



GEORGE
TEL: +27 (0) 44 873 4923 **FAX:** +27 (0) 44 874 5953
EMAIL: info@sesc.net **WEBSITE:** www.sesc.net
ADDRESS: 102 Merriman Street, George 6530
PO BOX: 9087, George , 6530

CAPE TOWN
TEL: +27 (0) 21 554 5195 **FAX:** +27 (0) 86 575 2869
EMAIL: betsy@sesc.net **WEBSITE:** www.sesc.net
ADDRESS: Tableview, Cape Town, 7441
PO BOX: 443, Milnerton, 7435

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR THE

THE PROPOSED REPAIR AND REHABILITATION OF FLOOD DAMAGE ALONG THE CAMPHERSDRIFT RIVER, VAN RIEBEECK PARK, 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
6530

DATE: 20 November 2023

DEADP REF NO: 16/3/3/6/7/1/D2/11/0292/23
SES REF NO: 02/CD/FR/GM/11/23

-
- Environmental Impact Assessments • Basic Assessments • Environmental Management Planning
 - Environmental Control & Monitoring • Water Use License Applications • Aquatic Assessments



CONTENTS

DOCUMENT DETAILS.....	1
1. Introduction	2
2. About this EMPr	2
2.1 Important caveat to the report	2
3. How to use this document.....	3
4. Background and Location of the activity	3
4.1 Background and description.....	3
5. Legal Framework	6
5.1 Environmental Impact Assessment Regulations (2017)	6
5.2 Other applicable legislation	7
6. Scope of this EMPr	7
7. General Environmental Management.....	7
7.1 Site access and traffic management	8
7.2 Site demarcation	8
7.3 Site camp and associated facilities.....	9
7.3.1 Fencing & Security.....	9
7.3.2 Fire Fighting Equipment	9
7.3.3 Waste Storage Area.....	9
7.3.4 Hazardous Substances Storage Area	9
7.3.5 Potable Water.....	10
7.3.6 Ablution Facilities.....	10
7.3.7 Eating Area & Rest Area	10
7.3.8 Vehicle & Equipment Maintenance Yard	10
7.3.9 House-keeping.....	10
7.4 Vegetation clearing	10
7.5 Topsoil and subsoil management	11
7.6 Integrated waste management approach	11
7.7 Hazardous substances and fuels.....	12
7.8 Cement and concrete batching.....	13
7.9 Erosion control and stormwater management	13
7.10 Construction near a watercourse.....	13
7.11 Excavations and Earthworks	15
7.12 Site closure and rehabilitation.....	16
8. Environmental Impact Management Planning and design phase	17
OBJECTIVE 1: APPOINTMENT OF AN ENVIRONMENTAL CONTROL OFFICER	17
OBJECTIVE 2: UPDATE ENVIRONMENTAL MANAGEMENT PROGRAMME.....	18
9. Environmental Impact Management Pre-Construction Phase.....	19
OBJECTIVE 1: IDENTIFY & DEMARCATÉ NO-GO AND WORKING AREAS.....	19
OBJECTIVE 2: ESTABLISH ENVIRONMENTALLY SENSITIVE SITE CAMP & SITE FACILITIES.....	20
OBJECTIVE 3: PRE-CONSTRUCTION ECO INSPECTION	21
10. Environmental Impact Management Construction Phase	22
OBJECTIVE 1: TO LIMIT HYDRODYNAMIC CHANGES CAUSING SEDIMENTATION AND EROSION...22	
OBJECTIVE 2: TO LIMIT CHANGES TO SURFACE WATER QUALITY	26
OBJECTIVE 3: LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY	29
OBJECTIVE 4: TO LIMIT DIRECT MORTALITY OF FAUNA.....	30
OBJECTIVE 5: TO LIMIT THE DISTURBANCE OF AQUATIC HABITAT AND BIOTA	30
11. Environmental impact management post construction rehabilitation phase	34
OBJECTIVE 1: SITE CLOSURE & REHABILITATION	35
OBJECTIVE 2: PREVENT CONTAMINATION OF SURFACE WATER.....	36
OBJECTIVE 3: TO LIMIT THE DISTURBANCE OF AQUATIC HABITAT AND BIOTA	37
12. Emergency Preparedness	38
12.1 Emergency response procedures.....	38
12.2 Emergency preparedness	38
12.3 Control of emergency incidents.....	39
13. Method statements	41

Environmental Management Programme

14. Roles and Responsibilities.....	41
14.1 Duties and Responsibilities of the Applicant.....	42
14.2 Duties and Responsibilities of the Contractor.....	42
14.3 Duties and Responsibilities of the ECO.....	43
15. Environmental Awareness Plan.....	44
16. Monitoring, Record Keeping and Reporting.....	45
16.1 Environmental Auditing.....	45
16.2 Construction phase monitoring, reporting and record keeping.....	46
16.3 Corrective Action Procedure.....	47
17. CONCLUSION.....	49

List of Tables

Table 1: Appendix 4 of the EIA Regulations 2014 (as amended 2017).....	4
Table 2: Listed activities in terms of the amended Environmental Impact Assessment Regulations (2017).....	6
Table 3: NEMA Section 30.....	39

List of figures

Figure 1: Approximate Locality of the site.....	4
Figure 2: Closer view - Locality of the site.....	4
Figure 3: Locality of the sites.....	5
Figure 4: Locality of the sites.....	5

LIST OF APPENDICES:

Appendix A: Locality Maps

Appendix B: Site Development Plans

Appendix C: Environmental Authorisation

Appendix D: Curriculum Vitae of the Author

Appendix E: Environmental Awareness Guideline

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 G- 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

Environmental Management Programme

	<p>Section 9 - Environmental Impact Management: Pre-construction Phase</p> <p>Section 10 - Environmental Impact Management: Construction Phase</p> <p>Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase</p>
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	<p>Section 14 - Roles and Responsibilities</p> <p>Section 16 - Monitoring, Record Keeping and Reporting</p>
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	<p>Section 8 - Environmental Impact Management: Planning and Design Phase</p> <p>Section 9 - Environmental Impact Management: Pre-construction Phase</p> <p>Section 10 - Environmental Impact Management: Construction Phase</p> <p>Section 11 - Environmental Impact Management: Post Construction Rehabilitation Phase & Operational Phase</p> <p>Section 14 - Roles and Responsibilities</p> <p>Section 16 - Monitoring, Record Keeping and Reporting</p>
(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:	02/CD/FR/GM/11/23
Conditions of Use:	<p>This report is the property of the sponsor, <i>Sharples Environmental Services cc (SES)</i>, who may make allowance to publish it, in whole provided that:</p> <ol style="list-style-type: none"> Approval for copy is obtained from SES. SES is acknowledged in the publication. SES is indemnified against and claim for damages that may result from publication of specifications, recommendations or statements that is not administered or controlled by SES. That approval is obtained from SES if this report is to be used for the purposes of sale, publicity or advertisement. <p>SES accepts no responsibility for failure to follow the recommended program.</p>

DETAILS OF PERSONS WHO COMPILED THIS DOCUMENT:

Role:	Name:	E-Mail Address:	Qualifications:
Author:	Michael Bennett	michael@sesc.net	<ul style="list-style-type: none"> B.Sc. Environmental and Geographical Sciences, Ocean and atmospheric Science (UCT) EAPASA # 2021/3163
Co-Author	Carla Swanepoel	carla@sesc.net	<ul style="list-style-type: none"> BSc Hons Environmental Sciences – Biodiversity and Conservation Ecology (NWU)
Reviewer:	John Sharples	john@sesc.net	<ul style="list-style-type: none"> Masters in Environmental Management (UFS) Bachelor's degree in Conservation.

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 (**Environmental Assessment Practitioner, 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 D for his curriculum vitae. Michael is registered with EAPASA as a certified Environmental Practitioner (EAPASA # 2021/3163).

CARLA SWANEPOEL (**Candidate Environmental Practitioner, Co-Writer**)

Carla obtained her Bachelor of Science Honours Degree in Environmental Sciences from the North-West University. Carla joined the SES team in 2022 and is gaining experience in conducting assessments by working with and being mentored by her experienced colleagues.

JOHN SHARPLES (**Managing Director**) -

John started Sharples Environmental Services in 1998 and has overseen the company's growth and development since then. John also started the Cape Town office in 2010. John holds a Masters in Environmental Management from the University of the Free State as well as a Bachelor's degree in Conservation. He has consulted for 18 years running a team of highly trained and qualified consultants and prior to this gained 12 years of experience working for environmental organizations. John is registered with EAPASA as a certified Environmental Practitioner.

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 repair and rehabilitation of flood damage along the Camphersdrift River, Van Riebeeck Park, 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

The George Municipality experienced damage ranging from minor to extensive on infrastructure within the George Municipal Boundary during the November and December 2021 flood event. The Municipality applied for a disaster relief grant for the purposes of mitigating and responding to the severe weather event experienced to the Western Cape Government during December 2021. The funding application was successful and confirmed in a government gazette dated 03 February 2023. The funding was formally received by the municipality on 31 March 2023.

George Municipality appointed Lukhozi Consulting Engineers (Pty) Ltd (Lukhozi Consulting Engineers)) in June 2023 as their professional service provider for Project 28, Package 3 of the 2021 Municipal Disaster Recovery Grant (MDRG) projects for the flood damage repairs, rehabilitation and other mitigation measures. This specific project is in the Van Riebeek Gardens and the Camphersdrift Areas. The main focus of the project runs along the Camphersdrift River, from north-east of Camphersdrift Street, down past Davidson and CJ Langenhoven Roads, to where the river runs parallel to Belmont Street.

Scope of works

- The general extent of the scope of works applicable to all areas include:
- Refurbish / replace gabion structures;
- Reinstatement of erosion protection structures;
- Rehabilitation of eroded areas and implementation of erosion protection structures;
- Stabilization of riverbanks and beds and implementation of erosion protection structures;
- Reinstatement of retaining walls;
- Reconstruction of stormwater pipes, outlets, headwalls, and associated erosion



Figure 1: Approximate Locality of the site.

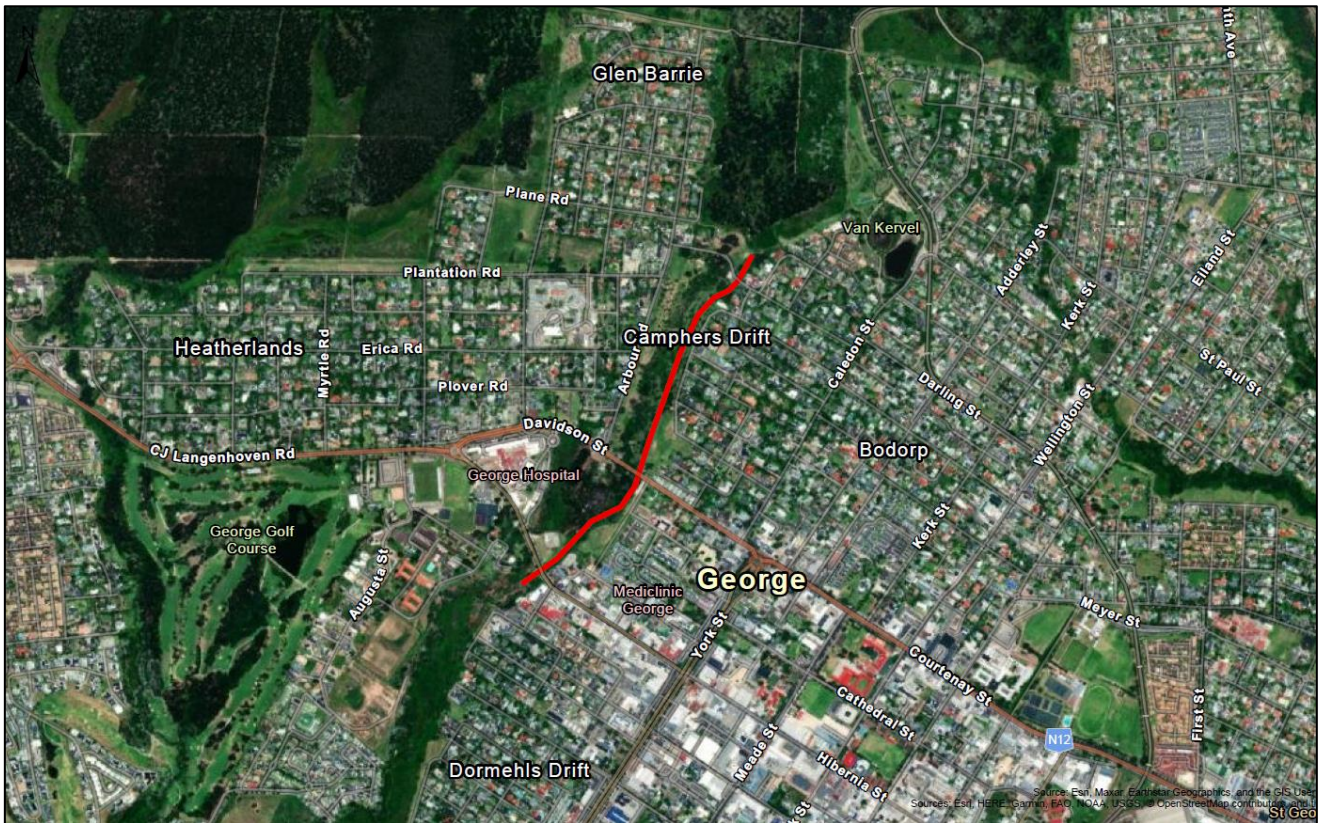


Figure 2: Closer view - Locality of the site.

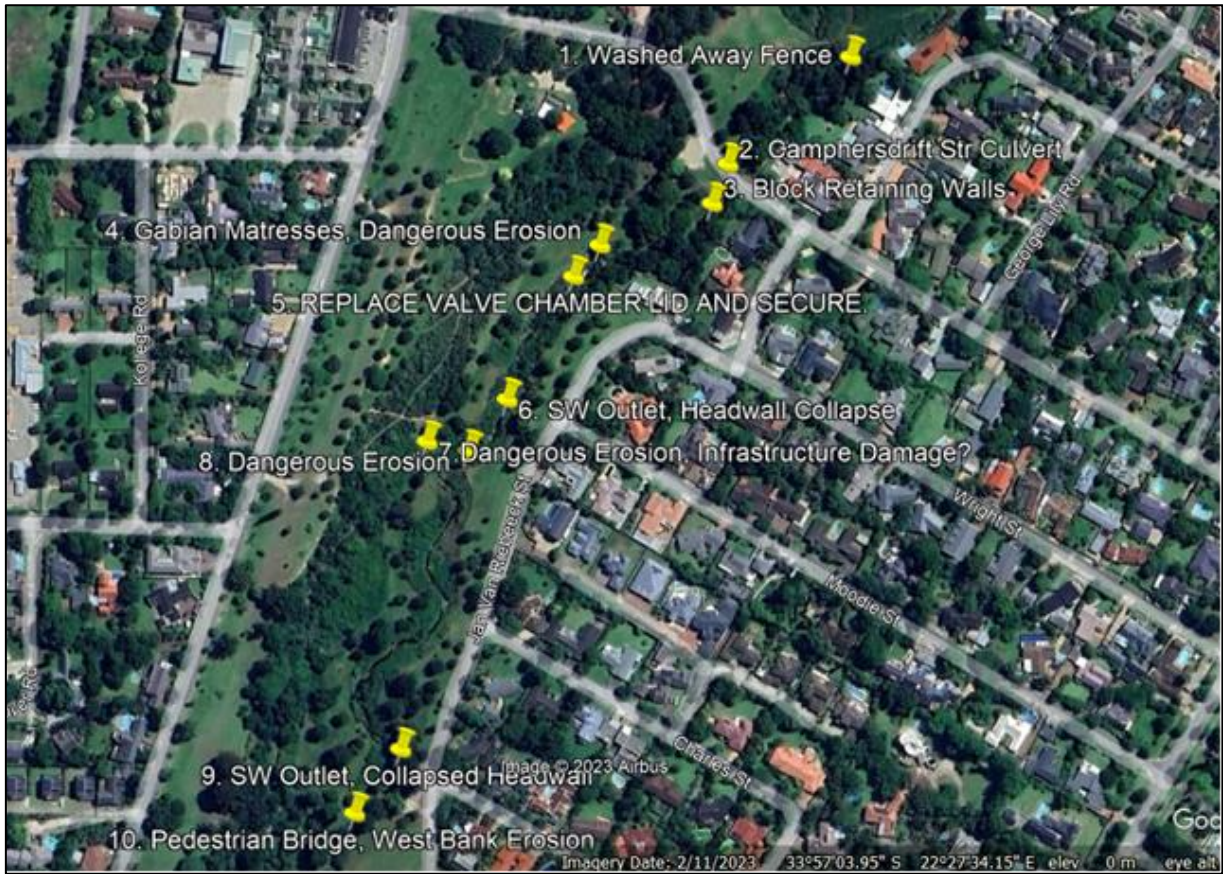


Figure 3: Locality of the sites

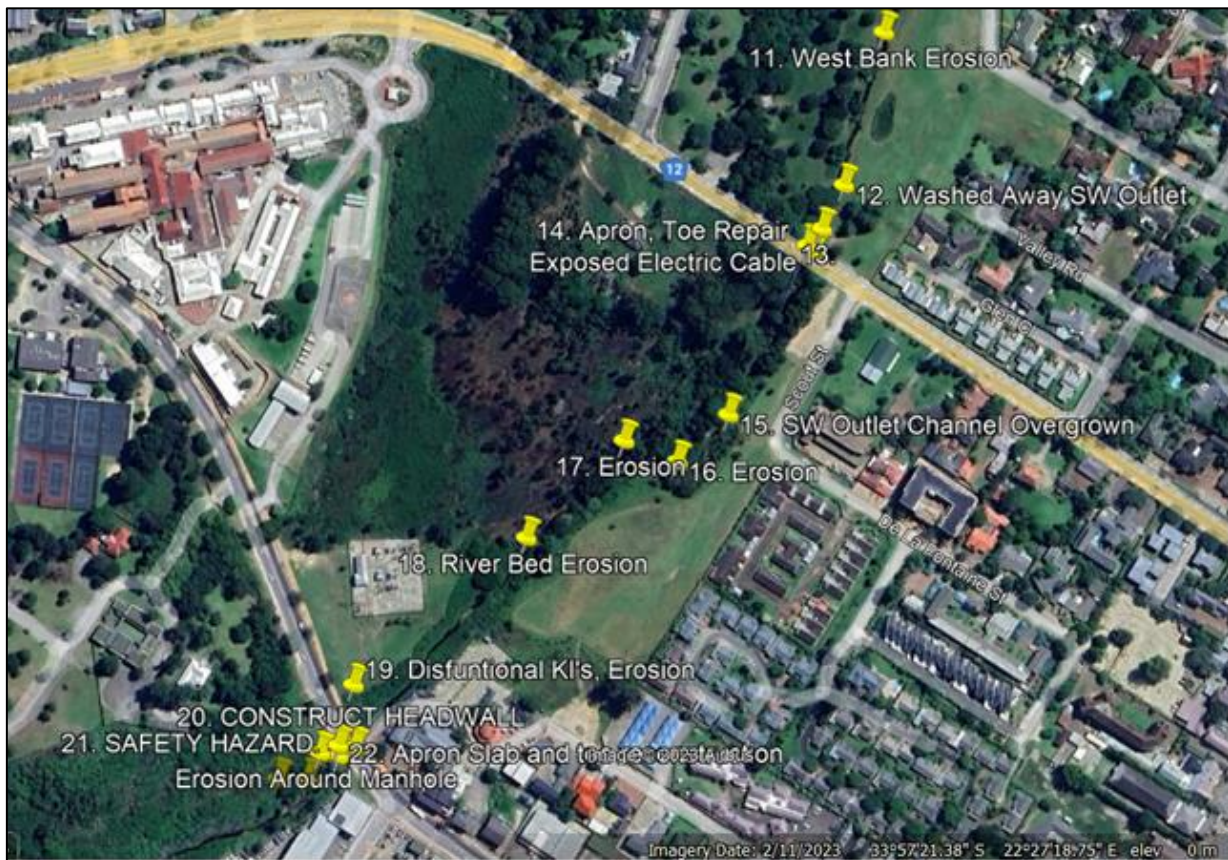


Figure 4: Locality of the sites

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)
12	<p>The development of—</p> <p>(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or</p> <p>(ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs—</p> <p>(a) within a watercourse;</p> <p>(b) in front of a development setback; or</p> <p>(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —</p> <p>excluding—</p> <p>(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;</p> <p>(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;</p> <p>(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;</p> <p>(dd) where such development occurs within an urban area;</p> <p>(ee) where such development occurs within existing roads, road reserves or railway line reserves; or</p> <p>(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.</p>
19	<p>The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse;</p> <p>but excluding where such infilling, depositing, dredging, excavation, removal or moving—</p> <p>(a) will occur behind a development setback;</p> <p>(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;</p> <p>(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;</p> <p>(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or</p> <p>(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.</p>
Listed Activity No(s):	Describe the relevant Basic Assessment Activity(ies) in writing as per Listing Notice 3 (GN No. R. 985)
12	<p>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.</p> <p>i. Western Cape</p> <p>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;</p> <p>ii. Within critical biodiversity areas identified in bioregional plans;</p>

- | | |
|--|---|
| | <p>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;</p> <p>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</p> <p>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.</p> |
|--|---|

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
- Operational 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 banks of the river directly at each site.

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.

No-go areas

As the activities will be undertaken within the Camphersdrift river it is not practical to demarcate the entire extent of the working areas as that will entail installing demarcation within the river. It is therefore recommended that only the riparian area and riverbanks outside of the footprint and practical working area.

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.

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.

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:

- Where feasible vegetation must simply be trimmed to facilitate access/ construction, rather than being completely cleared or removed.
- 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 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 EMP 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.

7.6 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.

7.7 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-authorized 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.

7.8 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.

7.9 Erosion control and stormwater management

Appropriate measures must be implemented to control the flow of storm water across the construction site, to prevent possible flooding, soil loss and dispersion of pollutants. All exposed earth surfaces must also be protected from wind and water erosion. Stripped areas must not remain uncovered for extended periods of time and must be provided with a suitable cover (vegetation, mulch, brush-packing) as soon as possible.

The scale and nature of the erosion and storm water control measures implemented on site must be appropriate to the conditions on site, and sufficient to achieve the desired outcomes (soil preservation, prevention of flooding, storm water control) to the satisfaction of the ECO and consulting engineer.

It may be necessary to implement small-scale erosion protection measures at the construction site, to prevent soil erosion. Such measures may include the use of shade netting, geo-fabric, brush-packing, logs and stakes or similar barriers in areas susceptible to erosion and along exposed slopes. The netting/fabric is placed directly across the path of flow of storm water. Poles and logs, staked in along the contours of a slope susceptible to erosion may also be used.

7.10 Construction near a watercourse

Construction within the vicinity of the aquatic system needs to be conducted in a conscious manner. The Freshwater Assessment Report completed by Debbie Fordham of Upstream Consulting highlights the following mitigation measures to be adhered to during construction.

- Final designs and method statements should be approved by the aquatic ecologist, together with the river engineer, prior to the commencement of construction.
- Objectives should be to halt bed incision and bank erosion from hydrological changes by improving culvert outlet designs to reduce scour, flow velocity and flow confinement and installing grade control structures to halt channel incision and upstream bank erosion due to confined flow, trap sediment, and achieve a more natural longitudinal profile. To allow, where

possible, for the river channel to migrate laterally and maintain sinuosity in the valley floor. To slope and revegetate eroded banks as gently as possible, with the least amount of hard infrastructure, to reflect the channel morphology prior to downward incision and subsequent erosion.

- Interventions/ hard infrastructure must be set as far back from the channel as possible, including stormwater outlets.
- Steep channel banks should be pulled back to gradients no steeper than 1:4 and preferably much gentler, taking care to vary the position of the toe of the slope with distance along the bank, so as to create a meandering effect, and to pull the bank back coarsely, so that the final product has a natural, rough appearance, with vertical and longitudinal heterogeneity.
- Do not compromise on the extent of erosion control below culvert and pipe outlets. Where possible, install check dams/ low weirs to slow flow and widen channel.
- Where infrastructure is not at risk, to allow for natural bank collapse and reshaping, whilst the grade control structures prevent further erosion.
- Use locally indigenous vegetation to revegetate disturbed river areas, whether from search and rescue, propagation, plugs, or purchased.
- Allow for a riverbed with diversity of types, reflecting riffles and pools, as opposed to creating a plane bed. Widen and raise the channel where possible.
- Bank stabilisation structures must attempt to reflect the natural bends of the river without straightening or narrowing the channel.
- Structures must be kept largely inside the space that used to be occupied by the river bank prior to its washing away, i.e. the structures are kept within the footprint as well as the level to which the bank existed, so as to not present more of a resistance to flow than what the previous bank did.
- A construction 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).
- The specific boundaries of areas to be excavated and recontoured etc. must be clearly demarcated.
- Use the smallest possible working corridor. Outside the working corridor, all areas are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and identified and demarcated clearly before any construction commences to minimise the impact. The edges of the construction / rehabilitation zone within the vicinity of the riparian habitat must be clearly staked-out and demarcated using highly visible material (e.g. poles 5m apart) prior to construction commencing.
- The longitudinal gradient must not be altered in a way that results in erosion downstream or impoundment of flows upstream. The cross sectional profile of the bed and banks must be restored as far as possible.
- Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- Access to and from the area should be either via existing roads or transformed land.
- During construction, it is important to stabilise any steep, bare areas on the slope and river banks via geotextiles and/or revegetation.
- It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which infestation of the cleaned areas.

Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use.

- Monitoring of the project activities is essential to ensure the mitigation measures are implemented. Compliance with the mitigation recommendations must be audited by a suitably qualified independent Environmental Control Officer daily.
- Sedimentation must be minimised with appropriate measures. Any construction causing bare slopes and surfaces to be exposed to the elements must include measures to protect against erosion using covers, silt fences, sandbags, etc. Effective stormwater management must include effective stabilisation of exposed soil.
- All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.
- Construction must have contingency plans for high rainfall events during construction.
- The area must be maintained through alien invasive plant species removal (which is the landowner's responsibility regardless of mitigation associated with this project) and the establishment of indigenous vegetation cover to filter run-off before it enters the aquatic habitat.
- Any potential pipeline leaks should be investigated as moisture content of the bank increases the likelihood of mass failure by increasing the weight of the soil mass and decreasing soil strength. This coupled with lateral interflow during floods will create destabilising forces. It is possible that the location of the pipeline has contributed to the extent of erosion in that upper right bank location as the substrate of the bank/ slope will have been altered for installation and altered moisture content in the soil profile. It is worth investigating other factors such as this which contributed to the bank failure in this site, not only the scour from deflected flood water.
- A monitoring programme must be in place, not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts.
- It is recommended that another project phase be added to improve the ecological integrity and functioning of the river, not just for the direct protection of infrastructure, but for supporting services and must including further channel and bank grade control interventions. Should this additional support be implemented successfully then there will be positive impacts. This can be compiled in the form of a river rehabilitation plan with engineering input. It can include the grade control structures to raise the incised channel and the rehabilitation of the wetland upstream of the urban area to attenuate flood waters.
- It is also important to note that bank stabilisation is a reactive measure to treat only a symptom of flood damage, and further actions focussing on addressing the causes should be investigated. For example, improving the stormwater system and culvert/pipe outlets (incorporating the principles of Sustainable Drainage Systems) to decrease the volume and slow the velocity of surface runoff entering the system during floods.
- Enhancing the aquatic buffer zone surrounding the river channel will reduce bank erosion. The are areas where cut lawn extends right up to the banks and it is recommended that, where possible, a buffer strip be adopted with higher surface roughness.

7.11 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).

All excavated material must be stored on a flat surface away from any drainage line or area susceptible to erosion. The location must be decided upon in consultation with the ECO. 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.

7.12 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 the construction operations, the site camp area must be cleared of all site camp facilities, ablution facilities, fencing, signage, waste and surplus material.
- All areas within the working area and site camp that have become devoid of vegetation or where soils have been compacted due to construction activities must be scarified or ripped to improve filtration and reduce run-off.
- 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 asphaltting 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 that was removed and stockpiled before construction, must be replaced by spreading it evenly over the areas from which it was removed. This topsoil (and the seedbank it contains) will facilitate the re-vegetation of the site.
- Disturbed areas, especially areas where excavations have taken place, must be shaped as appropriate (original topography must be restored where possible), and covered with a layer of stockpiled topsoil as soon as possible.
- Any topsoil, subsoil or other excavated material that cannot be utilised during site rehabilitation must be removed from the site and disposed of at an appropriate disposal site.
- The disturbed, newly rehabilitated surfaces (particularly steeper slopes and areas recently covered with topsoil) must be protected from wind & water erosion using mulch, brush packing or other appropriate erosion protection measures. Brush-packing/ mulching is done by covering the exposed surface with organic plant material such as branches, plant cuttings and leafy material. Ideally the vegetation removed from site at the start of the construction must be utilised. Brush-packing/ mulching plays a valuable role in erosion control, while also promoting re-vegetation of the site by retaining moisture in the soil, introducing seeds and/or trapping wind-blown seeds and providing organic material (compost) to promote new plant growth.
- 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

<i>Impact Management Objective: To appoint a suitably qualified and experienced Environmental Control Officer.</i>		
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
<ul style="list-style-type: none"> • 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.

<i>Impact Management Objective: To ensure the EMPr adheres to the requirements of the Environmental Authorisation and makes provision for the final detailed site layout.</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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

<i>Impact Management Objective: Identify and demarcate no-go areas, working areas and site facilities.</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • The no-go areas must be identified. • Demarcation of working area and no-go areas must be done in accordance with Section 8.2 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

<i>Impact Management Objective: To set up and equip the site camp and associated site facilities in a manner that will promote good environmental management.</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • The site camp and site facilities described in Section 8 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 8 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.

<i>Impact Management Objective: Environmental Control Officer to conduct an inspection prior to the commencement of construction activities on site.</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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 hydrodynamic changes causing sedimentation and erosion
- To limit changes to surface water quality
- Limit the impact on terrestrial biodiversity
- To limit direct mortality of fauna
- To limit the disturbance of aquatic habitat and biota

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 HYDRODYNAMIC CHANGES CAUSING SEDIMENTATION AND EROSION

<i>Impact Management Objective: To Limit hydrodynamic changes causing sedimentation and erosion</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • Clearance of vegetation, earthworks on the riverbanks, habitat modification, and further invasive alien plant infestation. • Direct physical destruction or disturbance which can result in further deterioration in freshwater ecosystem integrity, and a reduction in the supply of ecosystem services 	
Impact Management Outcome	Hydrodynamic changes, erosion and sedimentation is kept to a minimum	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
<ul style="list-style-type: none"> • Final designs and method statements should be approved by the aquatic ecologist, together with the river engineer, prior to the commencement of construction. 	Contractor	Construction phase

<ul style="list-style-type: none"> • Objectives should be to halt bed incision and bank erosion from hydrological changes by improving culvert outlet designs to reduce scour, flow velocity and flow confinement and installing grade control structures to halt channel incision and upstream bank erosion due to confined flow, trap sediment, and achieve a more natural longitudinal profile. To allow, where possible, for the river channel to migrate laterally and maintain sinuosity in the valley floor. To slope and revegetate eroded banks as gently as possible, with the least amount of hard infrastructure, to reflect the channel morphology prior to downward incision and subsequent erosion. • Interventions/ hard infrastructure must be set as far back from the channel as possible, including stormwater outlets. • Steep channel banks should be pulled back to gradients no steeper than 1:4 and preferably much gentler, taking care to vary the position of the toe of the slope with distance along the bank, so as to create a meandering effect, and to pull the bank back coarsely, so that the final product has a natural, rough appearance, with vertical and longitudinal heterogeneity. • Do not compromise on the extent of erosion control below culvert and pipe outlets. Where possible, install check dams/ low weirs to slow flow and widen channel. • Where infrastructure is not at risk, to allow for natural bank collapse and reshaping, whilst the grade control structures prevent further erosion. • Use locally indigenous vegetation to revegetate disturbed river areas, whether from search and rescue, propagation, plugs, or purchased. • Allow for a riverbed with diversity of types, reflecting riffles and pools, as opposed to creating a plane bed. Widen and raise the channel where possible. • Bank stabilisation structures must attempt to reflect the natural bends of the river without straightening or narrowing the channel. • Structures must be kept largely inside the space that used to be occupied by the river bank prior to its washing away, i.e. the structures are kept within the footprint as well as the level to which the bank existed, so as to not present more of a resistance to flow than what the previous bank did. • A construction 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. 		
--	--	--

<ul style="list-style-type: none"> • 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). • The specific boundaries of areas to be excavated and recontoured etc. must be clearly demarcated. • Use the smallest possible working corridor. Outside the working corridor, all areas are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and identified and demarcated clearly before any construction commences to minimise the impact. The edges of the construction / rehabilitation zone within the vicinity of the riparian habitat must be clearly staked-out and demarcated using highly visible material (e.g. poles 5m apart) prior to construction commencing. • The longitudinal gradient must not be altered in a way that results in erosion downstream or impoundment of flows upstream. The cross sectional profile of the bed and banks must be restored as far as possible. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Access to and from the area should be either via existing roads or transformed land. • During construction, it is important to stabilise any steep, bare areas on the slope and riverbanks via geotextiles and/or revegetation. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use. • Monitoring of the project activities is essential to ensure the mitigation measures are implemented. Compliance with the mitigation recommendations must be audited by a suitably qualified independent Environmental Control Officer daily. • Sedimentation must be minimised with appropriate measures. Any construction causing bare slopes and surfaces to be exposed to the elements must include measures to protect against erosion using covers, silt fences, sandbags, etc. Effective stormwater management must include effective stabilisation of exposed soil. 		
--	--	--

<ul style="list-style-type: none"> • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • Construction must have contingency plans for high rainfall events during construction. • The area must be maintained through alien invasive plant species removal (which is the landowner's responsibility regardless of mitigation associated with this project) and the establishment of indigenous vegetation cover to filter run-off before it enters the aquatic habitat. • Any potential pipeline leaks should be investigated as moisture content of the bank increases the likelihood of mass failure by increasing the weight of the soil mass and decreasing soil strength. This coupled with lateral interflow during floods will create destabilising forces. It is possible that the location of the pipeline has contributed to the extent of erosion in that upper right bank location as the substrate of the bank/ slope will have been altered for installation and altered moisture content in the soil profile. It is worth investigating other factors such as this which contributed to the bank failure in this site, not only the scour from deflected flood water. • A monitoring programme must be in place, not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts. • It is recommended that another project phase be added to improve the ecological integrity and functioning of the river, not just for the direct protection of infrastructure, but for supporting services and must including further channel and bank grade control interventions. Should this additional support be implemented successfully then there will be positive impacts. This can be compiled in the form of a river rehabilitation plan with engineering input. It can include the grade control structures to raise the incised channel and the rehabilitation of the wetland upstream of the urban area to attenuate flood waters. • It is also important to note that bank stabilisation is a reactive measure to treat only a symptom of flood damage, and further actions focussing on addressing the causes should be investigated. For example, improving the stormwater system and culvert/pipe outlets (incorporating the principles of Sustainable Drainage Systems) to decrease the volume and slow the velocity of surface runoff entering the system during floods. 		
--	--	--

<ul style="list-style-type: none"> Enhancing the aquatic buffer zone surrounding the river channel will reduce bank erosion. The are areas where cut lawn extends right up to the banks and it is recommended that, where possible, a buffer strip be adopted with higher surface roughness. 		
Performance Indicator	Hydrodynamic changes, erosion and sedimentation is kept to a minimum	

OBJECTIVE 2: TO LIMIT CHANGES TO SURFACE WATER QUALITY

<i>Impact Management Objective: To limit changes to surface water quality</i>		
Potential impact to avoid	<ul style="list-style-type: none"> During construction there are a number of potential pollution inputs into the aquatic systems (such as hydrocarbons and raw cement). Water and/or soil pollution cause negative changes in the physical, chemical and biological characteristics of water resources (i.e. water quality). This can result in possible deterioration in aquatic ecosystem integrity and a reduction in species. 	
Impact Management Outcome	Changes to surface water quality are limited	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
<ul style="list-style-type: none"> Final designs and method statements should be approved by the aquatic ecologist, together with the river engineer, prior to the commencement of construction. Objectives should be to halt bed incision and bank erosion from hydrological changes by improving culvert outlet designs to reduce scour, flow velocity and flow confinement and installing grade control structures to halt channel incision and upstream bank erosion due to confined flow, trap sediment, and achieve a more natural longitudinal profile. To allow, where possible, for the river channel to migrate laterally and maintain sinuosity in the valley floor. To slope and revegetate eroded banks as gently as possible, with the least amount of hard infrastructure, to reflect the channel morphology prior to downward incision and subsequent erosion. Interventions/ hard infrastructure must be set as far back from the channel as possible, including stormwater outlets. Steep channel banks should be pulled back to gradients no steeper than 1:4 and preferably much gentler, taking care to vary the position of the toe of the slope with distance along the bank, so as to create a meandering effect, and to pull the bank back coarsely, so that the final product has a natural, rough appearance, with vertical and longitudinal heterogeneity. 	Contractor	Construction phase

<ul style="list-style-type: none"> • Do not compromise on the extent of erosion control below culvert and pipe outlets. Where possible, install check dams/ low weirs to slow flow and widen channel. • Where infrastructure is not at risk, to allow for natural bank collapse and reshaping, whilst the grade control structures prevent further erosion. • Use locally indigenous vegetation to revegetate disturbed river areas, whether from search and rescue, propagation, plugs, or purchased. • Allow for a riverbed with diversity of types, reflecting riffles and pools, as opposed to creating a plane bed. Widen and raise the channel where possible. • Bank stabilisation structures must attempt to reflect the natural bends of the river without straightening or narrowing the channel. • Structures must be kept largely inside the space that used to be occupied by the river bank prior to its washing away, i.e. the structures are kept within the footprint as well as the level to which the bank existed, so as to not present more of a resistance to flow than what the previous bank did. • A construction 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). • The specific boundaries of areas to be excavated and recontoured etc. must be clearly demarcated. • Use the smallest possible working corridor. Outside the working corridor, all areas are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and identified and demarcated clearly before any construction commences to minimise the impact. The edges of the construction / rehabilitation zone within the vicinity of the riparian habitat must be clearly staked-out and demarcated using highly visible material (e.g. poles 5m apart) prior to construction commencing. • The longitudinal gradient must not be altered in a way that results in erosion downstream or impoundment of flows upstream. The cross sectional profile of the bed and banks must be restored as far as possible. 		
---	--	--

<ul style="list-style-type: none"> • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Access to and from the area should be either via existing roads or transformed land. • During construction, it is important to stabilise any steep, bare areas on the slope and riverbanks via geotextiles and/or revegetation. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use. • Monitoring of the project activities is essential to ensure the mitigation measures are implemented. Compliance with the mitigation recommendations must be audited by a suitably qualified independent Environmental Control Officer daily. • Sedimentation must be minimised with appropriate measures. Any construction causing bare slopes and surfaces to be exposed to the elements must include measures to protect against erosion using covers, silt fences, sandbags, etc. Effective stormwater management must include effective stabilisation of exposed soil. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • Construction must have contingency plans for high rainfall events during construction. • The area must be maintained through alien invasive plant species removal (which is the landowner's responsibility regardless of mitigation associated with this project) and the establishment of indigenous vegetation cover to filter run-off before it enters the aquatic habitat. • Any potential pipeline leaks should be investigated as moisture content of the bank increases the likelihood of mass failure by increasing the weight of the soil mass and decreasing soil strength. This coupled with lateral interflow during floods will create destabilising forces. It is possible that the location of the pipeline has contributed to the extent of erosion in that upper right bank location as the substrate of the bank/ slope will have been altered for installation and altered moisture content in the soil profile. It is worth investigating other factors such as this which contributed to the bank failure in this site, not only the scour from deflected flood water. 		
---	--	--

<ul style="list-style-type: none"> • A monitoring programme must be in place, not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts. • It is recommended that another project phase be added to improve the ecological integrity and functioning of the river, not just for the direct protection of infrastructure, but for supporting services and must including further channel and bank grade control interventions. Should this additional support be implemented successfully then there will be positive impacts. This can be compiled in the form of a river rehabilitation plan with engineering input. It can include the grade control structures to raise the incised channel and the rehabilitation of the wetland upstream of the urban area to attenuate flood waters. • It is also important to note that bank stabilisation is a reactive measure to treat only a symptom of flood damage, and further actions focussing on addressing the causes should be investigated. For example, improving the stormwater system and culvert/pipe outlets (incorporating the principles of Sustainable Drainage Systems) to decrease the volume and slow the velocity of surface runoff entering the system during floods. • Enhancing the aquatic buffer zone surrounding the river channel will reduce bank erosion. The are areas where cut lawn extends right up to the banks and it is recommended that, where possible, a buffer strip be adopted with higher surface roughness. 		
Performance Indicator	Changes to surface water quality are limited	

OBJECTIVE 3: LIMIT IMPACT ON TERRESTRIAL BIODIVERSITY

<i>Impact Management Objective: To limit the impact on terrestrial biodiversity</i>			
Potential impact to avoid	<ul style="list-style-type: none"> • Temporary loss of riparian vegetation and Garden Route Shale Fynbos. • Impairment of the biodiversity network. Impact on ecosystem functioning. Impact will be temporary. 		
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	
<ul style="list-style-type: none"> • During the construction phase, fence off the construction areas. Restrict all construction activities, such as stockpiling, parking and cement mixing, to transformed areas away from the riparian and fynbos areas. The contractor(s) must be made aware of the sensitive 	Contractor	Construction phase	

<p>surroundings. The riparian areas outside the footprints must be declared 'no-go' areas and not be disturbed in any way.</p> <ul style="list-style-type: none"> • Pollutant substances brought onto site must be properly contained. Cement/concrete mixing must be contained on impervious and bunded surfaces. No cement mixing is allowed inside the riparian and fynbos areas. Cement water is highly alkaline and considered toxic. 		
Performance Indicator	Impact on terrestrial biodiversity is limited to what is only required to undertake the activities	

OBJECTIVE 4: TO LIMIT DIRECT MORTALITY OF FAUNA

<i>Impact Management Objective: To limit direct mortality of fauna</i>		
Potential impact to avoid	To limit direct mortality of fauna from construction vibration and noise	
Impact Management Outcome	No avoidable loss of fauna	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period
<ul style="list-style-type: none"> • Every effort should be made to save and relocate any mammal, reptile, amphibian, bird, or invertebrate that cannot flee of its own accord, encountered during site preparation (i.e., to avoid and minimise the direct mortality of faunal species). These animals should be relocated to a suitable habitat area immediately outside the project footprint, but under no circumstance to an area further away. Vibration and noise through machinery, vehicles and people are unavoidable during the construction and no mitigation measures are suggested. 	Contractor	Construction phase
Performance Indicator	No avoidable loss of fauna	

OBJECTIVE 5: TO LIMIT THE DISTURBANCE OF AQUATIC HABITAT AND BIOTA

<i>Impact Management Objective: To limit the disturbance of aquatic habitat and biota</i>		
Potential impact to avoid	<ul style="list-style-type: none"> • Clearance of vegetation, earthworks on the riverbanks, habitat modification, and further invasive alien plant infestation. • Direct physical destruction or disturbance which can result in further deterioration in freshwater ecosystem integrity, and a reduction in the supply of ecosystem services 	
Impact Management Outcome	Disturbance of aquatic habitat and biota is limited	
IMPACT MANAGEMENT ACTIONS		
Mitigation measure	Responsible party	Time period

<ul style="list-style-type: none"> • Final designs and method statements should be approved by the aquatic ecologist, together with the river engineer, prior to the commencement of construction. • Objectives should be to halt bed incision and bank erosion from hydrological changes by improving culvert outlet designs to reduce scour, flow velocity and flow confinement and installing grade control structures to halt channel incision and upstream bank erosion due to confined flow, trap sediment, and achieve a more natural longitudinal profile. To allow, where possible, for the river channel to migrate laterally and maintain sinuosity in the valley floor. To slope and revegetate eroded banks as gently as possible, with the least amount of hard infrastructure, to reflect the channel morphology prior to downward incision and subsequent erosion. • Interventions/ hard infrastructure must be set as far back from the channel as possible, including stormwater outlets. • Steep channel banks should be pulled back to gradients no steeper than 1:4 and preferably much gentler, taking care to vary the position of the toe of the slope with distance along the bank, so as to create a meandering effect, and to pull the bank back coarsely, so that the final product has a natural, rough appearance, with vertical and longitudinal heterogeneity. • Do not compromise on the extent of erosion control below culvert and pipe outlets. Where possible, install check dams/ low weirs to slow flow and widen channel. • Where infrastructure is not at risk, to allow for natural bank collapse and reshaping, whilst the grade control structures prevent further erosion. • Use locally indigenous vegetation to revegetate disturbed river areas, whether from search and rescue, propagation, plugs, or purchased. • Allow for a riverbed with diversity of types, reflecting riffles and pools, as opposed to creating a plane bed. Widen and raise the channel where possible. • Bank stabilisation structures must attempt to reflect the natural bends of the river without straightening or narrowing the channel. • Structures must be kept largely inside the space that used to be occupied by the river bank prior to its washing away, i.e. the structures are kept within the footprint as well as the level to which the bank existed, so as to not present more of a resistance to flow than what the previous bank did. • A construction method statement must be compiled and available on site. 	<p>Contractor</p>	<p>Construction phase</p>
--	-------------------	---------------------------

<ul style="list-style-type: none"> • 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). • The specific boundaries of areas to be excavated and recontoured etc. must be clearly demarcated. • Use the smallest possible working corridor. Outside the working corridor, all areas are to be considered no go areas. Any unnecessary intrusion into these areas is prohibited. Where intrusion is required, the working corridor must be kept to a minimum and identified and demarcated clearly before any construction commences to minimise the impact. The edges of the construction / rehabilitation zone within the vicinity of the riparian habitat must be clearly staked-out and demarcated using highly visible material (e.g. poles 5m apart) prior to construction commencing. • The longitudinal gradient must not be altered in a way that results in erosion downstream or impoundment of flows upstream. The cross sectional profile of the bed and banks must be restored as far as possible. • Removal of vegetation must only be when essential for the continuation of the project. Do not allow any disturbance to the adjoining natural vegetation cover or soils. • Access to and from the area should be either via existing roads or transformed land. • During construction, it is important to stabilise any steep, bare areas on the slope and riverbanks via geotextiles and/or revegetation. • It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use. • Monitoring of the project activities is essential to ensure the mitigation measures are implemented. Compliance with the mitigation recommendations must be audited by a suitably qualified independent Environmental Control Officer daily. • Sedimentation must be minimised with appropriate measures. Any construction causing bare slopes and surfaces to be exposed to the elements must include measures to protect 		
---	--	--

<p>against erosion using covers, silt fences, sandbags, etc. Effective stormwater management must include effective stabilisation of exposed soil.</p> <ul style="list-style-type: none"> • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable. • Construction must have contingency plans for high rainfall events during construction. • The area must be maintained through alien invasive plant species removal (which is the landowner's responsibility regardless of mitigation associated with this project) and the establishment of indigenous vegetation cover to filter run-off before it enters the aquatic habitat. • Any potential pipeline leaks should be investigated as moisture content of the bank increases the likelihood of mass failure by increasing the weight of the soil mass and decreasing soil strength. This coupled with lateral interflow during floods will create destabilising forces. It is possible that the location of the pipeline has contributed to the extent of erosion in that upper right bank location as the substrate of the bank/ slope will have been altered for installation and altered moisture content in the soil profile. It is worth investigating other factors such as this which contributed to the bank failure in this site, not only the scour from deflected flood water. • A monitoring programme must be in place, not only to ensure compliance with the EMPr throughout the construction phase, but also to monitor any post-construction environmental issues and impacts. • It is recommended that another project phase be added to improve the ecological integrity and functioning of the river, not just for the direct protection of infrastructure, but for supporting services and must including further channel and bank grade control interventions. Should this additional support be implemented successfully then there will be positive impacts. This can be compiled in the form of a river rehabilitation plan with engineering input. It can include the grade control structures to raise the incised channel and the rehabilitation of the wetland upstream of the urban area to attenuate flood waters. • It is also important to note that bank stabilisation is a reactive measure to treat only a symptom of flood damage, and further actions focussing on addressing the causes should be investigated. For example, improving the stormwater system and culvert/pipe outlets (incorporating the principles of Sustainable Drainage Systems) to decrease the volume and slow the velocity of surface runoff entering the system during floods. 		
---	--	--

<ul style="list-style-type: none"> Enhancing the aquatic buffer zone surrounding the river channel will reduce bank erosion. The are areas where cut lawn extends right up to the banks and it is recommended that, where possible, a buffer strip be adopted with higher surface roughness. 		
Performance Indicator	Disturbance of aquatic habitat and biota is limited	

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 limit the impact on terrestrial biodiversity
- To limit the disturbance of aquatic habitat and biota

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	<ul style="list-style-type: none"> • 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. • Failure to stabilise disturbed surfaces may result in soil erosion and increased storm water run-off, which may limit successful revegetation of the site. 	
Impact Management Outcome	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • On completion of the construction operations, the site camp area must be cleared of all site camp facilities, ablution facilities, fencing, signage, waste and surplus material. • Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the ECO. • Any contaminated soil must be collected and disposed of as hazardous waste. • All construction waste, litter and rubble are to be removed from the site and re-used elsewhere or recycled/disposed of at an appropriate facility. • Burying or burning of waste or rubble on site is prohibited. • All areas within the working area and site camp that have become devoid of vegetation or where soils have been compacted due to construction activities must be scarified or ripped. • Topsoil removed during the establishment of the site camp and the working area must be spread evenly over the entire site camp area and all other disturbed/ exposed areas after those areas have been ripped, scarified, shaped and contoured (as required). • Where necessary seeding and planting of vegetation can take place after the replacement of the topsoil. Hardy, drought tolerant, non-invasive plant species must be selected. If needed, a layer of mulch can be applied to the newly shaped/ landscaped and topsoiled areas. The mulch will serve to limit erosion and will promote the re-vegetation of the site by retaining moisture in the soil and providing organic material (compost) for new plant growth. Mulched material must be spread to a depth of ± 50mm – a thinner layer is likely to be ineffective in protecting the site, while thicker layers may suppress plant growth. 	Contractor	Post-Construction phase

<ul style="list-style-type: none"> • All exposed soils and recently topsoiled areas are to be re-vegetated or stabilised to the satisfaction of the ECO, to protect these areas from wind and water erosion. No areas are to be left exposed to erosive forces. Erosion protection measures that can be applied include mulching (described above), the placement of geotextile, onion bags filled with wood chips, brush-packing or other similar measures. • 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. • 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. • It is recommended that follow-up alien clearing be conducted 6 months after construction is complete. 		
<p>Performance Indicator</p>	<ul style="list-style-type: none"> • All construction-related materials, equipment, facilities, waste and contaminated soils have been removed from the site. • Compacted soils have been scarified/ ripped and stabilised. • All disturbed/exposed surfaces have been provided with a suitable covering and/or stabilised. • No alien vegetation is evident on site. 	

OBJECTIVE 2: PREVENT CONTAMINATION OF SURFACE WATER

<i>Impact Management Objective: To limit the impact on terrestrial biodiversity</i>			
<p>Potential impact to avoid</p>	<ul style="list-style-type: none"> • Increased opportunity for alien infestation. • Erosion of the riverbanks due to poor rehabilitation and maintenance efforts. 		
<p>Impact Management Outcome</p>	<p>The disturbed areas are rehabilitated sufficiently and no alien vegetation establish in the recovering areas</p>		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure	Responsible party	Time period	
<ul style="list-style-type: none"> • Where needed, rehabilitate the disturbed surfaces after construction. Erosion prevention measures may be needed on steep riverbanks, such as logs or netting, to slow down runoff and potential erosion. Mulching and seeding with indigenous grass seed may also be needed. • Engage in alien clearing, focussing on invasive species such as black wattle, blackwood, gums and pines. These species are category 2 and 1b invaders that require compulsory control as part of an invasive species control programme. Their control will become a medium- to long-term maintenance requirement. 	<p>Holder of EA</p>	<p>Post-Construction phase</p>	

<ul style="list-style-type: none"> Allow at least 24 months for the monitoring of rehabilitation success and alien infestation post construction. It is recommended that a strip of at least 10 m wide around the construction areas also be monitored for aliens during the maintenance period. 		
Performance Indicator	The disturbed areas are rehabilitated sufficiently and no alien vegetation establish in the recovering areas	

OBJECTIVE 3: TO LIMIT THE DISTURBANCE OF AQUATIC HABITAT AND BIOTA

<i>Impact Management Objective: To limit the disturbance of aquatic habitat and biota</i>			
Potential impact to avoid	Establishment of alien vegetation on site		
Impact Management Outcome	Disturbed areas a sufficiently rehabilitated		
IMPACT MANAGEMENT ACTIONS			
Mitigation measure	Responsible party	Time period	
<ul style="list-style-type: none"> The area must be maintained through alien invasive plant species removal (which is the landowner's responsibility regardless of mitigation associated with this project) and the establishment of indigenous vegetation cover to filter run-off before it enters the aquatic habitat. It is the contractor's responsibility to continuously monitor the area for newly established alien species during the contract and establishment period, which if present must be removed. Removal of these species shall be undertaken in a way which infestation of the cleaned areas. Any use of herbicides in removing alien plant species is required to be investigated by the ECO before use. Use locally indigenous vegetation to revegetate disturbed river areas, whether from search and rescue, propagation, plugs, or purchased. 	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 8.3).
- 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.

12.3 Control of emergency incidents

In the event of an emergency incident, Section 30 of the National Environmental Management Act, 1998, must be complied with.

Any incidents must be reported to the relevant authorities and within the prescribed period.

Table 3: NEMA Section 30

<p>30.(1) in this section</p> <p>(a) "incident" means an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment. Whether immediate or delayed.</p> <p>(b) "responsible person" includes any person who</p> <p>(i) is responsible for the incident</p> <p>(ii) owns any hazardous substance involved in the incident; or</p> <p>(iii) was in control of any hazardous substance involved in the incident at the time of the incident</p> <p>(c) "relevant authority" means</p> <p>(i) a municipality with jurisdiction over the area in which an incident occurs</p> <p>(ii) a provincial head of department or any other provincial official designated for that purpose by the MEC in a province in which an incident occurs;</p> <p>(iii) the Director-General</p> <p>(iv) any other Director-General of a national department</p> <p>(2) Where this section authorises a relevant authority to take any steps, such steps may only be taken by</p> <p>(a) the person referred to in subsection (1)(c)(iv) if no steps have been taken by any of the other persons listed in subsection (1)(c):</p> <p>(b) the person referred to in subsection (1)(c)(iii) if no steps have been taken by 20 any of the persons listed in subsection (1)(c)(i) and (c)(ii):</p> <p>(c) the person referred to in subsection (1)(c)(ii) if no steps have been taken by the person listed in subsection (1)(c)(i):</p> <p>Provided that any relevant authority may nevertheless take such steps if it is necessary to do so in the circumstances and no other person referred to in subsection (1)(c) has yet taken such steps.</p> <p>(3) The responsible person or, where the incident occurred in the course of that person's employment, his or her employer must forthwith after knowledge of the incident, report through the most effective means reasonably available.</p> <p>(a) the nature of the incident</p> <p>(b) any risks posed by the incident to public health, safety and property</p> <p>(c) the toxicity of substances or by-products released by the incident; and</p> <p>(d) any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to</p> <p>(i) the Director-General</p> <p>(ii) the South African Police Services and the relevant fire prevention service;</p> <p>(iii) the relevant provincial head of department or municipality; and</p> <p>(iv) all persons whose health may be affected by the incident</p> <p>(4) The responsible person or, where the incident occurred in the course of that person's employment, his or her employer, must, as soon as reasonably practicable after knowledge of the incident</p>
--

(a) take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;

(b) undertake clean-up procedures:

(c) remedy the effects of the incident:

(d) assess the immediate and long-term effects of the incident on the environment and public health:

(5) The responsible person or, where the incident occurred in the course of that person's employment, his or her employer, must, within 14 days of the incident, report to the Director-General, provincial head of department and municipality such information as is available to enable an initial evaluation of the incident, including

(a) the nature of the incident

(b) the substances involved and an estimation of the quantity released and their possible acute effect on persons and the environment and data needed to assess these effects;

(c) initial measures taken to minimise impacts:

(d) causes of the incident, whether direct or indirect, including equipment, technology, system, or management failure; and

(e) measures taken and to be taken to avoid a recurrence of such incident.

(6) relevant authority may direct the responsible person to undertake specific measures within a specific time to fulfil his or her obligations under subsections (4) and (5): Provided that the relevant authority must, when considering any such measure or time period, have regard to the following:

(a) the principles set out in section 2

(b) the severity of any impact on the environment as a result of the incident and the costs of the measures being considered;

(c) any measures already taken or proposed by the person on whom measures are to be imposed, if applicable:

(d) the desirability of the state fulfilling its role as custodian holding the environment in public trust for the people

(e) any other relevant factors.

(7) A verbal directive must be confirmed in writing at the earliest opportunity. Which must be within seven days.

(8) Should

(a) the responsible person fail to comply, or inadequately comply with a directive under subsection (6):

(b) there be uncertainty as to who the responsible person is: or

(c) there be an immediate risk of serious danger to the public or potentially serious detriment to the environment

A relevant authority may take the measures it considers necessary to

(i) contain and minimise the effects of the incident:

(ii) undertake clean-up procedures: and

(iii) remedy the effects of the incident.

(9) A relevant authority may claim reimbursement of all reasonable costs incurred by it in terms of subsection (8) from every responsible person jointly and severally.

(10) A relevant authority which has taken steps under subsections (6) or (8) must, as soon as reasonably practicable, prepare comprehensive reports on the incident. Which reports must be made available through the most effective means reasonably available to

(a) the public;

(b) the Director-General

(c) the South African Police Services and the relevant fire prevention service;

(d) the relevant provincial head of department or municipality; and

(e) all persons who may be affected by the incident.

(11) A person who contravenes or fails to comply with subsection (3), (4), (5) or (6) is guilty of an offence and liable on conviction to a fine not exceeding R1 million or to imprisonment for a period not exceeding 1 year, or to both such a fine and such imprisonment.

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 15.3 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 E 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.

Environmental Management Programme

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.