RE and ECO of any spills.	ECO	Prior to moving onto site.	
• Any contaminated soil or water must be removed and stored in a skip until it can be disposed of at an appropriate disposal site.	ECO	When necessary.	
Recording of Incidents The Contractor must provide an Environmental Incident Record Book on site to record the details of any environmental incidents (date, time, cause, action taken). This book will be regularly checked by the ECO who will also cross reference the entries with observations made during site visits.	ECO	Prior to moving onto site / Ongoing.	
Contaminated Water and Soils **Disposal of contaminated material is required at suitable disposal sites to prevent further contamination on site.**	**Responsibility**	**Timing**	**✓ / ×**
• All soil that is contaminated must be removed and stored in a skip until it can be disposed of at an appropriate disposal site.	ECO	Ongoing.	

• All wastewater and polluted runoff from contaminated areas must be channelled into appropriately sized, designed and located collection sump.	RE/ECO	During site establishment / Ongoing.	
• The size, design and location of the polluted runoff capture system must be assessed and approved by the ECO.	ECO	During site establishment.	
• The collection sumps must be properly managed and regularly cleared to prevent overflows.	ECO	Ongoing.	
• Contaminated water / sediment from the sumps must be disposed of at an appropriate disposal site.	RE/ECO	Ongoing.	
Equipment / Machinery **Use and maintenance of machinery should take into account potential for pollution of the surrounding environment and disturbance to neighbouring residents.**	**Responsibility**	**Timing**	**✓ / ×**
• The Contractor must store all equipment that may leak on an impermeable surface, with watertight drip trays to catch any pollutants.	ECO	Ongoing.	
• The drip trays must be cleaned regularly.	RE/ECO	Ongoing.	
• Chemicals collected in the drip trays must be collected and disposed of in an appropriate manner (MSDS).	RE/ECO	Ongoing.	
Personal Safety **Worker safety on site must be ensured through the distribution and use of appropriate Personal Protective Equipment (PPE).**	**Responsibility**	**Timing**	**✓ / ×**
Hard Hats • The following personnel are required to wear hard hats: - All persons within 10m of any situation where any form of lifting or hoisting equipment is being undertaken; - Any personnel working in any other situation where possibility of head injury is present.	RE/ECO	Ongoing.	
Protective Gloves • Protective gloves are to be worn by all persons engaging in the following: - Handling of heavy or sharp edged materials; - Welding or gas cutting activities; - Handling of corrosive chemicals.	RE/ECO	Ongoing.	
Safety Footwear • All persons entering the workshop area at the storage site and working area must wear approved safety boots.	RE/ECO	Ongoing.	
Safety Goggles • The following persons must wear safety goggles at all times: - Persons operating equipment under dusty conditions; - Persons engaged in cutting or welding activities; - Persons engaged in grinding activities; - Persons handling hazardous chemicals.	RE/ECO	Ongoing.	

Socio-Economic Environment **The site has neighbours in close proximity along two boundaries. Disturbance to them and their quality of life should be minimised as much as possible.**			
Disruption of Infrastructure and Services			
• Should the construction staff be approached by members of the public or other stakeholders they are to assist them in locating the RE or Contractor.	RE	Ongoing.	
• Disruption of access for local residents must be minimised and must have the RE's permission.	RE	Ongoing.	
• The Contractor is to inform surrounding residence and businesses in writing of disruptive activities at least 24 hours in advance. This can either take place by way of leaflets placed in post boxes giving the RE and Contractor's contact details or any other method approved by the RE.	RE/ECO	At least 24 hours before the activity is to take place.	
Visual Impacts **Lighting on site should not be intrusive or a nuisance to surrounding property owners. Vegetative buffers are recommended to reduce visual impacts.**			
• The site is to be kept clean at all times to minimise the visual impacts of the site.	ECO	Weekly.	
• Lighting of the storage site should be pointed downwards and away from oncoming traffic and surrounding properties to minimise the visual intrusion.	ECO	During site establishment.	
Noise **Noise sources should be minimised to prevent unnecessary disturbance to neighbours.**	**Responsibility**	**Timing**	**✓ / ×**
• Disturbance of the residents / businesses in the vicinity of the construction areas will have to be taken into account during the construction period.	RE	Ongoing.	
• Construction activities should only be carried out during daylight hours (08h00 – 18h00) and no construction should take place on Sundays and public holidays – AS SET OUT IN THE NATIONAL BUILDNG REGULATIONS AND BUILDING STANDARDS ACT	RE	Ongoing.	
• The siting of areas for delivery of equipment and materials must take into account the noise generated by the vehicle as well as noise generated by off-loading equipment.	RE	During site establishment.	
• Jackhammers and their associated compressors exhibit continuous noise that could impact on nearby residents. Acoustic treatment of the jackhammers must include silencers.	RE	Prior to moving ont site / Ongoing.	
• All vehicles and equipment must be properly maintained to reduce unnecessary noise.	RE	Ongoing.	
• Noisy activities are to be restricted to the times given in the project specifications or general conditions of the contract.			

Staff Conduct	Responsibility	Timing	✓ / ×
• The Contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary the ECO and / or a translator should be called onto site to further explain aspects of environmental or social behaviour that are unclear.	**RE/ECO**	**Ongoing.**	
Damage to Property and Structures	**Responsibility**	**Timing**	**✓ / ×**
• Damage to structures and fences on private property must be avoided as far as possible.	RE	Ongoing.	
• Should damage to the aforementioned occur, the Contractor will be responsible for repairing the damage caused or compensating the property owner accordingly.	RE	Ongoing.	
• Any fencing removed to enable construction to proceed must be replaced on completion of work in that area.	RE	Ongoing.	
Communication with I&AP's Ongoing communication with I&APs is important to facilitate a two-way exchange of information, i.e. neighbours being informed of construction activities and Contractors being informed of problems which may be affecting neighbours.	**Responsibility**	**Timing**	**✓ / ×**
• The RE and Contractor are responsible for ongoing communication with all I&AP's. It is strongly recommended that an environmental liaison forum is established. This should be chaired by the ECO for the purposes of interaction between the developer, relevant authorities, construction personnel and I&APs for information exchange and effective communication.	RE/ECO		
• A complaints register is to be located on site office. This must be in carbon copy format, with numbered pages. The Contractor must account for any missing pages. This register is to be tabled during monthly site meetings.	ECO	Monthly.	
• I&AP's need to be made aware of the existence of the complaints register and the methods of communication available to them. The Contractor is to achieve this by personal communication with neighbouring landowners.	RE/ECO	Ongoing.	
• Queries and complaints are to be handled by: - Documenting details of such communications; - Submitting these for inclusion into the complaints register; - Bringing issues to the immediate attention of the RE; and - Taking remedial action as per the RE and / or ECO's instructions.	ECO	Ongoing.	
• Selected staff are to be made available for formal consultation with I&AP's in order to: - Explain the construction process; and - To answer any questions.	ECO	Ongoing.	

Additional Notes:

4.3 Post Construction Activities

Site rehabilitation is an essential component of this EMP and must be carried out in conjunction with the ECO. The guideline is to be used as the basic structure for the site rehabilitation; the specific details must be decided by a Rehabilitation Contractor in conjunction with the ECO. This applies most specifically to the soil replacement and re-vegetation components.

- The requirements for the control of soil, water, dust and noise pollution stipulated in this EMP still applies during the site rehabilitation phase of the project.
- Similarly, the requirements for soil management, erosion control, alien vegetation removal and vegetation and fauna protection also apply.

Post Construction **All infrastructure and wastes associated with the construction phase will need to be removed so that the site is left in a tidy state with no hazards to human, animal or environmental health.**			
Infrastructure	**Responsibility**	**Timing**	**✓ / ×**
• Disassemble all infrastructure units and remove components from the working areas and Contractors Camp. This will include temporary office and storage structures and containers, water supply pipelines, water storage containers, power supply, etc.	RE	On completion of the project.	
• Drain all portable chemical toilets, being careful not to spill the contents. Transfer the contents to an appropriate disposal site.	RE	On completion of the project.	
• Drain all wastewater and sewage associated with the temporary ablution facilities and transfer the waste to an appropriate disposal site.	RE	On completion of the project.	
• Disassemble all fencing around the camp and either sell, auction or donate the components to the local community or transfer the waste components to the Contractors base.	RE	On completion of the project.	
Pollution Control Structures	**Responsibility**	**Timing**	**✓ / ×**
• Excavate all areas of contaminated substrate, transfer the contaminated substrate to an appropriate disposal site and treat the affected areas with appropriate ameliorants.	RE	On completion of the project.	
• Remove all plastic linings used for pollution control and transfer to an appropriate disposal site.	RE	On completion of the project.	
• Break up all concrete structures that have been created (e.g. working and parking surfaces) and remove concrete waste to an appropriate disposal site.	RE	On completion of the project.	

Waste	Responsibility	Timing	✓ / ×
• Remove all leftover construction materials from the camp and working areas and either sell, auction, donate to the local community or transfer to the Contractor's base.	RE	On completion of the project.	
• Remove all construction debris, litter and domestic waste from the camp and working areas and transfer to an appropriate disposal site. Remove all waste receptacles from the camp and working area either donate to the local community, auction, or transfer to Contractor's base.	RE	On completion of the project.	
• Do not burn or bury any waste at the storage site or in the working area – all waste is to be transferred to a permitted disposal site.	RE/ECO	On completion of the project.	
Collection Sumps	**Responsibility**	**Timing**	**✓ / ×**
• Drain all collection sumps and dispose of the contaminated liquid and solids at an appropriate disposal site.	RE/ECO	On completion of the project.	
• Remove the tanks or plastic linings or similar and transfer to a permitted site for disposal.	RE/ECO	On completion of the project.	
Re-vegetation Re-planting of areas with suitable indigenous vegetation must be carried out within appropriate timeframes in order to reduce the duration of exposure of soil.	**Responsibility**	**Timing**	**✓ / ×**
• It is important that the re-vegetation activities be planned in advance to ensure that seed and plant stockists are able to supply the required volume when required.	RE	On completion of the project.	
• All re-vegetated areas will need to be watered to ensure plant growth and development. The volume and frequency of watering will be left to the discretion of the Rehabilitation Contractor and ECO.	RE/ECO	As per the instructions of the ECO.	

Additional Notes:

5 CONCLUSION

In terms or NEMA everyone is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally responsible manner. Furthermore, in terms of NEMA, the cost to repair any environmental damage shall be borne by the person responsible for the damage.

Should any amendments or additions to this EMP be required, Metamorphosis will need to be contacted for discussion of such. Motivation for such amendments will then be forwarded to DAEA by the ECO on behalf of the client. DAEA will then be in a position to make a decision regarding the proposed amendments or additions.

The proposed construction of the Inkwazi Estate is likely to have negative impacts on the biophysical environment. Furthermore, the proposed development could have adverse impacts on neighbouring residents and may therefore affect the socio-economic environment of the local area.

If the above-mentioned management recommendations are adopted, however, it is anticipated that the negative environmental impacts of construction can be prevented or at least reduced. An appointed ECO will need to monitor the site throughout construction to ensure that the required environmental controls are in place and working effectively, and to revise the EMP if necessary.

INKWAZI ESTATE DEVELOPMENT

OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN

19 March 2009

1 OPERATIONAL GUIDELINES

Introduction

Several operational activities and amenities will be implemented during the occupational phase of the estate. These include a wellness centre, a church, sports facilities and a deli. Furthermore, a large area of wetland is present on the property, primarily along the northern and western boundaries. These are highly sensitive ecological habitats and act as sponges and filters for water moving over the landscape.

The requirements for the control of water, waste management, sewerage treatment plant, refuse collection, noise and visual pollution, alien vegetation removal, re-vegetation and fauna protection stipulated in this Operational EMP all apply during the operational phase of this development, i.e. during occupation of the houses and apartments and use of the facilities and amenities.

Contents of this Document

The purpose of this Operational EMP is to highlight sensitive ecological features and habitats as well as to identify potentially harmful or hazardous activities or infrastructure associated with the operational / occupational phase. The aim is then to minimise, as far as possible, potential negative impacts on the biophysical and / or socio-economic environment and promote positive impacts.

The two most important facets of the Inkwazi Estate, as identified through the EIA process, are:

i) Alien Plant Removal and Rehabilitation

ii) Wetland Rehabilitation and Management

These issues are dealt with separately in Sections 2 and 3 while other general operational issues are detailed in Section 4.

Environmental Monitoring and Responsibilities

An EMP for the construction phase of the development was compiled during the EIA process. The Construction EMP recommends the appointment of an independent Environmental Control Officer (ECO) to undertake regular monitoring of the construction activities, thereby ensuring compliance with all aspects of the Construction EMP.

The Inkwazi Estate Homeowners Association will be responsible for ongoing monitoring of all aspects of this Operational EMP during the operational / occupational phase of the residential estate in order to ensure that the contents are complied with. Compliance with both the Estate Management Articles of Association as well as the Construction EMP must also be ensured. It is recommended that the Homeowners Association appoint a panel of appropriate persons to monitor this. This should include persons responsible for specific topics such as technical / engineering aspects, environmental aspects and general services e.g. domestic /garden refuse.

If any procedure stated in this document is required to be modified or amended in any way, consultation with the Metamorphosis will be required, who will in turn consult with the relevant authorities and / or other interested and affected parties, as necessary. Any fundamental changes to this document must be approved, prior to them being instituted, by the DAEA.

Environmental Awareness

As a requirement of the Operational EMP, it is recommended that the residents of the estate be educated in terms of environmental awareness, particularly with regard to the function and importance of protection of the wetlands on site.

2 ALIEN VEGETATION REMOVAL AND REHABILITATION PLAN

Background

The site falls into the Indian Ocean Coastal Belt (Mucina and Rutherford 2006). Land use in the area is primarily sugarcane farming (over 88% of the cultivated area - Camp 1999b). The coastline is highly developed with only small isolated occurrences of natural vegetation. About 39% of the area has been transformed with only approximately 7% of the coastal belt formally protected in reserves.

Cultivation and afforestation are the greatest threats to biodiversity in the region and alien invasive plants present an increasing problem in the area. Chromolaena odorata is the main problem plant.

The vegetation on the site would have been classified as Kwazulu Natal Coastal Belt (Mucina and Rutherford 2006), typical of the area at altitudes of between 20 – 450mamsl. The area is typified by highly dissected undulating coastal plains which would have been covered in various types of subtropical coastal forest. Trees occurring in the natural vegetation in the area include *Bridelia micrantha, Phoenix reclinata, Syzygium cordatum, Acacia natalia, Albizia adianthifolia* and *Antidesma venosum.*

There is a wide variety of grasses, herbs and shrubs associated with this vegetation type.

Alien vegetation constitutes a significant problem in the area with species such as *Chromolaena odorata, Lantana camara, Melia azedarach* and *Solanum mauritianum* occurring commonly in the area.

The site comprises mainly sugar cane (approximately 90%), with small pockets of indigenous vegetation in some of the drainage channels. However, even where there are isolated areas of natural vegetation, these are heavily infested with alien vegetation. There are therefore unlikely to be any faunal species of significance on the property.

Whilst there are significant wetlands on the site, these are predominantly occupied by sugar cane and there are very few indigenous species in these areas.

There is also a significant presence around the dam of the alien tree *Schinus terebinthifolius* (Brazilian Pepper Tree). Other alien species present include *Chromolaena odorata* (Chromolaena), *Ipomea purpurea*, *Lantana camara* (Lantana), *Melia azedarach* (Syringa) and *Solanum mauritianum* (Bugweed).

Along the drainage channels there are isolated bands of forest, these bands have in places a closed canopy and can therefore be classified as forest in terms of the National Forest Act **National Forest Act**, No 84 of 1998. Section 7 of this Act describes a forest as a group of trees (2 or more) whose crowns are largely contiguous. This section of the Act pertains also to the forest understorey/canopy and any indigenous seedlings within the group of trees.

A diversity of species occurs, including species typically associated with wet areas, such as *Barringtonia racemosa (Powder-puff Tree)*, *Bridelia micrantha (Mitzeerie)*, *Ficus sur* (Broom Cluster Fig*)* and *Syzygium cordatum* (Umdoni).

An herbaceous layer still persists in these bands, and whilst this is an important component of forest - and once entirely eliminated does not naturally tend to re-establish - these bands cannot be described as swamp forest as they lack the true diversity and size of such an eco-system because this woody vegetation has been pressed back by agriculture in the past – severely so in certain sections.

However better recovery of this vegetation within these bands can easily be achieved thus allowing the forest biome to re-establish itself.

It must be noted that some of the species identified such as *Barringtonia racemosa (Powder-puff Tree)* are protected also in terms of the National Forest Act as well as provincial legislation namely, KwaZulu-Natal Nature Conservation Act.

Relevant Legislation

Amended Regulation 15 of the Conservation of Agricultural Resources Act (CARA - Act No 43 of 1983) stipulates that Category 1 plants (Declared Weeds) will no longer be tolerated in South Africa and must be removed. This is applicable to the Bugweed, Brazilian Pepper, Chromolaena and Lantana on site. Ipomea and Syringa are classified as Category 3 invaders and as such may not be allowed to exist within 30m of the 1:50 year floodline of any watercourse or dam. A landowner is required to curtail the spread of these weeds.

Methods of control in terms of S 15 of the CARA Regulations

15E(1) Where category 1, 2 or 3 plants occur contrary to the provisions of these regulations, a land user shall control such plants by means of one or more of the following methods of control as is appropriate for the species concerned and the ecosystem in which it occurs:

(a) Uprooting, felling, cutting or burning;

(b) Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;

(c) Biological control carried out in accordance with the stipulations of the Agricultural Pests Act, 1983 (Act No. 36 of 1983), the Environment Conservation Act, 1989 (Act No. 73 of 1989) and any other applicable legislation;

(d) Any other method of treatment recognised by the executive officer that has as its object the control of the plants concerned, subject to the provisions of sub-regulation (4);

(e) A combination of one or more of the methods prescribed in paragraphs (a), (b), (c), and (d), save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.

(2) The methods contemplated in sub-regulation (1) shall also be applied with regard to the propagating material and the re-growth of category 1, 2 and 3 plants in order to prevent such plants from forming seed or re-establishing in any manner.

(3) The performance of an act of control is not in itself proof that the objects of the control methods have been achieved and follow-up operations are mandatory to achieve the appropriate level of combating.

(4) Where uncertainty exists about the presence or efficacy of any biological control agent, a biological control expert shall be consulted.

(5) Any action taken to control category 1, 2 and 3 plants shall be executed with caution and in a manner that will cause the least possible damage to the environment.

Certain individual trees, as well as closed canopy forests are protected in terms of the **National Forest Act**, No 84 of 1998.

Removal Methods

Wildlife and Environment Society of South Africa

The website of the Wildlife and Environment Society of South Africa (WESSA) recommends the following for the removal of the problematic species found on site (www.geocities.com/wessaaliens/species/):

Removal Methods recommended by WESSA:

ALIEN SPECIES	METHOD	PRODUCT AND RATE
Bugweed	**Manual**: Ring bark tall trees. Pull out seedlings when soil is wet. **Chemical:** Basal Stem Cut Stump Foliar Spray **Biocontrol**: first defoliator insects to be released soon.	 GARLON 4 (200ml/10 litres diesel) GARLON 4 (200ml/10 litres diesel) or CHOPPER (125ml/10 litres water) GARLON 4 (50ml/10 litres water); ROUNDUP (150ml/10 litres water) or MUSTER (150ml/10 litres water) o None.
Brazilian Pepper	**Manual** Hand pull seedlings where practical but avoid cutting as it coppices easily. **Chemical**: -Basal Stem	 GARLON 4 (200ml/10 litres diesel)
Chromolaena	**Manual**: Hand-pull seedlings. Press down disturbed soil and cover with leaves. **Chemical**: Cut Stump Foliar Spray **Biocontrol**	 CHOPPER (200ml/10 litres water) GARLON 4 (400ml/10 litres water) or ROUNDUP (100ml/10 litres water) Available

Lantana	**Manual**: Hand-pull seedlings when soil is moist. **Chemical**: Cut Stump Foliar Spray **Biocontrol**	 CHOPPER (200ml/10 litres water) ROUNDUP (300ml/10 litres water) None
Syringa	**Manual**: Ring bark but beware coppicing – follow up necessary **Chemical**: Cut Stump Basal stem **Biocontrol**	 CHOPPER (300ml/10 litres water) GARLON 4 (200ml/10 litres diesel) None

Re-vegetation

Re-vegetation of previously disturbed areas, i.e. areas cleared of alien species, should be done using appropriate indigenous species. Sufficient time, irrigation, rest periods and organic fertilisers should be applied to rehabilitated areas to promote establishment of plants.

Planting of indigenous trees must begin as soon as possible, particularly along the property boundaries, in order to screen firstly the construction activities and eventually the entire development from surrounding landowners. Furthermore, the indigenous trees will serve as nesting and roosting sites for birds following the removal of alien tree species.

Ongoing Management

- Performance Indicators: Introduction of 'new' invasive species is prevented and the spread of existing weeds is minimised. Indigenous plant species are established and spreading.
- Monitoring and Reporting: Visual site assessment. This is to be done initially by the Environmental Control Officer during the construction phase, then by the iNKWAZI ESTATE Management Association during operation / occupation of the estate.
- Corrective Action: Education of residents and workers with regard to spread and maintenance of alien plants, both on the communal areas of the estate and in individual gardens. Ongoing implementation of alien plant removal methods is to be done, as described above followed up with re-vegetation using indigenous species.

3 WETLAND REHABILITATION AND MANAGEMENT PLAN

Wetland rehabilitation has been widely documented as being pivotal for improved water quality, catchment functioning and improvement of biodiversity. The Wetland Fix series of booklets compiled by Jon Wyatt (1995) for the Rennies Wetlands Campaign recommends several detailed management activities for hands-on rehabilitation / restoration as well as long term management of such systems.

Wyatt (1995) states that for the best results to be achieved in rehabilitating wetlands, the restoration needs to begin high up in the catchment and stream and continue downstream. For the Inkwazi site, however, the rehabilitation of the wetland will cover all areas of the wetland and its associated drainage lines within the boundary of the property.

Removal of alien vegetation and rehabilitation

The first step in the rehabilitation of the wetlands on this site would be to remove any alien invasive species and sugar cane from both the buffer zones and the wetland areas, as depicted on the development layout plan of the Environmental Impact Assessment Report.

The area needs to be fenced off in order to stop any livestock IS IT NECESSARY TO MENTION THIS? or local people in the area having access to the wetland area and causing more damage to the sensitive areas.

Alien invader plants should be eliminated from the wetland and its buffer (and the rest of the property). It is more effective to begin removing these from higher up the wetland area and continue the process downstream. These plants will need to be checked on a regular basis to maintain control and prevent further outbreaks (refer to Section 3 above for methods of alien plant removal).

It is further recommended that if large alien trees are present in the drainage lines on the property, these should be felled to ground level and cross-cut on site. The logs should then be placed perpendicular to the slope gradient i.e. along the contour and left to decompose in situ. This will serve to slow the velocity of surface water flow, thereby reducing the chances of erosion occurring on site and promoting wetland type conditions in which water is stationary or very slow-moving. The presence of the logs will also serve to create stable conditions for wetland plants to become established.

Furthermore, the drainage lines and overflow points must be well vegetated as this will stabilise the soil and encourage filtration of the water through the system. The vegetation will also serve to improve biodiversity on the property by attracting birds, insects and small mammals.

Rehabilitation and Re-vegetation of Wetland Areas

During the re-vegetation phase of wetland rehabilitation, only indigenous plants should be used. A list of suitable herbaceous plants and trees as listed in Wetland Fix Part 4 (Wyatt, 1995) is attached in Addendum 1.

Two methods of wetland rehabilitation are explained in Wetland Fix Part 3 (Wyatt, 1995), namely stream bank stabilisation and channel plug development.

4.2.1 Stream Bank Stabilisation

The stream bank can be stabilised using either herbaceous plants (reeds, sedges, grasses) or trees, or a combination of both. This will reduce the likelihood of erosion and collapse of this area of the wetland. The INKWAZI ESTATE site is moderately to very steep along the western boundary as it slopes down towards the wetland and large dam. Other steep areas are also present on the northern boundary, particularly between the two small dams in this area. These areas must be prioritised for stream bank stabilisation and this should be implemented as soon as possible.

In using herbaceous plants, several methods can be implemented, as follows:

METHOD 1: **Root rhizome cuttings** planted along the edge of the bank 50-100cm apart.

METHOD 2: **Root clumps** of grass, sedge, reed or bulrush species i) **buried** or ii) **anchored down** with rocks in the stream 50-100cm apart.

METHOD 3: **Reed culm bundles** i) **planted** or ii) **anchored down** with rocks at 50-100cm intervals.

METHOD 4: **Root clumps** of grass, sedge, reed or bulrush species placed in i) **roll gabions** (cylindrical) or ii) **standard gabions** (square) **anchored into trenches** with stakes.

METHOD 5: **Root clumps** of grass, sedge, reed or bulrush species placed in i) **roll gabions** (cylindrical) or ii) **standard gabions** (square) **anchored over silt trap layer** of dead branches with stakes.

Trees may also be used along the stream bank for stabilisation. They should not be planted in lines but rather randomly to create a full canopy across the stream bank in order to assist the recovery of the stream bank. The front line of trees is best placed as close to the stream bank as possible however should not be on the edge of steep banks as collapse of the bank is likely.

Trees can be planted as follows:

METHOD 1: Tree seedlings planted on the edge of the bank at 3m intervals.

METHOD 2: Tree truncheons and seedlings planted along the bank at 3m intervals.

METHOD 3: Tree truncheons laid either i) vertically along the water course (piling) or ii) horizontally along the bank (ground layering).

METHOD 4: Tree truncheons laid in or planted through wire netting rolls that are anchored into the trenches with stakes.

METHOD 5: Tree truncheons laid into front and top or through gabions filled with stone or soil.

METHOD 6: Tree truncheons staked **alongside gabion deflectors**.

Illustrations of stream bank stabilisation using herbaceous plants and trees are included in Addendum 2.

4.2.2 Channel Plug Development

Using channel plugs for rehabilitation of the wetland forces the water to flow in a less stream-like fashion i.e. slows water velocity by spreading the water over a larger area rather than confining its flow to a channel. This will recreate wetland conditions. Channel plugs may be designed to raise the stream channel floor or they may be more substantial structures which force water to be stored in the wetland with a slow outflow rate.

Wyatt (1995) recommends that buildings should be positioned at least 20m from the 1:50 year floodline. For the Inkwazi site, no building lines will be implemented according to the boundary of the wetland, i.e. edge of the temporary wetland zone, as defined by Sivest during the environmental scoping process.

Plugs are best placed at the head cut of the channel and as high up in the system as possible initially before making more plugs further downstream. Similarly with stream bank stabilisation, channel plugs can be created using either herbaceous plants or trees, or both.

Using herbaceous plants:

METHOD 1: **Rock fill** placed into the head-cut and **supported by root clumps** of sedge, reed or bulrush species.

METHOD 2: Creation of a **diversion plug** using i) a **soil hump** or ii) **sand bags** planted with grass, sedge, reed or bulrush species.

METHOD 3: **Channel sills** planted with i) **root clumps** of sedge, reed or bulrush species or ii) **reed culm bundles** in 100cm wide strips. The root clumps / reed culm bundles can also be **supported by rocks**.

METHOD 4: **Roll gabion channel sills** planted with root clumps of sedge, reed or bulrush species and anchored with rocks.

METHOD 5: **Gabion or concertainer plugs** with root clumps of sedge, reed or bulrush species planted in front of and in the top of the stone and soil-filled gabions.

METHOD 6: i) **Concrete weirs** or ii) **clay core dam walls** supported by **root clump planting**.

For Methods 5 and 6, reno mattresses may be required and it is recommended that specialists from Cedara be consulted with regard to the design of these structures. A reno mattress is defined as a structure comprising long flat wire-mesh or veldspan baskets filled with rocks or stones to protect water overfall points against downstream scour.

Using trees to develop a channel plug:

METHOD 1: **Trees** planted into the **head-cut**.

METHOD 2: **Seedlings** and / or **truncheons** planted **into the water course** at 150 cm intervals.

METHOD 3: **Truncheons** i) **ground layered** into the channel or ii) **planted** into a rock sill.

METHOD 4: **Truncheons** planted i) **alongside** or ii) **through** a **roll gabion sill** filled with rocks and soil.

METHOD 5: **Truncheons staked** and / or **ground layered** alongside a **gabion or concertainer plug**. A reno mattress may be required and it is recommended that specialist at Cedara be contacted regarding its design.

Illustrations of channel plug development using herbaceous plants and trees are included in Addendum 3.

Additional Recommendations for Wetland Areas

- Only suitable indigenous, preferably endemic, species should be used in the wetland rehabilitation process (see list in Addendum 1).
- Re-vegetation should be done during the wet, frost-free months to ensure establishment of plants and trees.
- Wetland areas should be given sufficient time to establish. Ongoing monitoring by wetland specialists should be conducted to assess the progress of the wetland.
- Wetland areas should be afforded sufficient protection from disturbance, thus designated paths and sufficient sign posting should be constructed. Penalties must be in place to ensure people do not stray from designated walking areas.
- Residents must be educated in terms of the sensitivity of the wetland environment to disturbance and pollution.

Ongoing Management

- Performance Indicators: Indigenous wetland species are established and spreading. Little or no alien species present. Water flow rate is slower, creating larger wet areas and some areas of standing water. Improved biodiversity e.g. nesting birds in reeds.

- Monitoring and Reporting: Visual site assessment. This should be done by a wetland expert. Regular monitoring of wetland water quality upstream, on site and downstream of site, preferably every 3 months for the first year followed by 6-monthly monitoring thereafter and results should be forwarded to DWAF. The samples should be tested for the following parameters:

    1. Suspended Solids
    2. PH
    3. Total Dissolved Salts
    4. Chemical Oxygen Demand
    5. Soap oil and grease
    6. Ammonia
    7. Calcium
    8. Magnesium
    9. Faecal coliforms
    10. Nitrates and Nitrites

- Corrective Action: Education of residents with regard to functioning of wetland and importance of no disturbance. Ongoing implementation of alien plant removal methods and re-planting of indigenous wetland species where necessary. Relevant authorities to be notified as and when required, e.g. DWAF, DAEA.

4 GENERAL MANAGEMENT GUIDELINES & RECOMMENDATIONS

Hazardous Substances

- Residents must be provided with a list of hazardous substances (e.g. paint, detergents and varnishes) which must be disposed of off-site. Alternatively they may be collected in a designated hazardous chemical area situated within the estate and must be removed and disposed of weekly by the HA.

- Spill kits of spill control products, e.g. Drizit / Zorbit, should be kept on the estate and be easily accessible. These spill kits should be used by suitably qualified persons.

- The relevant authorities, e.g. DWAF, must be informed of major spills if and when they occur.

Domestic Refuse

- Residents will be required to place their domestic refuse in suitable receptacles (preventing access by dogs and dispersion by wind) and make this refuse available for collection by the HA. Domestic refuse will be removed from the site by the Kwadukuza Municipality, and transferred directly to the Kwadukuza landfill for disposal on a weekly basis.

- Separation and recycling of domestic refuse (organic material, glass, tins, newspaper, plastic etc.) should be encouraged. Organic material could be used for compost.

- Separate receptacles for the disposal of these recyclable materials could be positioned within the estate and the HA could remove these regularly to the nearest recycling depots.

Organisations such as Collect-a-Can and War on Waste could be contacted in connection with establishing a recycling depot within the estate.

- Staff training should be undertaken every six months to capacitate staff in terms of waste minimisation, waste disposal, recycling and other waste issues.

Visual Impacts

- Compliance with the Architectural Code must be ensured at all times in order to minimise visual impacts.
- Planting of indigenous trees as buffers along the property boundaries is strongly recommended and should be initiated as soon as possible. This will reduce visual impacts of the estate for neighbouring landowners.
- Capped / soft lighting should be installed and it must be ensured that lights do not shine directly / intrusively onto neighbouring properties. Lights should be of a low wattage to further reduce their intrusiveness.

Infrastructure and Services

- Services such as electricity, water supply, sewage and refuse disposal systems will require ongoing monitoring and maintenance for the duration of occupation.

Fire Management

- Fire prevention equipment (fire extinguishers, hydrants) will be required at suitable locations throughout the property for use in the event of a fire. All houses should be equipped with fire extinguishers, as per fire safety regulations and insurance requirements.
- Activities within the residential estate must be undertaken in a manner which will not create a fire risk. Braai areas must be protected from the prevailing wind, and the surrounding area will need to be paved or regularly mown to prevent accidental fires.
- **Gardens and Landscaping**
- Only the plants listed in the landscaping list specified by the landscape architects (Uys & White) will be permitted on the property.
- No alien invasive plants will be permitted as this would be in direct contravention of the Regulations specified in the Conservation of Agricultural Resources Act (Act No 43 of 1983).
- Only indigenous species will be used in areas which are to be rehabilitated as natural zones (as specified by Uys & White).
- The use of organic fertilisers is recommended in preference to chemical types.
- Surface water recycling should be encouraged. This could include the storage of water from the house gutters and its use for irrigation of rehabilitated construction areas and landscaped areas, as well as private and communal gardens.

Flora and Fauna

- Disturbance to or removal of wildlife on the property and on adjacent properties and damage to their breeding and foraging sites must be prevented at all times.
- No poaching and / or unauthorised shooting or hunting will be permitted on the property or on adjacent properties.
- No collection of or damage to protected plant species will be permitted. Expert advice should be sought regarding the identification of protected plant species. Ezemvelo KZN Wildlife can be contacted in this regard on tel: 033 – 845 1999.
- If dogs are permitted, they must be contained within fenced gardens. Owners wishing to walk their dogs within the estate must keep dogs controlled on leads at all times. Dogs should not be allowed to stray onto neighbouring properties at any time due to their propensity for chasing indigenous fauna.
- It is strongly recommended that penalties should be enforced by the HA in the event that any of the above rules are contravened.

Noise, Motorised Vehicles and Equipment

- No unnecessary noise such as hooting or shouting will be permitted. Activities of the residents should be undertaken responsibly and should take into account other residents and neighbouring landowners.
- Noisy activities such as the use of lawnmowers should be restricted to daylight hours.
- Residents should be made aware of any noise complaints received from public and neighbours and should be dealt with by the HA.
- No off-road driving will be permitted under any circumstances. No quad bikes or motor bikes will be permitted on the property or on neighbouring properties due to the temptation to drive off-road and ability to access remote and potentially sensitive ecosystems.
- Appropriate speed limits should be adhered to at all times within the estate, to avoid accidents and reduce noise for surrounding residents and road users.

Further Recommendations

- No littering will be permitted on the property.
- It is recommended that all residents of Inkwazi become involved in the local Community Watch Group as well as the local environmental Conservancy, if applicable
- No fires to be ignited unless in designated braai areas or fireplaces at the houses.
- No trespassing on neighbouring properties. Residents should be made aware of the property boundaries to prevent such trespassing.
- No damage to or removal of culturally significant resources such as rock art sites or historical relics. Should such resources be discovered, Amafa AKwazulu Natal, the relevant authority, should be contacted on tel: 035 – 870 2050.
- All residents must be made aware of the presence and content of this Operational EMP, understand it and agree to obey it at all times

- Should any properties be sold, the new owners will be subject to the Construction EMP and this Operational EMP.

- Management of the estate (including parks and gardens) should be ongoing and a panel should be elected to oversee management issues, e.g. Operations Manager for the everyday maintenance of the estate, Environmental Manager to oversee the wetland and its rehabilitation and the removal of alien species in the area.

- Relevant authorities (including KwaDukuza Municipality, DAEA, DWAF, Ezemvelo KZN Wildlife and WESSA should be kept informed at all times of the ongoing progress on the estate.

5 CONCLUSION AND RECOMMENDATIONS

The specific mitigation measures and recommendations included in this Operational EMP should be strictly followed at all times and regularly assessed by the Inkwazi Homeowners Association.

It is further recommended that environmental groups and authorities such as the Department of Agriculture and Environmental Affairs, KwaDukuza Municipality, Ezemvelo KZN Wildlife and WESSA be contacted as role-players for the occupational phase of this residential development.

In conclusion, if these recommendations are followed, the operation of this residential estate will have significantly reduced impacts on the environment and could serve as an example of how a suburban residential development can be successfully integrated with surrounding communities and valuable ecological features such as wetlands.

REFERENCES

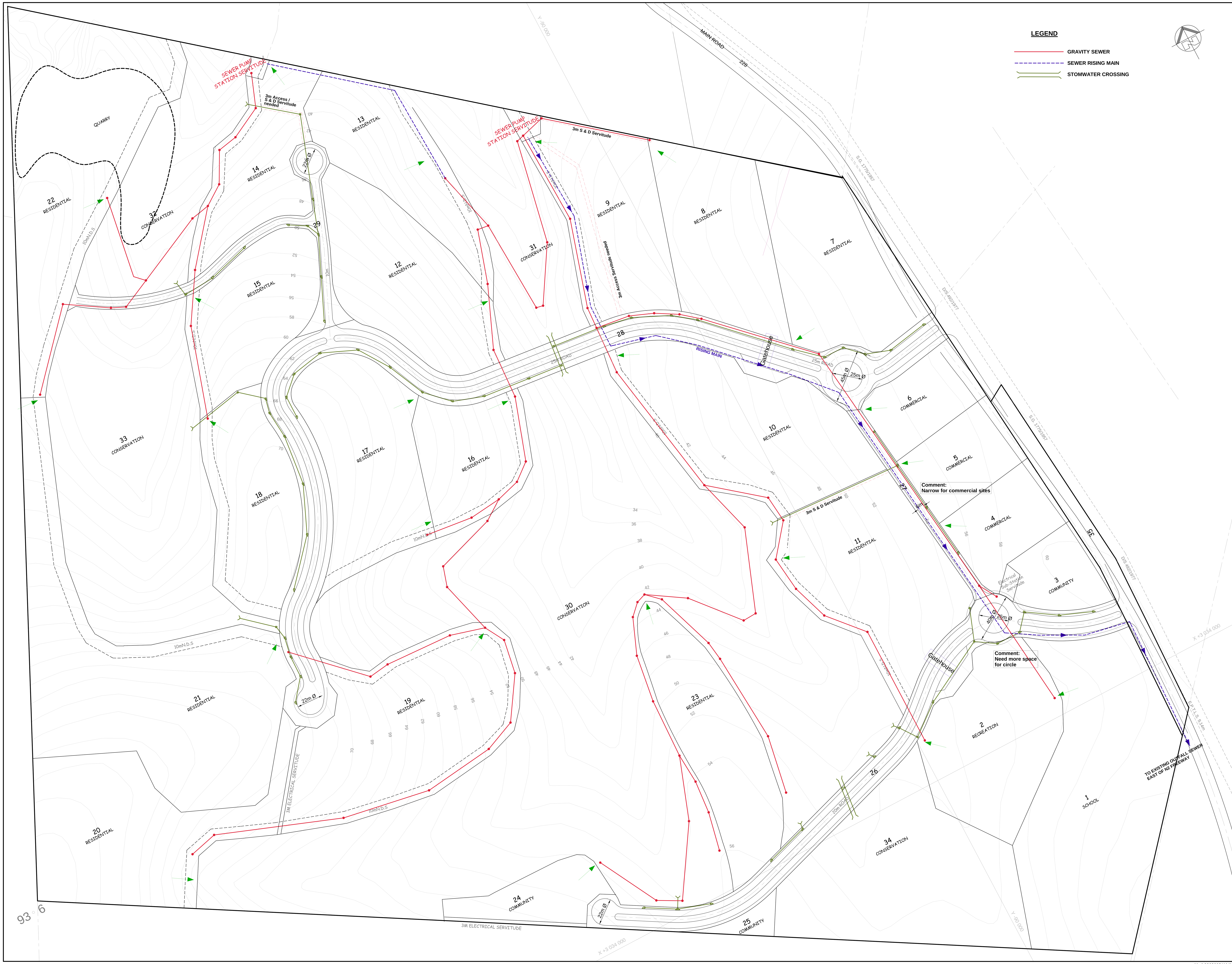
Camp K. G. (1997), **The Bioresource Groups of Kwazulu-Natal – Condensed Report**. Cedara Report No N/A 97/6.

Siyageza Website: **www.siyageza.co.za**

Wyatt, J. 1995. **Wetland Fix – Assessment, Management and Restoration of South African Wetlands: Part 3 & 4.** Rennies Wetlands Campaign.

Wildlife & Environment Society Website: **www.geocities.com/wessaaliens**

Working for Water Website: **www.dwaf.gov.za/wfw/Control**



Notes

All dimensions to be checked on site before any work is put in hand. Refer any discrepancies to the engineer.

DOCUMENT CONTROL STATUS

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Amendment

No.	Date	Checked	Done by	Description
	.	.	.	.

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Westway Office
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Westville, 3630

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Westville, 3630

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KV3 ENGINEERS

Designed	Drawn	Checked
M. J. RICHMOND	L. DU PLESSIS	M. J. RICHMOND

Consulting Engineer — Date

Client — Date

Client

CHAPMAN ENTERPRIZES

Project

INKWAZI ESTATE

Drawing description

CIVIL ENGINEERING SERVICES LAYOUT

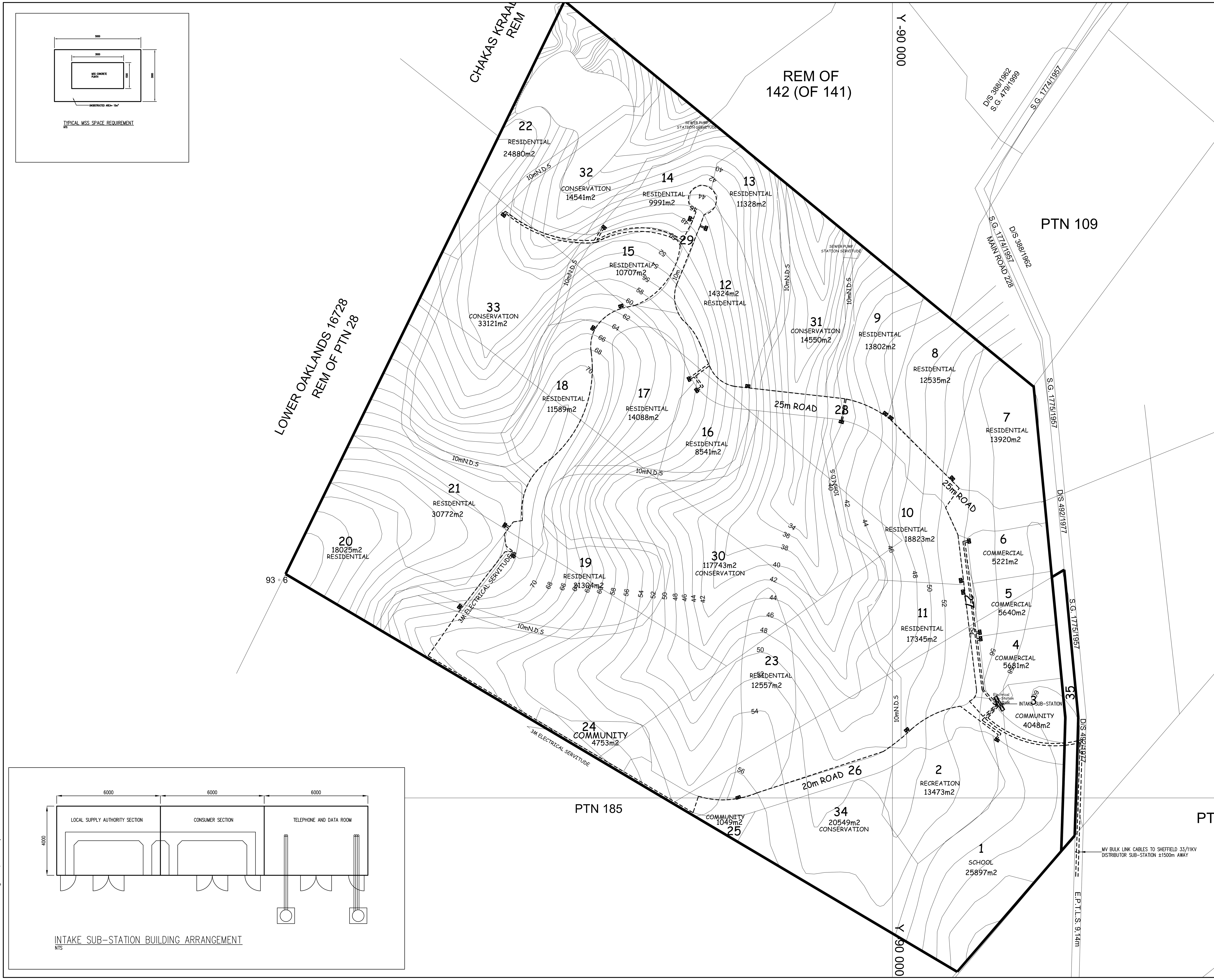
Scale	Date
1 : 1000	FEBRUARY 2009

Drawing number

236860DK

Rev. .

M : \ 236860DK \ INKWAZI ESTATE, SHEFFIELD CHAPMAN \ DRAWINGS


TYPICAL MSS SPACE REQUIREMENT
NTS
INTAKE SUB-STATION BUILDING ARRANGEMENT
NTS
LOCAL SUPPLY AUTHORITY SECTION
CONSUMER SECTION
TELEPHONE AND DATA ROOM
6000
4000
LOWER OAKLANDS 16728
REM OF PTN 28
CHAKAS KRAAL
REM
REM OF
142 (OF 141)
PTN 109
PTN 185
Y -90 000
93 6
LEGEND
MV CAVLE
MINIATURE SUB-STATION (MSS)
22 RESIDENTIAL 24880m2
32 CONSERVATION 14541m2
14 RESIDENTIAL 9991m2
13 RESIDENTIAL 11328m2
29
15 RESIDENTIAL 10707m2
12 14324m2 RESIDENTIAL
33 CONSERVATION 33121m2
31 CONSERVATION 14550m2
9 RESIDENTIAL 13802m2
8 RESIDENTIAL 12535m2
18 RESIDENTIAL 11589m2
17 RESIDENTIAL 14088m2
16 RESIDENTIAL 8541m2
28
25m ROAD
7 RESIDENTIAL 13920m2
21 RESIDENTIAL 30772m2
10 RESIDENTIAL 18823m2
6 COMMERCIAL 5221m2
20 18025m2 RESIDENTIAL
19 RESIDENTIAL 81304m2
30 117743m2 CONSERVATION
5 COMMERCIAL 5640m2
11 RESIDENTIAL 17345m2
27
4 COMMERCIAL 5681m2
23 RESIDENTIAL 12557m2
INTAKE SUB-STATION
3 COMMUNITY 4048m2
35
24 COMMUNITY 4753m2
2 RECREATION 13473m2
20m ROAD 26
34 20549m2 CONSERVATION
25 COMMUNITY 1049m2
1 SCHOOL 25897m2
3M ELECTRICAL SERVITUDE
10mN.D.S
SEWER PUMP STATION SERVITUDE
D/S 388/1962
S.G. 479/1999
S.G. 1774/1957
MAIN ROAD 228
S.G. 1775/1957
D/S 492/1977
E.P.T.L.S. 9,14m
MV BULK LINK CABLES TO SHEFFIELD 33/11KV DISTRIBUTOR SUB-STATION ±1500m AWAY

DO NOT SCALE

REV	DATE	BY	DESCRIPTION	CHK	APD
P1	2009.02.27	JZ	PRELIMINARY, ISSUE FOR COMMENT		

DRAWING STATUS: PRELIMINARY

WSP

P.O. BOX 670 WESTVILLE, 3630 SOUTH AFRICA
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CLIENT: CHAPMAN ENTERPRISES

ARCHITECT: DZM SPACE

PROJECT: INKWAZI ESTATE (PTY) LTD

TITLE: ELECTRICAL INSTALLATION MV RETICULATION LAYOUT

SCALE @ A1: 1: @ A1	CHECKED:	APPROVED:
CAD FILE:	DESIGN-DRAWN: LL/JZ	DATE: DATE
PROJECT No: D9900	DRAWING No: D9900/IE-60-00	REV: P1

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