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ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR THE

PROPOSED UPGRADING OF STORMWATER INFRASTRUCTURE ROSEMOOR, GEORGE, WESTERN CAPE

APPLICATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998
(ACT NO. 107 OF 1998), AS AMENDED, AND THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014

PREPARED FOR:
George Municipality
Water & Sanitation: Civil Engineering Services
PO Box 19
George
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DATE: 24 October 2025

DEADP REF NO: 16/3/3/1/D2/47/0013/25
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Appendix 4 of the EIA Regulations 2014 (as amended 2017).

This Environmental Management Programme has been drafted in accordance with Appendix 4 of the Environmental Impact Assessment Regulations 2014 (as amended 2017). The table below shows how the requirements of Appendix 4 have been included within this Environmental Management Programme.

Table 1: Appendix 4 of the EIA Regulations 2014 (as amended 2017).

(1) An EMPr must comply with section 24N of the Act and include— (a)details of– (i)the EAP who prepared the EMPr; and (ii)the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Appendix C- EAP CV
(b)a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 4 – Description of the Activity
(c)a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Section 4 - Description of the Activity
(d)a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i)planning and design; (ii)pre-construction activities; (iii)construction activities; (iv)rehabilitation of the environment after construction and where applicable post closure; and (v)where relevant, operation activities;	Section 8 - Environmental Impact Management: Planning and Design Phase Section 9 - Environmental Impact Management: Pre-construction Phase Section 10 - Environmental Impact Management : Construction Phase Section 11 - Environmental Impact Management : Post Construction Rehabilitation Phase & Operational Phase
(f)a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to — (i)avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii)comply with any prescribed environmental management standards or practices; (iii)comply with any applicable provisions of the Act regarding closure, where applicable; and (iv)comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 8 - Environmental Impact Management: Planning and Design Phase Section 9 - Environmental Impact Management: Pre-construction Phase Section 10 - Environmental Impact Management: Construction Phase Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase
(g)the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 14 - Roles and Responsibilities Section 16 - Monitoring, Record Keeping and Reporting
(h)the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 14 - Roles and Responsibilities Section 16 - Monitoring, Record Keeping and Reporting
(i)an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 8 - Environmental Impact Management: Planning and Design Phase Section 9 - Environmental Impact Management: Pre-construction Phase Section 10 - Environmental Impact Management: Construction Phase Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase Section 14 - Roles and Responsibilities
(j)the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 8 - Environmental Impact Management: Planning and Design Phase

	Section 9 - Environmental Impact Management: Pre-construction Phase Section 10 - Environmental Impact Management: Construction Phase Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase
(k)the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 14 - Roles and Responsibilities Section 16 - Monitoring, Record Keeping and Reporting
(l)a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 8 - Environmental Impact Management: Planning and Design Phase Section 9 - Environmental Impact Management: Pre-construction Phase Section 10 - Environmental Impact Management: Construction Phase Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase Section 14 - Roles and Responsibilities Section 16 - Monitoring, Record Keeping and Reporting
(m)an environmental awareness plan describing the manner in which— (i)the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii)risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 14 - Roles and Responsibilities
(n)any specific information that may be required by the competent authority.	N/A

DOCUMENT DETAILS

Project Ref. No:	16/3/3/1/D2/47/0013/25
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Candidate EAP	Onela Mhobo	onela@sescc.net	• BSc Environmental Science • Bsc Honours Environmental Management • EAPASA #2022/4522

Sharples Environmental Services cc (SES) has been actively engaged since 1998 in the fields of environmental planning, assessment and management. Clients include private, corporate and public enterprises on a variety of differing land use applications ranging from large-scale residential estates and resorts to golf courses, municipal service infrastructure installations and the planning of major arterials. The consultants have over 40+ years of combined experience and operate in the Southern, Eastern and Western Cape regions.

MICHAEL BENNETT **(Director**, **Report Writer):**
Michael studied at the University of Cape Town completing a Bachelor of Science degree majoring in Environmental and Geographic Science and Ocean and Atmospheric Science. Michael joined SES in 2014 and has extensive experience in assessments and monitoring and has worked on a variety of technical projects. See Appendix C for his curriculum vitae. Michael is registered with EAPASA as a certified Environmental Practitioner (EAPASA # 2021/3163).

Onela Mhobo **(Candidate Environmental Practitioner)**
Onela graduated from the University of South Africa completing her BSc honors degree in Environmental Management and also holds a BSc in Botany and Geography from the Nelson Mandela University. She is well versed in the technicalities associated with Monitoring.

1. Introduction

Sharples Environmental Services cc (SES) has been appointed *the George Municipality: Water & Sanitation: Civil Engineering Services,* to complete the Environmental Management Programme (EMPr) as part of the Basic Assessment Process for the proposed upgrading of stormwater infrastructure Rosemoor, George, Western Cape.

The proposed upgrade triggered listed activities in terms of the Amended Environmental Impact Assessment Regulations of 2014 (GN No. R.324 - 327 of 7 April 2017). Environmental Authorisation is therefore required from the competent authority (Western Cape Department of Environmental Affairs & Development Planning) before construction can commence.

2. About this EMPr

This document is intended to serve as a guideline to be used by *the George Municipality: Water & Sanitation: Civil Engineering Services* (as the Implementing Agent) and any person/s acting on behalf of *George Municipality: Water & Sanitation: Civil Engineering Services*, during the pre-construction, construction, post-construction, and rehabilitation phases of the proposed upgrade and development. This document provides measures that must (where practical and feasible) be implemented to ensure that any environmental degradation that may be associated with the development is avoided, or where such impacts cannot be avoided entirely, are minimised, and mitigated appropriately.

This EMPr has been prepared in accordance with the requirements of an EMPr as specified in the Amended Environmental Impact Assessment Regulations, 2014 (GN No. R. 326 of 7 April 2017), and with reference to the "Guidelines for Environmental Management Programmes" published by the Department of Environmental Affairs and Development Planning (2005).

It is important to note that the EMPr is not designed to manage the physical rehabilitation and protection of infrastructure *per se* but should rather be seen as a tool which can be used to manage the environmental impacts of the development.

The rehabilitation, mitigation, management, and monitoring measures prescribed in this EMPr must be seen as binding to *George Municipality: Water & Sanitation: Civil Engineering Services*, and any person acting on its behalf, including but not limited to agents, employees, associates, guests, or any person rendering a service to the development site.

2.1 Important caveat to the report

In the past, some developments have had a devastating impact on the environment even though they have had Environmental Management Programmes in place, while other developments have had a low impact even though no management plans have been compiled.

The Implementing Agent and the attitude of the construction team play an integral role in determining the impact that the development will have on the environment. The ECO (see Chapter 15) needs to ensure that all role-players are "on board" with regard to the constraints that the EMPr places on the development and construction team. The end result relies on cooperation and mutual respect and understanding of all parties involved.

3. How to use this document

It is essential that this EMPr be carefully studied, understood, implemented, and adhered to as far as reasonably possible, throughout all phases of the proposed development. The *George Municipality: Water & Sanitation: Civil Engineering Services* must retain a copy of this EMPr, and another copy of this EMPr must be kept on site at all times during the pre-construction, construction, and post-construction rehabilitation phases of the development.

This EMPr must be included in all contracts compiled for contractors and subcontractors employed by *George Municipality: Water & Sanitation: Civil Engineering Services*, as this EMPr identifies and specifies the procedures to be followed by engineers and other contractors to ensure that the adverse impacts of construction activities are either avoided or reduced. *George Municipality: Water & Sanitation: Civil Engineering Services* and any appointed contractors must make adequate financial provision to implement the environmental management measures specified in this document.

This EMPr must be seen as a working document, which may be amended from time to time as needed, in order to accommodate changing circumstances on site or in the surrounding environment, or in order to accommodate requests/ conditions issued by the competent authority, the Department of Environmental Affairs & Development Planning. Amendments to this EMPr must first be approved by the competent authority, in writing.

4. Background and Location of the activity

4.1 Background and description

George Municipality identified the need to upgrade the stormwater infrastructure and associated streets in the Municipality after severe flooding in numerous areas following heavy rainfall. A Stormwater Masterplan was developed by Nadeson Consulting Services (Pty) Ltd in 2020 to analyse the catchments, identify problematic areas and proposed upgrades to the stormwater system (both low and high priority).

This project forms a part of the overall storm water management plan specifically focused on the area of Rosemore. Neil Lyners & Associates (Lyners) was appointed in April 2024 by George Municipality to execute and manage the process and procedures for the upgrading of the Rosemore Storm Water Network in line with the Storm Water Masterplan completed for the area (by Nadeson Consulting Services 2019) as part of the approved capital budget.

SCOPE OF WORKS

Rosemore Storm Water Upgrades Phase 1

- Miller Street: Upgrade from Ø 450mm to Ø 600mm diameter – Approx 20m
- Parson Street: Upgrade from Ø 450mm to Ø 600mm diameter – Approx 360m
- Niewoudt Street: Upgrade from Ø 450mm to Ø 600mm diameter – Approx 195m
- Niewoudt Outlet: Upgrade from Ø 600mm to Ø 750mm diameter – Approx 170m
- Truter Street: Upgrade from Ø 450mm to Ø 600mm diameter – Approx 125m

Rosemore Storm Water Upgrades Phase 2

- Attakwas Street: Upgrade from Ø450mm to Ø600mm diameter – Approx 410m –
- Aleman and Beer Street: Upgrade from Ø 450mm to Ø600mm diameter – Approx 275m
- Hibiscus Street: Upgrade from Ø450mm to Ø600mm diameter -Approx 70m
- St Mary Street: Upgrade from Ø450mm to Ø600mm diameter – Approx 65m
- Miller Street Upgrade from Ø150mm to Ø450mm diameter -Approx 20m
- Harmony Street Upgrade from Ø350mm to Ø 450mm diameter – Approx 60m

Fifteen (15) stormwater outlets requiring upgrades were identified during the detail design stage Design Report (REPORT NO. T/ING/010/2020 (Project 8, Work Package 7): REVISION NO. 2), dated 05 March 2025.

Figure 1: Approximate Locality of the site

Figure 2: Overview of proposed stormwater infrastructure upgrades.

Figure 3:Stormwater Outlets structures (1-15).

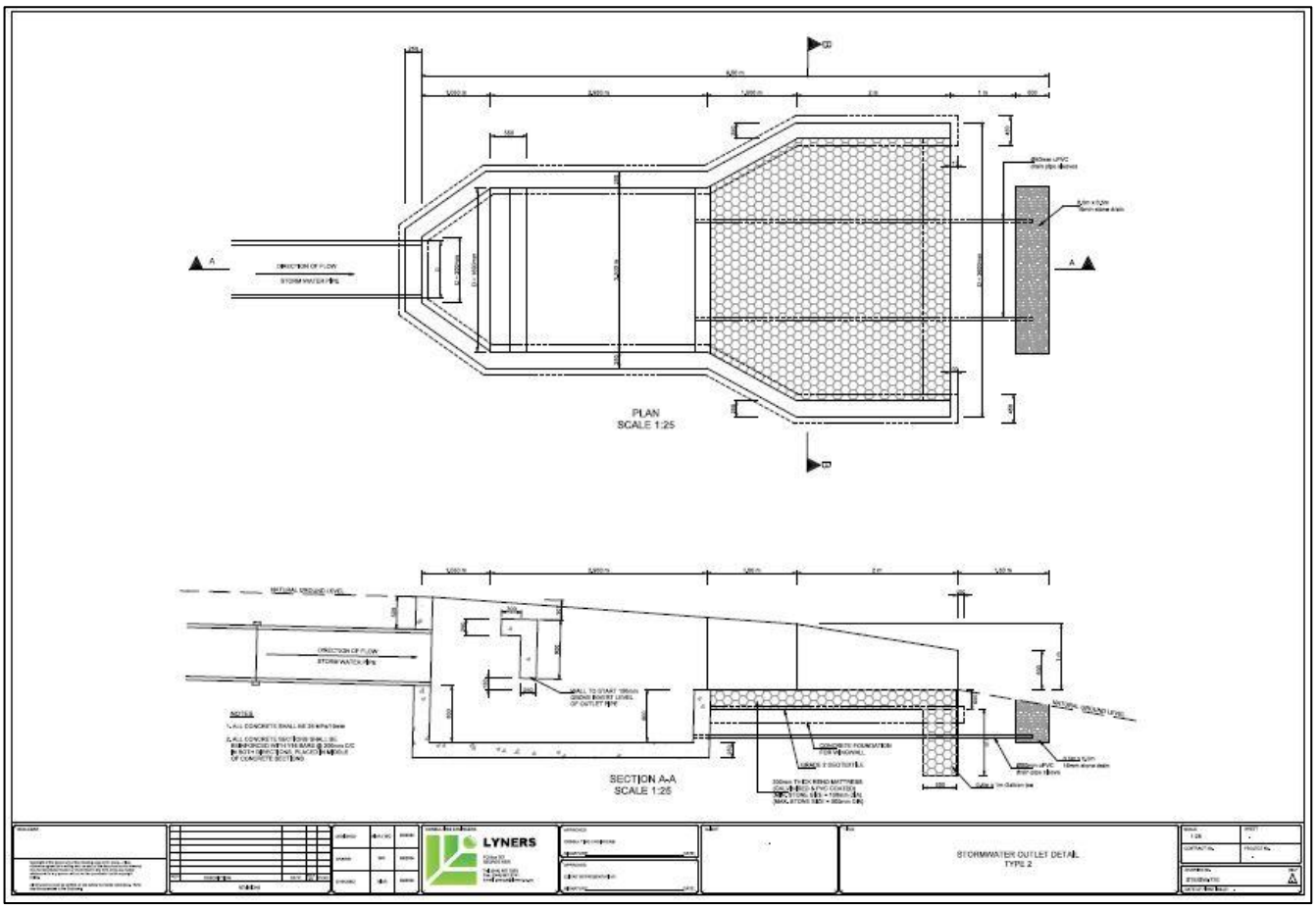


Figure 4: Stormwater Outlet design drawing

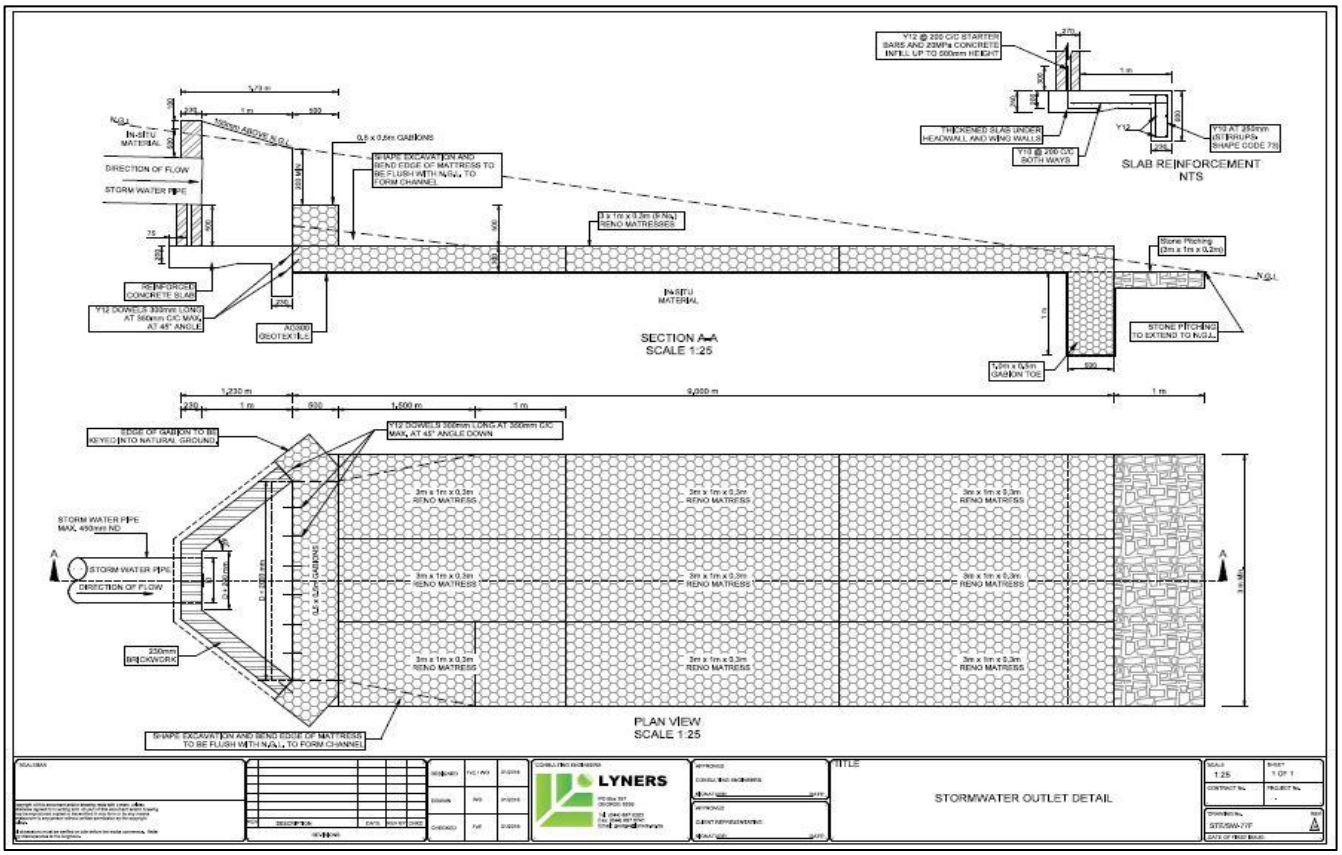


Figure 5: Stormwater Outlet Design Drawing

5. Legal Framework

5.1 Environmental Impact Assessment Regulations (2017)

The following listed activities, in terms of the amended Environmental Impact Assessment Regulations, 2017 (GN No. R. 324 – 327) will be triggered by the proposed development:

Table 2: Listed activities in terms of the amended Environmental Impact Assessment Regulations (2017)

Listed Activity No(s):	Describe the relevant Basic Assessment Activity(ies) in writing as per Listing Notice 1 (GN No. R. 983)
19	**The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse**; but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.
27	**The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—** (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.
45	**The expansion and related operation of infrastructure for the bulk transportation of water or storm water where the existing infrastructure—** **(i) has an internal diameter of 0,36 metres or more; or** (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or **(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;** excluding where such expansion— aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or (bb) will occur within an urban area.
48	**The expansion of –** **(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more;** **(ii)** dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more**;** **where such expansion occurs—** (a) within a watercourse; (b) in front of a development setback; or **(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;** excluding— (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;

	(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such expansion occurs within an urban area; or (ee) where such expansion occurs within existing roads, road reserves or railway line reserves.
Listed Activity No(s):	Describe the relevant Basic Assessment Activity(ies) in writing as per Listing Notice 3 (GN No. R. 985)
12	**The clearance of an area of 300 square metres or more of indigenous vegetation** except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **i. Western Cape** **i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;** ii. Within critical biodiversity areas identified in bioregional plans; iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.
23	**The expansion of—** (i) dams or weirs where the dam or weir is expanded by 10 square metres; or **(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;** where such expansion occurs— (a) within a watercourse; (b) in front of a development setback adopted in the prescribed manner; or **(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;** excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. **i. Western Cape** **i. Outside urban areas:** (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) World Heritage Sites; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Sites or areas listed in terms of an international convention; **(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;** (gg) Core areas in biosphere reserves; or (hh) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.

5.2 Other applicable legislation

George Municipality: Water & Sanitation: Civil Engineering Services, is responsible for ensuring that all contractors, labourers and any other appointed person/entity acting on their behalf, remain compliant with the conditions of the received environmental authorisation and water-use authorisations, as well as the provisions of all other applicable legislation, including *inter alia*:

- National Environmental Management Act (NEMA) (Act No 107 of 1998, as amended);
- National Environmental Management Biodiversity Act (Act 10 of 2004);
- National Water Act (Act 36 of 1998)
- National Environmental Management: Waste Act (Act 59 of 2008);
- National Forest Act (Act No 84 of 1998);
- National Heritage Resources Act (Act No 25 of 1999);
- Occupational Health and Safety Act (Act 85 of 1993);

The above listed legislation have general applicability to most development applications, and it is George Municipality: Water & Sanitation: Civil Engineering Services responsibility to ensure that all contractors and employees are aware of their obligations in terms of these Acts. This EMPr does not detract from any other legal requirements.

6. Scope of this EMPr

This EMPr describes the measures that must be implemented in order to avoid, minimise, manage and monitor the potential environmental impacts of the development, during all phases of the project life cycle, namely:

- Planning and Design Phase
- Pre-construction Phase
- Construction Phase
- Rehabilitation Phase

General environmental management measures that must be applied throughout the project lifecycle (as and where applicable) are described in Chapter 8. Additional management measures that must be implemented to address specific impacts that may arise during each phase are provided in **Chapters 9-12** of this EMPr.

7. General Environmental Management

The following general management measures are intended to protect environmental resources from pollution and degradation during all phases of the project life cycle. These measures must be implemented as and where applicable, reasonable and practicable during the pre-construction, construction and post-construction and rehabilitation phases of the proposed development.

7.1 Site access and traffic management

The site is accessed from directly from the adjacent road network.

In general, all construction vehicles need to adhere to traffic laws. The speed of construction vehicles and other heavy vehicles must be strictly controlled to avoid dangerous conditions for other road users. As far as possible care must be taken to ensure that the local traffic flow pattern is not too significantly disrupted, and all vehicle operators therefore need to be educated in terms of "best-practice" operation to minimise unnecessary traffic congestion or dangers. Construction vehicles must therefore not unnecessarily obstruct the access point or traffic lanes used to access the site. Construction vehicles also need to consider the load carrying capacity of road surfaces and adhere to all other prescriptive regulations regarding the use of public roads by construction vehicles. Adequate signage that is both informative and cautionary to passing traffic (motorists and pedestrians) warning them of the construction activities. Signage would need to be clearly visible and need to include, among others, the following:

- Identifying working area as a construction site;
- Cautioning against relevant construction activities;
- Prohibiting access to construction site;
- Clearly specifying possible detour routes and / or delay periods;
- Possible indications of time frames attached to the construction activities, and;
- Listings of which contractors are working on the site.

Other mitigation measures include:

- ECO to do awareness training with the contractor and labourers before construction commences.
- Ensure appropriate behaviour of operators of construction vehicles.

7.2 Site demarcation

The following areas must be clearly demarcated on site during the pre-construction or construction phases of the development, as appropriate.

Construction working area

Prior to the commencement of any construction activities, the outer boundary of the development area must be surveyed and pegged. The demarcation boundary must be tight around the site, typically allowing a working area of no more than 2.5m around the development footprint. This demarcation boundary is to ensure that construction activities are restricted to only that area strictly required for the proposed development, and to prevent unnecessary disturbance of soil surfaces and vegetation outside of the development footprint. Demarcation of the site within the river is not practical and as such markers can be placed on the edges of the working area in the river to highlight the limitations of site to the construction team.

No-go areas

No-go areas are not identified within the site. All areas outside of the development footprint considered no- go areas for construction.

No-go areas must be off-limits to all construction workers, vehicles, and machinery during all phases of the development. No vegetation may be cleared from within the no-go areas, and no dumping of any material (waste, topsoil, subsoil etc.) may occur in these areas. Construction workers must be informed of the no-go areas, and if necessary appropriate signage and/or temporary fencing (e.g., droppers with danger tape) can be used to enforce the no-go areas.

Demarcation of the site camp

The area chosen for the site camp and associated facilities must be the minimum area reasonably required to accommodate the site camp facilities, and which will involve the least disturbance to the environment. It is recommended that easily accessible, transformed areas are used for the site camp. Site selection must be done in consultation with the ECO.

The contractor will have to make use of disturbed areas or areas that don't trigger listed activities.

7.3 Site camp and associated facilities

The following general management measures pertaining to the set-up, operation and closure of a site camp must be applied where appropriate, reasonable and practicable:

7.3.1 Fencing & Security

The site camp area must be secured to prevent any un-authorised individuals from entering the site camp and possibly getting injured or posing a safety and/or security risk. Adequate signage must be displayed, designating the site office / camp as a restricted area to non-personnel. If required, the site camp and associated areas may be fenced off along the demarcated boundaries of these areas, preferably with 2m high fence and shade netting or similar.

7.3.2 Fire Fighting Equipment

No less than 2 fire extinguishers must be present in the site camp. The extinguishers must be in a working condition and within their service period. A fire extinguisher must always be present wherever any "hot works" (e.g., welding, grinding etc.) are taking place. It is recommended that all construction workers receive basic training in fire prevention and basic fire-fighting techniques and are informed of the emergency procedure to follow in the event of accidental fires. No open fires may be made on the construction site during any phase of the project. Construction workers may make small, contained fires (e.g., for warming or cooking purposes), within the site camp provided the small fire is encircled by a corrugated iron structure, drum or similar, to prevent wind-blown cinders from causing fires elsewhere. Such fires may not be left unattended and must be thoroughly extinguished after use. No smoking must be allowed on the construction site. In the case of accidental fires, the contractor must (if required) alert the Local Authority's Fire Department as soon as a fire starts prior to the fire becoming uncontrollable.

7.3.3 Waste Storage Area

Sufficient bins for the temporary storage of construction related waste must be provided inside the site camp and/or at the working area and should be located in such a way that they will present as little visual impact to surrounding residents and road users as possible. Label each waste receptacle for waste separation, and ensure waste is contained either by use of lids or by ensuring waste receptacles are emptied prior to filling up, making them susceptible to wind dispersion. Sufficient signage and awareness should be created to ensure that these bins are properly used.

7.3.4 Hazardous Substances Storage Area

Fuels, chemicals, lubricants and other hazardous substances must be stored in a demarcated, secured and clearly sign-posted area within the site camp away from the watercourses on site. Sufficient signage and awareness should be created to ensure that these bins are properly used. Ensure that when substances are transferred, this is done on an impermeable and/or bunded surface, to contain any spillage. Spillage, should it occur, should be disposed of appropriately.

7.3.5 Potable Water

An adequate supply of potable water must be provided to construction workers at the site camp. It is the Contractors duty to ensure that the labour has adequate access to potable water throughout construction phase, and to monitor weather conditions, to ensure that labour has enough drinking water on hotter days, or construction activity must cease, until conditions are safe to continue.

7.3.6 Ablution Facilities

Chemical toilets should be maintained on the site camp for the duration of the construction phase and rehabilitation, on a level surface and secured from blowing over and located in such a way that the toilets will not cause any form of pollution. As per the SANS10400 requirement, one ablution facility for every 8 male workers and 2 ablution facilities for every 8 female workers will be provided.

Ablution facilities must not be located near the watercourse. The ablution facilities must not be linked to the river or dam system in any way. Toilets must be serviced regularly and kept in an orderly state. The contractor must ensure that no spillage occurs when the toilets are cleaned, serviced or moved. The toilet facilities should be emptied on a weekly basis, by an appropriately registered service provider. Proof of this weekly servicing must be obtained and filed in the Environmental File on site. Performing ablutions outside of the provided toilet facilities is strictly prohibited and the ECO would need to regularly inspect the state of the chemical toilets to ensure compliance.

7.3.7 Eating Area & Rest Area

A dedicated area within which construction workers can rest and eat during breaks should be provided within the site camp. Seating and shade should be provided.

7.3.8 Vehicle & Equipment Maintenance Yard

Where possible, construction vehicles and equipment that require repair must be removed from site and taken to a workshop for servicing. If emergency repairs and/or basic maintenance of construction vehicles or equipment are necessary on site, such repair work must be undertaken within the designated maintenance yard area away from any watercourses. Repairs must be conducted on an impermeable surface, and/or a tarpaulin and/or drip trays must be laid down prior to emergency repairs taking place, in order to prevent any fuel, oil, lubricant or other spillages from contaminating the surrounding environment.

7.3.9 House-keeping

The site camp and related site camp facilities must be kept neat and orderly at all times, in order to prevent potential safety risks and to reduce the visual impact of the site during construction.

7.4 Vegetation clearing

Where vegetation must be cleared the following measures must be implemented where applicable, reasonable and practical:

- No clearing outside of development footprint to take place.
- Vegetation clearing/trimming must be cleared by hand (i.e. brush cut) and stockpiled for use as mulch/ brush-packing during rehabilitation of the site. Any alien vegetation that is cleared must be disposed of in consultation with the ECO, unless the cleared alien vegetation does not contain seeds in which case it may be retained for use in site rehabilitation.
- No bulldozing must be undertaken for the purpose of vegetation clearing.
- Only the areas required to accommodate the construction activities and access to the construction site must be cleared/trimmed of vegetation.
- Vegetation outside of the construction footprint and beyond any No-Go areas must not be cleared.

7.5 Alien invasive management

The following measures must be implemented to ensure that the introduction and spread of alien invasive vegetation is minimised, where deemed necessary:

- Alien species must be removed from the site as per the National Environmental Management: Biodiversity Act (No. 10 of 2004) requirements.
- A suitable weed management strategy must be implemented in the construction phase and carried through the operational phase(Appendix E).

- Weeds and alien species must be cleared by hand before the rehabilitation phase of the areas. Removal of alien plants are to be done according to the Working for Water Guidelines.
- The Contractor is responsible for the removal of alien species within all areas disturbed during construction activities. Disturbed areas include (but are not limited to) access roads, construction camps, site areas and temporary storage areas.
- In consultation with relevant authorities, the Engineer may order the removal of alien plants (when necessary). Areas within the confines of the site are to be included.
- All alien plant material (including brushwood and seeds) should be removed from site and disposed of at a registered waste disposal site. Should brushwood be utilised for soil stabilization or mulching, it must be seed free.
- After clearing is completed, an appropriate cover crop may be required, should natural re-establishment of grasses not take place in a timely manner.

7.6. Flora Search and Rescue

- The following flora relocation plan is recommended, where deemed necessary:
- Once the final layout has been determined the botanist will be consulted in order to finalise the plant relocation and vegetation clearing plan.
- Respective permits to be obtained.
- Flora search and rescue is to be conducted before vegetation clearing takes place.
- Areas should only be stripped of vegetation as and when required and once species of special concern have been relocated for that area.
- Once site clearing is to commence, the area to be cleared of vegetation will be surveyed by the vegetation and plant search and rescue team clearing under the supervision of the botanist to identify and remove species suitable for rescue and commence removal of plants.
- These species are to be replanted immediately in a suitable area of similar vegetation, where future development is unlikely to occur, or within a nearby protected area.

7.7 Fuana Search and Rescue

- The following fauna relocation plan is recommended for inclusion in the EMP and Fauna removal permit applications, where deemed necessary:
- An on-foot search, conducted by a professional reptile handler/team, is to be carried out to search for reptiles within every possible habitat.
- Once caught, each reptile will be placed into transport containers suited for that individual reptile.
- The transport containers must be kept cool to decrease stress for the reptiles.
- The reptiles will be relocated as soon as possible after they have been caught.
- Professional equipment will be used to ensure limited harm to the reptiles and to prevent the team members from being bitten by venomous snakes.
- Nooses should not be used as they cause injury to lizards.
- Safety procedures will be in place for the release of the reptiles.
- Amphibians should be caught by hand and net.
- Amphibians must be placed into transport containers with damp substrates to avoid dehydration.
- Tadpoles may be collected, placed into water containers and released as soon as possible, where required.
- During release, the tadpoles will be allowed to acclimatize to the new water in terms of temperature, pH etc.
- Small mammals will be caught with nets and by hand. They will then be transported in carry cages and released as soon as possible.

7.8 Topsoil and subsoil management

It is recommended that topsoil be removed from any area where physical disturbance of the surface will occur, including within the footprint of the development site (working area) and possibly within the site camp, ablution area, vehicle maintenance yard, refuelling area and temporary waste storage area. Topsoil removal and stockpiling must be undertaken only after consultation with the ECO.

- Removed topsoil and subsoil must be stockpiled for the duration of the active construction period and utilised for the final landscaping and rehabilitation of disturbed areas on site.
- The removed topsoil must be stockpiled in a berm, in a demarcated area as agreed with the ECO.
- Removed subsoil must be stockpiled separately from topsoil.
- The topsoil & subsoil storage area must be located on a level area outside of any surface drainage channels and at a location where it can be protected from disturbance during construction and where it will not interfere with construction activities.
- Where applicable topsoil and subsoil stockpiles must be adequately protected from being blown away or eroded by storm water. If necessary, shade cloth or other suitable measures must be used to stabilise and protect the stockpile from wind/water erosion. Topsoil stockpiles must not be covered with tarpaulin, as this may smother and decrease the virility of topsoil.
- Handling of topsoil must be minimised as much as possible, and the location of the topsoil berm must be chosen carefully to avoid needing to relocate the topsoil berm at a later date. The ECO must be consulted with regards to the placement of the stockpiles, to ensure that the selected location is in compliance with this EMPr and EA (once granted).
- Ideally, topsoil is to be handled twice only, once to strip and stockpile, and once to replace, level, shape and scarify.
- If soil stockpiles will be stored for an extended period of time, the stockpiles must be kept clear of weeds and alien vegetation growth by regular weeding, (or application of herbicides if agreed with the ECO).
- Spoil material that will not be re-utilised on site may be removed from site and taken to an appropriate site for re-use or disposal.
- Note that the topsoil must be the final layer applied to a rehabilitated/ re-landscaped site, after subsoil/ spoil material has been placed and shaped on the site.

7.9 Integrated waste management approach

It is recommended that an integrated waste management system is adopted on site. The system must be based on waste minimisation and must incorporate reduction, recycling, re-use and disposal where appropriate. Waste bins for the different categories of recyclable waste (i.e., paper, plastic, metal) must be provided on site. These bins must be emptied, and the waste must be taken to a registered recycling facility. The receipts from the facility must be kept on file and must be available on request. Images 1 and 2 show two such systems within a construction site.

Image 1: Recycling system implemented on a construction site. Skips provided for general waste, plastic, cardboard and metal.

Image 2: Recycling system implemented on a construction site. Lidded bins provided for general waste, plastic, cardboard, and metal.

The non-recyclable and non-reusable waste (e.g., builder's rubble, etc.) generated on site must be stored and disposed of at a landfill site licensed in terms of the applicable legislation.

7.10 Hazardous substances and fuels

If hazardous substances and fuels such as diesel, oil, lubricant, detergents etc. are to be stored on site for construction purposes, a designated area must be set aside for this within the site camp.

- All hazardous substances must be stored in the designated area within the site camp.
- The area selected for storage of hazardous fuels must be located on a level area, well outside of any water courses, water bodies or surface drainage channels.
- The designated area must be clearly demarcated and secured by use of fencing and/or cages, to prevent access by un-authorised persons and/or animals.
- Access to the hazardous material storage area must be restricted to authorised personnel only and must be treated as a no-go zone to unauthorised personnel.
- Appropriate hazard signage indicating the nature of the stored materials must be prominently displayed at the storage area.
- Those persons tasked with handling any hazardous substances must be equipped with the knowledge, equipment, and safety gear necessary to handle the substance/s safely.
- Material Safety Data Sheets (MSDSs) must be available on site for all hazardous chemicals and hazardous substances to be used on site. Where possible and available, MSDSs must additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes
- Storage vessels of hazardous substances must be situated in an impermeable bunded area large enough to accommodate at least 110% of the capacity of the tank in question. If plastic sheeting

is used to line the bunded area, care must be taken to ensure it is not punctured in any way during the course of the construction period.
- Fuel tanks must ideally be elevated so that leaks can easily be detected.
- No smoking may be permitted at or surrounding the area where fuels and hazardous substances are stored.
- Firefighting equipment must be located in close proximity to the storage area.

7.11 Cement and concrete batching

Cement and concrete batching is permitted on site, but may only take place on designated impermeable, bunded surfaces, as agreed with the ECO.

- Cement/ concrete must not be mixed on bare ground.
- Cement/concrete must not be mixed within any drainage lines.
- The impermeable/ bunded area must be established in such a way that cement slurry, runoff and cement water will be contained and will not flow into the surrounding environment or contaminate the soil.
- Cement run-off and excess cement slurry must be collected in the designated impermeable area, allowed to dry and then disposed of at an appropriate facility. Alternately, the contaminated water can be collected in sealed tanks and transported to an appropriate disposal site for disposal.
- Empty cement bags are currently not recycled within the Garden Route and must be disposed of in the un-recyclables waste bins on site.

7.12 Erosion control and stormwater management

- Stormwater Management Plans must be developed for the site and should include the following:
    - The management of stormwater during construction.
    - The installation of stormwater and erosion control infrastructure.
    - The management of infrastructure after completion of construction.
- Temporary drainage works may be required to prevent stormwater to prevent silt laden surface water from draining into river systems in proximity to the site. Stormwater must be prevented from entering or running off site.
- To ensure that site is not subjected to excessive erosion and capable of drainage runoff with minimum risk of scour, their slopes should be profiled at a maximum 1:3 gradient.
- Diversion channels should be constructed ahead of the open cuts, and above emplacement areas and stockpiles to intercept clean runoff and divert it around disturbed areas into the natural drainage system downstream of the site.
- Rehabilitation is necessary to control erosion and sedimentation of all eroded areas (where works will take place).
- Existing vegetation must be retained as far as possible to minimise erosion problems.
- It is importation that the rehabilitation of site is planned and completed in such a way that the runoff water will not cause erosion.
- Visual inspections will be done on a regular basis with regard to the stability of water control structure, erosion and siltation.
- Sediment-laden runoff from cleared areas must be prevented from entering rivers and streams.
- No river or surface water may be affected by silt emanating from the site.

7.13 Construction near a watercourse

Construction within the vicinity of the aquatic system needs to be conducted in a conscious manner. The aquatic Report completed by Dr. James Dabrowski of Confluent Environmental Pty (Ltd) highlights the following mitigation measures to be adhered to during construction.

- Construction activities must be timed to coincide with low rainfall probability (dry season) to avoid erosion of exposed banks.
- Existing erosion gulleys must be backfilled and re-profiled to match natural contours/slopes.
- Interventions/ hard infrastructure must be set as far back from the channel as possible, including stormwater outlets.
- Since stormwater outlets will be built where erosion potential is high, construction must be sequenced so that they are put in place with the minimum possible delay. Disturbance/excavation of areas where stormwater outlets are to be constructed must be undertaken only when final placement can follow immediately following the initial disturbance.
- A construction schedule must be developed and clearly defined so as to avoid multiple sites being exposed and unattended to at any moment in time. The completion date for each phase of development must be indicated and all clearing, excavation, and stabilisation operations must be completed before moving onto the next phase.
- Construction within wetland seep areas must be confined to clearly demarcated areas so as to prevent unnecessary disturbance of wetland habitat outside of these areas.
- Following backfilling and construction of stormwater infrastructure, exposed unvegetated slopes must be stabilised with appropriate geotextiles (e.g. SoilSaver®) or vegetated with appropriate indigenous vegetation. Banks should ideally be regraded to a achieve slopes of 1:4 or flatter.
- Wooden stakes must be used to anchor erosion control mats as there is a high probability that metal stakes will be stolen.
- method statement must be compiled and available on site.
- The edges of the construction footprint must be clearly staked-out and demarcated prior to construction commencing.
- The contractor or ECO must educate all staff undertaking the work on the best practice methods and environmentally sensitive areas (general do's and don'ts).
- Areas where instream construction activities will take place must be confined to clearly demarcated areas so as to prevent unnecessary disturbance of instream and riparian habitat outside of these areas.
- A single point of access must be used to access each site.
- The stormwater outlet structures must be inspected on a routine basis to ensure that is free of any blockages and debris and is operating according to design specifications.
- The bed and banks of the river must be routinely inspected (especially following heavy rainfall events) to ensure that the outlet structure is not causing unnecessary erosion of the bed and banks of the river. Any erosion observed must immediately be attended to through appointment of a suitably qualified aquatic specialist.
- All gabion structures must be inspected on a routine basis to ensure that the baskets are intact and that rocks have not displaced. Any faults must be immediately repaired.
- Gabion structures must be lined with geotextiles to prevent the migration of fines that would otherwise undermine these structures.

7.14 Excavations and Earthworks

Any major earthworks with heavy machinery must be under constant supervision and operators are to be aware of all the environmental obligations, as there is always the potential to inflict damage to the sensitive areas. Any unnecessary or excessive heavy machinery movement must be kept to a minimum i.e., only what is absolutely necessary. Areas to be excavated must be clearly demarcated. It may be necessary to demarcate excavations or earthworks along busier haulage routes with orange barrier netting (or a similar product).

Whenever any excavation is undertaken, the following procedures shall be adhered to:

- Excavations shall take place only within the approved demarcated site.
- Excavations must follow the contour lines where possible.
- The construction site will not be left in any way to deteriorate into an unacceptable state.
- The excavated area must serve as a final depositing area for waste rock and overburden during the rehabilitation process.
- Once excavations have been filled with overburden, rocks and coarse natural materials and profiled with acceptable contours (including erosion control measures), the previous stored topsoil shall be returned to its original depth over the area.
- The area shall be fertilised, if necessary, to allow vegetation to establish rapidly. The site shall be seeded with a local or adapted indigenous seed mix in order to propagate the locally occurring flora.
- Stored material must be protected from wind and water erosion, and this may entail covering the material with suitable shade cloth material or similar (if and when necessary). The shade cloth may need to be weighed down by logs (or similar material) in such a manner that any stream flow is directed away from the stockpile, reducing the risk of erosion.

7.15 Site closure and rehabilitation

Upon completion of the construction phase, all disturbed areas, including the working area (disturbance corridor), temporary access roads, and all areas utilised for the site camp and associated site camp facilities will require rehabilitation as follows:

- On completion of construction, the surface of the processing areas especially if compacted due to hauling and dumping operations shall be scarified to a depth of at least 200 mm and graded to an even surface condition and the previously stored topsoil will be returned to its original depth over the area.
- The area shall be fertilised, if necessary, to allow vegetation to establish rapidly. The site shall be seeded with suitable grasses and local indigenous seed mix.
- All demarcation fencing, including all droppers, wires, netting and barrier tape must be removed from site and taken to an appropriate site for re-use or disposal.
- Surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared in a manner approved by the ECO. Any soil contaminated with oil, fuel or other hazardous substance must be collected and disposed of as hazardous waste.
- All construction waste, litter and rubble is to be removed from the site and disposed of at an appropriate facility. Burying or burning of waste or rubble on site is prohibited.
- Topsoil and subsoil will be stripped and stockpiled separately and only used in rehabilitation work towards the end of the operation. This is in contract to the gravel activity where rehabilitation and topsoil replacement was earmarked at the completion of each phase.
- Stripped overburden will be backfilled into the worked-out areas where needed.
- Stripped topsoil will be spread over the re-profiled areas to an adequate depth to encourage plant regrowth.
- The vegetative cover will be stripped with the thin topsoil layer to provide organic matter to the relayed material and to ensure that the seed store contained in the topsoil is not diminished.
- Reseeding may be required should the stockpiles stand for too long and be considered barren from a seed bank point of view. Stockpiles should ideally be stored for no longer than a year.
- The topsoil and overburden will be keyed into the reprofiled surfaces to ensure that they are not eroded or washed away.
- All prepared surfaces will be seeded with suitable grass species to provide an initial ground cover and stabilize the soil surface. The following grass seed that is commonly available and suitable:

Cynon dactylon	Kweek	12 kg / Ha
Eragrotis curvula	Weeping Love Grass	6 kg/ Ha
Eragrotis tef	Teff	2 kg/ Ha
Digitaria eriantha	Smuts Grass	4 kg/ Ha

- Areas to be disturbed in future activities will be kept as small as possible (i.e. conducting the operations in phases), thereby limiting the scale of erosion.
- Slopes will be profiled to ensure that they are not subjected to excessive erosion but capable of drainage runoff with minimum risk of scour (maximum 1:3 gradient).
- All existing disturbed areas will be re-vegetated to control erosion and sedimentation.
- Existing vegetation will be retained as far as possible to minimize erosion problems.
- Final rehabilitation of the site must be done to the satisfaction of the ECO, and must adhere to all conditions/ requirements of the Environmental Authorisation.
- If the site camp was located on the footprint of an erf or road, the location of the site camp must then be rehabilitated in accordance with the site development plan.

8. Environmental Impact Management Planning and design phase

No direct environmental impacts are associated with the planning and design phase. However, poor planning or inappropriate design decisions in this phase may result in environmental impacts arising during subsequent phases of the project.

Planning and design activities must therefore take into account the environmental constraints and opportunities identified during the Environmental Impact Assessment process, in order to avoid or minimise the potential future impacts of the development. Proper planning is also essential to ensure that adequate provision is made to implement the environmental requirements of this EMPr, and to ensure that the development remains compliant with the received Environmental Authorisation.

The environmental management objectives (goals) during this phase are to:

- Appoint an Environmental Control Officer.
- Environmental Control Officer to conduct an inspection prior to the commencement of construction activities on site

These environmental management outcomes, as well as the management actions that must be implemented in order to achieve the desired outcome and avoid/minimise potential impacts are discussed in more detail below.

OBJECTIVE 1: APPOINTMENT OF AN ENVIRONMENTAL CONTROL OFFICER

Impact Management Objective: ***To appoint a suitably qualified and experienced Environmental Control Officer.***		
Potential impact to avoid	Failure to appoint an ECO will result in non-compliance with the Environmental Authorisation and the requirements of the EMPr.	
Impact Management Outcome	The conditions of Environmental Authorisation and the requirements of the EMPr are implemented and monitored during all phases of the development, which will promote sound environmental management on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• A suitably qualified and experienced Environmental Control Officer must be appointed before any activities commence on site. • The appointed ECO must adhere to the requirements stated in Chapter 15 and 17 of the EMPr and any other requirements specified in the Environmental Authorisation. • The appointed ECO must be advised of the construction start date, before any activities commence on site so that the ECO can perform a pre-commencement inspection and plan for environmental awareness training of construction workers.	*George Municipality: Water & Sanitation: Civil Engineering Services*	During design phase

Performance Indicator	A qualified ECO is appointed prior to the commencement of any construction activities (including pre-construction set-up activities) on site.

OBJECTIVE 2: UPDATE ENVIRONMENTAL MANAGEMENT PROGRAMME

The Environmental Authorisation issued for the development may require certain amendments to be applied to the EMPr. In addition, the final site layout and detailed design may also necessitate the amendment of the EMPr, in order to ensure that the development is accommodated in the EMPr.

Impact Management Objective: ***To ensure the EMPr adheres to the requirements of the Environmental Authorisation and makes provision for the final detailed site layout.***		
Potential impact to avoid	• Failure to update the EMPr in accordance with conditions specified in the EA may result in non-compliance with the EA. • Failure to update the EMPr to accommodate the final detailed site layout may result in non-compliance with the EA.	
Impact Management Outcome	Good environmental management is promoted on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• An independent Environmental Consultant must be appointed to amend the EMPr. • All amendments to the EMPr specified in the EA must be applied to the EMPr unless agreed otherwise in writing with the Competent Authority. • Amendments to the EMPr must be approved in writing by the Competent Authority. • Public participation may be required on the proposed EMPr amendments. The Competent Authority must be consulted for clarity on these requirements.	*George Municipality: Water & Sanitation: Civil Engineering Services*	During design phase
Performance Indicator	An updated EMPr that adheres to the conditions of the EA and that reflects the requirements of the final detailed site layout is approved by the Competent Authority prior to commencing activities on site.	

9. Environmental Impact Management Pre-Construction Phase

Proper set-up during the pre-construction phase can set the foundation for good environmental management during the active construction phase to follow and can avoid potential impacts from arising at a later date.

The Impact Management Objectives for this phase of the project relate to:

- Demarcation of no-go areas and working areas.
- Establishment of site camp and associated site facilities.
- Pre-construction ECO visit.

OBJECTIVE 1: IDENTIFY & DEMARCATE NO-GO AND WORKING AREAS

Impact Management Objective: ***Identify and demarcate no-go areas, working areas and site facilities.***		
Potential impact to avoid	• Insensitive location of working areas and site facilities may result in environmental impacts during construction phase. • Failure to accurately demarcate working areas may result in increased disturbance footprint. • Failure to demarcate no-go (open spaces) areas may result in disturbance to these areas during construction.	
Impact Management Outcome	Future construction activities will be restricted to within the designated areas & environmentally sensitive areas (no-go areas) will be protected from disturbance.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The no-go areas must be identified. • Demarcation of working area and no-go areas must be done in accordance with Section 7.2 of this EMPr. • Site camp facilities must be situated as far away from the No-Go areas as possible.	Engineer / Contractor	Pre-construction phase (prior to arrival of construction equipment, machinery, or workers on site)
Performance Indicator	No-go areas, working areas and areas for site camp facilities have been identified and appropriately demarcated to the satisfaction of the ECO, before construction activities commence on site.	

OBJECTIVE 2: ESTABLISH ENVIRONMENTALLY SENSITIVE SITE CAMP & SITE FACILITIES

<u>Impact Management Objective:</u> To set up and equip the site camp and associated site facilities in a manner that will promote good environmental management.			
Potential impact to avoid	• Inappropriate siting of site camp facilities may result in impacts to sensitive resources (e.g. contaminated run-off from refuelling area may contaminate soil). • Failure to properly demarcate and set up site facilities may result in disorganised construction activities and unnecessary disturbance to the site. • Failure to provide the necessary site facilities and/or failure to equip these facilities with the necessary equipment/materials may impede good environmental management & compromise ability to respond to emergencies.		
Impact Management Outcome	Site camp facilities do not impact significantly on environment. The equipment required to implement the provisions of the EMPr are provided on site.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• The site camp and site facilities described in Section 7 of this EMPr must be provided on site. • The site camp and associated site facilities must be set-up and managed in accordance with the general environmental management measures specified in Section 7 of this EMPr.		Contractor	Pre-construction phase (prior to start of construction activities)
Performance Indicator	Appropriate, well organised and properly equipped site facilities are available on site prior to commencement of construction activities. The location and set up of the facilities does not impact on the natural resources.		

OBJECTIVE 3: PRE-CONSTRUCTION ECO INSPECTION

It is essential that the appointed ECO be advised of the intended construction start date before construction activities commence on site, so that the ECO can conduct an initial site inspection to assess the pre-commencement condition of the site. The ECO can also advise on the appropriate siting and demarcation of the site facilities, and the identification and demarcation of the no-go areas. The ECO may also conduct the first round of environmental awareness training at this stage, if the construction workers are present on site.

Impact Management Objective: ***Environmental Control Officer to conduct an inspection prior to the commencement of construction activities on site.***		
Potential impact to avoid	• Failure to appoint ECO or to notify ECO of commencement prior to commencement will result in non-compliance with the EA. • If a pre-commencement ECO inspection is not performed, the Applicant may be held liable for environmental degradation that took place prior to the Contractor commencing work on site.	
Impact Management Outcome	• Good environmental management is promoted and enforced by the ECO during the full pre-construction and construction phases. • Site facilities are appropriately located on site. • Construction workers receive environmental awareness training before commencing work on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The appointed ECO must be advised of the construction start date, before any activities commence on site so that the ECO can perform a pre-commencement inspection and plan for environmental awareness training of construction workers.	Contractor	Start of construction phase
Performance Indicator	A pre-commencement site inspection is conducted by the appointed ECO before construction activities commence on site.	

10. Environmental Impact Management Construction Phase

A number of potential environmental impacts may arise during the construction phase of the development. These impacts have been identified and assessed during the Environmental Impact Assessment process. Environmental Management outcomes and actions that will prevent the identified potential impacts from arising – or where avoidance is not possible, that will minimise and mitigate the impact – are provided in this section.

The environmental management actions and mitigation measures prescribed in this section must be implemented throughout the construction phase, and must be implemented in conjunction with the general management measures specified in Chapter 8 of this EMPr as well as any other conditions stated in the Environmental Authorisation. The Environmental Control Officer must monitor and enforce the implementation of the relevant environmental management measures and may provide guidance on the implementation of these environmental management measures as and when required.

The environmental management objectives (goals) for the Construction phase are:

- To limit disturbance and pollution of wetland habitat
- To limit Erosion and sedimentation of wetland habitat
- To limit disturbance of a wetland habitat
- To limit impact on Terrestrial biodiversity (Vegetation)
- To limit impact on terrestrial biodiversity (Protecting flora and fauna)
- To limit impact on terrestrial biodiversity (Erosion)
- To limit impact on terrestrial biodiversity (Ecological process)
- To create a habitat free of alien vegetation
- To limit on Terrestrial Biodiversity (Faunal species)
- To limit dust on site

The environmental management actions that must be implemented in order to achieve the desired outcomes and avoid/minimise potential impacts are discussed in more detail in the sections below.

OBJECTIVE 1: TO LIMIT DISTURBANCE AND POLLUTION OF WETLAND HABITAT

***Impact Management Objective:* To limit disturbance and pollution of wetland habitat (Management of construction site and works)**		
Potential impact to avoid	• Direct physical destruction or disturbance and pollution of wetland habitat as a result of general construction impacts associated with vehicles, workers and storage of construction equipment.	
Impact Management Outcome	Generic construction phase impacts are kept to minimum	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period

• Excavators and all other machinery and vehicles must be checked for oil and fuel leaks daily. No machinery or vehicles with leaks are permitted to work in the wetland. • Refuelling and fuel storage areas, and areas used for the servicing or parking of vehicles and machinery, must be located on impervious bases and should have bunds around them (sized to contain 110 % of the tank capacity) to contain any possible spills; • No laydown areas, stockpiling of construction materials or excavated topsoil is permitted within delineated wetland areas. • Waste from chemical toilets must be disposed of regularly (at least once a week) in a responsible manner by a registered waste contractor • Chemical toilets should be provided on-site at 1 toilet per 10 persons. • Cement/concrete used in the construction must not be mixed on bare ground or within the delineated extent of the wetlands. An impermeable/bunded area must be established in such a way that cement slurry, runoff and cement water will be contained and will not flow into the surrounding environment or contaminate the soil. • Construction within wetland seep areas must be confined to clearly demarcated areas so as to prevent unnecessary disturbance of wetland habitat outside of these areas. • Workers must be properly instructed in the proper care of the environment, especially with respect to poaching, disturbance of nesting and roosting areas, disposal of human waste, garbage etc. • Construction areas to be inspected on a regular basis (at least weekly) by an appropriately qualified ECO for signs of disturbance, sedimentation and pollution, during the construction phase. If signs of disturbance, sedimentation or pollution are noted, immediate action should be taken to remedy the situation and, if necessary, a freshwater ecologist should be consulted for advice on the most suitable remediation measures. • A construction method statement must be compiled and available on site. • The contractor or ECO must educate all staff undertaking the work on the best practice methods and environmentally sensitive areas (general do's and don'ts).	Contractor	Construction phase
Performance Indicator	Generic construction phase impacts kept to a minimum	

OBJECTIVE 2: TO LIMIT EROSION AND SEDIMENTATION OF WETLAND HABITAT

<u>Impact Management Objective:</u> To limit erosion and sedimentation of wetland habitat (Excavation of banks)

Potential impact to avoid	• Mobilisation of sediment caused by the excavation of the beds and banks for construction of stormwater outlets.		
Impact Management Outcome	Erosion and sedimentation of wetland habituated is limited.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• Construction activities must be timed to coincide with low rainfall probability (dry season) to avoid erosion of exposed banks. • Existing erosion gulleys must be backfilled and re-profiled to match natural contours/slopes. • Since stormwater outlets will be built where erosion potential is high, construction must be sequenced so that they are put in place with the minimum possible delay. Disturbance/excavation of areas where stormwater outlets are to be constructed must be undertaken only when final placement can follow immediately following the initial disturbance. • A construction schedule must be developed and clearly defined so as to avoid multiple sites being exposed and unattended to at any moment in time. The completion date for each phase of development must be indicated and all clearing, excavation, and stabilisation operations must be completed before moving onto the next phase. • Construction within wetland seep areas must be confined to clearly demarcated areas so as to prevent unnecessary disturbance of wetland habitat outside of these areas. • Following backfilling and construction of stormwater infrastructure, exposed unvegetated slopes must be stabilised with appropriate geotextiles (e.g. SoilSaver®) or vegetated with appropriate indigenous vegetation. Banks should ideally be regraded to a achieve slopes of 1:4 or flatter. • Wooden stakes must be used to anchor erosion control mats as there is a high probability that metal stakes will be stolen.		Contractor	Construction phase
Performance Indicator	Changes to surface water quality are limited		

OBJECTIVE 3: TO LIMIT THE DISTURBANCE OF WETLAND HABITAT

***Impact Management Objective:* To limit disturbance wetland habitat**	
Potential impact to avoid	• Disturbance of aquatic and riparian habitat caused by the excavation of bed and banks.
Impact Management Outcome	Disturbance of the wetland is limited.

IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Areas where instream construction activities will take place must be confined to clearly demarcated areas so as to prevent unnecessary disturbance of instream and riparian habitat outside of these areas. • A single point of access must be used to access each site	Contractor	Construction phase
Performance Indicator	Disturbance of the aquatic and riparian habitat is limited.	

OBJECTIVE 4: TO LIMIT THE DISTURBANCE OF WETLAND HABITAT

<u>Impact Management Objective:</u> To limit erosion of the wetland habitat (Discharge of stormwater into wetland habitat)		
Potential impact to avoid	• Discharge of stormwater into wetland habitat.	
Impact Management Outcome	Reduced erosion of wetland habitat	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The stormwater outlet structures must be inspected on a routine basis to ensure that is free of any blockages and debris and is operating according to design specifications; • The bed and banks of the river must be routinely inspected (especially following heavy rainfall events) to ensure that the outlet structure is not causing unnecessary erosion of the bed and banks of the river. Any erosion observed must immediately be attended to through appointment of a suitably qualified aquatic specialist; • All gabion structures must be inspected on a routine basis to ensure that the baskets are intact and that rocks have not displaced. Any faults must be immediately repaired; and • Gabion structures must be lined with geotextiles to prevent the migration of fines that would otherwise undermine these structures	Contractor	Construction phase
Performance Indicator	Erosion of the wetland habitat is limited.	

Objective 5: LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY: VEGETATION

<u>Impact Management Objective:</u> To limit the impact on terrestrial biodiversity (Vegetation)

Potential impact to avoid	• Permanent or temporary loss of indigenous vegetation cover because of site clearing. Site clearing before construction will result in the blanket clearing of vegetation within the affected footprint.		
Impact Management Outcome	Impact on terrestrial biodiversity is limited to what is only required to undertake the activities		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• No clearing outside of development footprint to take place. • Areas surrounding the footprints should be revegetated on completion of construction		Contractor	Construction phase
Performance Indicator	Impact on terrestrial biodiversity is limited to what is only required to undertake the activities		

OBJECTIVE 6: LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY (PROTECTION OF FLORA AND FAUNA)

***Impact Management Objective:* To limit the impact on terrestrial biodiversity**			
Potential impact to avoid	• Potential disturbances to terrestrial fauna during land clearing or construction activities • The clearing/ trimming of vegetation will result in loss/ disturbances of indigenous vegetation Impairment of the biodiversity network.		
Impact Management Outcome	Impact on terrestrial biodiversity is limited to what is only required to undertake the activities.		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure		Responsible party	Time period
• Search and rescue operations for Species of Conservation Concern must be undertaken before the commencement of site clearing activities. • A flora search and rescue is unlikely to be required and no protected flora were found to be present within a natural context. • Indigenous vegetation encountered on the sites that are to be conserved and left intact. • It is important that clearing activities are kept to the minimum and take place in a phased manner. This allows animal species to move into safe areas and prevents wind and water erosion of the cleared areas. • Stripped vegetation should be temporarily stored during operations and to be used later to stabilise slopes. This excludes exotic invasive species. • No animals are to be harmed or killed during the course of operations. • Workers are NOT allowed to collect any flora or snare any faunal species. All flora and fauna remain the property of the landowner and must not be disturbed, upset or used without their expressed consent. • No domestic animals are permitted on the sites. • Trees and shrubs that are directly affected by the operations may be felled or cleared but only by the expressed written permission of the ECO.		Contractor	Construction phase

• Rehabilitation of vegetation of the site must be done as described in the Rehabilitation Plans.		
Performance Indicator	Flora and Fauna are protected.	

OBJECTIVE 7: LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY: EROSION

Impact Management Objective: ***To limit the impact on terrestrial biodiversity (Erosion)***		
Potential impact to avoid	• Susceptibility of some areas to erosion because of construction related disturbances. • Removal of vegetation cover and soil disturbance may result in some areas being susceptible to soil erosion after completion of the activity.	
Impact Management Outcome	Erosion is kept to a minimum.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Suitable measures must be implemented at all discharge points to protected against erosion • Areas must be rehabilitated, and a suitable indigenous grass seed mix planted where natural vegetation re-establishment does not occur.	Contractor	Construction phase
Performance Indicator	Erosion is kept to minimum.	

Objective 8: To limit impact on terrestrial biodiversity (Ecological processes)

Impact Management Objective: ***To limit the impact on terrestrial biodiversity (Ecological processes)***		
Potential impact to avoid	• Activity may result in disturbances to ecological processes.	
Impact Management Outcome	Limit disturbances to the ecological processes.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The habitats and microhabitats present on the project site are not unique and are widespread in the general area, hence the local impact associated with the footprint above current baseline levels would be of low significance if mitigation measures are adhered to.	Contractor	Construction phase
Performance Indicator	Disturbances to ecological processes is limited.	

OBJECTIVE 9: ALIEN CLEARING

Impact Management Objective: ***To create a habitat free of alien vegetation.***	
Potential impact to avoid	• No proliferation of alien vegetation once construction is completed.
Impact Management Outcome	To create a habitat free of alien vegetation.

IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• The ECO must be informed in advance of any vegetation that will be removed, irrespective of whether or not the vegetation is alien or indigenous. This is especially true or any vegetation clearing to be done within the watercourses. • Alien species must be removed from the site as per the National Environmental Management: Biodiversity Act (No. 10 of 2004) requirements. • A suitable weed management strategy must be implemented in the construction phase and carried through the operational phase. Please note that the municipal parks department is responsible for alien clearing and will be undertaken by them. If the municipality would like the contractor to undertake alien clearing the attached plan (Appendix E) can be used. • Weeds and alien species must be cleared by hand before the rehabilitation phase of the areas. Removal of alien plants are to be done according to the Working for Water Guidelines. • The Contractor is responsible for the removal of alien species within all areas disturbed during construction activities. Disturbed areas include (but are not limited to) access roads, construction camps, site areas and temporary storage areas. • In consultation with relevant authorities, the Engineer may order the removal of alien plants (when necessary). Areas within the confines of the site are to be included. • All alien plant material (including brushwood and seeds) should be removed from site and disposed of at a registered waste disposal site. Should brushwood be utilised for soil stabilization or mulching, it must be seed free. • After clearing is completed, an appropriate cover crop may be required, should natural re establishment of grasses not take place in a timely manner.	Contractor	Construction phase
Performance Indicator	No alien invasive species are observed in areas that have been disturbed.	

OBJECTIVE 10: TO LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY: FAUNA

Impact Management Objective: ***To limit mortality among faunal species***		
Potential impact to avoid	Activities associated with bush clearing, killing of perceived dangerous fauna, may lead to increased mortalities among faunal species	
Impact Management Outcome	No avoidable loss of fauna	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period

• Small mammals within the habitat on and around the affected area are generally mobile and likely to be transient to the area. Specific measures are made to reduce this risk. The risk of species of special concern is low, and it is unlikely that there will be any impact to populations of such species because of the activity. • A faunal search and rescue is unlikely to be required and no protected species are likely to be affected but is recommended as a precautionary measure. • No animals are to be harmed, trapped or killed during the course of operations other than where rescue is required and only undertaken by an expert.	Contractor	Construction phase
Performance Indicator	No avoidable loss of fauna	

Objective 11: To limit Dust

***Impact Management Objective:* To limit dust generated by construction activities**		
Potential impact to avoid	• No excessive dust generated by construction.	
Impact Management Outcome	No avoidable dust impacts emanate from the site during the construction phase.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• To manage complaints in relation to impacts on the nearby communities, a dust register will be developed. • If required, water spray vehicles will be used to control wind cause by strong winds during activities on the works. • Wind screens should be used to reduce wind and dust in open areas. • No over-watering of the site or road surfaces.	Contractor	Construction phase
Performance Indicator	Dust on site minimised.	

11. Environmental impact management post construction rehabilitation phase

After all construction activities have ceased, the sites must be cleared of all construction related equipment, materials, facilities and waste. In addition, all disturbed surfaces – including disturbed areas around the structures and all areas utilised for site facilities – must be stabilised, rehabilitated and provided with a suitable cover. All temporary access roads constructed must rehabilitated and access must be restricted from the public.

The environmental management objective (goal) for this phase is to:

- rehabilitate all areas disturbed by construction activities in an environmentally sensitive manner

- To reduce the erosion of the wetland habitat
- To limit impact on terrestrial biodiversity.

OBJECTIVE 1: SITE CLOSURE & REHABILITATION

Impact Management Objective: ***To rehabilitate all areas disturbed by construction activities in an environmentally sensitive manner.***		
Potential impact to avoid	• Failure to remove all construction related waste and materials may result in environmental pollution. • Failure to remove all construction related equipment, machinery and site facilities may pose an impact to the natural environment.	
Impact Management Outcome	• The site is neat and tidy, and all exposed surfaces are suitably covered/ stabilised. • There is no construction-related waste or pollution remaining on site.	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• On completion of construction, the surface of the processing areas especially if compacted due to hauling and dumping operations shall be scarified to a depth of at least 200 mm and graded to an even surface condition and the previously stored topsoil will be returned to its original depth over the area. • Rehabilitating the worked-out areas to take place concurrently within prescribed framework established in the EMP. • All infrastructure, equipment, plant and other items used during the construction period will be removed from the site. • Waste material of any description, including scrap, rubble and tyres, will be removed entirely from the site and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on site. • Any topsoil, subsoil or other excavated material that cannot be utilised during site rehabilitation must be removed from the site and reused elsewhere on the property or disposed of at an appropriate disposal site. • Stripped overburden will be backfilled into the worked-out areas where needed. • Stripped topsoil will be spread over the re-profiled areas to an adequate depth to encourage plant regrowth. • The vegetative cover will be stripped with the thin topsoil layer to provide organic matter to the relayed material and to ensure that the seed store contained in the topsoil is not diminished. • Reseeding may be required should the stockpiles stand for too long and be considered barren from a seed bank point of view. Stockpiles should ideally be stored for no longer than a year. • The topsoil and overburden will be keyed into the reprofiled surfaces to ensure that they are not eroded or washed away.	Contractor	Post-Construction phase

• The topsoiled surface will be left fairly rough to enhance seedling establishment, reduce water runoff and increase infiltration. • Where necessary disturbed soils must be revegetated with the local indigenous vegetation such as that which occurs at the site or provided with other suitable cover. • All prepared surfaces will be seeded with suitable grass species to provide an initial ground cover and stabilize the soil surface. The following grass seed that is commonly available and suitable: *Cynon dactylon* — Kweek — 12 kg / Ha *Eragrotis curvula* — Weeping Love Grass — 6 kg/ Ha *Eragrotis tef* — Teff — 2 kg/ Ha *Digitaria eriantha* — Smuts Grass — 4 kg/ Ha • It is recommended that follow-up alien clearing be conducted 6 months after construction is complete. • If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the Regional Manager may require that the soil be analysed and any deleterious effects on the soil arising from the activity, be corrected and the area be seeded with a vegetation seed mix to his or her satisfaction. This must be done in conjunction with the ECO. • Final rehabilitation must comply with the requirements mention in the Rehabilitation Plan		
Performance Indicator	• All construction-related materials, equipment, facilities, waste and contaminated soils have been removed from the site. • All disturbed/exposed surfaces have been provided with a suitable covering and/or stabilised. • No alien vegetation is evident on site.	

OBJECTIVE 2: REDUCED EROSION OF WETLAND HABITAT

***Impact Management Objective:* To reduce erosion of the wetland habitat**		
Potential impact to avoid	• Modification to wetland habitat caused by discharge of stormwater runoff	
Impact Management Outcome	Reduced erosion of wetland habitat	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period

• The stormwater outlet structures must be inspected on a routine basis to ensure that is free of any blockages and debris and is operating according to design specifications. • The bed and banks of the river must be routinely inspected (especially following heavy rainfall events) to ensure that the outlet structure is not causing unnecessary erosion of the bed and banks of the river. Any erosion observed must immediately be attended to through appointment of a suitably qualified aquatic specialist. • All gabion structures must be inspected on a routine basis to ensure that the baskets are intact and that rocks have not displaced. Any faults must be immediately repaired. • Gabion structures must be lined with geotextiles to prevent the migration of fines that would otherwise undermine these structures.	Contractor/ Holder of EA	Post-Construction phase
Performance Indicator	Reduced erosion of wetland habitat	

OBJECTIVE 3: TO LIMIT IMPACT ON TERRESTRIAL HABITAT

***Impact Management Objective:* To limit the impact of terrestrial habitat.**		
Potential impact to avoid	Erosion after construction is completed.	
Impact Management Outcome	Disturbed areas a sufficiently rehabilitated	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
• Areas where construction is completed should be rehabilitated immediately. • Areas must be rehabilitated, and a suitable indigenous grass seed mix planted where natural vegetation re- establishment does not occur. • Existing vegetation must be retained as far as possible to minimise erosion problems. • Areas to be disturbed in future activities will be kept as small as possible (i.e. conducting the operations in phases), thereby limiting the scale of erosion. • Slopes will be profiled to ensure that they are not subjected to excessive erosion but capable of drainage runoff with minimum risk of scour (maximum 1:3 gradient). • All existing disturbed areas will be re-vegetated to control erosion and sedimentation. • Existing vegetation will be retained as far as possible to minimize erosion problems.	Contractor/ holder of EA	Post-Construction phase
Performance Indicator	Disturbed areas a sufficiently rehabilitated	

12. Emergency Preparedness

12.1 Emergency response procedures

The potential environmental risks that may arise as a result of construction activities must be identified, and appropriate emergency response procedures must be compiled for each emergency scenario. Potential environmental emergencies that require an emergency response include – but are not limited to – unplanned fires, sewage spills, spills of hazardous chemicals, snake bites etc.

- The construction contractor is responsible for ensuring that the requirements of the Occupational Health & Safety Act (OHSA) are adhered to during the construction phase. The Applicant is responsible for ensuring compliance with the OHSA during the undertaking of construction activities.

12.2 Emergency preparedness

The following measures must be implemented, as appropriate, to ensure effective responses to emergencies:

- All workers on site during the construction and maintenance phase must be properly educated about possible emergency incidents that may arise, how to avoid such incidents and how to respond in the event of an incident. "Refresher" training sessions on emergency procedures must be held if needed.
- All workers must ideally be given basic fire-awareness training and advised on basic firefighting and safety techniques. Fire-fighting equipment must be available on site during construction activities (see section 7.3).
- All workers must be trained on how to respond in the event of a spill of a hazardous substance(fuel, chemicals etc.), if hazardous substances are to be used on site.
- A spill kit for containing and/or neutralising spills of hazardous substances (e.g., hydrocarbons) must be available on site at all times, when hazardous substances are present.
- Any incidents of pollution or spillage of hazardous materials during construction must be reported to the ECO as soon as possible. The ECO must then (depending on the nature of the spill) notify the relevant authorities, if needed. A first aid kit must be available on site at all times.
- Emergency contact numbers (including the fire department, police and ambulance) must be prominently displayed on site at all times and regularly updated.
- All emergency incidents must be recorded in a site incident log. The cause of the incident, the measures taken in response to the incident and the efficacy of those measures must also be recorded. This information must be used to inform future emergency preparedness planning, and to avoid prevent similar incidents from arising again.

13. Method statements

The Competent Authority and/or the ECO may require the Applicant or Construction Contractor to submit Method Statements for one or more construction-related activity, or any aspect of the management of the site, before the activity is undertaken or during the performance of the activity if the activity is causing or may cause significant environmental damage or pose a health and safety risk.

Method Statements need not be complex and lengthy, but must clearly state **how**, **when** and **where** the activity concerned will be undertaken, and must specify **who** will be responsible for undertaking each component of that activity. Method Statements must be prepared by the Construction Contractor and submitted to the ECO for approval before undertaking the activity concerned.

The ECO and / or Competent Authority have the authority to request method statements for other activities, including but not limited to:

- Establishment of site camp and stockpile area.
- Cement/ concrete batching, disposal and emergency contingencies.
- Topsoil and sub-soil storage/ stockpiling.
- Storage of fuels and hazardous chemicals and emergency contingencies.
- Waste management system.
- Storm water management and control.
- Emergency preparedness plan / emergency response procedure (see Chapter 13).

The ECO has the authority to prevent activities from being undertaken until such time as a satisfactory Method Statement has been submitted to the ECO and approved by the ECO.

14. Roles and Responsibilities

This EMPr, once approved by the competent authority (DEADP), should be seen as binding to the Applicant, and any person acting on the Applicant's behalf, including but not limited to agents, employees, associates, contractors and service providers.

The Applicant and all other persons who may be directly involved in the development are also bound by their general Duty of Care, as stated in Section 28 of the National Environmental Management Act, 1998:

> ***Duty of Care:***
>
> *"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 cannot reasonably be avoided or stopped, to minimize and rectify such pollution or degradation of the*

14.1 Duties and Responsibilities of the Applicant

The Applicant is ultimately responsible for ensuring that the environmental management measures specified in this EMPr, as well as any other conditions specified by the competent authority, are implemented and adhered to during the construction phase of the proposed development.

The Applicant or party delegated by the applicant is responsible for monitoring during the construction phase. The Applicant must ensure that all appointed service providers, contractors and workers are capable of complying with all statutory requirements of this EMPr and the conditions of the Environmental Authorisation. The Applicant is responsible for ensuring that this EMPr and the conditions of the Environmental Authorisation are implemented and adhered to during construction activities undertaken by the Applicant.

The Applicant or appointed consultant is responsible for identifying emergency situations that may arise during operational activities undertaken by the Applicant and must formulate appropriate emergency response procedures for these emergency scenarios.

14.2 Duties and Responsibilities of the Contractor

The "Construction Contractor" is the entity responsible for undertaking the physical construction of the residential development. The construction contractor is responsible for ensuring that all environmental management measures specified in this EMPr and in the EA are implemented during the pre-construction, construction and post-construction rehabilitation phases, unless agreed otherwise with the Applicant. The contractor will be responsible for all costs incurred in the rehabilitation of the site and for ensuring effective environmental management during construction. The contractor must therefore make adequate financial provision for the implementation of all prescribed measures.

It is strongly recommended that the Construction Contractor appoint an Environmental Site Officer (ESO), who will act as the Contractor's representative to monitor and enforce compliance with the conditions of this EMPr, throughout all phases of construction.

In addition to the above, the Construction Contractor is responsible for the following:

- Identify emergency situations that may arise as a result of construction activities and formulate appropriate emergency response procedures (see Chapter 13).
- Ensure that all construction workers, including sub-consultants and service providers, undergo environmental awareness training prior to commencing work on site, or as soon as possible thereafter (see Chapter 16).
- Compile the required method statements, which must be to the satisfaction of the ECO, before commencing with the activity to be governed by the method statement (Chapter 14).
- Respond to concerns or issues identified by the ECO, as relates to environmental management, and implement the appropriate management or remediation measures, at the Contractor's own expense (unless agreed otherwise)
- Should third parties be called to the site to perform clean up and rehabilitation procedures, the Construction Contractor will be responsible for all associated costs.

Note that failure to comply with the requirements and conditions of this EMPr and the Environmental Authorisation may result in fines or other penalties being levied against the Construction Contractor by the Competent Authority.

14.3 Duties and Responsibilities of the ECO

The appointed Environmental Control Officer (ECO) is responsible for undertaking regular site visits to monitor and report on the implementation of the EMPr and adherence to the conditions of the Environmental Authorisation during the pre-construction, construction and post-construction rehabilitation phases. The ECO is not required to monitor the site during the operational phase of the development.

Competency of the ECO

The ECO must be independent of the Applicant, Engineer, Construction Contractor and their service providers. The appointed ECO must be suitably qualified and experienced, and must be able to demonstrate that he / she is of sufficient competency to undertake the required task. The ECO should preferably be a resident in close proximity to the development area to ensure quick response if required. The ECO must work in close co-operation with the Construction Contractor, resident engineer or ESO

(where applicable) and all contractors in order to identify potential problems before they occur, and provide suitable guidance as to how the identified problems (environmental impacts) can be avoided.

Duties of the ECO

The duties of the ECO include, but are not limited to:

- Conduct a pre-construction site inspection to ascertain the pre-commencement condition of the site (i.e. the status quo) and determine whether faunal search-and-rescue is required;
- Conduct environmental awareness training (see Chapter 16);
- Undertake regular site visits to monitor compliance with all mitigation, monitoring and management measures contained in the EMPr and the Environmental Authorisation, during the pre-construction, construction and rehabilitation phases of the development (see section below regarding frequency of ECO visits).
- Evaluate the achievement of the performance indicators associated with each impact management outcome specified in this EMPr (Chapters 9-12)
- Liaise with site contractors, engineers and other members of the development team with regard to the requirements of the EMPr;
- Provide guidance as and when required regarding the implementation of the environmental management measures contained in the EMPr and EA, so as to assist the Applicant and contractor in remaining compliant with these measures;
- Assist in finding environmentally acceptable solutions to construction problems;
- Ensure that the working area, site camp facilities, access roads and no-go areas are properly demarcated;
- Ensure that proper topsoil management practices are adhered to on site;
- Ensure that proper waste management & pollution prevention strategies are practised on site;
- Examine method statements;
- Email contractors with potential non-compliance notices in case of contravention of the EMPr;
- Ensure satisfactory rehabilitation of disturbed areas on site, after construction is complete;
- Keep detailed records of all site activities that may pertain to the environment, and produce compliance-monitoring reports (ECO Reports) for submission to the Applicant, and the Competent Authority at regular intervals during the construction phase;
- Submit a final post-construction inspection report, within 6 months of completion of the construction phase. The audit report must detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.
- All ECO Reports and Inspection Reports must be submitted to the Applicant and Competent Authority.

Frequency of ECO visits

The ECO must conduct weekly site visits during construction and rehabilitation Phase, to check compliance with the conditions of the EA, mitigation measures and recommendations of this EMPr. The ECO has the discretion to undertake additional visits if he / she feels this is justified due to the actions of the contractors, and to make *ad hoc* visits in order to ensure compliance.

The ECO must also undertake a final inspection (audit) 6 months of completion of construction activities. The purpose of this final inspection is to ensure that the rehabilitation measures applied at the conclusion of the construction phase have been sufficient to promote the successful rehabilitation of the site, and to identify any further issues that require attention or follow-up.

Authority of the ECO

The ECO has the authority to recommend that the Engineer suspend all works (or part thereof) occurring on site, should any action being undertaken on site not comply with the environmental requirements, and where such actions pose a serious threat to any element of the surrounding environment.

The ECO has the authority to recommend measures to the Engineer, regarding measures that must be implemented on site in order to ensure compliance with the EMPr and Environmental Authorisation, and/or to prevent environmental degradation or pollution from occurring.

The ECO has the authority to issue verbal and written warnings to contractors. Should verbal and written instructions and/or warnings be ignored, the ECO has the authority to request the Engineer to issue pre-determined fines or other penalties.

15. Environmental Awareness Plan

Environmental Awareness Training must be conducted prior to the commencement of construction activities. It is the applicant's responsibility to familiarise himself/herself with the content and requirements of this EMPr. The applicant is also responsible to ensure that the contractor and all labourers working on site during the construction phase are familiar with the content of this EMPr.

The following actions must be taken to ensure that all relevant parties are aware of their environmental role and duties:

1. This EMPr must be kept on site at all times.
2. The provisions of this EMPr and the conditions of the Environmental Authorisation must be explained in detail to all staff during Awareness Training.
3. Training booklets will be handed out to all labourers and must be explained to them.
4. Weekly checks to be done by the Applicant's environmental representative (where available) who must be on site at all times.
5. The ECO to do frequent site visits, as recommended in Section 14.3 of the EMPr.
6. Monthly monitoring reports to be compiled by the ECO. These reports will be circulated to all parties involved (including the applicant, contractor and the competent authority).

The Construction Contractor must make allowance for all construction site staff, including all subcontractors that will be working at the site, to attend environmental awareness training sessions (undertaken by the ECO) before commencing any work on site. During this training, the ECO will explain the EMPr and the conditions contained therein. Attention will be given to the construction process and how the EMPr fits into this process. Other items relating to sound environmental management which must be discussed and explained during the environmental awareness training sessions include:

- The demarcated "No-Go" areas;
- General do's and don'ts of the site;
- Making of fires;
- Waste management, use of waste receptacles and littering;
- Use of the toilets provided;
- Use and control of construction materials and equipment etc.;
- Control, maintenance and refuelling of vehicles;
- Methods for cleaning up any spillage;
- Access and road safety;
- Emergency procedures (e.g. in case of fire, spillage etc.)

- General "best practice" principles, with regards to the protection of environmental resources.

Environmental awareness training and education must be ongoing throughout the construction phase and must be undertaken regularly if deemed necessary (especially if it becomes apparent that there are repeat contraventions of the conditions of the EMPr), or as new workers come to site. Translators must be utilised where needed. An Environmental Awareness Guideline has been compiled and is included in Appendix D of the EMPr.

16. Monitoring, Record Keeping and Reporting

16.1 Environmental Auditing

In accordance with the requirements of the Amended Environmental Impact Assessment Regulations of 2014 (GN No. R.327 of 7 April 2017), the holder of the Environmental Authorisation (i.e. the Applicant) must, for the period that the Environmental Authorisation is valid, appoint a suitably qualified independent person to conduct an environmental audit to audit compliance with the conditions of the Environmental Authorisation and the EMPr.

The appointed auditor must undertake environmental audits within 6 months after the completion of the rehabilitation measures. Following each audit the environmental auditor must submit an audit report to the Competent Authority (in this instance the DEA&DP). The Auditor must be independent from the EAP and ECO.

- Environmental auditing and environmental audit reports must adhere to the requirements of the Environmental Impact Assessment Regulations, in particular Section 34 (*Auditing of Compliance with Environmental Authorisation, Environmental Management Programme*) and Appendix 7 (*Objective and Content of Environmental Audit Report*).
- The audit report must provide verifiable findings on the level of compliance with the provisions/ conditions of the Environmental Authorisation and the EMPr, and must also comment on the ability of the measures contained in this EMPr to sufficiently avoid, manage and mitigate environmental impacts.
- Where the findings of the audit report indicate that the impact management measures stated in the EMPr are insufficient to adequately address environmental impacts, recommendations as to how the EMPr must be amended so as to address the identified shortcomings must be made and submitted to the competent authority together with the audit report.

16.2 Construction phase monitoring, reporting and record keeping.

The appointed Environmental Control Officer (ECO) is responsible for monitoring the site at regular intervals during the construction phase, in order to ensure that the provisions of this EMPr and the Environmental Authorisation are adhered to and that sound environmental management is ensuing on site.

The ECO must compile a monthly ECO report detailing the ECO's observations on site, any instances of non-compliance and any issues or aspects that require attention, follow-up or remedial action. The ECO reports must be submitted to the Applicant, and to the Competent Authority as requested by the DEADP in the EA. The ECO inspection reports must include both photographic and written records.

ECO Inspections - Photographic Records

The condition of the surrounding natural environment must be monitored regularly in order to ensure that construction and management activities are not impacting negatively on the condition of the

landscape and any sensitive ecosystems. The most effective way to achieve this is by means of a detailed photographic record. In this way, a record of any shift in ecosystem condition can be maintained and potential impacts be detected at an early stage. It is thus recommended that fixed-point photo-monitoring sites could be set up, and photographs should be taken at these sites during each ECO inspection. Where necessary, the entire working area should be well documented and photographed.

ECO Inspections - Written Records

The following record-keeping during the pre-construction, construction and rehabilitation phases of the development is recommended:

- The ECO should complete an ECO Checklist after each ECO site visit.
- The ECO must compile an ECO monitoring report and submit this to the Applicant, the Contractor and the Competent Authority (the latter only if required by the Competent Authority). The monthly reports must be a summary of the ECO inspections from the preceding month and must highlight the key concerns/ issues on site, instances of non- compliance with the EA and EMPr, all instructions issued to the contractor, actions taken and aspects that still require attention.
- All ECO reports and ECO instructions must be retained on file by the Applicant at least for the duration of the construction period (retaining reports for a period of at least 5 years is recommended, in the event that the Competent Authority should request information).
- A record (minutes) of construction site meetings, liaison site meetings between the ECO and resident engineer or contractor, monitoring reports, ECO instructions and ECO observations should be clearly documented and filed on a master file off-site for safe keeping.
- It is recommended that a site register (incident register) should be kept on site at the site office for the recording of any environmental incidents (e.g., fires, spills etc.), observations which are contrary to the stipulations within the EMPr and any other contravention deemed necessary for the attention of the resident engineer. Actions taken to remedy the incidents should also be recorded.
- A complaints register should be kept on site in which complaints by any member of the public should be logged.
- The ECO must compile a final post-construction audit report, within 6 months of completion of each construction phase. The audit report should detail the rehabilitation measures undertaken, describe all major incidents or issues of non-compliance and any issues or aspects that require attention or follow-up.

Construction Phase Record Keeping

A copy of the approved EMPr, the Environmental Authorisation and any relevant construction method statements must be kept on site at all times during pre-construction, construction and rehabilitation activities. The ECO Reports must be retained by the Applicant for a period of at least 5 years and must be provided to the Competent Authority upon request. Additionally, any groundwater or water quality results must be made available to all relevant authorities upon request.

16.3 Corrective Action Procedure

Correction actions need to be followed in the event where there is non-compliance with a condition of the EA and any recommendation and mitigation measure as stipulated in this EMPr in order to rectify the non-compliance and to prevent reoccurrence.

The ECO will be responsible for reporting non-compliance with any condition of the EA and the recommendations and mitigation measures as included in this EMPr. The ECO will also be responsible for the compilation of non-compliance reports and identifying steps to correct the non-compliance.

The ECO must report all non-compliance issues to the contractor whose responsibility it is to correct. A timeframe for the completion of the corrective actions must be agreed to the ECO. Once the corrective actions have implemented the contractor must notify the ECO. The ECO must review the effectiveness of the corrective actions and if it is found to be inadequate, additional measures must be implemented. Only once the corrective actions have been completed to the satisfaction of the ECO will the matter be considered as closed.

In instances where there are repeated instances where the requirements and conditions of this EMPr and the Environmental Authorisation are contravened or not fully complied with, the Construction Contractor may be liable for financial penalties. Penalties shall be issued by the Engineer, in accordance with the Schedule of Fines contained in the table below. Penalties may be issued at the Engineer's discretion, and/or upon the request/ recommendation of the ECO or Competent Authority.

Depending on the nature of transgression, the Engineer and/or ECO may issue one or more warnings to the Contractor prior to the issuing of a fine. Warnings may be given in writing or orally, but oral warnings must be followed up with written confirmation of the warning within 48 hours of the oral warning. The Engineer has the discretion to issue a fine without first issuing a warning, if the severity of the transgression is judged by the Engineer and/or ECO and/or Competent Authority to warrant such action.

The Engineer must ensure that the levying of fines/penalties forms part of the contract between the Construction Contractor and the Engineer and is subject to the provisions of South African contract law.

The table below specifies the transgressions for which the Construction Contractor may incur financial penalties, and the amount of the fines that may be levied. Levying of fines/ penalties is subject to alignment with South African Contractual Law. For repeat offences of the same/ similar transgression by the same party, the value of the fine shall be doubled for each subsequent repeat offence to a maximum value of **R50 000.00** per offence.

Note: "Provisions", as stated in the table below, relates to the requirements specified in this EMPr and any requirements or conditions specified in the EA, as well as any other requirements governing the environmental management aspects of the development, which the Contractor is responsible for implementing.

#	Finable Transgression	Min Fine	Max Fine
1	Failure to notify the ECO of the commencement of construction or pre-construction activities, prior to the commencement of such activities	R1 000	R2 000
2	Failure to comply with the provisions relating to the demarcation of the working area, site camp and associated facilities, and the maintenance of the demarcated boundaries.	R1 000	R5 000
3	Failure to comply with the provisions relating to the demarcation of all "no-go" areas, and the maintenance of the demarcated boundaries.	R2 000	R5 000
4	Failure to provide secured ablution facilities (1:30 ratio) on site.	R500	R15 000
5	Failure to comply with the provisions relating to the clearance of vegetation on site.	R2 000	R5 000
6	Clearance of indigenous vegetation (regardless of the density of alien vegetation present) outside of the demarcated boundaries of the working area and site camp.	R2 500	R15 000
7	Damage to indigenous vegetation in the surrounding areas within No-Go areas	R2 000	R10 000
8	Failure to apply herbicide to alien vegetation when required to do so.	R500	R2 000

9	Failure to adhere to designated access routes and/or the driving of vehicles through undeveloped vegetation outside of the demarcated working area or site camp.	R1 000	R5 000
10	Movement of vehicles and/or construction workers in no-go areas;	R1 000	R10 000
11	Empty cement bags found on site or surrounding vegetation. Open cement bags on site with cement blowing from the bag	R2 500	R15 000
12	Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, within designated "no-go" areas.	R1 000	R10 000
13	Parking or storage of vehicles, machinery, tools and other materials or equipment related to the Contractors operations, outside of the areas demarcated for such parking/storage.	R500	R5 000
14	Failure to comply with the provisions relating to the management of topsoil and subsoil.	R1 000	R5 000
15	Excessive excavation of material in areas not depicted for such purpose / activity on the approved design plans.	R2 500	R10 000
16	Failure to comply with the provisions relating to waste management on site i.e. recycling of waste	R500	R5 000
17	Failure to comply with the provisions relating to the storage, use and management of hazardous substances and fuels on site and/or the spillage of hydrocarbons or hazardous substances on site.	R1 000	R10 000
18	Mixing cement or concrete on bare ground and/or failure to comply with any other provision regarding cement/ concrete batching	R1 000	R5 000
19	Failure to provide adequate fire-fighting equipment (in working order) on site at all times and/or failure to comply with the provisions relating to fire prevention and/or the occurrence of unattended or out of control fires.	R500	R5 000
20	Refuelling of vehicles, machinery or equipment outside of the designated refuelling area.	R500	R2 000
21	Maintenance of vehicles, machinery or equipment outside of the designated maintenance yard, except in emergencies	R500	R2 000
22	Failure to undertake refuelling or repairs over a drip tray or other impermeable bunded surface to collect spilled hydrocarbons (fuels, lubricants, oils etc.) and other hazardous substances; failure to provide drip trays under fuel burning equipment (including pumps and generators) where there is a risk of hydrocarbon leakage.	R500	R2 000
23	Storing / placing fuel containing equipment (i.e. bowsers and other fuel containers) within a drainage line.	R2 500	R10 000
24	Failure to produce a required method statement/s to the engineer's and ECO's satisfaction prior to undertaking the activity concerned and/or failure to adhere to an approved method statement	R1 000	R5 000
25	Waste found to be buried or burnt on site	R5 000	R15 000

17. CONCLUSION

The recommendations and mitigation measures prescribed in this EMPr have been formulated with the intention of addressing potential pre-construction, construction and operational phase impacts on the environment. It is likely that if the conditions, requirements and recommendations of the above EMPr are implemented as described and the relevant stakeholders adhere to the various mitigation measures, then the project will be completed without unforeseen negative environmental impacts. Familiarity with the contents of this EMPr by the contractors and other individuals involved in the development project will assist in achieving "environmental best-practice", which ultimately ensures that the project arrives at a sustainable outcome.

APPENDIX A1:

FIGURE 1: LOCALITY MAP FOR THE PROPOSED UPGRADING OF STORMWATER INFRASTRUCTURE IN ROSEMOOR, GEORGE, WESTERN CAPE

Prepared for:

George Municipality

Date:

October 2025

FIGURE 2: LOCALITY MAP FOR THE PROPOSED UPGRADING OF STORMWATER INFRASTRUCTURE IN ROSEMOOR, GEORGE, WESTERN CAPE

Prepared for:	**Date:**
George Municipality	*October 2025*

Figure 3:CLOSE-UP LOCALITY MAP OF THE STORMWATER OUTLET STRUCTURES FOR THE PROPOSED UPGRADING OF STORMWATER INFRASTRUCTURE IN ROSEMOOR, GEORGE, WESTERN CAPE

Prepared for:

George Municipality

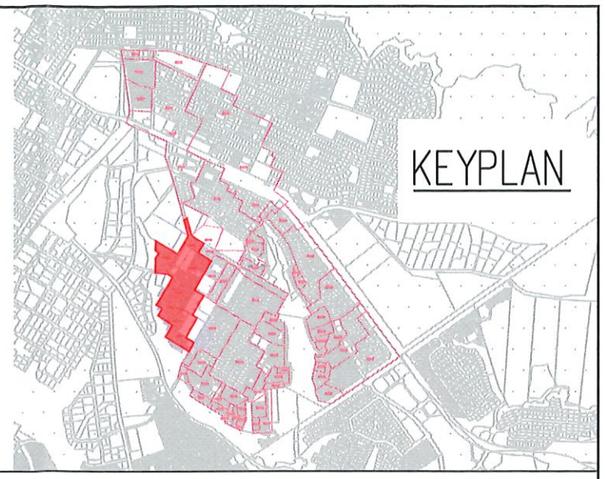
Date:

October 2025

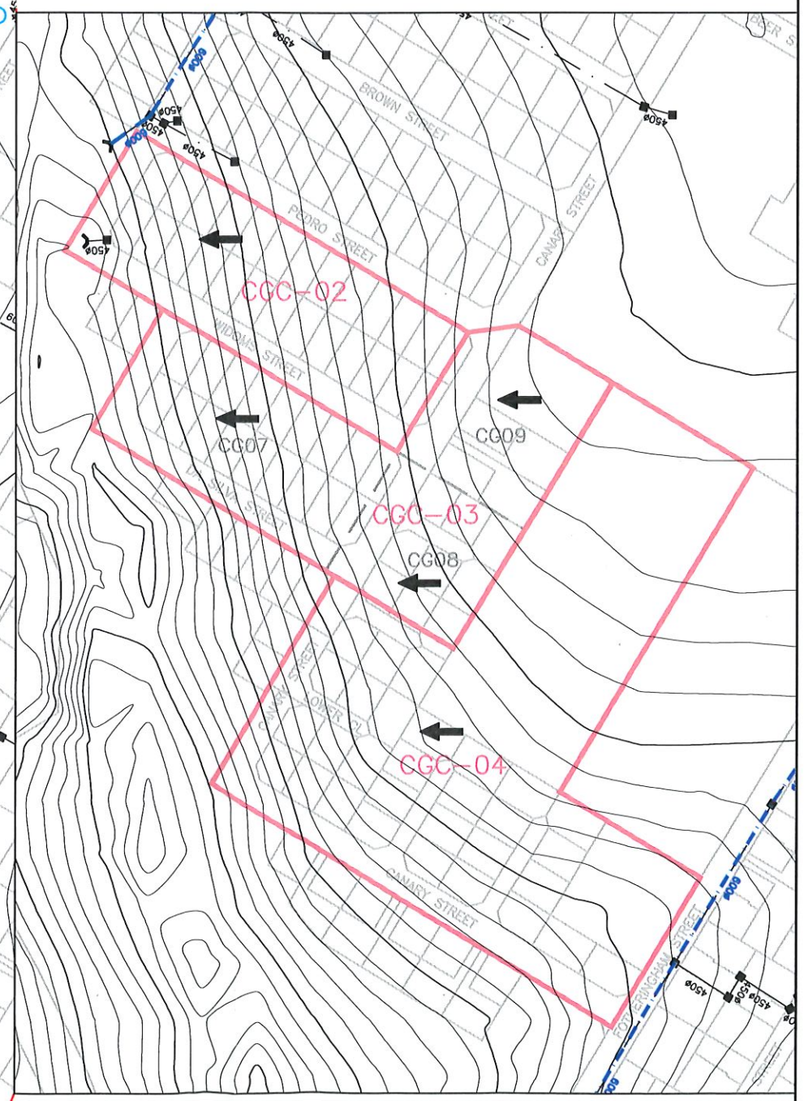
LEGEND

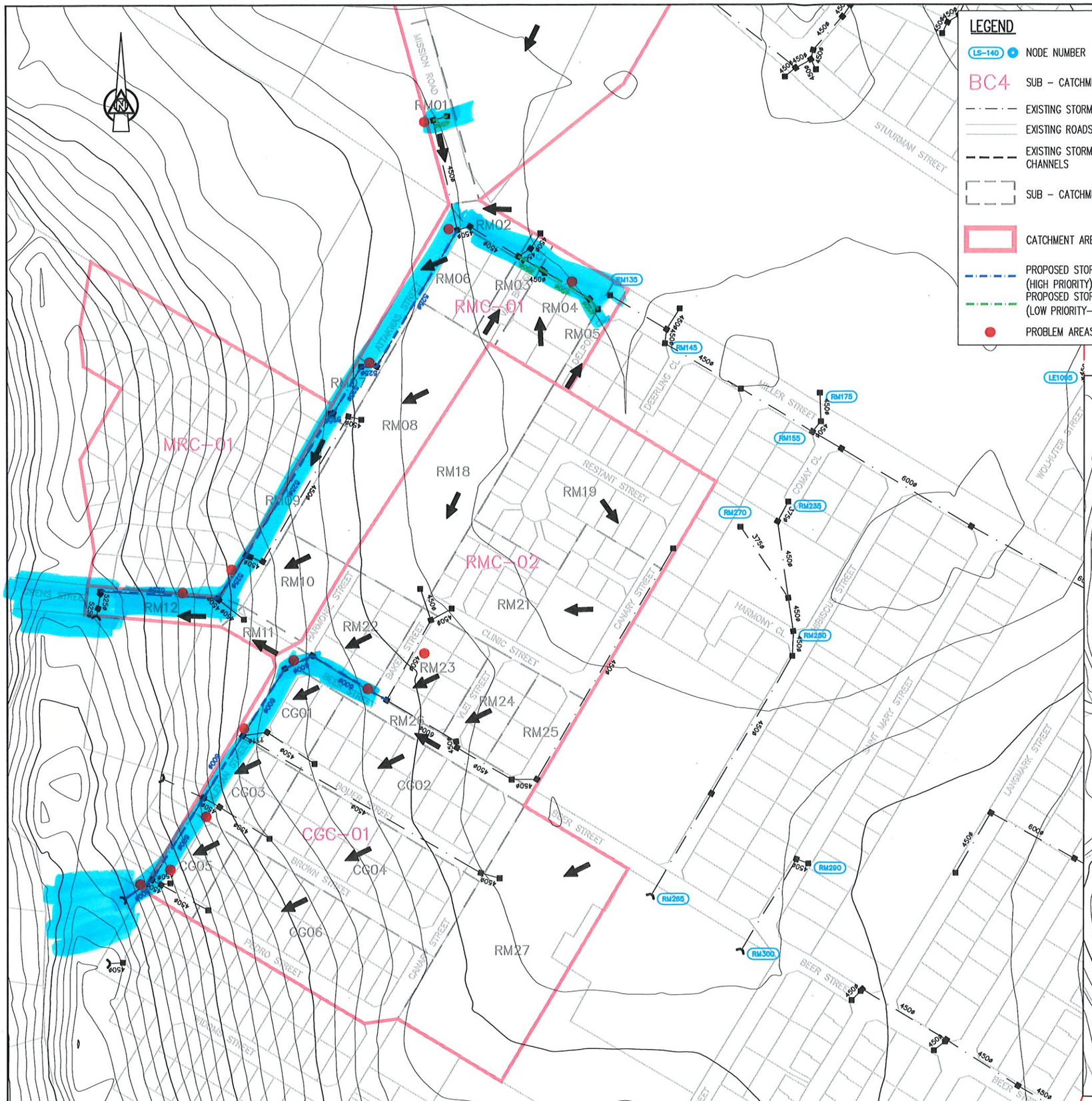
- LS-140 — NODE NUMBER
- BC4 — SUB – CATCHMENT NUMBER
- EXISTING STORMWATER PIPE
- EXISTING ROADS
- EXISTING STORMWATER CHANNELS
- SUB – CATCHMENT AREA
- CATCHMENT AREA
- PROPOSED STORMWATER PIPE (HIGH PRIORITY)
- PROPOSED STORMWATER PIPE (LOW PRIORITY–450mm dia.)
- PROBLEM AREAS

KEYPLAN



INSERT A: CGC–02 TO CGC–04 CATCHMENT





GEORGE
THE CITY FOR ALL REASONS

NADESON
CONSULTING SERVICES
Millwood Building, York Street, George, 6530
T +27 44 873 4831
E george@nadeson.net

GEORGE STORMWATER MASTER PLAN

FIG: 4.7 **ROSEMOOR/CONVENT RMC–01&02,CGC–01 to 04 PROPOSED NETWORK**

KEYPLAN

LEGEND

- NODE NUMBER
- SUB – CATCHMENT NUMBER
- EXISTING STORMWATER PIPE
- EXISTING ROADS
- EXISTING STORMWATER CHANNELS
- SUB – CATCHMENT AREA
- CATCHMENT AREA
- PROPOSED STORMWATER PIPE (HIGH PRIORITY)
- PROPOSED STORMWATER PIPE (LOW PRIORITY–450mm dia.)
- PROBLEM AREAS

GEORGE
THE CITY FOR ALL REASONS

NADESON CONSULTING SERVICES
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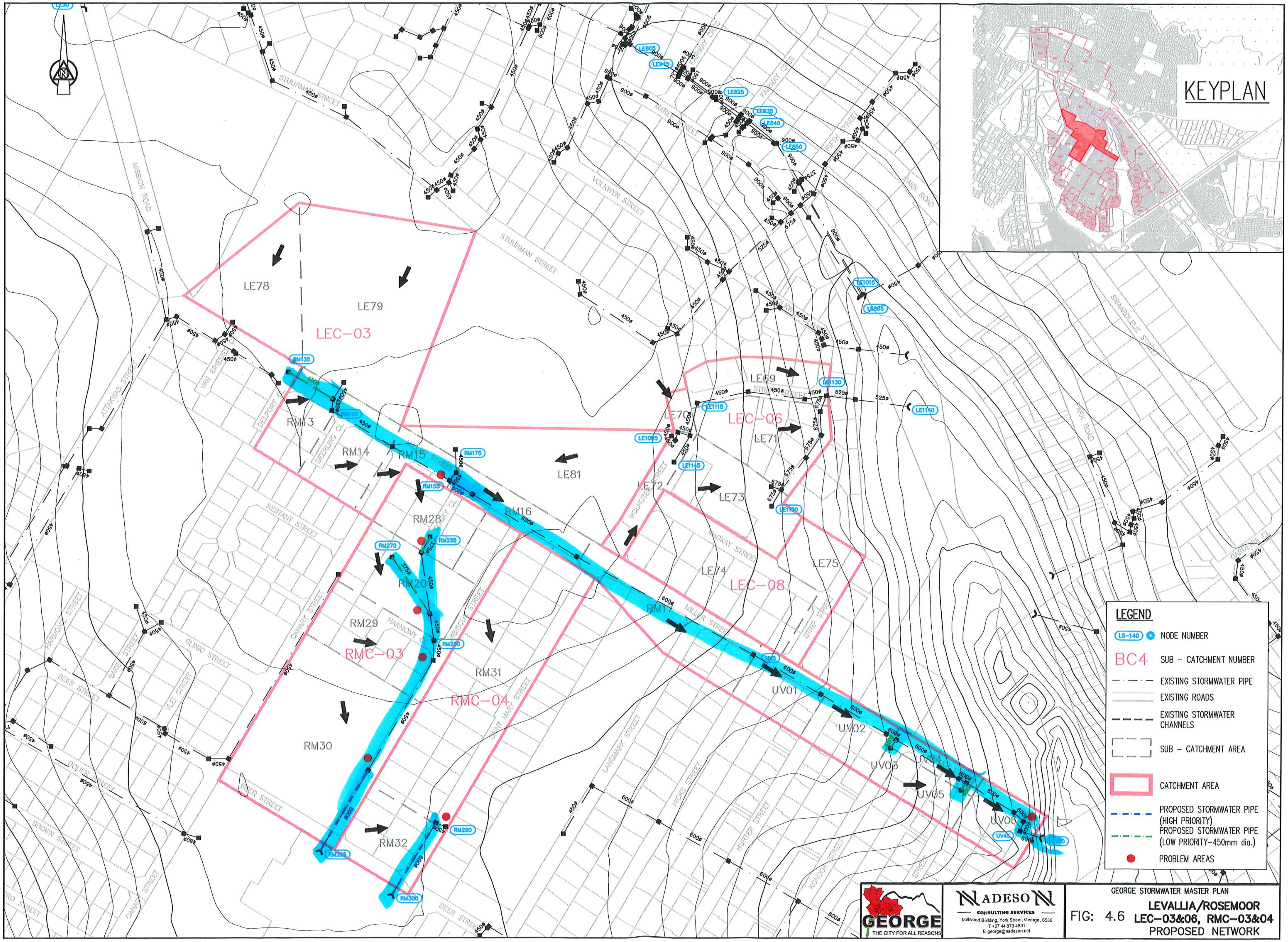
E george@nadeson.net

GEORGE STORMWATER MASTER PLAN

FIG: 4.8 URBANSVILLE CATCHMENT 01 – 04 (UVC–01 to 04) PROPOSED NETWORK


KEYPLAN
LEGEND
NODE NUMBER
SUB - CATCHMENT NUMBER
EXISTING STORMWATER PIPE
EXISTING ROADS
EXISTING STORMWATER CHANNELS
SUB - CATCHMENT AREA
CATCHMENT AREA
PROPOSED STORMWATER PIPE (HIGH PRIORITY)
PROPOSED STORMWATER PIPE (LOW PRIORITY-450mm dia.)
PROBLEM AREAS
LEC-03
LEC-06
LEC-08
RMC-03
RMC-04
GEORGE
THE CITY FOR ALL REASONS
NADESON
CONSULTING SERVICES
GEORGE STORMWATER MASTER PLAN
FIG: 4.6
LEVALLIA/ROSEMOOR
LEC-03&06, RMC-03&04
PROPOSED NETWORK

INSERT A: UVC-20 TO UVC-26 CATCHMENT

INSERT A: UVC-11 TO UVC-12 CATCHMENT

LEGEND

- LS-140 — NODE NUMBER
- BC4 — SUB - CATCHMENT NUMBER
- EXISTING STORMWATER PIPE
- EXISTING ROADS
- EXISTING STORMWATER CHANNELS
- SUB - CATCHMENT AREA
- CATCHMENT AREA
- PROPOSED STORMWATER PIPE (HIGH PRIORITY)
- PROPOSED STORMWATER PIPE (LOW PRIORITY–450mm dia.)
- PROBLEM AREAS

KEYPLAN

RGRADE PIPE FROM UV490 TO UV 495

GEORGE
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E george@nadeson.net

GEORGE STORMWATER MASTER PLAN

FIG: 4.9 URBANSVILLE CATCHMENT 05–26 (UVC–05 to 26) PROPOSED NETWORK

CURRICULUM VITAE

MICHAEL JON BENNETT

PERSONAL

Profession: Principle Environmental Assessment Practitioner and Senior Environmental Control Officer, Sharples Environmental Services cc, George

Nationality: South African

Date of Birth: 22 October 1985

Languages: English (read, write and speak) & Afrikaans (read, write and speak)

Marital Status: Single

Drivers License: Code B

Health: Excellent

EAPASA Reg: 2021/3163

IAIASA Membership: 7334

WORK EXPERIENCE

2014 – Present: Sharples Environmental Services cc, George, WC

Environmental Assessment Practitioner

I have gained extensive experience in assessments and monitoring and have worked on a variety of multidisciplinary projects and am proficient in:

- Basic Assessments Reports
- Water Use Authorisation Applications
- Environmental Monitoring and Reporting
- Environmental Management Programmes
- Environmental Control Officer Training
- Conducting Outeniqua Sensitive Coastal Area licensing applications

2016 – 2017: Sharples Environmental Services cc, Cape Town, WC

Intrim Office Manager, Environmental Assessment Practitioner

2011 – 2014: Peninsula Permits & NCC Group, Cape Town, WC

Environmental Control Officer

- Environmental Monitoring

TERTIARY EDUCATION

2010 University of Cape Town

- I hold a Bachelor of Science Degree specialising in Environmental and Geographic Science & Ocean and Atmospheric Science

PROJECTS

2023 George Urban Country Estate (Pty) Ltd

- Basic Assessment Report for the proposed residential development on erf 19374 (remainder erf 6182, erven 6179 and 6156), George, Western Cape

2023 George George Municipality

- Basic Assessment Report for the Upgrading of the Eden Pumpstation, George, Western Cape

2023 Mossel Bay Paprenax Trading 6 cc

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed upgrade of the Schaapkop Pumpstation rising main on remainder of erf 464 and erf 13486, George, Western Cape

2023 George Garden Route Gateway Plaza

- Basic Assessment Report for proposed mixed-use development on portions 278 and 282 of farm Kraaibosch no. 195, George, Western Cape

2023 George George Municipality

- Basic Assessment Report for proposed development of a Photovoltaic Solar Plant on erf 2819, George, Western Cape

2023 George EARP Construction

- Basic Assessment Report for the proposed commercial development on portion 49 of Farm Hansmoeskraal 202, George, Western Cape

2022 George Pieterkoen Trust

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Mossel Bay Dalmar

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the Proposed Residential Development On A Portion Of The Farm Vaale Valley 219, Mossel Bay (Hartenbos Landgoed II), Western Cape

2022 George Dalmar

- Amendment of Environmental Authorisation Proposed Development of Herold's Bay Country Estate on A Portion of Portion 7 of The Farm Buffelsfontein No. 204, Herold's Bay, Western Cape

2022 George Pieterkoen Trust

- Basic Assessment Report for the proposed residential development on Portion 21 of the Farm Kraaibosch No. 195 (Pieter Koen), George, Western Cape

2022 Still Bay W. Nel & Irma Oosthuizen Trust IT 1596/2008

- Basic Assessment Report for the development of 5 residential units on erven 4139, 4140, 4141, 4142, 4143, 4144, 4145 (Erf 3997), Still Bay West, Western Cape

2022 George Octo Trading 377 cc

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful construction of a road clearance of vegetation to establish a house on remainder of Farm Holle Kloof 91 and Portion 1 of the Farm Plattekloof 131, Waboomskraal, George, Western Cape

2022 Knysna CapeNature

- Basic Assessment Report for the Proposed development on Portions 38 and 39 of Farm 205 and Remainder of Farm 211, Goukamma Nature Reserve, Knysna, Western Cape

2021 Prince Albert Jurie Klue

- Section 24 G Retrospective Environmental Authorisation for the alleged unlawful clearance of vegetation on Farm Angliers Bosch (Fernkloof), Remainder of Farm 157, Klaarstroom, Prince Albert, Western Cape

2021 Mossel Bay Mossel Bay Municipality

- Basic Assessment Report for the proposed Dana Bay Emergency Access Road on Remainder of Portion 7 of the Farm 225, Dana Bay, Mossel Bay, Western Cape

2021 Willowmore LEZMIN 2087cc

- Basic Assessment Report for the proposed development of Portion 1 of the Farm Matjiesfontein No. 206, Baviaanskloof, Division Willowmore, Eastern Cape

2020 Sedgefield Knysna Municipality

- Basic Assessment Report for the proposed housing development on erven 3861, 3865, 3866, 3917, 3918 and 5010 in Sedgefield, Knysna, Western Cape

2020 Mossel Bay Paprenax Trading 6 cc

- Basic Assessment Report for the proposed establishment of a filling station and associated business infrastructure on a portion of erf 13996, Kwanonqaba, Mossel Bay, Western Cape

2020 Ladismith Department of Transport and Public Works

- Maintenance Management Plan for the periodic maintenance of Trunk Road 31, section 4, km 30.8 to km 76.06, Barrydale to Ladismith, Western Cape

2020 Knysna Knysna Municipality

- Maintenance Management Plan for the Maintenance of the potable water pipeline system on Erven 4197, RE/1352, RE/1351, RE/1146 and 1316 in Knysna, Western Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Phase 1A of New municipal 66kV double circuit overhead line between the Melkhout substation at Humansdorp and the main intake substation at Jefferys Bay, Eastern Cape

2020 Humansdorp Kouga Municipality

- Environmental Control Officer for the Construction of a new 22kv overhead powerline between Melkhout substation and Allison Street, Humansdorp, Eastern Cape

2020 Knysna Knysna Municipality

- Environmental Control Officer for the Charlesford raw water pumping scheme: Upgrade and refurbishment of pumpstation: Mechanical and electrical, Knysna, Western Cape

2020 Seweweekspoort, Department of Transport & Public Works

- Amendment of Environmental Authorisation (Part 2, Substantive amendment) for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 – 2021 Seweweekspoort, Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to road structures on MR309 in Seweweekspoort, Western Cape

2019 George George Municpality

- Environmental Control Officer for the Raising of the Garden Route Dam Spillway on Portion 3/352, Remainder of 536 of Erf 221, Erf 3055 and Erf 3056, George, Western Cape

2019 Laingsburg Department of Agriculture

- Environmental Control Officer for the Construction Of Erosion Prevention Structures Within The One In Ten Year Flood Line Of The Buffels River, Laingsburg, Western Cape

2019 Williston Williston Municipality

- Environmental Control Officer for the Upgrading of bulk water network in Williston – Phase 3, Williston, Northern Cape

2019 George George Municipality

- Environmental Control Officer for the construction of new 66kV overhead line between Ballots Bay and Glanwood substations, George, Western Cape

2019 Oudtshoorn Department of Transport & Public Works

- Environmental Control Officer for the Periodic maintenance of Trunk Road 31, Section 6, km 23.3 to km 47.8 Calitzdorp to Oudtshoorn, Western Cape

2019 Kleinbrak Mossel Bay Municipality

- Environmental Control Officer for the Upgrading of Beyers Street, Klienbrak River, Western Cape

2019 George Outeniqua Eye Clinic Body Corporate

- Environmental Control Officer for the proposed expansion of parking area on erf 5950 and part of remainder erf 464, George, Western Cape

2019 Mossel Bay Hey Innovations

- Basic Assessment Report for the proposed establishment of a residential development on Erf 2839, Great Brak River, Western Cape

2019 Oudtshoorn Oudtshoorn Municipality

- Environmental Management Programme for the Blossoms Emergency Supply Scheme, Oudtshoorn, Western Cape

2019 Humansdorp Clinkscales Maughan-Brown

- Environmental Management Programme for the proposed construction of a new 22kV overhead powerline between Melkhout Substation and Allison Street, Humansdorp, Eastern Cape

2019 George PN&MR Lotter Family Trust

- Addendum to the Environmetnal Management Programme for the Establishment of a Township (Rivendale) on Portions 5, 15, 16 and 31 of the Farm Hansmoeskraal 202, Western Cape

2019 Oudtshoorn Department of Transport and Public Works

- Basic Assessment Report for the Proposed Maintenance Activities of Trunk Road 33/4 between km 4.6 and km 14.4, Meiringspoort, Western Cape

2019 George Dynarc Capital

- Substantive amendment of environmental authorisation for the proposed Development of Portion 130, 131 and 132 of the Farm Gwayang 208

2019 George Department of Transport & Public Works

- Basic Assessment Report for the proposed Upgrading of Bridge No. 2221 on Trunk Road 2/9 at km 15.1 over the Maalgate River.

2018 - 2019 Oudtshoorn Department of Transport and Public Works

- Maintenance Management Plan for the proposed periodic maintenance of Trunk Road 31, section 6, km 23.3 to km 47.8, Western Cape

2018 - 2019 Humansdorp Clinkscales Maughan-Brown

- Applicability of the EIA regulations Checklist for the proposed new 22kV overhead line between Melkhout Substation and Allison Street, Eastern Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed Rheenendal infill housing, subdivision and rezoning of portions of erf 42, 36 and 387 as well as erven 535, 536, 553, 54, 393, 406, 672, 673 and 68, Rheenendal, Western Cape

2018 - 2019 Knysna Knysna local Municipality

- Applicability of the EIA regulations Checklist for the proposed infill housing and subdivision of erven in Welsyndorp and the rezoning and subdivision of erven in Bosdorp, Karatara, Western Cape.

2018 Port Elizabeth ACSA P.E.

- Applicability of the EIA regulations Checklist for the proposed ACSA Port Elizabeth Airport Photovoltaic Plant, Eastern Cape Province

2018 Mossel Bay TopUp Prop Inv.

- Applicability of the EIA regulations Checklist for the proposed Farm Stall Centre and filing Station on Portion 65 of the Farm Hartenbosch 217, Hartenbos

2018 George Outeniqua Eye Clinic Body Corporate

- Basic Assessment Report for the proposed expansion of parking area on erf 5950 and part of remainder erf 464

2018 Beaufort West Beaufort West Municipality

- Environmental Control Officer for the First and Second Environmental Audit for the provision of adequate water supply within the jurisdiction of the Beaufort West municipality

2018 Mossel Bay Element Consulting Engineers

- Environmental Management Programme update for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation and the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations.

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the construction of a new 22kV overhead power line between the Midbrak and Kleinbrak Substations

2018 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the Upgrade of Amy Searle Canal – Phase 5, Great Brak River

2018 Gouritsmond Hessequa Consulting Engineers

- Environmental Control Officer for the Upgrade and expansion of the Gouritsmond Water Water Treatment Works on remainder of erf 140, Gouritsmond

2018 George Biprops 14

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195, Groenkloof Woods: Phase C & D

2018 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 2B

2018 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the upgrade of the Kranshoek Bulk Water Supply Scheme: Construction of Pipelines, reservoirs and associated infrastructure near Plettenberg Bay.

2018 Mossel Bay SMEC

- Environmental Control Officer for the Upgrade of Kusweg and associated infrastructure in Rheebok

2017 George EARP Construction

- Invasive Alien Management Plan for the proposed residential development on portions 21, 23, 24 & 48 of Farm Hansmoeskraal 202 near George

2017 Mossel Bay Mossel Bay Municipality

- Environmental Control Officer for the development of the new Mossel Bay municipal cemetery on erf 2001/0

2017 Knynsa Knysna Municipality

- Environmental Control Officer for the remedial work to prevent further settlement of the low-lift pump sump and retaining wall at Gouna River Pump Station

2017 Knynsa Knysna Municipality

- Environmental Control Officer for upgrading of Knysna bulk water supply scheme: phase 1

2017 George Biprops 14 (Pty) Ltd

- Environmental Control Officer for the residential development on portion 5 of the farm Kraaibosch No. 195

2017 Still Bay Hessequa Municipality

- Environmental Control Officer for the construction of a reservoir, booster pump station and associated infrastructure in Melkhoutfontein near Still Bay

2016 - 2017 Heidelberg Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Heidelberg North

2016 - 2017 Riversdale Department of Transport & Public Works

- Environmental Control Officer for the flood damage repairs to structures in the Central Eden District Municipality Region, Riversdale East area

2016 - 2017 Still Bay Department of Transport & Public Works

- Environmental Control Officer for the upgrade of main road 332 near Still Bay

2016 - 2017 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College: Phase 3, Mossel Bay Campus

2016 - 2017 Klein Brak Mossel Bay Municipality

- Environmental Control Officer for the removal of obstructions in the lower floodplain of the Klein Brak River Estuary

2016 Prince Albert Milway Trade and Invest 1014cc

- Basic Assessment for the proposed guest lodge on remainder of Farm Rietpoort 13

2016 Plettenberg Bay Bitou Municipality

- Basic Assessment for the proposed Qolweni phase 5 development near Plettenberg Bay

2016 Mossel Bay Element Consulting Engineers

- Environmental Management Programme for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2016 George SMEC

- Environmental Policy for the resurfacing of York Street, George

2016 Mossel Bay Department of Transport & Public Works

- Maintenance Management Plan for proposed upgrade of Louis Fourie Road.

2016 George Oaklands Bridge Country Estate HOA

- Maintenance Management Plan for proposed repair and maintenance of the riverbank at Oaklands Bridge Country Estate in Heather Park

2016 Gouritz Department of Transport & Public Works

- Update of the Maintenance Management Plan for proposed repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2016 George Ivorybell Investment (Pty) Ltd

- Outeniqua Sensitive Coastal Area Environmental Impact Report for the proposed new house on erf 379 in Heralds Bay

2016 George George Municipality

- Environmental Assessment Report for the substantive amendment of environmental authorisation of the proposed upgrade and extension of the overhead power lines and associated substations

2016 Oudtshoorn SA Army Infantry School

- Environmental Control Officer for the construction of a fighting in built up areas (FIBUA) range on portion 10 of the farm Blaauwtjes Drift 110 in Oudtshoorn

2015 - 2016 Gouritz Department of Transport & Public Works

- Environmental Control Officer for the repair and maintenance of the Gouritz River Bridge bank protection along the R325 near Gouritzmond

2015 - 2016 Albertinia Garden Route Game Lodge (Pty) Ltd

- Environmental Control Officer for the five new units at the Garden Route Game Lodge

2015 - 2016 Mossel Bay Element Consulting Engineers

- Environmental Control Officer for the replacement of 22kV overhead powerline between Power Town and Hartenbos and between Hartenbos and the Hartenbos sewage substation

2014 - 2016 Plettenberg Bay Chauke Quanity Surveyers

- Environmental Control Officer for the Qolweni and Kwanokuthula High Density Units and engineering services

2016 Plettenberg Bay Bitou Municipality

- Environmental Control Officer for the civil engineering works for Kwanokuthula Phase 4 and the extension of Sishuba Street

2014 - 2016 Mossel Bay The South Cape College

- Environmental Control Officer for the extension of the South Cape College, Mossel Bay Campus

2016 George SMEC

- Environmental Control Officer for the resurfacing of York Street

2014 - 2015 Mossel bay The Muller Murray Trust

- Environmental Control Officer for the construction of gravity pipeline from the Nautilus take-off to the Boggomsbaai Reservoir phase 2

2015 Swellendam Casidra SOC Ltd

- Environmental Control Officer for the Grootvaderbos Groynes in the Buffeljags River

2015 George Element Consulting Engineers

- Environmental Control Officer for the upgrading and extension of overhead power lines and substations: construction of a new 66kV overhead line between Protea and Ballots Bay substation

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George BDE Consulting Engineers (Pty) Ltd

- Environmental Control Officer for the photovoltaic solar plant for the ACSA George Airport

2015 Heidelberg Bergstan South Africa

- Environmental Control Officer for the Duiwenhoks River stabilization works: Sites B31, B38 and B39

2015 Krakeel Element Consulting Engineers

- Environmental Control Officer for the construction of filling station at SSK Tuinrote Agri on portion 5 of the farm no. 320

2014 - 2015 Herbertsdale SMEC

- Environmental Control Officer for the flood damage repairs to structures in the Eden region: Herbertsdale area

2014 - 2015 George Department of Transport & Public Works

- Environmental Control Officer for the flood damage repair projects in the George and Knysna local municipal areas

2015 George SMEC

- Environmental Control Officer for the improvements to the Pacaltsdorp interchange and new pedestrian bridge

2014 - 2015 Still Bay De Villiers & Moore Consulting Engineers

- Environmental Control Officer for the Still Bay 66kV substation and overhead powerline

2014 Beaufort West Worley Parsons Consulting Engineers

- Environmental Control Officer for the Nelspoort bulk water supply scheme northeast of Nelspoort

CURRICULUM VITAE

ONELA MHOBO

PERSONAL

Profession: Candidate Eanviromental Assesssmenr and Environmental Control Officer, Sharples Environmental Services cc, George

Nationality: South African

Date of Birth: 06 August 1999

Languages: English (read, write and speak) & Ixishosa (read, write and speak)

Marital Status: Single

Drivers License: Code B

Health: Excellent

EAPASA registration : 2022/4522

SACNASP Registration: 151484

WORK EXPERIENCE

2025 – Present: Sharples Environmental Services cc, George, WC

Candidate Environmental Assessment Practitioner

- Basic Assessments Reports
- Environmental Monitoring and Reporting
- Environmental Management Programmes

2023 – 2024: Department of Economic Small Buisiness Development, Tourism and Enviromental Affairs, Bloemfontein FS

Enviromental Officer Intern: Waste Management and Pollution Control

- Conduct environmental audits of waste management facilities ann monitor the operation and performance of the facilities for compliance with waste management license/ permits issued.
- Review Waste license applications for authorization of waste activites
- Environmental Monitoring and Reporting
- Ensure provision of sector training and capacity building to sector members and other relevant stakholders.
- Perform and Ad hoc tasks and duties as requested and required by management.
- Comply with Public service prescript

TERTIARY EDUCATION

2022 Unisa

- Bsc Honours- Enviromental management

2021 Nelson Mandela University

- BSc Enviromental Science

SHORT COURSES

2023- DSQ Academy

- ISO 14001: 2015 Enviromental Managament Systems

2023- DSQ Academy

- ISO 45001:2018 Occupational Health and Safety

2024- ESRI

- ArcGIS Pro : Standard

2024- Nosa Safety cloud

- Introduction to SAMTRAC

2025- Nosa Safety cloud

- SAMTRAC general

PROJECTS

2025- **George** Lukhozi Consulting Engineers

- Environmental Control Officer for repair and rehabilitation of flood damages along Camphersdrift River, Van Riebeeck Gardens .

2025- **George** – Zutari

- Environmental Control Officer for the Development of an Additional 40 Megalitre Raw Water Balancing Dam at the George Water Treatment Works, George, Western Cape..

2025- **Plettenberg Bay**- Status Homes Property Developers

- Environmental Control Officer for the mixed-use development on Portion 9 of the Farm Kranshoek No. 432, Knysna Road, Plettenberg Bay**.**

2025- **George-** Lukhozi Consulting Engineers

- Environmental Control Officer for the upgrade of the Existing Eden Sewage Pump Station, on Erven RE/5987, 6013 and 6014, George, Western Cape Province**..**

2025- **George-** George Municipality

- Environmental Control Officer for the rehabilitation of a donga and upgrade of the effluent pipe at the Gwaing Waste Water Treatment Works, Remainder Erf 464, George Local Municipality, George, Western Cape Province.

2025- **Mossel Bay**- Western Cape Provincial Government: Department of Transport and Public Works – Roads

- Environmental Control Officer for the Upgrade of Louis Fourie Road in Mossel Bay, Western Cape

2025- **George**- SNA Consulting Engineers on behalf of WCG

- Environmental Control Officer for Upgrade of Bridge No. 2221 on Trunk Road 2/9 at KM 15.1 over the Maalgate River, Plettenberg Bay**.**

2025- **George-** George Municipality

- Basic Assessment Report for the Proposed flood damage repairs to the Langenhoven Substation, George, Western Cape.

2025**- George-** George Municipality

- Basic Assessment Report for the The Proposed Upgrading Of Stormwater Infrastructure In Rosemoor, On Erven 9000, 14079,17362,17328,17327,17362, 4250, 4372, 8621 and Remainders of Ervern 464, 8581,8596,8662, 8602,8596, 8651, George, Western Cape.

2025**- George-** George Municipality

- Basic Assessment Report for the The Proposed Upgrading Of Stormwater Infrastructure In Rosemoor, On Erven 9000, 14079,17362,17328,17327,17362, 4250, 4372, 8621 and Remainders of Ervern 464, 8581,8596,8662, 8602,8596, 8651, George, Western Cape.

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ENVIRONMENTAL AWARENESS TRAINING BOOKLET

Environmental Monitor's Foreword

SES is here to ensure that everyone complies with the conditions of "Duty to Care". If these conditions are not complied with the project can be stopped and fines can be issued.

We hope that with your co-operation the project won't be stopped and fines won't be issued, and a successful project can be finished on time.

Notes:

- Workers working on this project must undergo environmental training.

- The information contained in this document should be used during day-to-day activities.

HOW IS THIS PROJECT IMPLEMENTING ENVIRONMENTAL MANAGEMENT?

This project is implementing Environmental Management on an ongoing basis throughout the duration of the project. The following aspects would be implemented to achieve the above stated:

- A dedicated Environmental Manager or Environmental Control Officer appointment to the project to implement and monitor Environmental Management.
- Regular environmental inspection on the site.
- Regular environmental training for workers
- Environmental audits on a regular basis.

WASTE TREATMENT

Refuse:

- Refuse waste includes: waste food, food containers, packaging materials, cans, bottles, newspapers and magazines.
- Day to day household waste should always be disposed of in the containers provided on site by the company.
- No dumping of waste anywhere other than in the bins provided.
- No burning of refuse.
- If there are not enough refuse containers on site, the ECO or supervisor needs to be informed.

Construction Waste:

- Construction waste includes: concrete, steel, cement, rock, pre-coated chips, wood, plastic, empty bags and rubble.
- Construction waste must be discarded in skips located in strategic areas for removal.
- Construction waste must not be discarded in holes or burned on site.

- Small amounts of construction waste should be collected and not discarded into vegetation or down fill slopes.
- Material should only be spoiled if a rehabilitation plan has been designed for the area.

Liquid waste:

- Liquid waste includes: concrete, paint, thinners, diesel, hydraulic fluids, cooking oil, chemicals, other fuel and sewage.
- Use facilities provided for waste.
- The liquid waste should be recycled as far as possible.
- Use chemical toilets and ablution facilities.

INFORM THE ENVIRONMENTAL CONTROL OFFICER (ECO) IMMEDIATELY OF ANY IMMEDIATE OR POTENTIAL ENVIRONMENTAL INCIDENT.

SPECIFIC ENVIRONMENTAL ISSUES

SPESIFIEKE OMGEWINGSKWESSIES
IMIBA ETHILE YEZOBUME BEMEKO YENDALO

The basic Do's and Don'ts towards environmental awareness are as follows:

Die basiese Moets en Moenies van omgewingsbesinning is as volg:

Oondoqo bo mawukwenze no mawungakwenzi kwilinge lezobume be meko yendalo bume ngoluhlobo:

Toilet Facilities:
Toilet Fasiliteite:
Izindlu Zangasese:

DO:
USE THE TOILET FACILITIES PROVIDED - REPORT FULL FACILITIES
MOET:
GEBRUIK MAAK VAN TOILET FASILITEITE WAT VOORSIEN WORD – RAPPORTEER AS FASILITEITE VOL IS
OMAWUKWENZE: SEBENZISA IZINDLU ZANGASESE EZIBONELELWEYO- NIKA INGXELO NGAMALUNGISELELO AGCWELEYO.

DO NOT:
USE THE BUSH
MOENIE:
DIE BOS GEBRUIK NIE
OMAWUNGAKWENZI: UKUSEBENZISA ITYHOLO.

Vehicles operation and maintenance:
Voertuig werking en onderhoud:
Ulawulo nophatho lezithuthi:

DO:
ENSURE THAT VEHICLES AND MACHINERY DO NOT LEAK FUEL OR OILS. REFUELLING, MAINTENANCE, SERVICING OR WASHING MUST BE DONE WITHIN THE DESIGNATED AREA IN THE CONSTRUCTION CAMP AREA ONLY.
MOET:
VERSEKER DAT VOERTUIE EN MASJINERIE NIE OLIES OF BRANDSTOF LEK NIE. VOLMAAK, ONDERHOUD, DIENS OF SKOONMAAK VAN VOERTUIE MOET SLEGS IN AANGEWYSTE AREAS IN DIE KONSTRUKSIE KAMP GESKIED.
OMAWUKWENZE: QINISEKISA IZITHUTHI NOMATSHINI ABAVUZI MAFUTHA OKANYE I OYILE, UKUGALELA, UKUPHATHA, UKULUNGISA OKANYE UKUHLAMBA KUFUNEKA KWENZIWE KUMMANDLA OTYUNJIWEYO KWINKAMPI YOLWAKHIWO KUPHELA NGOKUKHAWULEZILEYO.

DO:
REPORT ALL FUEL OR OIL SPILLS IMMEDIATELY & STOP THE SPILL CONTINUING.
MOET:
RAPPORTEER ENIGE BRANDSTOF OF OLIE STORTE & VERHOED DAT DIE STORT AANHOU.
OMAWUKWENZE: NIKA INGXELO NGE OLI NAMAFUTHA ACHITHEKILEYO, UZE UNQANDE UCHITHEKO LUNGAQHUBEKI.

DO:
PREVENT CONTAMINATION OR POLLUTION OF STREAMS AND WATER CHANNELS.
MOET:
VERHOED DIE KONTAMINASIE EN BESOEDELING VAN STROME & WATERKANALE.
OMAWUKWENZE : NQANDA USULELEKO OKANYE UNGCOLISEKO LWEMILAMBO NEMISELE YAMANZI.

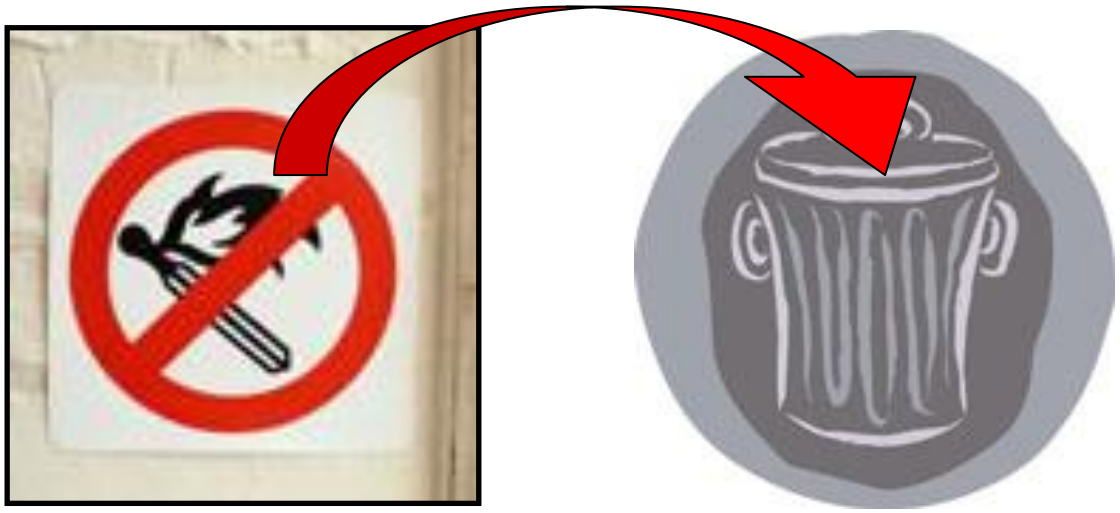
DO NOT:
ALLOW WASTE, LITTER, OILS OR FOREIGN MATERIALS INTO THE STREAM
MOENIE:
TOELAAT DAT AFVALPRODUKTE, GEMORS, OLIES OF VREEMDE MATERIALE IN STROME BELAND NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA INCITHO, ULAHLO, IOYILE OKANYE EZINYE IZINTO EMILANJENI.

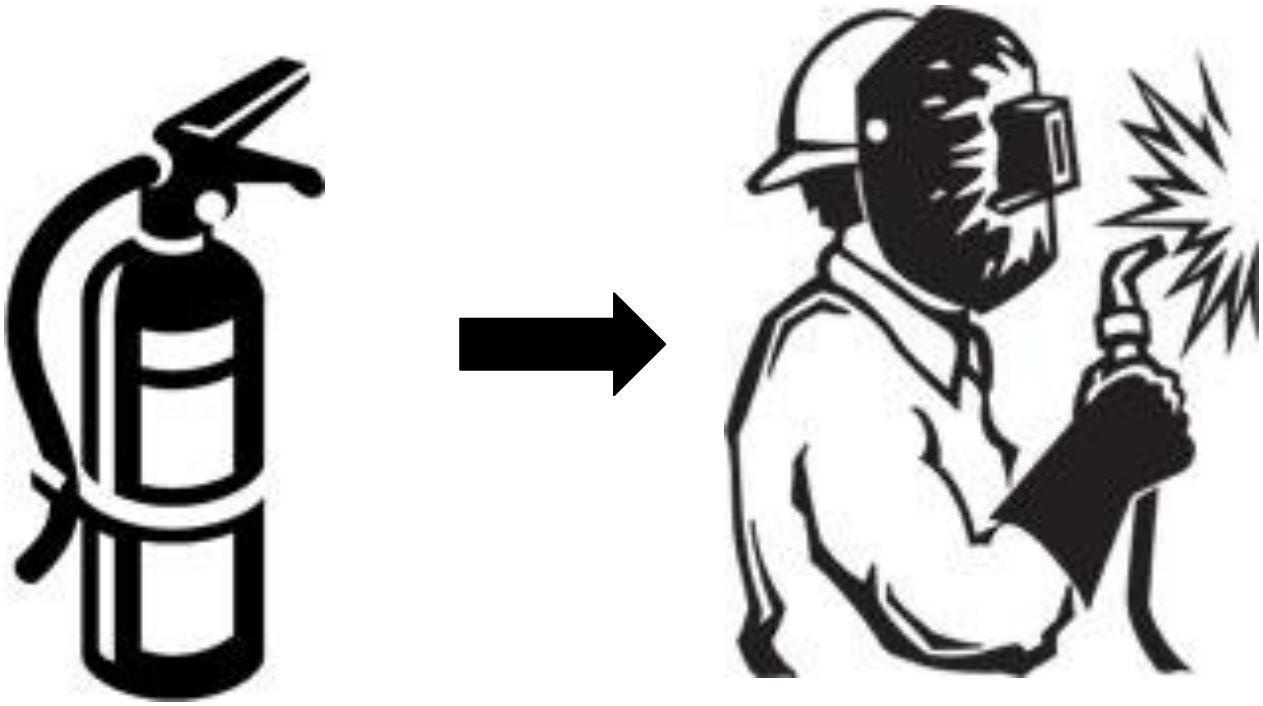
Fire Control:
Vuur Beheer:
Ulawulo Lemililo:

DO:
DISPOSE OF CIGARETTES AND MATCHES CAREFULLY. (Littering is an offence.)
MOET:
GOOI SIGARETTE & VUURHOUTJIES OP GEPASTE MANIER WEG WEG (rommelstrooi is 'n oortreding)
OMAWUKWENZE: LAHLA ISIGARETE NOOMATSHISI NGONONOPHELO (ukulahla lityala).

DO:
ENSURE A WORKING FIRE EXTINGUISHER IS IMMEDIATELY AT HAND IF ANY "HOT WORK" IS UNDERTAKEN e.g. welding, grinding, gas cutting etc.
MOET:
VERSEKER DAT 'N WERKENDE BRANDBLUSSER BYDERHAND IS INDIEN "WARM WERK" GEDOEN WORD bv. Sweiswerk.
OMAWUKWENZE: QINISEKISA ISICIMA-MLILO ESISEBENZAYO SISESANDLENI UKUBA KUKHO UMSEBENZI "OTSHISAYO" OWENZIWAYO, umz. ukuwelda, ugubo, ukuqhawula ugesi, njl.

DO NOT:
MAKE ANY FIRES
MOENIE:
ENIGE VURE MAAK OF ENIGEIETS VERBRAND NIE
OMAWUNGAKWENZI: UKWENZA IMILILO OKANYE UTSHISE NOKUBA YINTONI.





Fencing and Restricted Areas:
Omheining en Beperkte Areas:
Ubiyelo Nemimanndla Engavumelekanga:

DO:
CONFINE WORK AND STORAGE OF EQUIPMENT TO WITHIN THE IMMEDIATE WORK AREA.
MOET:
BEPERK ALLE WERK EN STOOR VAN GEREEDSKAP TOT IN DIE GEGEWE WERKAREA.
OMAWUKWENZE:GCINA UMSEBENZI NEZIXHOBO ZOKUSEBENZA NGAKUMMANDLA OKUSETYENZELWA KUWO.

DO NOT:
ENTER ANY FENCED OFF OR MARKED AREA. SUCH AREAS HAVE BEEN MARKED WITH "NO-GO AREA" SIGNS AND SHOULD BE ADHERED TO.
MOENIE:
ENIGE OMHEINDE OF GEMERKTE AREAS BINNEGAAN NIE. SULKE AREAS IS MET "NO-GO AREA" TEKENS GEMERK EN MOET GEHOORSAAM WORD.
OMAWUNGAKWENZI: MUSA UKUNGENA KWI NDAWO EBIYIWEYO OKANYE EPHAWULWEYO. IMIMANDLA ENJALO IPHAWULWE NGAMAGAMA ATHI **" NO-GO AREA**".

NO-GO AREA

Safety:
Veiligheid:
Ukhuseleko:

DO:
USE ALL SAFETY EQUIPMENT AND COMPLY WITH ALL SAFETY PROCEDURES.
MOET:
GEBRUIK ALLE VEILIGHEIDSGEREEDSKAP EN VOLDOEN AAN ALLE VEILIGHEIDS PROSEDURES.
OMAWUKWENZE: SEBENZISA ZONKE IZIXHOBO ZOKHUSELEKO, UZE UTHOBELE YONKE IMIGAQO YOKHUSELO.

Driving and Dust:
Bestuur en Stof:
Uqhubo Nothuli:

DO:
DRIVE ON DESIGNATED ROUTES ONLY.
MOET:
NET OP AANGEWYSTE ROETES BESTUUR.
OMAWUKWENZE: QHUBA KWIMIMANDLA EPHAWULWEYO KUPHELA.

DO NOT:
SPEED OR DRIVE RECKLESSLY
MOENIE:
JAAG OF ROEKELOOS BESTUUR NIE.
OMAWUNGAKWENZI: SUKUQHUBA NGESANTYA ESIPHEZULU OKANYE NGOKUNGAKHATHALI.

DO NOT:
ALLOW CEMENT TO BLOW AROUND.
MOENIE;
TOELAAT DAT SEMENT WEGWAAI NIE.
OMAWUNGAKWENZI: MUSUKUVUMELA ISAMENTE ISASAZWE.

DO NOT:
CAUSE EXCESSIVE DUST
MOENIE:
OORDREWE STOF VEROORSAAK NIE.


SLOW


PPC

Vegetation protection:
Plantegroei Beskerming:
Ukhuselo Lwezityalo:

DO NOT:
DAMAGE OR REMOVE ANY VEGETATION WITHOUT DIRECT INSTRUCTION.
MOENIE:
ENIGE PLANTEGROEI SONDER DIREKTE INSTRUKSIE BESKADIG OF VERWYDER NIE.
OMAWUNGAKWENZI: MUSA UKUTSHABALALISA OKANYE USUSE NASIPHINA ISITYALO NGAPHANDLE KOMYALELO.

Animals:
Diere:
Izilwanyana:

DO NOT:
INJURE, CAPTURE/SNARE, FEED OR CHASE ANIMALS – this includes birds, frogs, snakes, lizards, tortoises, etc.
MOENIE:
ENIGE DIERE BESEER, VANG, VOER OF JAAG NIE – dit sluit in: voëls, paddas, slange akkedisse, skilpaaie ens.
OMAWUNGAKWENZI: MUSA UKWENZAKALISA, UKUBAMBA, UKONDLA OKANYE UKULEQA IZILWANYANA- okuquka iintaka, amasele, iinyoka, amacilikishe, izikolopati.

DO:
REPORT ANY INJURY OF AN ANIMAL.
MOET:
DIE BESERING VAN 'N DIER RAPPORTEER.
OMAWUKWENZE: XELA NASIPHI ISENZAKALO SESILWANYANA.

Preventing Pollution:
Voorkoming van Besoedeling:
Ukhuselo Longcoliseko:

DO:
CLEAR YOUR WORK AREAS OF LITTER AND BUILDING RUBBLE AT THE END OF EACH DAY – use the waste bins provided and ensure that litter will not blow away.
MOET:
RUIM NA ELKE DAG DIE WERK AREA OP EN GOOI ENIGE ROMMEL WEG IN DIE GEGEWE HOUERS – maak seker dat rommel nie kan wegwaai nie.
OMAWUKWENZE: COCA INDAWO OSEBENZA KUYO, IZINTO EZILAHLIWEYO NENKUNKUMA YOKWAKHA QHO EKUPHELENI KWEMINI-sebenzisa imigqomo yenkunkuma uze uqiniseke ukuba inkunkuma ayivuthuzwa ngumoya.

DO NOT:
ALLOW WASTE BINS TO OVERFLOW OR WASTE TO BLOW AROUND.
MOENIE:
TOELAAT DAT ROMMELHOUERS OORVLOEI OF DAT ROMMEL ROND WAAI NIE.
OMAWUNGAKWENZI: MUSA UKUVUMELA IMIGQOMO YENKUNKUMA IGCWALE KAKHULU OKANYE INKUNKUMA ISASAZEKE.

DO NOT:
LITTER OR LEAVE FOOD LAYING AROUND
MOENIE:
ROMMEL OF KOS LAAT RONDLÊ NIE.
OMAWUNGAKWENZI: MUSA UKUNGCOLISA OKANYE USHIYE UKUTYA KULELE INDAWO YONKE.

DO NOT:
BURY ANY LITTER OR WASTE IN THE GROUND.
MOENIE:
ENIGE ROMMEL OF GEMORS IN DIE GROND BEGRAWE NIE.
OMAWUNGAKWENZI: MUSA UKUNGCWABA INKUNKUMA EMHLABENI.


GLASS
CARDBOARD
PAPER

environment, forestry
& fisheries
Department:
Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

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Ref: GeorgeMunicipality, George AIS Control Management Plan Approval
Enquiries: Mr Stiaan Kotze
Tel: (021) 441 2816 Email: SKotze@dffe.gov.za

PostNet Suite 63
George
6530

Attention: Paul Buchlholz
Tel: 079 881 4447
Email: pbulcholz@outlook.co.za

ALIEN INVASIVE SPECIES CONTROL, MANAGEMENT AND ERADICATION PLAN OF GEORGE MUNICIPALITY, GEORGE, WESTERN CAPE

1. I refer to the following:

   1.1. Alien Invasive Species Control Management and Eradication Plan of George Municipality, George, submitted to the Department of Forestry, Fisheries and Environment (DFFE) on the 11 March 2021, compiled by, Paul Buchlholz.

2. Having reviewed the Alien Invasive Species Control, Management and Eradication Plan of CDC, I have noted the following:

   2.1. The plan includes the entire property.
   2.2. The listed invasive plant species present on your property and their categories.
   2.3. The combined integrated control methods (mechanical, chemical and biological) will be used to control listed invasive plant species on your property.
   2.4. The Alien Invasive Species Control and eradication Plan will be implemented for **two (2) years** and all invasive plant species will be under control **by end 2025**; and there after annual follow up is recommended to keep the portion clean.

3. In view of the above background, the department is satisfied that the recommended clearing control methods will prevent further invasion by listed invasive species on the property. The submitted Alien Invasive Species Control and Eradication Plan with specified timeframe is therefore approved. The clearing methods must be implemented as set out in the approved control plan; however, any changes in the plan must be submitted to DEFF for approval prior such changes could be affected.

4. A progress report must be submitted at least every year (at the completion of each management unit) to the DFFE outline the progress that has been made. Moreover, a close out report must be submitted to the department after clearing have been completed.

   The close out report must, among other things include;

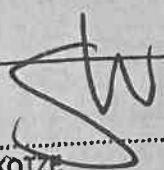
   a. The description of the control methods implemented and the manner in which they were implemented
   b. Assessments (which include photographs) of the cleared areas; and
   c. Option used for the handling of the plant materials (biomass) after clearing.

5. Should you have any queries in relation to this matter, please do not hesitate to contact Mr Stiaan Kotze at the above-mentioned telephone number or e-mail address.

Yours sincerely

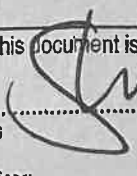
STIAAN KOTZE
CONTROL BIODIVERISTY OFFICER: COMPETENT AUTHORITY
MINISTERIAL DELEGATION ENVIRONMENTAL MANAGEMENT INSPECTOR: HEAD
DEPARTMENT OF ENVIRONMENTAL AFFAIRS FORESTRT

APPROVED



.....
Full Name:STIAAN KOTZE
Control Biodiversity Officer:
Competent Authority
Directorate: Oceans, Coast & Biosecurity Compliance
Department of Forestry, Fisheries & The Environment
14 Loop Street, Cape Town
Date: 29/03/2023

I hereby certify that this document is a true copy of the original



.....
Commissioner of Oaths
STIAAN KOTZE
Control Biodiversity Officer:
Competent Authority
Directorate: Oceans, Coast & Biosecurity Compliance
Department of Forestry, Fisheries & The Environment
14 Loop Street, Cape Town
Date: 29/03/2023

Report:

George municipality invasive alien plant monitoring, control & eradication plan

Reference: GMIAP042021

Prepared for: George Municipality

Revision: Revision 1

11 May 2021

Report details

Document prepared by:

Paul Buchholz

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6530

Comments should be directed to:

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Document control				
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Report status	Final document	**Report number**	GMIAP042021	
Client	George Municipality	**Client contact**	Priscilla Burgoyne	
Rev	**Date**	**Author**		
1	**11 May 2021**	Paul-Werner Buchholz		

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Annexures

1. Introduction

The National Environmental Management Biodiversity Act, 10 of 2004 (NEMBA), Section 76, states that all state organs are required to draw up an invasive and alien monitoring, control and eradication plan for the land under their control. Such a plan must include:

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

In terms of Section 4(2)(a) of the NEMBA, all municipalities must manage and conserve biological diversity. This includes taking steps to control and eradicate Invasive Alien Plants (IAPs) in areas that they own or manage. The purpose of this document is to respond to this obligation and to coordinate the Municipality approach in this regard to reduce future IAPs control costs and improve the integrity of the natural areas and ecosystems in George Municipality (Figure 1).

The George Municipality (the Municipality) is responsible for the management of one thousand four hundred and twenty (1420) properties (management units) covering a surface area of approximately 4680 hectares and are distributed among the following towns/settlements (Figure 1):

- George
- Uniondale
- Haarlem
- Wildernis
- Kleinkrantz

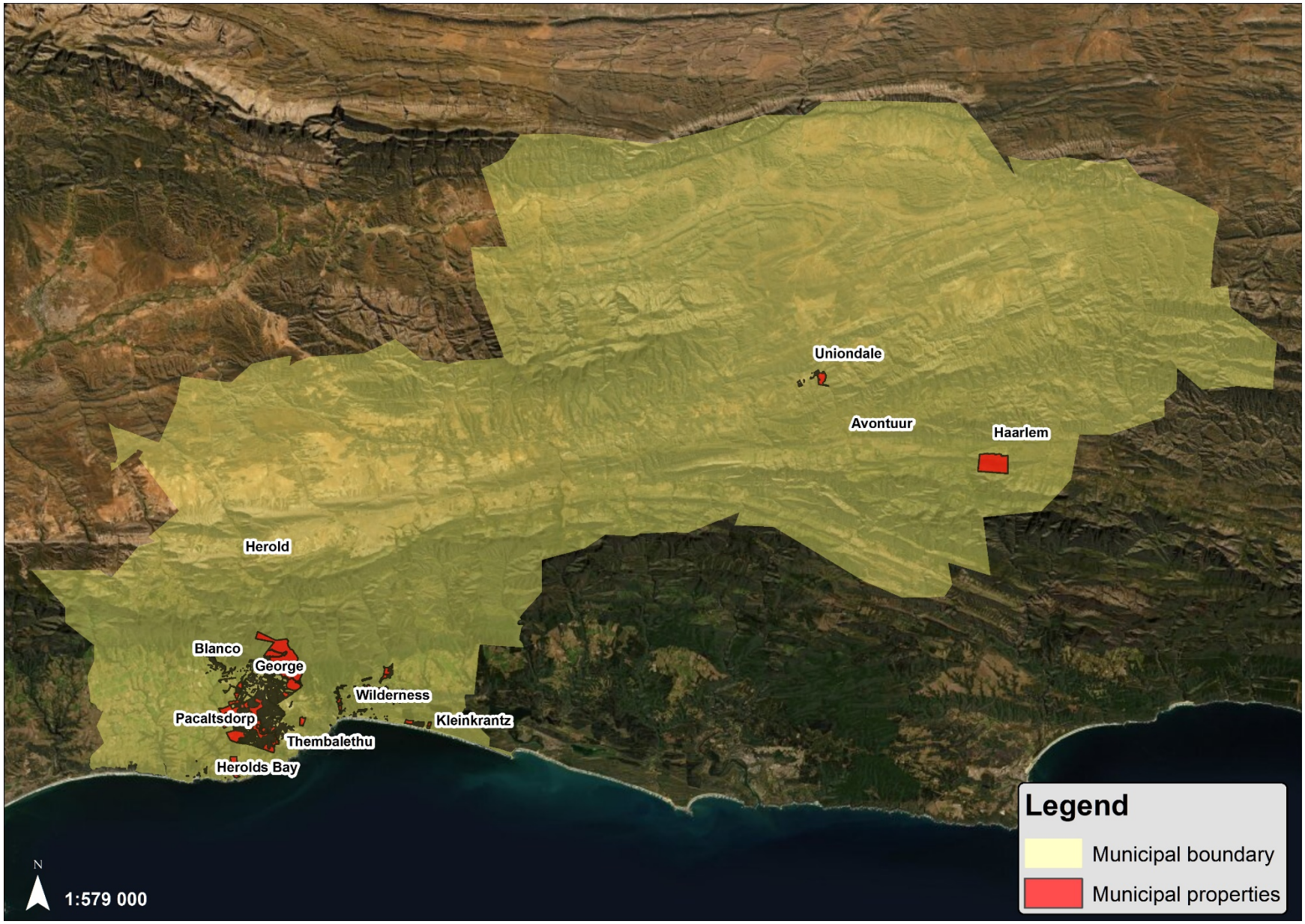

Figure 1: Map showing George municipality properties

2.1. Description of the project area

The George Municipality is in an extremely biodiverse area within a global biodiversity hotspot (the Cape Floristic Region) two hours from Cape Town. The municipal area also has various landscapes and cultures and an important economic centre in the region with a rapidly increasing human population. Urban expansion, agriculture and invasive alien plants are key threats to the loss of habitat and native biodiversity and negatively impact ecosystem services.

2.2. Invasive species impacts

Invasive alien plants (IAPs) refer to plants brought to South Africa from other countries, both intentionally and unintentionally, that cause human, environmental or economic harm. Invasive alien plants have negative impacts on ecosystems, affecting both biodiversity and ecosystem functioning. The successful control of IAPs can ameliorate these impacts.

Without natural enemies, invasive alien plants can reproduce and spread rapidly, taking valuable water and space from indigenous vegetation. Many IAPs consume more water than local plants, depleting valuable underground water resources and create additional fuel for veld fires.

Many invasive alien plants are adapted to fire and can sprout after a fire or re-establish from large soil-stored seed banks that can stay viable for more than 20 years. After a fire, many IAPs will germinate from soil-stored seeds creating dense stands of young plants that, if left uncontrolled, will create an invasive alien plant forest, increasing fuel loads and thereby increasing veld fire risk.

Invasive alien plants do not affect either the weather or the frequency and distribution of fire ignitions, but they can drastically change the vegetation structure, changing both the amount and the type of fuel available to support fires. As a result, they can introduce fires into areas where fires did not occur historically, and by increasing the mass of plant material in fire-prone vegetation such as fynbos, they can make fires more intense and challenging to control.

In an increasingly urbanised world, urban biodiversity and ecosystem services are not only threatened by the expansion of urban areas and the proliferation of anthropogenic features such as land cover change but also by IAPs. Valuable services from healthy ecosystems in a town include filtering the air, reducing noise, draining rainwater and attenuating overland flow, flood protection, regulating the micro-climate, increasing property values, and providing a suite of cultural services. Restoring invaded ecosystems in towns has the potential to benefit inhabitants by helping to ensure the sustained delivery of these ecosystem goods and services.

2.3. Invasion pathways

Municipal properties are vulnerable to the introduction of invasive alien plants. The processes that lead to the introduction of alien species have been termed the pathways of introduction. These pathways are numerous and involve both the intentional and accidental introduction of invasive alien plants. For example, biological control agents are intentionally introduced to manage invasive species from their native range. In contrast, invasive alien plants are often accidentally introduced when plants are imported from other countries.

Most invasive alien plants in the region were deliberately introduced and subsequently escaped cultivation. Managing invasive alien plants once introduced is difficult and costly, and it is often more efficient and cost-effective to prevent their introduction. Information on how and/or why invasive alien plants are introduced is used to identify the pathways of introduction and prioritise these pathways for interventions. Once the information has been gathered, adequate pathway-specific policies and interventions that target priority pathways can be developed, implemented and enforced, and their effectiveness monitored.

The Convention on Biological Diversity (United Nations Environment Programme) recognises the following six pathways of introduction:

- Release in nature
- Escape from confinement
- Transport contaminant
- Transport stowaway
- Corridor
- Unaided

Release in nature refers to the intentional introduction of an alien organism into the natural environment for human use (e.g. trout for angling purposes). An escape from confinement refers to the movement of an alien organism kept in confinement into the natural environment (e.g. Horticulture and aquaculture species). Transport contaminant involves the unintentional introduction of an alien organism with an intentionally imported commodity (e.g. pests on imported food, animals or plants) while transport stowaway refers to the introduction of an alien organism attached to transport vessels or their associated equipment and media (e.g. marine organisms introduced with the release of ballast water by ships).

Corridor involves the natural dispersal of alien organisms into a new region through human-constructed transport infrastructure, while unaided refers to the natural spread of an alien organism from an area where it was previously introduced, through the pathways mentioned above, to another region where it is not native.

Pathway-based control measures reduce the risks of transporting invasive alien plants to new areas outside of their natural ranges. Pathway-specific control measures focus on identifying the actual mechanism by which species can arrive in a new location. A pathway-centred approach is often more effective and uses information on how or why invasive alien plants are introduced to develop preventative strategies, early detection methods and develop regulations that target the most active pathways of introduction.

Small towns may also present a greater risk of spreading invasive alien plants to their surrounding environments than large cities. Small towns have a sizeable edge-to-area ratio, meaning that most areas of the town are proportionately close to the surrounding natural areas. Invasive alien plants on the peripheries of properties are more likely to escape into the semi-natural surrounding areas. The relative distance to the urban-wildland interface is low for many properties in a small town (instead of ones in a city, which may be several kilometres from natural areas).

Municipal properties are vulnerable to the intentional and unintentional introduction of invasive alien plants, and the risk of invasion may be attributed to several factors. Invasive alien plants species occur on properties because of the accidental introduction of seeds through on-site maintenance work. Also, vehicles entering the properties for educational or recreational purposes pose a risk for the accidental introduction of IAPs. Due to the proximity of municipal properties to gardens and other undeveloped areas, they can be re-infested or invaded by new emerging weeds. In addition, horticultural strains of indigenous plant species may also escape from gardens adjacent to Municipal properties and threaten the genetic diversity of naturally occurring specimens and endemic populations.

The following pathways are important for invasive species introductions into Municipal properties:

- Road network
- Garden escapees
- Illegal dumping
- Recreational activities
- Rivers

These invasive alien plant introduction and dispersal pathways must regularly be monitored to prevent new IAPs from establishing in Municipal properties.

2. Invasive alien plant management objectives

The overarching objectives of the George municipality invasive alien plant monitoring, control & eradication plan is for the Municipality to become compliant with NEM:BA and associated Invasive Species Regulations. The following strategic objectives of the invasive alien plant monitoring, control & eradication plan applies to all the municipal properties and provide guidance/direction on the fulfilment of the overall aim of being compliant with the NEM:BA and Invasive Species Regulations.

2.1 Strategic Objective 1: Prevention

The George municipality must put measures in place to prevent the introduction of new NEMBA listed invasive alien plants onto municipal properties and invasive alien plants from spreading from the properties to neighbouring properties. The following preventive measures must be implemented:

- No listed invasive alien plant species will be planted.
- Areas bordering onto neighbouring properties, particularly along ecological pathways, i.e. river valleys & remnant indigenous vegetation, will be prioritised for control to prevent existing invasive alien plants from spreading beyond the property's boundaries, and the maintenance of firebreaks.
- The prevention measures must be communicated to all users of the property (where applicable).

2.2 Strategic Objective 2: Early detection and rapid response (EDDR)

The George municipality must put measures in place whereby new and secondary invasive species are detected early and removed before establishing sustainable populations and start spreading. Category 1 invasive alien plants will typically fall in this category.

Emerging species refer to those species that appear after clearing an area. These species are normally not present before the clearing but emerge afterwards and have the potential to become the next problem if they are not controlled as soon as they appear. Emerging species refer to those invasive alien species with the potential to become important problems without timely intervention. When the early detection and rapid response (EDRR) management option is implemented, the new or emerging species can be locally eradicated before they produce seeds/increase by growing vegetatively or producing offspring. The following EDRR measures must be implemented:

- Regular surveys of municipal properties must be undertaken to detect any new or emerging listed invasive alien plants.
- Category 1a species must be reported immediately to the Department of Environment, Forestry and Fisheries and ask for assistance for the control of the species.

- Emerging or new species must not be allowed to produce seeds or offspring or start growing vegetatively and must be removed immediately.
- The invasive alien plant control plan must be updated by including these species and indicate where on the property they were located.
- Areas that have been cleared must be checked regularly to remove re-sprouting plants or seedlings quickly.

2.3 Strategic Objective 3: Restricted activities and Duty of Care

The George municipality must adhere to restrictive activities and Duty of Care as determined by NEMBA and Regulations concerning invasive alien plants. The NEM:BA and Regulations list certain restricted activities for the different categories of invasive alien plants: 1 (definitions); 65(2) – alien species; 66(2) – exempted species; 67(2) – prohibited species; 71(1) – listed species & Regulation 6 (a-g). The NEM:BA and Regulations place an obligation on a person to exercise Duty of Care when it comes to invasive alien plants. Sections 69 & 73 of the Act. The following Duty of Care actions must be implemented when controlling invasive alien plants:

- Comply with the permit conditions for permitted species in terms of Section 65(1) & 71(1).
- Take all the required steps to minimise the harm to biodiversity, including sensitive riparian areas.
- Notify the competent authority, in writing, of the listed invasive alien plants that occur on the property.
- Take all the required steps to control and eradicate the listed invasive alien plants on the property and prevent it from spreading.

2.4 Strategic Objective 4: Appropriate means and methods to control

The George municipality must ensure the means and methods of control are appropriate to the species and environment. The methods must be implemented in such a way that it minimises the risk to biodiversity and the environment. Where invasive alien plants occur within sensitive riparian & wetland areas, areas with steep slopes and Critical Biodiversity Areas, low impact manual (no heavy machinery such as back actors) control methods with limited use of herbicide must be used.

The Fertilizer, Farm Feeds, Agricultural & Stock Remedies Act (Act 36 of 1947), governs the use and application of herbicide. The Act includes the following requirements:

- Al herbicide applications are to be made under the direct supervision of a registered Pest Control Operator.
- All persons applying herbicide are to be trained in their use.
- Correct Personal Protective Equipment must be worn when applying herbicide (listed on herbicide label).
- Only registered herbicides may be used.

2.5 Strategic Objective 5: Fire prevention and preparedness

Invasive alien plants increase fuel loads and thereby the risk and intensity of vegetation fires. There are currently dense stands of invasive alien plants on several municipal properties (75) that create a high fire risk. Once control projects are implemented, large stacks of cut plant material will also pose a fire risk.

Therefore, the landowner must put measures in place that prevent the starting and spreading of vegetation fires on the property to neighbouring communities and properties. The landowner must implement the following fire prevention and preparedness actions:

- Manage invasive alien plant fuel loads by implementing effective invasive control methods and removing (chipping, transport to a legal dumpsite, community firewood etc.) cut biomass.
- Prepare and maintain firebreaks around the property and infrastructure.
- Ensure that the removal of biomass and the preparation of firebreaks do not cause soil erosion.

2.6 Strategic Objective 5: Implement the control plan

The George Municipality must bring invasive alien plants under control through systematic, integrated and appropriate control methods as stipulated in the control plan. Sufficient funding must be allocated to ensure the long-term control of invasive alien plants.

3. Legislative context

The legislation that is relevant to the George municipality is briefly outlined below. These environmental requirements are not intended to be definitive or exhaustive but highlight key environmental legislation and responsibilities only.

The Constitution of South Africa of 1993 regulates the responsibilities and legislative competence of each sphere of government. Municipal responsibilities include delivering a range of basic services such as access to water and sanitation (Section 73 of the Municipal Systems Act) to residents in a sustainable manner, promoting economic development and safe, healthy environments. The environment is placed at the National and Provincial level of legislative competence, and thus local government prioritises service delivery over environmental aspects, such as invasive species control. However, municipalities play an essential role in environmental planning and management but are not structured or mandated to perform their environmental responsibilities. Currently, the NEM:BA delegations are not devolved to municipalities.

The South African Local Government Association (SALGA) role is to ensure that municipalities are aware of the new legislation relevant to them and provide assistance by unblocking compliance challenges. According to

NEMBA Section 76(3), the minister may appoint the South African National Biodiversity Institute (SANBI) to assist municipalities with compiling management plans and status reports that report back on the efficacy of control measures. SALGA acts as an essential link between DEA, SANBI and municipalities to assist and guide municipalities.

The National Environmental Management Act (NEMA, Act 107 of 1998), as amended, makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require Environmental Authorization for the competent authority (in this case, the National Department of Environmental Affairs, DEA). Section 28 of NEMA provides for the Duty of Care principles that requires every person who causes, has caused or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution and degradation of the environment. "Reasonable measures" include measures to investigate, assess and evaluate the impact on the environment; cease, modify or control any act causing pollution or degradation and remedying the effects of pollution or degradation.

National Environmental Management: Biodiversity Act, 10 of 2004 (NEM:BA) places a 'Duty of Care' (Section 73 (2) [as amended]) on all landowners, whether private or public, to control invasive species on their land. Section 76(2a) determines that all Organs of State at all spheres of government (from National through to Local Government) must compile area management plans for land under their control; Section 76(4 a–f) of the Act states the requirements of these plans.

For Organs of State to become compliant with the NEM:BA regulations, they need to develop, submit for approval and implement area management plans, report back (Section 76[4][d]) and provide measurable indicators showing progress and timeframes for completion to the national government (Department of Environment, Forestry and Fisheries). The guidelines for the development of these plans have been published (DEA 2015) and are available on DEA's website. The completed area management plans were required to be submitted by the end of September 2016 (1 year after the publication of the guidelines for management plans (NEM:BA Regulations [2] [b]). Plans must be drawn up for all land under the control of Organs of State.

Area management plans must include a description of the land parcels in question, detailed lists and descriptions of all the listed species found on each of the land parcels, the extent of invasion and the efficacy of previous control and eradication measures. These plans should be included in the municipal Integrated Development Plans (IDPs) (Section 76 [2][b]), to ensure subsequent implementation and budget allocation. Furthermore, the NEM:BA

Act (Section 77[1]) states that all Organs of State managing protected areas are required to submit a status report 'at regular intervals', reporting on the progress made towards achieving the set targets.

National Environmental Management: Biodiversity Act, 10 of 2004 (NEM:BA), regulates all invasive organisms in South Africa. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEMBA. According to this act and the regulations, any species designated under Section 70 cannot be propagated, grown, bought or sold without a permit. Categories listed are:

- **Category 1a**: Invasive species requiring compulsory control. Any specimen of a Category 1a listed species must, by law, be eradicated.
- **Category 1b**: Invasive species requiring compulsory control as part of an invasive species control program. These species must be removed and destroyed.
- **Category 2**: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- **Category 3**: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities: import, possess, grow, breed, move, sell, buy or accept as a gift. No permits will be issued for Category 3 plants to exist in riparian zones.

The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) provides for the regulation of control over utilising natural agricultural resources to promote the conservation of soil, water and vegetation and provides for combating weeds and invader species.

The National Water Act (NWA) (Act 36 of 1998) was instituted to ensure that sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. The NWA places a strong emphasis on protecting water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations.

The project implementing entity must be in possession of a valid Pest Control Operators Licence (limited weeds controller) according to the Fertilizers Farm Feeds, Agricultural Remedies and Stock Remedies Act, Act No. 36 of 1947 when working with herbicides to control invasive alien plants. This is regulated by the Department of Environment, Forestry and Fisheries (DEFF).

Invasive alien plants increase fuel loads and thereby increase the risk and intensity of vegetation fires that pose a threat to life and infrastructure. The National Veld and Fire Forest Act (Act 101 of 1998) imposes the following duties on landowners:

- May not start a wildfire (s 18(1)).
- May only start a fire, including a cooking or braai fire, in a designated area.
- A landowner must have equipment available to fight wildfires (s 17(1)).
- A landowner must have trained personnel available to fight wildfires (s 17(1).
- A landowner must have a person on the property who keeps a lookout for fires (s 17(2)).
- Establish a system of firebreaks (s 12).
- May not burn firebreaks or carry out controlled burns when the Fire Danger Index is high
- A landowner must manage the fuel load on land under your control. This includes the removal of invasive alien vegetation from the area and other vegetation that creates unwanted fuel loads.

To ensure a safe and healthy working environment, all people involved in controlling invasive alien plants must comply with the Occupational Health and Safety Act, Act 85 of 1993.

4. Management Units

The George municipality has one thousand four hundred and twenty (1420) properties (management units). After delineating and naming the management units, baseline data was collected as prescribed by the National Environmental Management: Biodiversity Act (NEM:BA) Section 76. (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)

5. Invasive species present

The national Working for Water Program's mapping standards has been used to capture invasive alien plant distribution data for each management unit. The IAPs present in each unit were listed according to their taxonomic group, scientific and common names, age class (mature, adult, young). The extent of each species was estimated per management unit and expressed as percentage cover, and the NEM:BA listed category was assigned. The following twenty (20) invasive alien plants have been recorded (Annexure B: George municipality invasive alien plant database):

Nr	Species name	Common name	NEMBA category
1	Acacia baileyana	Baileys Wattle	• 3
2	Acacia cyclops	Red eye	• 1b
3	Acacia dealbata	Silver Wattle	• 2
4	Acacia mearnsii	Black wattle	• 2 • Exempted for an existing plantation
5	Acacia melanoxylon	Blackwood	• 2 • Exempted for an existing plantation

Nr	Species name	Common name	NEMBA category
6	Acacia saligna	Port Jackson	• 1b
7	Agave americana	American Agave	• 3 in the Western Cape • Not listed elsewhere
8	Cortaderia jubata	Pampas grass	• 1b
9	Eucalyptus grandis	Saligna gum	• 1b in riparian areas, Protected Areas, ecosystem identified Bioregional Plans, Fynbos, Grassland, Savanna, Albany Thicket, Forest and Indian Ocean Coastal Belt biomes • 2 in plantations, woodlots, bee-forage areas, wind-rows and the lining of avenues • Not listed within cultivated land that is at least 50 meters away from untransformed land but excluding within any area listed above • Not listed within 50 meters of the main house on a farm but excluding within any area listed above • Not listed in urban areas for trees with a diameter of more than 400 mm at 1000 mm height
10	Hakea sericea	Silky hakea	• 1b
11	Ipomoea indica	Morning glory (common)	• 1b
12	Lantana camara	Lantana	• 1b
13	Melia azederach	Seringa	• 1b • 3 in Urban areas
14	Opuntia ficus-indica	Sweet Prickly Pear	• 1b
15	Paraserianthes lophantha	Stink bean	• 1b
16	Pinus pinaster	Cluster pine	• 2 for plantations and windrows • 1b elsewhere. • National Heritage Trees or National Monument Trees in terms of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), are not listed
17	Rubus	Bramble	• 2
18	Salvinia molesta	Kariba Weed	• 1b
19	Sesbania punicea	Red sesbania	• 1b
20	Solanum mauritianum	Bugweed	• 1b

Table 1: George municipality invasive alien plant list

6. Efficacy of previous control and eradication methods

The efficacy of control methods is reflected through the decrease in IAPs density, cost per hectare, time and effort required (person-days and person-day cost) reflected before every control intervention. The efficacy of control methods will be determined through workload assessment before every control operation and by analysing the data to provide an annual update of infestation levels. Invasive alien plants on municipal properties are currently

not controlled in a sustained, systematic and prioritised manner. Once the implementation of the control plan commences, the efficacy of control and eradication methods must be determined through workload assessments.

7. Prioritisation of control projects

Resources for invasive alien plant control are limited, and restoring invaded vegetation is labour-intensive and expensive. Therefore, it is essential that the George municipality prioritise invasive alien plant control actions to achieve invasive alien plant control objectives as efficiently and effectively as possible.

It is impossible to control IAPs everywhere and tolerate inefficiency that would fail to stem the spread of IAPs, despite the investment of resources. Ultimately, this will lead to the erosion of ecosystem goods services, notably water resources, biodiversity-based ecosystem use, including resource harvesting and tourism. It is also critically important to adhere to best practice to improve efficiencies, making the most of the available limited resources.

The following factors must be considered when planning the implementation of invasive alien plant control projects:

- Aliens must be cleared in a manner that reduces the risk of cleared areas being reinvaded by other invaded areas. For example, the upstream area should be cleared before downstream areas if the river transports the seeds.
- The ability and resources available for follow up operations should determine the size and location of the initial clearing operation. It critically important that a balance is maintained between clearing new areas and follow-up operations on previously cleared areas. Once the invasive plants have been removed from an area (initial control), resources must first be allocated for at least three (3) follow-up treatments (treating seedlings and sprouting plants that might appear after the initial control operation) before a new area is cleared. If resources are taken away from existing control projects before they have reached maintenance level, it can result in invasive alien plant densities increasing again requiring additional investment to bring it back to a maintenance level.
- Prevention is cheaper than clearing, and therefore un-invaded areas must be protected from invasion. Several municipal management units (277) are un-invaded, and they should be kept clear of invasive alien plants (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)
- The economic benefits of clearing areas with high tourism, biodiversity, productivity or water yield potential are necessary to maintain the support for the continuation of the clearing project. In other words, the benefits of clearing, other than merely the cost, must be carefully considered. Several municipal management units (198) contain riparian, and wetland areas and clearing the dense stands of invasive in

the will improve the water yield potential of river systems. Critical Biodiversity Area 1 & 2 areas are located within some municipal management units (169), and it is, therefore, essential to control invasive alien plants in these areas to prevent the further loss of biodiversity. (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)

- If a management unit is affected by a vegetation fire, it must be targeted as a high priority for control, especially if the management unit was infested with species that create large soil stored seedbanks such as Black Wattle. The infestation level does not have to be very high, and a few individual mature trees located on the property can create a significant soil stored seed bank that will germinate after a fire. The fire stimulates the germination of the soil stored seed, and the seedlings can be controlled relatively cheaply with herbicide. Should the invasive alien plants on the management unit left untreated and be allowed to reach maturity, the control cost can triple.
- IAPs that pose a fire risk to life and infrastructure should be targeted as a priority. Several municipal management units have a high fire risk (175). (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)
- Effective firebreaks must be created where woody (fire-prone) IAPs are in dense stands near houses, settlements, power lines etc. Currently, very few municipal properties have firebreaks.
- Areas with young, less dense trees, which have smaller seed banks and a potentially high rate of spread, should be targeted first. Focusing on these areas requires fewer resources and will prevent further invasion and the build-up of seed banks. Dense mature stands should be left for last, as they most probably won't increase in density or pose a more significant threat than they are now. But if they pose a fire risk to life and infrastructure, they must be targeted as a priority.
- The ability and resources available for follow up operations should determine the size and location of the initial clearing operation.

The following criteria were used to prioritise the implementation of invasive alien plant control projects on the municipal management units:

- The 2017 Western Cape Biodiversity Spatial Plan (WCBSP)
- Fire risk

The development and implementation of the WCBSP is a core output for the Provincial Biodiversity Strategy and Action Plan (2017), which is aligned to the Aichi Targets for the United Nations Convention on Biological Diversity as well as the National Biodiversity Strategy and Action Plan (2015). The WCBSP provides stakeholders with strategic and practical guidance on how to ensure that planning and decision-making build the resilience of ecological infrastructure.

The WCBSP is a spatial tool that comprises the Biodiversity Spatial Plan Map (BSP Map) of biodiversity priority areas, accompanied by contextual information and land-use guidelines that make the most recent and best quality biodiversity information available for land use and development planning, environmental assessment and regulation, and natural resource management. The BSP Map covers both the terrestrial and freshwater systems and major coastal and estuarine habitats and delineates Critical Biodiversity Areas and Ecological Support Areas (ESAs), which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services.

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for species, ecosystems, ecological processes, and infrastructure. These include:

- All areas required to meet biodiversity pattern (e.g. species, ecosystems) targets;
- Critically Endangered (CR) ecosystems (terrestrial, wetland and river types);
- All areas required to meet ecological infrastructure targets, which are aimed at ensuring the continued existence and functioning of ecosystems and delivery of essential ecosystem services; and
- Critical corridors to maintain landscape connectivity.

Ecological Support Areas are not essential for meeting biodiversity targets, but they play an essential role in supporting the functioning of Protected Areas or CBAs and are often vital for delivering ecosystem services. ESAs need to be maintained in at least a functional and usually natural state. ESAs need to be maintained in at least a functional and often natural state in order to support the purpose for which they were identified, but some limited habitat loss may be acceptable. A greater range of land uses over wider areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives and ecological functioning are not compromised.

CBAs need to be kept in a natural or near-natural state, with no further loss of habitat or species. Degraded areas should be rehabilitated to natural or near-natural condition. Only low-impact, biodiversity-sensitive land uses are appropriate. Two hundred and fourteen (214) Municipal properties contain Critical Biodiversity Areas 1 & 2 (CBA1 & 2) and four (4) Ecological Support Areas 1 where IAPs must be controlled (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)

Human activities are continually and more widely encroaching along the edge of vegetation areas where there is enough plant litter, dead branches, and fine plant material to sustain a fire. Fuel accumulation increases the likelihood that fires will become uncharacteristically large and intense. Invasive alien plants do not affect either the weather or the frequency and distribution of fire ignitions, but they can drastically change the structure of the vegetation, changing both the amount and the type of fuel available to support fires.

As a result, they can introduce fires into areas where fires did not occur historically, and by increasing the mass of plant material in fire-prone vegetation such as fynbos, they can make fires more intense and difficult to control. Veld fires in invasive alien plant infested areas are on average about 65% more damaging than in fynbos fires.

The purpose of the National Veld and Forest Fire Act is to prevent and combat veld, forest and mountain fires throughout South Africa and to provide methods and practices for achieving this purpose. After the devastating Knysna fire of June 2017 and the 2018 George fire, the George municipality must comply with the National Veld, and Forest Fire Act that requires all landowners on whose land a veld fire may start or burn or from whose land it may spread must prepare firebreaks on their side of the boundary if there is a reasonable risk of a veld fire. Hundred and seventy-five (175) Municipal properties have a high fire risk. (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)

Invasive alien plants, especially trees, severely degrade riparian habitats in the Southern Cape. These invasions reduce water yields from catchments and affect riverine functioning and biodiversity. Riparian vegetation provides habitat, stabilises riverbanks and filters sediments and nutrients from the surrounding catchment. River ecosystems are highly prone to invasion by IAPs because of their dynamic hydrology and opportunities for recruitment following floods.

Many invasive alien plants in riparian areas are tall trees with higher water consumption than the indigenous vegetation. Alien invasive plants increase above-ground biomass and evapotranspiration and thereby decrease both surface water runoff and groundwater recharge. The increased biomass and evapotranspiration rates associated with invasive alien plants arise because of their greater height, root depth and senescence, compared to the native species that they replace.

A priority matrix was developed for the George municipality to prioritise the implementation of invasive alien plant projects (Table 2: George municipality invasive alien plant control priority matrix). The priority rating for each management unit is included in the George municipal invasive alien plant distribution map & invasive alien plant database that allows for the quick selection of the various priority classes (Annexure A: George municipality invasive alien plant distribution map & Annexure B: George municipality invasive alien plant database)

			Fire risk categories and codes (0,1,2)		
			No fire risk to life or infrastructure	Fire risk to life and infrastructure	Fire risk to infrastructure
			0	**1**	**2**
Critical Biodiversity Areas categories and codes (A, B, C, D)	Critical Biodiversity Areas 1 (CBA 1)	**A**	0A	1A	2A
	Critical Biodiversity Areas 2 (CBA 2)	**B**	0B	1B	2B
	Ecological Support Areas 1 (ESA 1)	**C**	0C	1C	2C
	No Critical Biodiversity Areas present	**D**	0D	1D	2D

Table 2: George municipality invasive alien plant control priority matrix

Based on the priority matrix, the following priority classes have been identified:

- **0A**: Invasive alien plant management units contain CBA 1 areas with no fire risk.
- **0B**: Invasive alien plant management units contain CBA 2 areas with no fire risk.
- **0C**: Invasive alien plant management units contain ESA1 areas with no fire risk.
- **0D**: Invasive alien plant management units contain no critical biodiversity areas and pose no fire risk.
- **1A:** Invasive alien plant management units contain CBA 1 areas and pose a fire risk to life and infrastructure.
- **1B**: Invasive alien plant management units contain CBA 2 areas and pose a fire risk to life and infrastructure.
- **1C**: Invasive alien plant management units contain ESA1 areas and pose a fire risk to life and infrastructure.
- **1D**: Invasive alien plant management units contain no critical biodiversity areas but pose a fire risk to life and infrastructure.
- **2A**: Invasive alien plant management units contain CBA 1 areas and pose a fire risk to infrastructure.
- **2B**: Invasive alien plant management units include CBA 2 areas and pose a fire risk to infrastructure.
- **2C**: Invasive alien plant management units contain ESA1 areas AND pose a fire risk to infrastructure.
- **2D**: Invasive alien plant management units contain no critical biodiversity areas but pose a fire risk to infrastructure.

8. Monitoring and evaluation

Monitoring and evaluation will involve repeated field surveys to track progress/success and determine the efficacy of control methods. The following factors must be monitored to track project implementation progress:

- The effectiveness of control methods being used to control invasive alien plants.
- Do the levels of invasive alien plant infestations decrease in areas where control projects are being implemented?

- What is the level of indigenous vegetation recovery in areas that have been cleared of invasive alien plants?
- How much herbicide is being used for each control project being implemented.

Field observation and relevant project data (workload assessments, photographs, herbicide volumes etc.) must be captured in a structured spatially explicit (Geographic Information System) project implementation database to track progress/success and determine the efficacy of control methods. As determined by NEM:BA (species, description and extent), data collection requirements must be achieved through workload assessments completed before every control operation. These assessments must then be collated, analysed and reported every quarter.

Monitoring of the efficacy of control methods as required by NEM:BA Section 76 will be achieved through analysing the extent of invasion annually. Monthly reports must be compiled to track the implementation success of control projects, and an annual report will reflect the progress against implementation targets for the year.

Photographic records must be kept of areas to be cleared before control work starts and at regular intervals during the initial clearing activities. Similarly, photographic records should be kept off the area immediately before follow-up clearing activities and after. Rehabilitation efforts must also be recorded.

Records must be kept of daily operations, e.g. area/location cleared, the number of labour units and the amount of herbicide used. This will assist with planning as each site will require work, once or twice a year, for several years and of evaluating the costs against the benefits of the work.

Should the survey results indicate that the targeted invasive alien plants have not been adequately controlled then, the specific control method and intervals that were used must be investigated to determine what caused the ineffectiveness of the control methods used. Once the specific problem has been identified in the control method, it must be rectified, e.g. if high levels of re-sprouting have occurred after applying herbicide, the herbicide mixture and application method must be corrected.

Before and after each control project, field surveys must also record the diversity of indigenous vegetation before and after each project that will indicate to what extent indigenous vegetation has recovered. If the recovery of indigenous vegetation is poor after clearing invasive alien plants, the clearing methodology and interval must be reviewed to ascertain if this might have led to the poor recovery. The incorrect application of herbicide, for example, might have led to indigenous vegetation also being treated with herbicide and would require appropriate training for herbicide applicators to ensure only invasive alien plants are treated with herbicide.

Invasive alien plants can replace indigenous vegetation entirely, and once they have been cleared from a project area, no or very little indigenous vegetation will be present. In cleared areas where very little indigenous vegetation remains active (seed sowing, planting of seedlings and cuttings) or passive (natural recovery of indigenous vegetation and reduce environmental stressors such as grazing), restoration interventions must be considered and implemented where applicable.

Accurate records must be kept of all herbicides used during the implementation of control projects to track usage over time. Analysing the herbicide usage data over time, trends in quantities for different infestation levels and species can be determined that will increase the success rate of control projects where the herbicide is used. The data will also assist in compiling accurate project budgets.

The George municipal invasive alien plant database must be updated annually through regular field surveys to ensure the species distribution data is up to date. If a vegetation fire has burnt down a portion of or the complete management unit, the unit must be surveyed six months after the fire to ascertain what the post-fire invasive alien plant densities are. Post-fire invasive alien plant densities might be higher than before the fire due to the stimulation and germination of soil stored seed that can stay viable for up to 20 years.

9. Methods to be employed in the control plan

Invasive plants will be controlled by integrating mechanical, manual and chemical control in compliance with NEM:BA section 75 (1-3) Duty of Care Guidelines:

- Means and methods must be appropriate to the species
- Conducted in such a way that it causes the least harm to biodiversity and the environment
- IAPs offspring will be targeted (follow-up operations)

9.1 Planning for invasive alien plant control projects

Proper planning and preparations are fundamental to achieving cost-effective and successful invasive alien plant control. Once there is a formalised work plan for clearing IAPs, preparation for clearing can begin. These preparations include procuring the required equipment and materials, having staff undergo the required training, and ensuring that the relevant land-owners and neighbours are notified of the clearing activities before they are undertaken.

The following planning factors must be considered before implementing control projects:

- The ability and resources available for follow up operations should determine the size and location of the initial clearing operation. It critically important that a balance is maintained between clearing new areas

and follow-up operations on previously cleared areas. Once the invasive plants have been removed from an area (initial control), resources must first be allocated for at least three (3) follow-up treatments (treating seedlings and sprouting plants that might appear after the initial control operation) before a new area is cleared. If resources are taken away from existing control projects before they have reached maintenance level, it can result in invasive alien plant densities increasing again, requiring additional investment to bring it back to a maintenance level.

- Invasive trees located away from any structures or roads can be ring-barked, poisoned and left standing rather than felled to reduce control costs. Invasive alien trees situated next to infrastructure (roads, houses, powerlines etc.) or found on steep slopes/cliffs must be removed by specialist contractors explicitly trained to remove invasive alien plants in these high-risk areas.
- To avoid the threat of soil erosion when clearing dense infestations of IAPs on steeper slopes, work should progress horizontally along the contours. IAPs should be cut in bands of approximately 3m in width along the slope contour. This will help to slow down water run-off.
- On gentle gradients, clearing should start from the outside of a management unit and move inwards towards the centre to assist in containing potentially invasive plant material and seeds within a confined area.
- Disposal of the cut invasive alien plant material (biomass) needs to be carefully considered. Options may include burning on-site, chipping and composting, use of the woody biomass for biochar/energy production or transportation of the material to a garden refuse or landfill site for disposal. Whatever disposal method is selected, it must meet all legal requirements and must not create risk for residents and infrastructure. Note that the burning of some types of IAPs stimulates seed release or rapid seed germination and follow-up treatment of burnt areas must be treated a high priority.
- If a management unit has been affected by a vegetation fire, it must be allocated a high priority for control interventions, especially if the management unit was infested with species that create large soil stored seedbanks such as Black Wattle. The infestation level does not have to be very high, and a few individual mature trees located on the property can create a large soil stored seed bank. The fire stimulates the germination of the soil stored seed, and the seedlings can be controlled relatively cheaply with herbicide. Should the invasive alien plants on the management unit left untreated and be allowed to reach maturity, the control cost can potentially triple.
- Identify the clearing methods that are best for the specific project site and target species and the associated field equipment and personal protective equipment (PPE) required.
- Identify the correct herbicides for IAPs present on the management unit if chemical control is to be used. Only herbicides registered for use on the target species may be used.
- Identify training needs for project workers and supervisors based on the nature of the area to be cleared, the target IAPs and identified clearing methods. This may include invasive alien plant identification to

ensure indigenous vegetation is not targeted, safety training for the use of specialised equipment, such as chainsaws and specialised training for working in difficult or sensitive terrain. A qualified specialist contractor should clear invasive alien plants located on dangerous terrain such as steep slopes or cliffs and trees situated next to infrastructure.

- If the area where invasive alien plant clearing will take place is not municipal-owned land, the landowner needs to be notified of the clearing activities that will be taking place. If neighbours may be negatively affected by noise, road and pathway closures, or herbicide spraying associated with the clearing activities, they should also be notified before any work commences.
- Herbicides, equipment and PPE should be procured and be on-site before any work commences.
- A safe storage area for the herbicides must be established, which is bunded to contain any leaking containers. Herbicide storage areas must be secured to ensure that children and animals cannot access the chemicals and that the chances of theft are minimised (Annexure D: George municipality correct handling and application of herbicide guideline).
- A site camp may be set up to accommodate vehicles bringing workers onto the site, herbicide and equipment storage areas, ablutions and changing areas for workers. The site camp must be located outside of sensitive natural areas, must not restrict access routes or points for residents and businesses, and must not damage private property. If the site camp is on private property, the land-owner must have given permission for the use of this area.
- All necessary staff and worker training must be completed before the clearing activities commence.

9.2 Follow-up and rehabilitation

There will always be some measure of regeneration of the cleared IAPs after the initial clearing work has been done. Proper follow-up work is thus essential and should be conducted regularly. If follow-up clearing is not done, the progress made in the initial clearing exercise will be lost within a few years as the IAPs become re-established.

Research has shown that if follow-up invasive alien plant clearing is executed correctly and consistently, the costs and time expended on each consecutive follow-up reduces drastically. The maintenance stage can then be reached, where regular monitoring will be required for any seedlings that may have germinated. Where dense stands of IAPs have been cleared, the re-establishment of indigenous vegetation needs to be supported to help reduce IAP species' reemergence and reduce the risk of soil erosion where the soil surface is poorly vegetated.

In most soils, the seeds from the plants of the former natural habitat that occupied the area before invasive alien plant infestation still survive. Natural regeneration without the need for planting may be possible in many cases. However, if natural regeneration is not likely owing to the length of time the invasive alien plant infestation has

been in place, or if the soil has been disturbed so that the natural seed stocks are destroyed, indigenous vegetation planting/seeding is required.

It is important to use only plants that have been properly hardened off from a nursery production system to minimize the loss of plants. Plants used for rehabilitation purposes must be sourced from within 50km of the rehabilitation site to ensure that the genetic composition of the introduced plants is not significantly different from that of naturally occurring indigenous plants in/around the rehabilitation area. For complex restoration projects (for example, involving the stabilization of significant erosion areas and wetland rehabilitation projects involving the construction of weirs), it is necessary to contract the services of a specialist environmental rehabilitation professional to provide a plan and guidance on implementation.

In terms of follow-ups, cleared areas should be monitored regularly for emergent seedlings and removal (hand pulling or chemical control). Maintenance work should be done in late summer when seedlings can be seen amongst the other plants, and follow-up work undertaken on a 3 to 6 monthly basis, depending on the rate of re-growth.

All areas of exposed soil should immediately be protected by placing the packed brush on the slope or creating erosion control barriers using branches, sticks or logs placed horizontally across the slope at 1m intervals (the steeper the slope, the closer the barriers should be placed to each other).

If the soil remains relatively undisturbed and the area has some indigenous vegetation left intact, the natural regeneration processes of the indigenous vegetation on the site should be managed. This involves regular follow-ups to remove emergent IAPs and to protect the area from other forms of disturbance (uncontrolled fire, heavy grazing/ browsing pressure, vehicles accessing the site, etc.) while the vegetation re-establishes naturally.

9.3 Invasive alien plant control methods

It is critically important to Identify the clearing methods that are best for a specific project site and target species and associated field equipment and personal protective equipment (PPE) required. Invasive alien plant control methods can be grouped into the following three categories:

- Mechanical control
- Chemical control
- Biological control

9.3.1 Mechanical control

Mechanical control involves the physical destruction or total removal of plants. Mechanical methods are generally appropriate for sparse infestations and for species that do not coppice after cutting and include the following methods:

- **Hand pulling**

  Hand pulling is the removal of plants by hand, ensuring that the root is also removed. Hand pulling is only recommended when an area is sparsely invaded, the soil should ideally be damp or soft, and sandy soils and the plants are small enough to be pulled out successfully with the roots intact. Hand pulling does create soil disturbance, but if the area is sparsely invaded, such disturbances are unlikely to be ecologically damaging.

- **Manual removal using hand tools**

  Manual removal using hand tools such as tree loppers and slashers can be used to remove IAPs. The use of hand tools is probably the most widely adopted and often the most effective of all the methods. This method is labour intensive and can, therefore, create numerous jobs. Methods of cutting the plants include the following:

  Ring-barking: Useful for killing large trees. An axe is used to remove the tree's bark and cambium, in a horizontal band about 30cm wide (about 50cm from the ground). Herbicide, if used, should be applied immediately after ring-barking on the cut area.

  Cut-stumping: Plants with a stem/trunk diameter larger than 10mm can be cut as low to the ground as possible with a saw. Herbicide, if used, should be applied to the cut surface immediately after cutting.

  Slashing: The seed stalks/branches of annuals (plants that die each year after they set seed) can be slashed with a cane knife, mattock, bill hook or slasher before the seeds have matured. This is an effective method significantly reducing the presence of viable seeds that will germinate in the new season. Costs are generally low for controlling annuals in this way, as no herbicide is required.

  Strip-barking: With the use of a cane knife or axe, the bark of large trees can be stripped completely, from waist height down to the base of the trunk. Herbicide, if used, should be applied to the stripped surface immediately after strip-barking. This is an effective but time-consuming method.

  Frilling: Small trees can be frilled by cutting an angled groove into the bark and cambium, right the way around the tree trunk. This can be achieved with either a cane knife or axe, depending on how hard the bark and cambium layers of the tree are. The herbicide is then applied into the groove, which kills the tree as it seeps into the cambium tissue. This is the

preferred method of killing small trees, as it is usually much quicker and therefore more cost-effective than ring-barking or strip-barking.

Advantages	Disadvantages
An effective method in areas with low infestations	Not an effective method for dense infestations, as the cost of clearing is exceptionally high, with little or no impact
High job creation and associated poverty alleviation potential	Time-consuming and may be slower to complete than other forms of control
No contamination of water with herbicides as these are applied directly to the tree	If no herbicides are used, then the manual control techniques must be very well executed to ensure success

Table 3: The advantages and disadvantages of the manual removal of IAPs using hand tools

- **Manual removal using mechanised tools**

  A variety of mechanised tools can be used to clear IAPs and include the following methods:

  Brush-cutter: Heavy-duty motorised brush-cutters that are usually powered by a small two-stroke engine are popular for controlling low-growing thickets of IAPs. Importantly, a suitable blade must be fitted to the brush-cutter; for example, fitting a steel blade will allow for the cutting of thicker stems. Herbicide application to the cut stems should follow immediately after cutting.

  Chainsaw: A chainsaw is ideal for felling large trees and can be used to cut logs and branches into shorter lengths. Common target species for felling include large specimens of Syringa, Pine, Gum and Wattle. Training for chainsaw operators is essential. Operators need to understand the techniques of felling, i.e. ensuring that the tree falls in the desired direction. Each operator must also understand and be able to apply the necessary safety precautions during the felling process. Understanding the effective use and operation of the chainsaw itself is critical. The operator should also have the means and knowledge to undertake any required onsite servicing of the motor and sharpening of the chain.

Advantages	Disadvantages
Dense stands of IAPs can be cleared.	The cost of the equipment, fuel and servicing. This may be balanced by reduced labour costs.
It may be possible to clear very large areas of IAPs faster than without mechanised tools	Requires specialised training and more safety equipment than non-mechanised methods
	Possible pollution caused by fuel and oil

Table 4: The advantages and disadvantages of the manual removal of IAPs using mechanised tools

10.3.2. Chemical control

Chemical control of IAPs involves the use of herbicides to kill targeted plants. Managers and herbicide operators must have a basic understanding of how herbicides function, as this will guide the correct selection of herbicides for different purposes and plants.

The use of inappropriate herbicides and the incorrect use of the appropriate herbicides are wasteful and expensive practices. They often do more harm than good. This is especially problematic when working near watercourses. Some herbicides can quickly contaminate freshwater systems and/or be transported downstream, where they may remain active in the ecosystem. This is especially the case for herbicides with a high soil residual effect, i.e. herbicides that remain active after contact with soil.

Herbicides are classified as either selective or non-selective. Selective herbicides are usually specific to a particular group of plants, e.g. those specified for use on broadleaf plants will be effective on most broadleaf plants but should not kill narrow-leaved species such as grasses. Non-selective herbicides can kill any plant they come into contact with and are therefore not suitable for use in areas where indigenous plants are present.

Contractors that will be using herbicides to control invasive alien plants must have a valid Pest Control Operators Licence (limited weeds controller) according to the "Fertilizers Farm Feeds, Agricultural Remedies and Stock Remedies Act", Act No. 36 of 1947. This is regulated by the Department of Environment, Forestry and Fisheries (DEFF).

Protective gear must be used at all times, and applicable guidelines for mixing and storing herbicides must be adhered to. Herbicide applicators should have completed a certified training course. Herbicide applicators need to understand the implications of splash and drift. When a plant is sprayed with herbicide, it is almost sure that excess herbicide will leave the target area (Annexure D: George municipality correct handling and application of herbicide guideline).

This might not be problematic in areas of high-density infestations because excess herbicide will either drift or drip onto other target IAPs; it is, however, problematic when there are many non-target species close nearby. The misting effect, where tiny droplets drift via a breeze to non-target species, often occurs when using high-velocity nozzles. Ideally, low velocity and high-volume nozzles should be used for drenching, while high velocity, low volume nozzles should be used for misting.

The following aspects must be considered when planning to implement a chemical control project (Annexure D: George municipality correct handling and application of herbicide guideline):

- Only use herbicides that are registered for use on the specific species to be treated.
- Spray only in suitable weather conditions. Milder temperatures and higher humidity are best. No wind or light winds are preferable to minimise the risk of herbicide drift on non-target species.
- Spray plants during the active growing period. When leaf colour starts to turn for winter, it is too late to apply herbicides.
- Spray plants before the seeds are produced.
- Avoid using herbicides on drought-stressed or diseased plants or in extremely hot or cold conditions.
- Herbicide should not be applied during wet conditions, before or after rain. If it rains after application, it is crucial to monitor the effect as one may need to re-apply.
- Carefully read and understand the instructions on the label before initiating chemical control.
- Always store herbicides in the original container and in secure storage areas out of reach of children and animals.
- All persons must wear the required personal protective equipment when working with herbicides.
- Avoid skin contact with herbicides and avoid breathing in the vapour.
- Herbicide should always be applied immediately after the selected mechanical control method. Once the stem has dried, it will not absorb the herbicide.
- Keep herbicide in the shade at the worksite to keep it cool.
- To avoid spills, keep herbicide containers on a waterproof tarpaulin, or inside a big plastic bucket. When mixing herbicides, ensure that a funnel is used to prevent spilling. Should the herbicide spill, it can be poured back into the container from the plastic bucket.
- Containers containing mixed herbicide should be clearly marked (e.g. 'glyphosate mix'). Likewise, containers filled with water to be used for mixing herbicide should also be marked to ensure that people do not drink from them.
- Always use a measuring jug to measure the correct quantity required.
- To mix herbicides, half fill the appropriate size container with water and then add the herbicide using the measuring jug. Secondly, close the container and shake, and then fill the rest of the container with water.
- Keep the herbicide away from food.

Chemical application techniques include the following methods:

- Foliar application,
- Stem applications (basal stem, frilling, stem injection)
- Stump applications (cut stumping, scrape and paint).

Foliar application: This method uses a knapsack sprayer to spray IAPs below 1 metre in height. Leaves are sprayed to the point of run-off. Correct training and certification are essential before a team member uses this method. Foliar spraying is generally regarded as a

cheaper method than cut stump treatment because fewer people are required to treat larger areas. It does, however, require large amounts of clean water (for mixing with herbicides), and therefore only practical where water is available.

Cut stumping: To use these methods, clear the area around the base of the stem, then cut the stem horizontally as close to the ground as possible, using secateurs, loppers, bush saw, or chain saw. It is essential that the cut is horizontal to avoid runoff of herbicide, and sharp-angled cuts may also present an injury risk. The herbicide is then applied as soon as possible (preferably within 10 seconds) to the exposed surface before the plant's cells close up and inhibit the entry of the herbicide. On larger stems, focus herbicide application on the sapwood and not the heartwood, as the herbicide will not be translocated through the stump by the heartwood and will be wasted. It is easiest to have two people for this process, one to cut and one ready to apply the herbicide as soon as possible. This approach, though reliable, does not always provide a 100% kill rate, and ongoing follow-up and monitoring of treated plants will be required.

Frilling: An axe is used to make angled cuts down into the cambium layer through the bark in a ring. The cuts must go around the entire stem and apply herbicide into the cuts.

Basal stem: This method involves mixing an oil-soluble herbicide in diesel and spraying the full circumference of the trunk or stem. Basal bark spraying is often used to treat thinly barked woody weeds and undesirable trees. It is an effective way to treat saplings, regrowth and multi-stemmed shrubs and trees. This method works by allowing the herbicide to enter the weed's underground storage organs, slowly killing it. The stem or trunk needs to be reasonably free of mud or dust and should be reasonably dry. It should be sprayed or painted with herbicide solution from ground level. The height to be covered varies with the species and maturity of the plant being treated. Check with local authorities for recommended coverage. Basal bark spraying is a useful method in difficult terrain and usually works well, provided bark is not too thick for the solution to penetrate

Scrape and paint: This method is helpful on vines and scrambling plants with a woody stem. Using a knife and starting from the base, scrape 20 mm to 1 m of the stem to expose the sapwood and apply herbicide to the scraped area within 10 seconds. Do not ringbark the stem. Scrape about one-third of the stem diameter. Larger stems (>10 mm) can be scraped on two sides. Vine 'curtains' can be cut at chest level and again at about 300 mm above the ground. Scrape or cut and paint these lower stems and spray new growth. Pulling vines out of trees may cause a lot of damage to tree foliage or

bark, and it may be better to leave the vine to die in the tree after treatment. As with all herbicide, methods avoid using cut and swab or scrape and paint and similar methods if rain is expected. Herbicide labels have information on the amount of time needed after application before rain for the chemical to still be effective

Stem injection: The aim is to get herbicide into the sapwood tissue of woody weeds and Cactus species so that it will be transported throughout the plant. This method targets individual plants, and the risk of off-target damage is diminished. Use a cordless drill or spike to make holes around the base of the plant. Holes should be drilled at an angle of 45 degrees and be made no more than 50 mm apart right around the stem. This angle will aid herbicide retention in the hole, increase absorption by the plant, and reduce the risk of spillage. Herbicide must be injected into the holes within 10 seconds of the hole being made. Holes should not be overfilled because excess herbicide will run down the stem and contaminate the environment. Injection guns enable you to deliver a precise amount of herbicide to each hole. A squeeze bottle with a firmly fixed tube to dispense the herbicide or veterinary syringes may also be useful.

Handheld spraying: Handheld spraying is a means to apply herbicide to the stump once the plant has been cut down mechanically (cut-stumping) or after ringbarking, frilling and strip-barking. The most common and convenient handheld sprayer has a 1.5-litre capacity and a nozzle that can be set to achieve the correct spray width. Handheld sprayers are cheap, and the application of herbicide is accurate.

Aerial spraying: Application of herbicides from a fixed-wing craft or helicopter is primarily used for spraying very high densities IAPs present in areas that might otherwise be difficult to reach or control. The results are good, but aerial spraying is expensive, and selectivity is impossible. Aerial spraying is only used in severe cases of infestation. Careful consideration of the herbicide type and mix is essential, given the risks of contaminating water and the impacts to fish and other aquatic biodiversity as well as impacts on human health.

The following factors must be considered when choosing the most appropriate herbicide for a specific project:

- Each herbicide has a chemical compound or active ingredient that makes it effective. Herbicides sold under different brand names may have the same active ingredient. A herbicide with the correct active ingredient must be selected. The concentration of the active ingredient can also differ from one product to the next. As such, the mixing ratios may vary. It is critical that the recommended mixing ratios are

adhered to, and the guideline document and label supplied with the product should always be consulted prior to calibration.

- The residual effect is the length of time that a herbicide will remain active once in the soil. Some herbicides denature immediately on contact with soil, while others can remain active in the soil for up to two years. The shorter the residual effect of a herbicide, the less likely it is that non-target species will be killed. The residual effect of a herbicide should be checked before purchasing.
- The dye must be mixed with herbicides to ensure a clear visual indication of which plants have been treated and which have not. This allows workers to see where they have applied the herbicide and allows for easy inspection of work a few days later. Some herbicides contain a pre-mixed dye that eliminates the need for on-site mixing of dye. If a dye must be added, ensure that it is of good quality and that it is chemically compatible with the active ingredient and adjuvant. The use of different colour dyes for different herbicides is a helpful approach. It makes it very easy for workers to differentiate which herbicide to apply to which plants where such a distinction is required.
- Some herbicides require the use of a wetter or adjuvant to be effective. Always check if a product has a recommended adjuvant or if an adjuvant must be added for targeting specific IAPs. Herbicides applied to leaves by foliar application often require a particular adjuvant, as do those applied to trees with very waxy stems. Always check with the manufacturer if there is any uncertainty regarding adjuvants.
- Either water or diesel can be used as a carrier for certain herbicides. However, water is the preferred carrier because diesel is expensive and can negatively impact the natural environment. There is also often a risk of diesel theft. Diesel should never be used for foliar applications due to its very negative impact on the environment. Diesel should only be used in direct application to stems, and run-off is to be minimised.

The following factors must be considered when applying herbicide in riparian areas:

- The use of herbicides and herbicide additives near waterways or in situations where herbicides may eventually enter waterways requires careful consideration and special care. If possible, it is best to avoid herbicide use in these situations because of the potential risk to aquatic life and other water users. If herbicides are to be used, they must be registered for use near waterways or in aquatic situations and label instructions need to be strictly adhered to.
- High volume foliar spray applications increase the chances of direct or indirect contamination of waterways. Consider alternatives such as knapsack spraying, basal bark application or cut stump/stem injection to reduce contamination risks.
- It is better to treat riparian weed infestations (situated near a waterway or water body) progressively rather than in one large-scale operation. This will reduce the risks of stream bank destabilisation and habitat

loss. A progressive process will allow indigenous vegetation to regenerate or revegetation to become established.

- Select herbicides that have the lowest tendency to leach are persistent in the environment for the shortest time and have the lowest toxicity that will still be effective against the target invasive alien plant.
- Mixing of chemicals and cleaning of equipment should be done well away from waterways in situations from which runoff will not directly enter waterways.
- Avoid spraying weeds that overhang waterways and, wherever possible direct spray away from waterways.

The following herbicide use and precaution measures must be considered when using herbicide:

- Only use herbicides that are registered for the invasive alien plant that will be treated.
- Spray plants during the active growing period. When leaf colour starts to turn for winter, it is too late to apply herbicides.
- Spray plants before the seeds are produced, namely, between flowering and fruit set.
- Avoid using herbicides on drought-stressed or diseased plants or in extremely hot or cold conditions.
- Herbicide should not be applied during wet conditions, before or after rain. If it rains after application, monitoring the effect as a re-application might be required.
- The instructions on the label must be carefully read and understood prior to initiating chemical control. Most selective herbicides will lose selectivity at a high enough dose.
- Always store herbicides in the original container and in secure storage areas out of reach of children and animals.
- All persons must wear the required personal protective equipment when working with herbicides. These include overalls, rubber gloves and a face mask.
- Avoid skin contact with herbicides and avoid breathing in the vapour.
- Herbicide should always be applied immediately after the selected mechanical control method (e.g. after frilling, ring-barking, cut stumping or strip- barking). Once the stem has dried, it will not absorb the herbicide. If herbicide must be applied a few days or a week or two later, it is imperative to remove any callous tissue that has formed. Once the living cells are exposed again, the herbicide should be applied.
- Herbicide must be kept in the shade to keep it cool.
- To avoid spills, herbicide containers must be kept on a waterproof tarpaulin, or inside a big plastic bucket. When mixing herbicides, ensure that a funnel is used to avoid spilling. Should herbicide be spilt the herbicide can be poured back into the container from the plastic bucket.
- Containers containing mixed herbicide should be clearly marked (e.g. 'glyphosate mix'). Likewise, containers filled with water to be used for mixing herbicide should also be clearly marked to ensure that people do not drink from them.
- A measuring jug must always be used to measure the correct quantity of herbicide required.

- To mix herbicides, half the appropriate size container must be with water, and then the herbicide must be added using a measuring jug. Secondly, the container must be closed and shaken, and then the rest of the container must be filled with water.
- Herbicide must be kept away from food.

Advantages	Disadvantages
Achieve results over a short period (within six weeks of application).	Herbicides are expensive.
Large areas can be treated quickly.	The use of herbicides may contaminate sites used for drinking water, for washing and fishing, and can therefore, threaten human and animal health.
Complements mechanical control methods, increasing the effectiveness of IAP control activities.	May kill non-target plants or species
	Specialised training and certification are required to use herbicide

Table 5: The advantages and disadvantages of chemical control

10.3.3. Biological control

Invasive alien plants can spread very rapidly due to the lack of natural enemies (e.g. browsers or pathogens) that might occur in their land of origin. Biological control, or bio-control, is the introduction of these natural enemies to remove the plants' competitive advantage and reduce population vigour to a level comparable to that of the natural vegetation. These natural enemies are termed 'biological control agents, and most include insects, mites and micro-organisms such as fungi or bacteria. Biological control agents usually attack specific parts of the plant.

They can either attack the reproductive organs directly, e.g. on the parent plant (flower buds, flowers, or fruit) or the seeds after they have dropped. The 'stress' caused by a bio-control agent may kill a plant outright or impact the plant's reproductive capacity. In certain instances, the reproductive capacity is reduced to zero, and the population is thus effectively sterilised. All these outcomes will help to lower rates of spread of the species.

Advantages	Disadvantages
Most environmentally friendly and most sustainable of all invasive alien plant control methods.	Generally slow, especially initially.
Usually does not require high or long-term maintenance.	Low levels of infestation, with occasional outbreaks, will remain a feature of systems under biological control.
Relatively low-cost implication over the long term.	Any use of chemicals around biocontrol agent colonies may adversely affect the potency of this control method
	It cannot be used where the biocontrol agent would threaten commercial populations of the target species that may exist nearby. This includes community woodlots.

Table 6: The advantages and disadvantages of biological control

10. Safety standards and guidelines

Safety is of the utmost importance when dealing with invasive alien plant control. Staff often work in remote areas and with potentially dangerous tools and chemicals. The proper safety training and equipment is therefore required.

10.1 General safety standards

The following general safety standards should be adhered to when implementing an invasive alien plant control project:

- Ensure that each person carries at least two litres of drinking water with him/her each day. Alternatively, bring 25-litre containers filled with clean water and clearly mark that it is drinking water.
- Ensure that there are emergency procedures in place and that the team is aware of what to do in an emergency.
- Make sure there is cellphone reception in the area the team is working in. If there is none, a vehicle parked close by will be helpful to drive to a cellphone reception area in case of an emergency or to transport anyone who may be injured.

10.2 Herbicide safety

A herbicide storeroom needs to comply with national Occupational Health and Safety standards and have adequate ventilation, thus allowing fresh air to circulate. Whirlybirds and windows can provide sufficient ventilation. If the air is stagnant or if there is a smell of herbicides when opening the storeroom, then it is a good indication that there is not enough ventilation. The following measures must also be implemented at a herbicide storeroom:

- Clean water needs to be available near the storeroom.
- The floor must be non-porous. This is important so that when the floor is cleaned (which needs to be regularly), no residue of herbicides remains. Place herbicide containers on wooden pallets to increase ventilation and make mopping up after spillages easier.
- 'No Smoking' and 'No Fire' signs should be posted on the door of the storeroom and a sign stating that it is a chemical store and who the responsible person is for the store.
- The storeroom must be kept locked to prevent the herbicide from getting into the wrong hands, e.g., children.
- A spill kit needs to be kept in the storeroom to mop up any spill. The spill kit must contain a bucket with sand and a spade. The sand is to be placed on the spill to absorb the liquid. Once the sand has absorbed the spill, it is to be collected and disposed of to not contaminate the environment. It is preferable to keep contaminated sand in a bucket and dispose of it with empty containers at a certified chemical recycling plant.

- Obtain the Material Safety Data Sheet from the supplier of the herbicide and ensure familiarity with the content. Keep the Material Safety Data Sheet in the storeroom in case of an emergency.
- Always store herbicides in the original labelled container to avoid confusion with other products. Do not store other products in the store, such as protective clothing, food, etc., as they may become contaminated.
- All empty herbicide containers, or herbicides that have reached their expiry date, need to be safely disposed of. This can be done at a registered chemical recycling company. All empty containers must be spiked before disposal. This ensures that they cannot later be used for carrying drinking water, food etc.

10.3 Personal protective clothing (PPE)

The use of Personal Protective Equipment (PPE) by any person controlling invasive alien plants in the field is required by law. The PPE specifications differ for the different types of control. Mechanised control includes using chainsaws and brush-cutters and will require slightly different PPE from someone using manual control (cane knife, slasher, knapsack sprayer, etc.).

Nr	Item	Specification
1	Overall	100% cotton, two-piece overalls are the best for absorbing perspiration; they last longer and are cooler. However, various cotton/polyester blends are available and suitable.
2	Rubber gloves	Standard rubber gloves for fieldwork are sufficient. Wrist length gloves are preferable over elbow length gloves for a warm climate.
3	Leather gloves	Standard wrist-length leather gloves are appropriate.
4	Safety boots	Investing in a good quality safety boot might save you in the long run. Gumboots or standard safety boots, which support the ankles, are acceptable. Steel toecaps are recommended for workers working with hand tools or with large trees.
5	Hat	If working with large trees, on steep gradients or if any other safety risks may be present, then wearing a hardhat is advisable. Alternatively, a wide brim hat can be used to protect the worker from the sun.
6	Safety glasses	Large, clear safety glasses, which allow air to pass through, are acceptable. Glasses with elastics, (e.g. welding glasses) are not acceptable as they tend to fog when a person perspires.
7	Face mask	A face mask that covers the nose and mouth is essential when mixing herbicides and for foliar spraying.
8	Raincoat	A raincoat is necessary in caseworkers are caught in the rain, or can be worn early morning to avoid getting wet from dew.

Table 7: Personal protective equipment for manual control

Nr	Item	Specification
1	Chainsaw safety pants	Standard safety chainsaw and long pants that provide protection against the chainsaw.
2	Leather gloves	Standard wrist length, leather gloves.

Nr	Item	Specification
3	Safety boots with steel cap	Steel toecaps are essential for the safety of the workers. Safety boots, not gumboots, are to be worn as they provide support around the ankle.
4	Hardhat	A hardhat with a visor and earmuffs is necessary for all mechanised control.
5	Safety glasses	Chainsaw safety glasses provide total cover around the eye area, thus preventing wood chips, stones, etc. entering.
8	Raincoat	A standard two-piece raincoat. However, it is better not to use mechanised control when it is raining.

Table 8: Personal protective equipment for mechanical control

10.4 Health and safety representatives and first aiders

For every 20 people employed, one person needs to be trained as a First Aider and a separate person as a Health and Safety Representative. Appointments need to be made in writing, and the person needs to understand his/her responsibilities before signing clearly. Persons appointed can be one of the workers, with these appointments bearing additional responsibilities. It is advisable to train an extra person as people can resign or be absent, leaving no first aider in the field.

Nr	First Aider responsibilities	Health & Safety representative responsibilities
1	Management of the First Aid Kit	Recording all near misses and minor and major injuries.
2	Keeping a record of all items issued from the first aid kit: the name of the person issued to, the item issued, and the date issued.	Reporting injuries.
3	Applying first aid when an injury occurs.	Reporting any unsafe act/condition in the workplace.
4	Attending Health and Safety Meetings when required.	Attending Health and Safety Meetings when required.
5	Reporting when stock is low in the first aid kit.	Speaking to workers regularly on healthy, safe working procedures and encouraging workers to report unsafe conditions.

Table 9: First Aider and Health and Safety representative responsibilities

10.5 Training requirements

The following table describes the compulsory training courses (to be legally compliant) to ensure the safe implementation of invasive alien plant control projects:

Nr	Training course	Length of course and frequency
1	Basic First Aid Course	A ±4-day course that must be renewed every two years
2	Health & Safety Representative Course	A ±3-day course that must be renewed every two years
3	Pest Control Operators Course	Dependant on service provider and experience of the person

Nr	Training course	Length of course and frequency
4	Chainsaw Operator Course	±3-day course and an annual refresher course
5	Brush-cutter Operator Course	±2-day course and an annual refresher course
6	Herbicide Application Training	1-day course

Table 10: Compulsory training courses

11. Project budget & scheduling

There have been few cases where entire invasive alien plant populations have been eradicated because it is extremely costly and not always viable. However, the clearing of invasive alien species in some areas will increase the delivery of ecosystem goods and services and increase biodiversity. The control of invasive alien plants and restoration plays an essential role in ensuring the sustainable provision of ecosystem services and the long-term conservation of biodiversity.

The George municipality invasive alien plant control budget was calculated using the national Working for Water Programme (Expanded Public Works Programme) costing model and person day per hectare norm. The successful functioning of the costing model requires the following input data that was collected during field surveys of the management units:

- The size in hectares of each management unit
- The growth form of the recorded invasive alien plant:
    - Aquatic weed
    - Cactus
    - Creeper
    - Grass
    - Herbaceous
    - Non-sprouting tree
    - Sprouting tree
    - Seedling
- Name of invasive alien plant species
- The percentage density cover of each recorded invasive alien plant within the management unit
- The size class of each recorded invasive alien plant species:
    - Seedling
    - Young
    - Adult
- The treatment stage of each management unit:

    - Initial treatment: the first control project within a management unit where no previous control actions have been implemented.
    - Follow-up treatment: once the initial treatment has been completed regular follow-up operations must be implemented until the maintenance (invasive alien plants have been completely removed or are at such low densities that it requires one person walking through the management unit once a year to treat the individual plants) has been reached.
- Control methods:
    - Foliar spray
    - Hand pulling
    - Lopping or pruning
    - Bark Strip
    - Basal stem treatment and diesel
    - Cut below the ground
    - Stem injection
    - Ring barking
    - Felling
    - Frilling
    - Cut stump
    - Bark strip
    - Spray from a boat (aquatic weeds)
    - Spray from the shore (aquatic weeds)
    - Cut and spray
- The underfoot conditions within the management unit:
    - Easy
    - Moderate
    - Difficult
- The height of obstructive vegetation within the management unit:
    - Head height
    - Chest height
    - Knee height
- The density of obstructive vegetation within the management unit:
    - Slight
    - Moderate
    - Dense

- Walk time from the closest safe parking area at the management unit to the centre of the management unit (minutes one way)
- Drive time from the furthest pick-up point (home, central pick-up point) to the closest safe parking area at the management unit
- Slope in degrees
- Indicate whether the management unit contains riparian areas.

The above-mentioned data for each management unit is captured in the costing model and combined with the Working for Water Programmes person day per hectare matrix (how long will it take one person to control a specific invasive alien plant species) to calculate how much it will cost to control the invasive alien plants within each management unit. The cost is calculated for a standard Working for Water Programme team that has the following composition:

- 1 Contractor
- 1 Chainsaw operator
- 2 Herbicide applicators
- 1 Health and Safety representative
- 1 Qualified First Aider
- 6 General workers

Walking time, drive time, underfoot conditions, the height of obstructive vegetation, the density of obstructive vegetation, and slope data is included into the budget calculation to accommodate the impact that these factors might have on the budget and duration of the various control projects (Annexure C: George municipality invasive alien plant control budget). For example, difficult underfoot conditions, head height and dense obstructive vegetation will increase the effort (time & cost) for a contractor to control the invasive alien plants within a management unit. Steep slopes and long walking/drive times will also increase the time and cost to control invasive alien plants.

The herbicide volume, type and cost for each management unit was estimated based on the species and density classes present in each management unit (Annexure C: George municipality invasive alien plant control budget, Annexure D: George municipality invasive alien plant herbicide database).

Based on the Working for Water Program costing model, the following additional cost estimates have been included in the control budget (Annexure C: George municipality invasive alien plant control budget):

- Compensation for Occupational Injuries and Diseases contribution
- Unemployment Insurance Fund contribution

- Personal Protective Equipment (PPE) contribution (the funds are used to replace or purchase PPE)
- Equipment fund contribution (the funds are used to replace, repair or purchase equipment)
- Transport cost (transport cost for a bakkie and trailer)
- Administrative support cost (the cost to cover administrative tasks such as invoicing and payments)

Research has shown that if follow-up invasive alien plant clearing is executed correctly and consistently, the costs and time expended on each consecutive follow-up reduces drastically. The ability and resources available for follow up operations should determine the size and location of scheduling initial clearing operation. It critically important that a balance is maintained between clearing new areas and follow-up operations on previously cleared areas.

Once the invasive plants have been removed from an area (initial control), funding must first be allocated for at least three (3) follow-up treatments (treating seedlings and sprouting plants that might appear after the initial control operation) before a new area is cleared. If resources are taken away from existing control projects before they have reached maintenance level, it can result in invasive alien plant densities increasing again requiring additional investment to bring it back to a maintenance level.

Urban areas are complex environments, where perceptions on the value of particular properties typically need to consider social equity, economic development and environmental conservation. Managing invasive alien plants are often controversial in such settings. The challenge in prioritising areas for invasive alien plant control projects is to weigh considerations relating to biodiversity conservation, social trade-offs and diverse "benefit to society" issues (refer to the section in the report dealing with the *Prioritisation of control projects*). Such decisions need to be transparent and must consider the opinions of a wide range of stakeholders involved in urban land-use and ecosystem management decisions. When vegetation can be restored to the benefit of society, projects are more likely to gain general support and be funded.

Although invasive alien plant control projects can be costed and the implementation scheduled for up to 20 years into the future, it is unrealistic to expect a municipality with all its other priorities (housing, supplying clean water etc.) to have all the financial and human resources to implement the project within the shortest period of time. In the case of the George municipality, it would require multiple contractor teams working simultaneously over a period of two years to implement only the initial control projects.

It should also be kept in mind that if a municipality allocates resources in a given financial year to control the invasive alien plants in some high priority management units the invasive alien plant densities will increase and age classes (seedling, young, mature) change in the remaining management units that are not actively being

cleared during the given financial year. Invasive alien plant densities and age classes have a significant impact on the calculation of invasive alien plant control costs and scheduling implementation.

For example, if the original invasive alien plant age class was captured as seedlings in 2021, then in 2022, the age class will change to young if it is not controlled in 2021. In 2021 the seedlings could have been treated with herbicide relatively cheaply, and in a short period of time but in 2022, the young plants are too tall to spray with herbicide safely, and they must first be cut down mechanically and depending on the density, the individual stems must be treated with herbicide (low infestations) or the contractor must wait (6 months or more) until the cut stems have sprouted (calve height) and then apply herbicide (high infestations).

Some management units might also require multiple treatments in one year, depending on the invasive alien plant species present. The requirement for a second treatment within the same year can only be determined once the initial control project has been completed. This scenario will require that a municipality update the complete invasive alien plant control plan in terms of priorities, budget and implementation schedule.

A vegetation fire can also have a huge impact on the implementation of an invasive alien plant control plan. A vegetation fire will remove all the invasive alien plants on the affected management units, and depending on the species that were present in the management unit; it might reduce or increase control costs. For example, after the devastating Knysna fire in 2017 areas that only had a handful of mature Black Wattle trees before the fire ended up being 100% infested within a few months after the fire due to the germination of ground stored seed banks.

A better approach would be for the municipality to take into account all its current commitments, invasive alien plant control priorities (budget included) and available resources (financial and human) to decide which high priority management units can be realistically controlled in year 1 (initial treatment). Resources must be allocated at the same time for the follow-up treatments for the selected management units. Once the municipality has selected the management units, a realistic project schedule can be compiled that can be monitored and evaluated to track progress. The project implementation schedule must be updated every year as resource availability, and municipality priorities change. It will also require the municipality to visit each management unit once a year to update the invasive alien plant database in terms of species, densities and age classes.

12. Responsibilities and reporting requirements

The George Municipality will be responsible for the implementation of the invasive alien plant monitoring, control & eradication plan. Based on the monitoring and evaluation data, regular reports must be submitted to track the implementation progress and the success of the plan.