ENVIRONMENTAL IMPACT ASSESSMENT FOR THE BEKHUMTHETO PHASE 2 HOUSING DEVELOPMENT AND INFRASTRUCTURAL UPGRADE

DRAFT BASIC ASSESSMENT REPORT

Prepared for

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Feb 2021

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DRAFT BASIC ASSESSMENT REPORT

BHEKHUMTHETO RESIDENTIAL DEVELOPMENT PROJECT _ PHASE 2

ABAQULUSI LOCAL MUNICIPALITY, VRYHEID

KWAZULU-NATAL

EDTEA REF: *(To be added)*

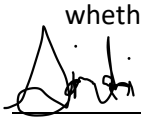
Brief Profile:

REPORT CONTTROL				
Project Tittle	**Bhekumthetho Housing Project Phase 2, eMondlo, VRYHEID**			
Date	**Jan 2021**	**Report Version**	**Draft BAR**	
Quality Control Aspects	**Name**		**Capacity /Designation**	**Signature**
Authors	**Mr MacCarthy Honu-Siabi**		**Environmental Assessment Practitioner**	
	Mr Fhumulani Mudau		**Environmental scientist**	

DECLARATION BY THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

I, **HONU-SIABI, MACCARTHY (MR)** declare that I –

(a) act as the independent environmental practitioner in this application;
(b) do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
(c) do not have and will not have a vested interest in the proposed activity proceeding;
(d) have no, and will not engage in, conflicting interests in the undertaking of the activity;
(e) undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;
(f) will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
(g) will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the Department in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the Department may be attached to the report without further amendment to the report;
(h) will keep a register of all interested and affected parties that participated in a public participation process; and
(i) will provide the Department with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.



Signature of the Environmental Assessment Practitioner:

Name of company: Bizycon Pty Ltd

Date 9th March 2021

DETAILS OF THE EAP

Name of representative of the EAP	Education qualifications	Professional affiliations	Experience at environmental assessments (yrs)
MacCarthy K Honu-Siabi	MSSC Development Studies (UKZN) Certs Environmental Impact Assessments (NWU) Cert: Post Decision Environmental Control (Auditing)(NWU)	IAIASA, SAMEA EAPSA (registration pending)	12 years in the field of Environmental management and Impact assessment
Fhumulani Mudau	BSc Environmental Science (UV)		4yrs in Environmental management

McCarthy Honu-Siabi

MSSc Development Studies: University of KwaZulu-Natal
Cert: Environmental Impact Assessment & Management: North West University:
Certs: Environmental Control and Monitoring: North West University
Certs; Project Management: University of KwaZulu-Natal
Bachelor of Management Studies: University of Cape Coast

McCarthy Honu-Siabi has been involved in projects relating to environmental impact assessment, social impact assessment and socio-economic planning, community developments, delivery of sanitation facilities, housing, planning; strategic and general service delivery. For the past five years he has been a project manager in teams of development professionals in the delivery and administration of several Housing Projects in both rural and urban areas of South Africa. He has worked on more than 65 Development projects, relating to environmental impact assessments, and strategic impact assessments. He therefore possesses vast experience which has assisted in the compilation of this report. MacCarthy currently work with Bizycon Pty Ltd, as a Senior EIA Consultant, working with many Government Agencies, and Municipalities and private sector developers and planners, on EIA related assessments, Strategic Development Planning and Environmental Management Frameworks and Strategic Development Frameworks among others.

NAMES AND EXPERTISE OF SPECIALISTS

Names and details of the expertise of each specialist that has contributed to this report:

Name of specialist	Education qualifications	Field of expertise	Title of specialist report/ s as attached in Appendix D
Sundras Patha	Pr *Sci.Nat*. Eng.	Geotechnical Engineering	Geotechnical Assessment for Bhekumthetho In-Situ Upgrade developemnt
Mr Mfaniseni Mpungose	Pr Techni Eng.	Civil Engineer	Civil Engineers Status Quo Report and preliminary Internal Serivces Specification and Layout
Brian Mafela	BSc (Hon) Forest Resource and Wildlife Management SACNASP *Cand.Sci.Nat*. (Ecological Science: 100214/15)	Ecological and Aquatic Habitat Assessment	Wetland Habbitat Assessment for the proposed Bhekumthetho Phase 2 Housing Development and Serivices Upgrade

Summary of where requirements of Section 22 of the 2014 NEMA EIA Regulations (GN R 983, as amended) are provided in this Basic Assessment Report

Section Requirements	YES/NO	SECTION IN BAR
Objective of the basic assessment process 1) The objective of the basic assessment process is to scope the issues in the environment through a consultative process- (a) Determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context; (b) Identify the alternatives considered, including the activity, location, and technology alternatives; (c) Describe the need and desirability of the proposed alternatives, (d) Through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic , heritage and cultural sensitivity of the sites and locations within sites and the risk impact of the proposed activity and technology alternatives on the these aspects to determine- (i) The nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and (ii) The degree to which these impacts- (aa) Can be reversed (bb) May cause irreplaceable loss of resources; and (cc) Can be avoided, managed or mitigated; (e) Through a ranking of the site sensitivities and possible	YES	

impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to- i. Identify and motivate a preferred site, activity and technology alternatives; ii. Identify suitable measures to avoid, manage or mitigate identified impacts; and iii. Identify residual risks that need to be managed and monitored.		
Scope of assessment and content of basic assessment reports 2) (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application , and must include : (a) Details of: i. The EAP who prepared the report ii. The expertise of the EAP, including a curriculum vitae:	YES	
(b) The location of the activity , including: i. The 21 digit surveyor general code of ach cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information items i and ii is not available , the coordinates of the boundary of the property or properties;	YES	
(c) A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or if it is- i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or on land where the property has not been defined , the coordinates within which the activity is to be undertaken;	YES	
(d) A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken associated structures and infrastructure;	YES	

(e) A description of the policy and legislative context within which the development is proposed including- I. An identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report ; and II. How the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	YES	
(f) A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	YES	
(g) A motivation for the preferred site, activity and technology alternative;	YES	
(h) A full description of the process followed to reach the proposed preferred alternative within the site, including: i. Details of all the alternatives considered;	YES	
ii. Details of the public participation process undertaken in terms of regulation 41 of the regulations, including copies of the supporting documents and inputs	YES	
iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	YES	
iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	YES	
v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) and (bb) may cause irreplaceable loss of resources; and (cc) can be avoided,	YES	

managed or mitigated		
vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration, and probability of potential environmental impacts and risks associated with the alternatives;	YES	
vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	YES	
viii. The possible mitigation measures that could be applied and level of residual risk	YES	
ix. The outcomes of the site selection matrix;	YES	
x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	YES	
xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity.	YES	
(i) A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- i. A description of all environmental issues and risks that were identified during the environmental impacts assessment process; and ii. An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	YES	

(J) An assessment of each identified potentially significant impact and risk, including- (i) Cumulative impacts; (ii) The nature, significance and consequences of the impact and risk; (iii) The extent and duration of the impact and risk; (iv) The probability of the impact and risk occurring; (v) The degree to which the impact and risk can be reversed; (vi) The degree to which impact and risk may cause irreplaceable loss of resources; and (vii) The degree to which the impact and risk can be avoided, managed or mitigated;	YES	
(k) Where applicable, a summary of the findings and impacts managements measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	YES	
(l) An environmental impact statement which contains- (i) A summary of the key findings of the environmental impact assessment; (ii) A map at an appropriate scale which superimpose the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	YES	
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;	YES	

(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	YES	
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	YES	
(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	YES	
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	×	
(r) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii)the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties any responses by the EAP to comments or inputs made by interested and affected parties; and	YES	
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	×	
(t) any specific information that may be required by the competent authority; and	×	
(u) any other matters required in terms of section 24(4)(a)	×	

and (b) of the act.		

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1. BACKGROUND

1.1 INTRODUCTION

Housing developments is one of government's main tools of providing an improvement to the living conditions of poor and low-income communities. As part of the upgrade of the Bhekumtheto residential area, the proposed development is intended to upgrade the housing infrastructure and formalise the township. These phases of the development entails putting in internal roads, water reticulation and sanitation facilities.

Maseko Hlongwa & Associates, as the planners of the proposed development have engaged Bizycon Pty Ltd to undertake an environmental impact assessment in order to obtain the necessary authorisations and legal approvals for the proposed development. This report details the findings of the Basic Environmental Assessment (EIA) process undertaken for the proposed settlement establishment.

1.2 PROJECT LOCATION

The community of Bekumthetho is situated in the small town of eMondlo, within Abaqulusi Local Municipality KwaZulu-Natal. eMondlo is located about 35km South-West of the Vryheid town on the western side of the municipality. A snap of the eMondlo locality is shown in Figure 1, a google photograph in relation to the major nearby towns while an aerial photograph is shown in Figure 2 of the site is shown in Figure 1 and 2 of the project area. The Global Positioning system (GPS) coordinates of the site are, 27°58'15 South, 30°43'30 East.

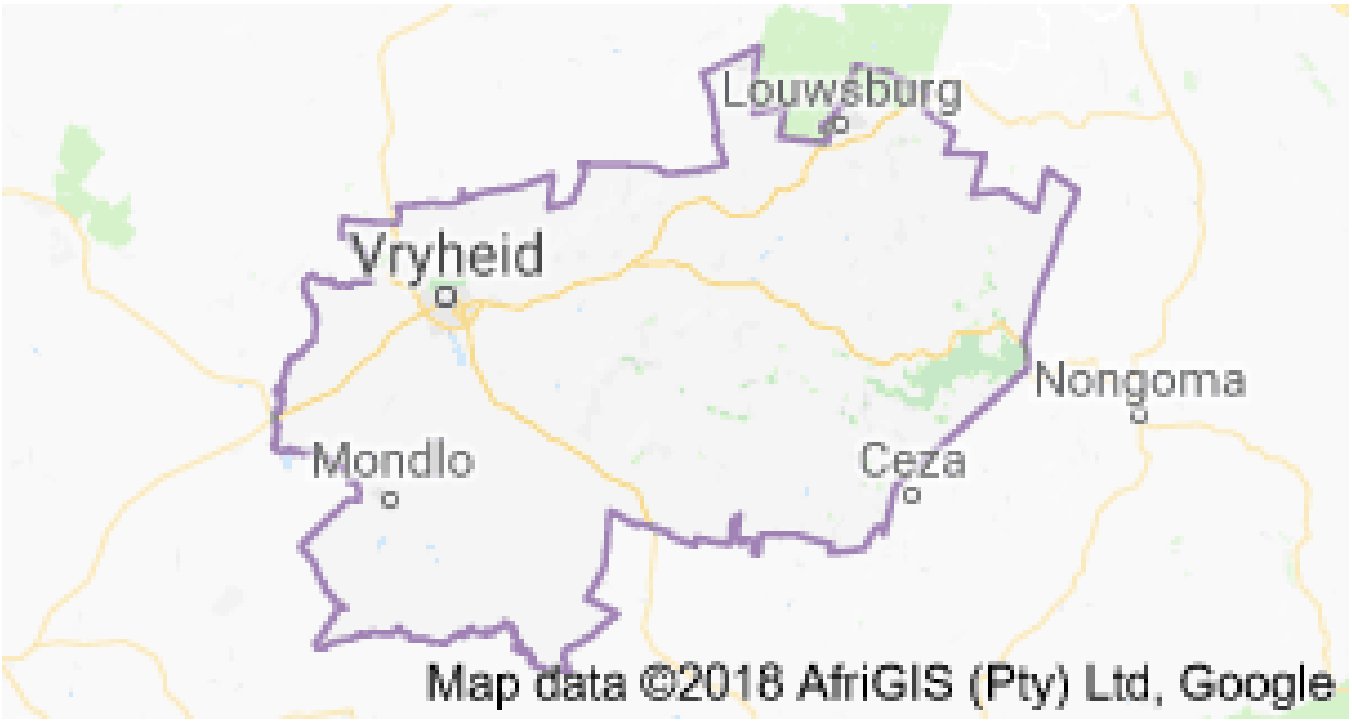


Figure 1 Abaqulusi Local Municipality

Figure 2 Location of the aerial and surrounding communities

2 PROJECT & ACTIVITY DESCRIPTION

The principal objective of this phase of the projects is to upgrade the standard of living of people through provision of basic housing infrastructure with accompanying settlements services. It is understood that a low-income residential development is being proposed. The phase one of the development consisted of construction of additional 3000 housing units. Phase 2 will include also additional 1000 houses and associated human settlement infrastructure, including roads and sanitation services.

The focus of this assessment is on the impacts of the installation of service infrastructure not However the This entails constructing about 42 -50m2 concrete residential units in a township establishment setting with proper urban layout as depicted in Figure 2. The upgrade is to also include the installation of UPVC pipelines for the transportation of water from the bulk 225kl reservoir into various parts of the community. In addition to this, it will include also internal reticulation for water and sewage. Currently the community uses lined Pit latrines, but this is recommended to be upgraded to a water reticulation system.

The development will also include an upgrade of internal roads and a few main roads and bus routes and stormwater drainage systems. The proposed development activities are summarised in table 1:

Activity	**Description**
Residential units	3000 units of 40-50m2 houses
Water reticulations	160 – 250 mm pipes Pipe lengths to be determined
Sanitation reticulation	Pipe lengths and flow throughputs are to be determined be distances between residential units and bulk
Road upgrades	Proposed Upgrade of **bus routes** to 6m wide with a road reserve of 13.5m

	Internal Access roads will be upgraded to 10m wide reserve and a 4.5 m wide stabilised surfaces
Installation of Storm water infrastructure	Stormwater management system is to be installed with piped drains at road crossings, side drains, catch pits and discharging into natural drains.
Solid waste disposal	It is proposed that the municipality will undertake solid waste collection and disposal, once internal roads are put in place to allow for accessibility.

Table 1project Description

2.1 LAYOUT

The conceptual layout of the proposed formalisation is shown in Figure 4. This shows the division of the evens and the internal access routes, as well as the watercourses and open spaces within the proposed community or development footprint. This application focuses on the activities such as the roads upgrades and associated pipes across the watercourses in the area. These watercourse points are labelled in the layout in Figure 4.

Figure 3 the housing infrastructure

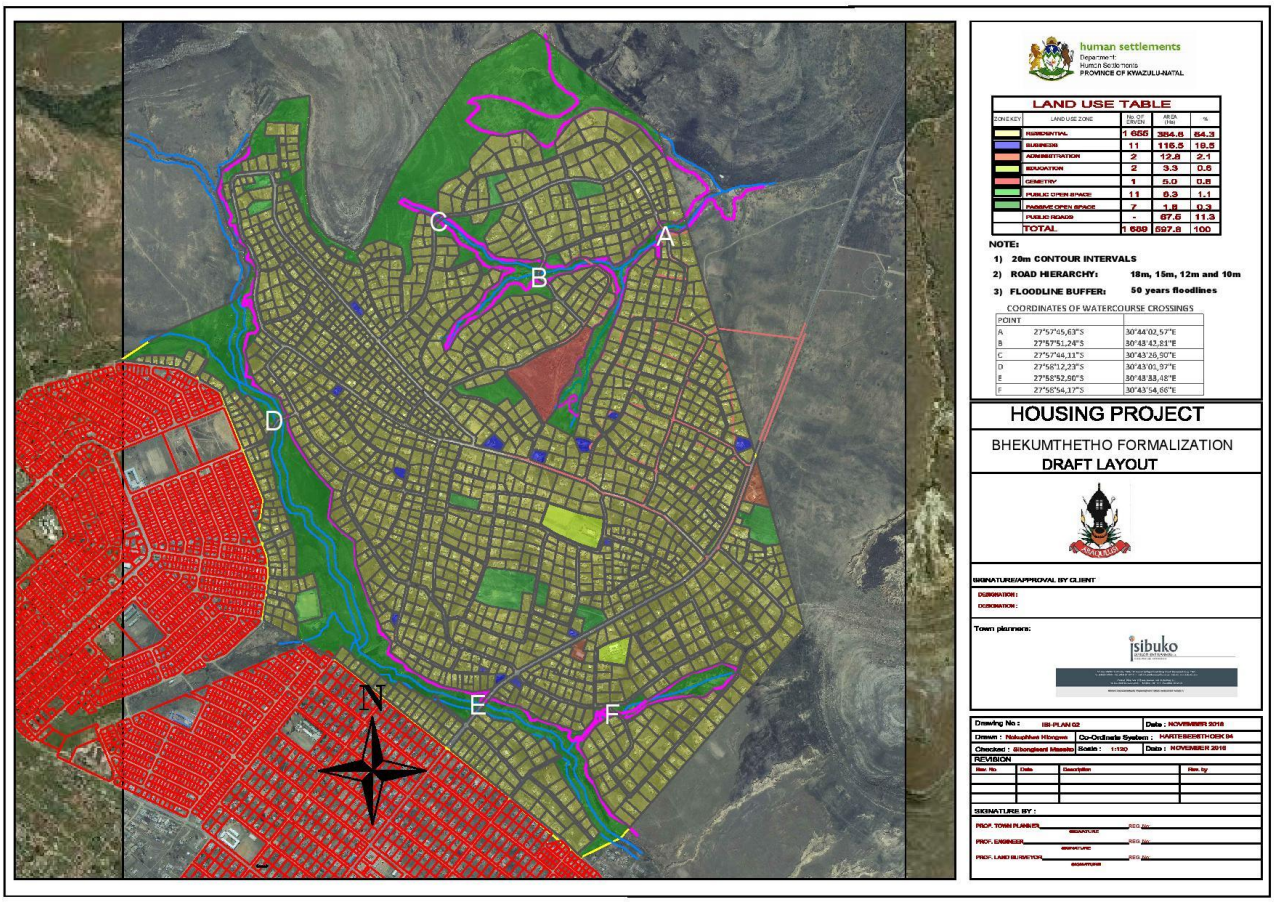


Figure 4 Proposed Layout of the development

2.2 LISTED ACTIVITIES IN TERMS OF NEMA REGULATIONS DEC 2014 AS AMENDED

As per Chapter 3 and 4 of the Environmental impact Assessment Regulations 2017, under the National Environmental Management Act (NEMA), Act 107 of 1998), a developer, upon crossing specified thresholds, must conduct impacts assessment processes to obtain authorisation from a competent authority prior to the commencement of such activities. It is the duty of the EAP to determine if proposed activities fall within such schedule. Depending on the magnitude of the proposed activities, a Basic Assessment Process (under regulations 983) or a full scoping and EIA (under regulations 984) may be undertaken in terms of Section 24D .

From the screening of the activities proposed by the developer as detailed in the attached Preliminary Engineering report and layout and the Wetland ecological study findings, the following listed activities are noted, for which a Basic Assessment Process for authorisation may be undertaken. These activities are described in table 2.

Act	Regulation	Activity	Activity Description	Applicability to this

		No		project
NEMA 1998 – EIA REGs April **2017** as amended	GNR 327 Listing Notice 1	9	The development of infrastructure exceeding 1000m in length for the bulk transportation of water or stormwater , i) with an internal diameter of 0.36m or ii) with a peak throughput of 120l per second or more, But excluding where such activities are within road reserves or within urban areas	The proposed development will largely entail using smaller pipes of between 150mm to 250mm diameter, however the main pipes from the reservoir from which the adjacent pipes will be connected may be more than 360mm in diameter. It is envisaged this will be about 450 Or more.
		10	The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;	The above pipe will run through the community for reticulation and may be cumulatively more than 1km and internal diameter of about 450mm.
		12	The development of- vi) bulk storm water outlet structures exceeding 100 square metres in size;	Bulk pipes will be connected from the reservoir to into various parts of the community from which the reticulation pipes will be connected.
		19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from- (i) a watercourse;	Several drainage lines and rivers travers the project area. Roadwork and pipe laying may result in excavations close to these drainage lines and in few cases, some of the upgrades will be across the drainage lines, where the roads go across and these are expected to be more than 10m3.
		24	The development of-	A few main roads will be

			(ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding- (b) Roads where the entire road falls within an urban area.	upgraded and which will be mode than 4m wide, though may not have a reserve of more than 13m, will be cumulatively more than 1km.
		27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Small patches of vegetation within different parts of the community may be removed, for either the houses or the roads of piping. These cumulatively may be more than 1ha.

3 THE BASIC ASSESSMENT PROCESS

The environmental impact assessment process as a whole is intended to provide information on the affected area, to determine whether there are any fatal flaws that may militate against the proposed development, to access any positive factors that the development may take advantage of, identify alternatives at an early stage, facilitate consultation with all Interested and Affected Parties (I&APs) and key stakeholders, including specialists and to address the concerns of I&Aps that may arise regarding the proposed development, thereby ensuring full public participation. This is to ensure a holistic planning approach that promotes full community engagement. A schematic representation of the basic Assessment (EIA) process is depicted in Figure 2.

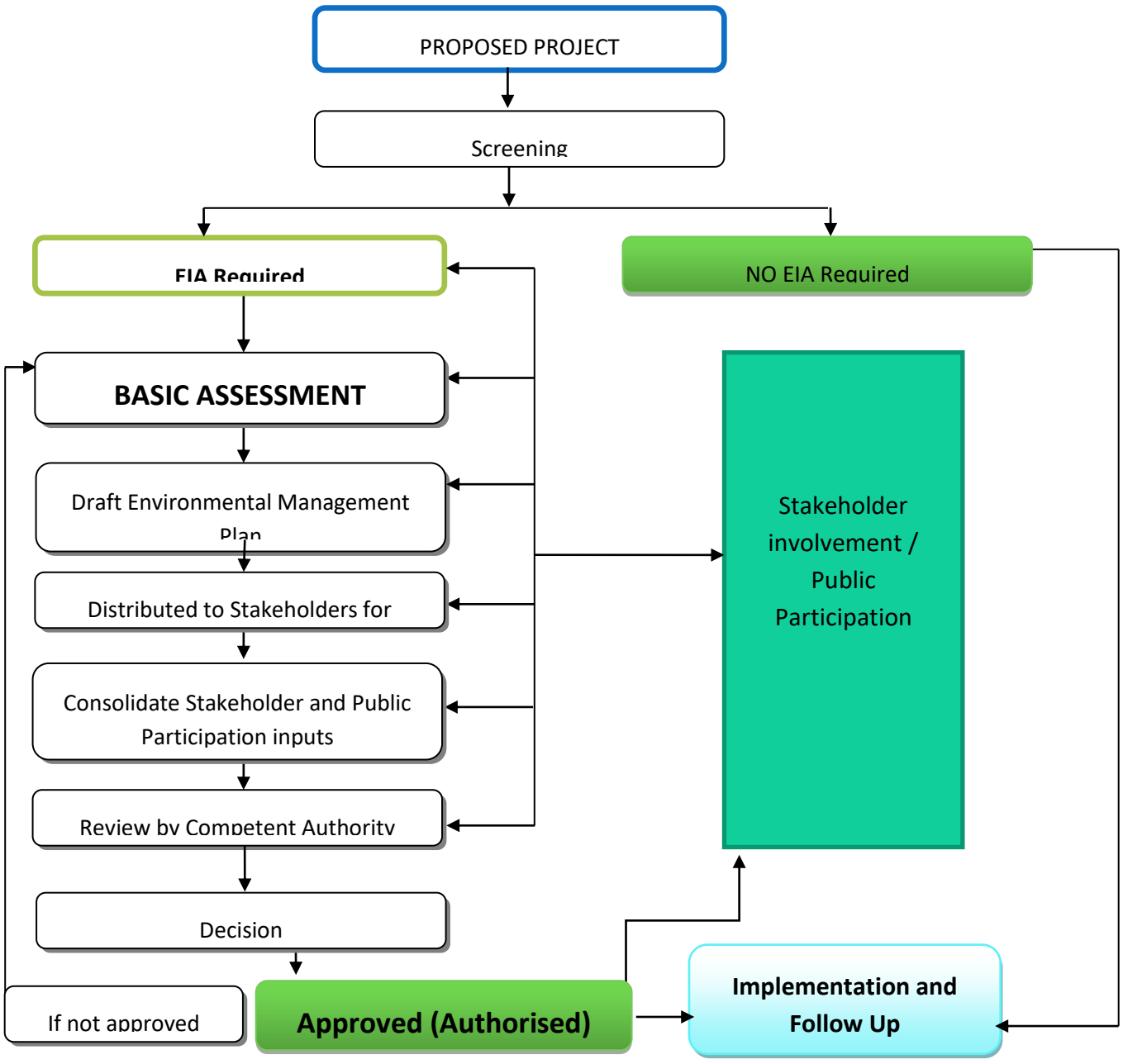


Figure 5 An illustration of the EIA Process flow (Source: Adapted from Aucamp J.P., 2010).

3.1 THE DETAIL SITE ANALSYSIS (BASIC ASSESSMENT)

The project is currently at the environmental scoping or issue impact identification and assessment phase of the environmental assessment process. Public participation is fundamental at this stage phase because it assists the Environmental Assessment Practitioner (EAP) to identify, categorize, and recommend issues that are significant and what impacts they may have on the proposed development and Vise-versa in accordance with the guidelines contained in Regulation 982 and 984 of the National Environmental Management Act 107 of 1998.

3.2 FIELD VISITS AND DATA COLLECTION

Field visits were conducted for two broad purposes namely collection of data for public participation and environmental assessment. Issues were identified using professional judgment, experience of similar projects, and previous knowledge of the study area, a review of available literature, public consultation, specialist input and consultation with relevant decision making authorities. Additionally, specialist duties were conducted to identify and confirm the significance of some of the issues identified.

3.3 PUBLIC PARTICIPATION REQUIREMENTS

The public participation process involved consultations with stakeholders, and the general public, neighbouring businesses, and stakeholders such as, South African National Biodiversity Institute (SANBI), The South African Heritage Resources Agency (SAHRA), and AMAFA Kwazulu-Natal, Department of Water and Sanitation (DWS) and all regional and local stakeholders. Further information gathering and interaction is also planned for the later stages of the project.

4 CONSIDERATION OF LEGAL AND REGULATORY REQUIREMENTS

The following are some of the key legislations relevant to this development:

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

The National Environmental Management Act 107 of 1998 has in terms of section 24 and 24D of the Act established regulations regarding the conduct of EIA processes made under section 24 (5) of the Act and published in Government Gazette 38282 of December 2014, as amended. These regulations published lists of activities (982, 983, 984 and 985) that require various levels of applications of EIA process. The section of the regulation that bears relevance to this project is ,GNR325 and GNR327 of April 2017

Under this regulation an environmental impact assessment, in this case, a basic assessment process is required, the elements of which are stipulated in relevant sections of the National Environmental Management Act 107 of 1998.

4.2 OCCUPATIONAL HEALTH AND SAFETY ACT (ACT 85 OF 1993)

The specific requirements under this Act that are relevant to the proposed project are the regulations on Major Hazardous Installations (MHI) and their potential health and safety impacts. Section 9 of the MHI regulation, which came into force in 1999, requires that where practicable the developer shall prevent the establishment of developments adjacent to sites or areas that the MHI would potentially pose a hazard.

This Act also bears relevance to the National Environmental Management Act, which requires proponents of development to ensure a 'risk averse' approach where there is adequate information that a given development is associated with potential for health and safety risks to beneficiary and neighbouring communities. Where a given development affects settlements, the requirement of this Act needs to be carefully and adequately integrated in the planning process.

4.3 DEVELOPMENT FACILITATION ACT (ACT 67 OF 1995)

The Development Facilitation Act was established to facilitate the speedy delivery of services and facilities to previously disadvantaged groups. However, enshrined in this Act is the provision that developers are to ensure that adequate provision is made for the assessment of

the potential impacts that the development project is likely to have on the receiving environment, and provision made for the management of these impacts. The EIA process is therefore being undertaken in fulfillment of the requirements of this Act.

4.4 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

The objective of this Act is to provide for the conservation of natural resources by maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of water resources, protecting natural vegetation, and preventing and/or combating invader plants and weeds. The planning and implementation processes of the proposed project therefore will take cognizance of relevant provisions of this Act.

4.5 NATIONAL WATER ACT (ACT 36 OF 1998)

Current regulations regarding discharge of surface water requires that surface water is handled with care both in terms of quality and quantity before being discharged into any natural water course, so that the quality and flow rate of natural systems are not significantly disrupted.

The development under investigation is expected to generate large quantities of stormwater, consequently an accelerated run off at the discharge points. This Act requires that stormwater control measures are satisfactorily addressed, and a maintenance programme developed to ensure that stormwater discharge points and downstream impacts are effectively mitigated.

In addition, Section 21 the act National Water Act (Act 36 of 1998) also requires that a water-use license be obtained from the competent authority prior to undertaking certain activities for developments that are within 500m of a watercourse. In this case the project site accommodates a wetland and hence a Water Use License Application may need to be made with the Department of Water and Sanitation.

4.6 NATIONAL FOREST ACT (ACT 84 OF 1998)

The National Forest Act dictates the procedures and processes required for the protection of natural forests and forest trees. The relevance of this Act to the development under

investigation is that the impact of the development on trees in the riparian vegetation on the site should be minimized as much as possible. Any removal of indigenous trees has to be authorized by the Department of Forestry.

4.7 NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

The National Heritage Resources Act (NHRA), Act No. 25 of 1999) defines a heritage resource as any place or object of cultural significance i.e. of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Reports in fulfilment of Section 38(3) of the NHRA must include the following information:

- the identification and mapping of all heritage resources in the area affected;
- an assessment of the significance of such resources in terms of the heritage assessment criteria set out in regulations;
- an assessment of the impact of the development on such heritage resources;
- an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
- if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- plans for mitigation of any adverse effects during and after completion of the proposed development.

The Heritage Impact Assessment (HIA) is limited to the actions described above, i.e. identification of heritage resources and recommendations for their management, and does not include mitigation costs. The final report will be submitted to the relevant authorities responsible for heritage for assessment and approval.

5 NEED AND DESIRABILITY

The provision of services to local communities is part of the current government's initiative to improve service delivery and improve the livelihoods of such communities. This is being done through many means, from improving residential infrastructure, improving of roads infrastructure and extension of other vital services such as water, electricity, sanitation and accessibility by emergency services. The Bhekumthetho community is currently informal, with poor roads infrastructure leading to poor access to services such as water and sanitation, and police patrols and emergency services to some aspects of the community. According to the engineering report, current storm water infrastructure is very poor leading to flooding and erosion in some parts of the community. Municipality has put in interim corrective measures but seems not enough, as most of the drainage areas and some roads are getting eroded. For this reason, the municipality intends to upgrade the roads and stormwater infrastructure to efficiently handle stormwater issues.

The first phase of this development was undertaken as a rural housing where qualified beneficiaries were provided with housing units. Other isolated developments have been undertaken by various agencies such as provision of electrical reticulation by ESKOM, and provision of VIP toilets by the District Municipality. What is lacking is a harmonious formalization of the community to which will include vital services such as roads. Once roads are improved and properly formalized, there will be access to various parts of the community. Other positive spillover developmental effects are expected to occur with the provision of these basic foundational infrastructure. For this reason, the local municipality in conjunction with various state development agencies, such as the department of human settlement and the district municipality intent to formalize the community through an integrated development approach. The expected long-term outcome is to improve livelihood of the community through the provision of basic services. This will also to be in alignment of the broader eMondlo community's development plan.

6 MOTIVATION FOR THE PROPOSED SITE, ACTIVITY AND TECHNOLOGICAL ALTERNATIVES

The EIA Regulations in the specification of the EIA process requires suitable and feasible alternatives to be provided if possible to the proposed activity as part of holistic planning. Chapter 1 of NGR 982 defines alternatives to the proposed activity to mean a different means of meeting the general purpose of the requirements of the activity. These include alternatives in terms of:

a) Property or location at which the proposed development is to occur,
b) Type of activity to be undertaken
c) Design or layout of the activity
d) Technology to be used in the activity or
e) Operational aspects of the activity

The alternatives are also to include the option of not carrying out the proposed activity, which is popularly referred to as the "no-go alternative". The impact assessment then is to include not only the desired alternative but also impacts of the identified alternatives. A summary is then provided of these alternatives to have an idea which will yield the most benefits with less undesirable impacts. It is also acknowledged that in some cases, where not suitable alternatives are feasible, then the proposed activity becomes the only alternative to the no-go alternative.

SITE ALTERNATIVE

Currently, the site proposed for the development is the existing community. This means that the houses will be constructed on the yards of the homesteads, as per the formalization plan. The roads will also be upgraded on the existing internal roads or as per the proposed layout. Due to the complicated nature of coming out with the layout of such communities, unless any significant issues are incurred, the most conducive sites are chosen in order to have the minimum negative impacts in terms of bulk infrastructure such as roads and reticulation pipes. According to the town planner's layout, the proposed layout is the only alternative so far. Any alternations to this plan in the future may only be informed by the details of any specialist studies, but at the time of this assessment the current layout is the only alternative considered and deemed suitable and takes into consideration the sensitive areas within the project site.

ACTIVITY ALTERNATIVE

The purpose of the development is to formalize the community by providing internal roads and other services. Currently due to budget and time constraints and the developmental needs of the community, it is indicated that the proposed activity is the most suitable means of improving the community's current outlook. In view of this no other activity alternative is considered as this is already an integrated service delivery project.

TECHNOLOGICAL ALTERNATIVE

Technological alternatives include the current ways of constructing houses by manually laying of brinks and using human labour in digging trenches laying pipes and covering them up. Roads construction will also be according to the current technological standards as per the transport sector regulations and budget parameters. No special technologies have been considered other than the current accepted technological ways of doing things as per the accepted standards. It is noted however that details of each technology employed will be approved by the project engineer prior to use.

NO-GO ALTERNATIVE

The no-go alternative to this development implies that the community upgrade does not take place. The areas where access and internal roads are in poor condition will remain as such, if not deteriorate. No water installations or extensions will be made to the households. The status quo will simply remain, coupled with current community unsatisfaction with the state of services, leading to potential social unrests and protests. That is the current nature of the no-go alternative.

7 DESCRIPTION OF THE RECEIVING ENVIRONMENT

7.1 PHYSICAL CHARACTERISTICS

7.1.1 TOPOGRAPHY

The general topography of the area varies significantly. Topographical character of the proposed site consist of gently sloping terrain in most parts. Steeper slopes characterise the areas along the northern and southern boundaries sloping into the numerous drainage systems on the outskirts of the community. Slope is noted to be steady. The site mostly is characterised with elevation of between 1200m above sea level in the high areas of the hills, and about 1070m above sea level on the lower sections.

It should be noted that there are restrictions on development of areas that slopes sharply. For instance, residential development on areas that are steeper than 1.3 is discouraged.

7.1.2 CLIMATE

The climatic conditions are noticeably between summer and winter months ranging between very cold temperature during the winter and high summer temperatures. The minimum temperature is below 0°c during the winter months and often higher than 30°c in the summer months. The average rainfall is between 650mm to 1000mm per year. Annual precipitation ranges from 620 to 1265mm per annum.

The impacts of climate change are very severe in Abaqulusi Municipality, the topography of the municipal jurisdiction, the air pollution and other physical elements of neighbouring municipalities contribute to major variations in weather patterns. There are extreme conditions of heat, cold and high rainfall stormy weathers which result in floods and erosion.

7.2 FLORA & FAUNA AND GENERAL BIODIVERSITY

7.2.1 FLORA

The vegetation type of the proposed development site consists of The KwaZulu-Natal Highland Thornville. This consist of woody grasslands interspersed with acacia trees.

Vegetation in the area is quite degraded due to the fact that most parts of the site are settled. The original vegetation left are found on the open spaces within the settlement, and on the vacant spaces on the outskirts of the development boundary. There are isolated patches of shrubs on various portions of the site, especially along the hills and in some of the valley systems.

7.2.2 FAUNA

Attempts were made during this assessment to identify animal species in the project area, especially within the vicinity of the site. Identification methods such as animal droppings, foot prints, nesting areas, sound, and trails were employed. However, no traces of the presence of wildlife were found perhaps owning to the fact that the site is been used as a farming area and located within the settled community. The presence of birdlife however could not be ruled out within the trees on isolates portions on the outskirts of the site.

7.2.3 GENERAL BIODIVERSITY

Biodiversity of a given environment goes beyond the vegetation alone. Biodiversity refers to the diversity of plants and animals (living things) that occur in a given area. These plants and animals interact with the physical elements of the area such as the soils, water, and atmospheric conditions (non-living things) in such a manner that the various living and non-living components of that area maintain a suitable living environment for all the components of that environment. The resulting suitable environment provides various benefits for people and communities that live in the area.

The Ezemvelo KZN CBA map the Critical Biodiversity Areas (CBAs) and protected areas, are the core areas, and the Ecological Support Areas (ESAs) provide for linkages/ corridors between the core areas, as well as buffering the core areas. The Ezemvelo Provincial and District CBA plans (as per District Biodiversity Sector plans)provide this bigger picture and need to be utilised to give the framework for this required incorporation of regional, provincial and national biodiversity networks.

- Critical Biodiversity Areas (CBA) areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and functionality of ecosystems (EKZN Wildlife, 2016)
- Ecological Support Areas (ESA) are areas required for the persistence of specific species. Although these areas are frequently modified, a change in current land use, to anything other than rehabilitated land, would most likely result in the loss of that feature from the area identified (EKZN Wildlife, 2016). ESAs are required to support and sustain the ecological functioning of CBAs

These include in addition to officially protected areas, *Irreplaceable Areas*, *Highly Significant Areas*, *Important and Necessary Areas*, *Ecological Corridors*, *Areas of Least Concern* and lastly areas with no *Natural Habitats Remaining*.

Protected Areas are areas that are formally marked and conserved as mandatory reserves. These are usually under institutional management usually in the form of game reserves. The most important of the six categories is the ***Irreplaceable Areas.*** These are those areas where there are no other alternatives available to achieving the conservation targets. This makes

their conservation very crucial. Areas marked as ***Highly Significant Areas*** are those that have very limited alternatives or options available elsewhere for meeting the conservation targets. These areas also require conservation or protection from further degradation. ***Important and Necessary Areas*** are those areas that require protection, but have greater choices available in other areas for meeting the biodiversity targets. The ***Ecological Corridors*** have a mixture of both natural and transformed areas which are noted for long term connectivity and biological movements. ***Areas of Least Concern*** are also natural areas but with most choices available for meeting biodiversity targets hence can be used for other activities including developments. And then there are those areas that have ***No Natural Habitats Remaining***. These areas are the transformed lands that do not contribute anything to achieving the biodiversity targets of the province. The detailed ecological functionality of the site will be undertaken and included in the final report. The impact of this will then be fully assessed.

In the case of Bhekunthetho development, it is noted that, given the current settlement on the site and the level of degradation, no critical biodiversity is noted. Areas around the rivers and hydrological features are the areas with potential sensitive environments. These may require careful planning and assessment to ensure their protection. These are noted to be excluded from the development as most of these are zoned as no-development zones and to incorporated into the public open spaces

7.3 HYDROLOGICAL CHARACTERISTICS

7.3.1 RIVERS

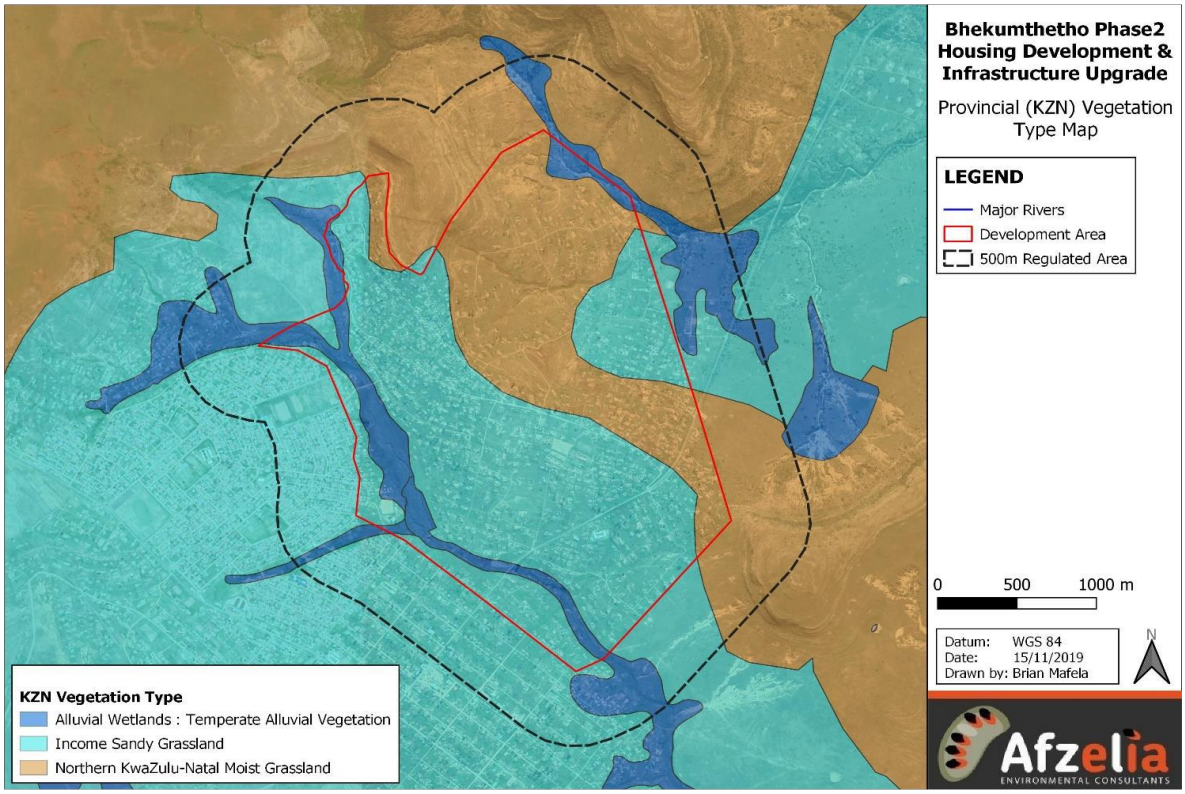
The site has two rivers and a few drainage lines that cut across. A perennial channeled watercourse traverses along the western boundary, while another set of valley systems occur on the northern eastern corner of the site. These have been identified and delineated by the Wetland and ecological studies undertaken. Figure 6, presents a map of the site, in the context of hydrological features within the boundary of the proposed site. These are also further presented and discussed in the attached Wetland delineation and assessment report in Appendix 2.

7.3.2 WETLANDS

A wetland is defined, by the National Water Resources Act (Act 36 of 1998) as:

> *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil"*

The wetland studies conducted on the site identified the main wetland areas associate with the river systems. These are properly delineated and are shown on Figure 8. One of such typical wetland areas is also shown in the photograph in Figure 7.



From the preliminary layout, these wetlands have been taken into consideration. However, the protection of these need to be considered in the impact assessment section and in the Environmental Management Plan. Other recommendations made in the wetland report also will assist in mitigating any potential impacts.

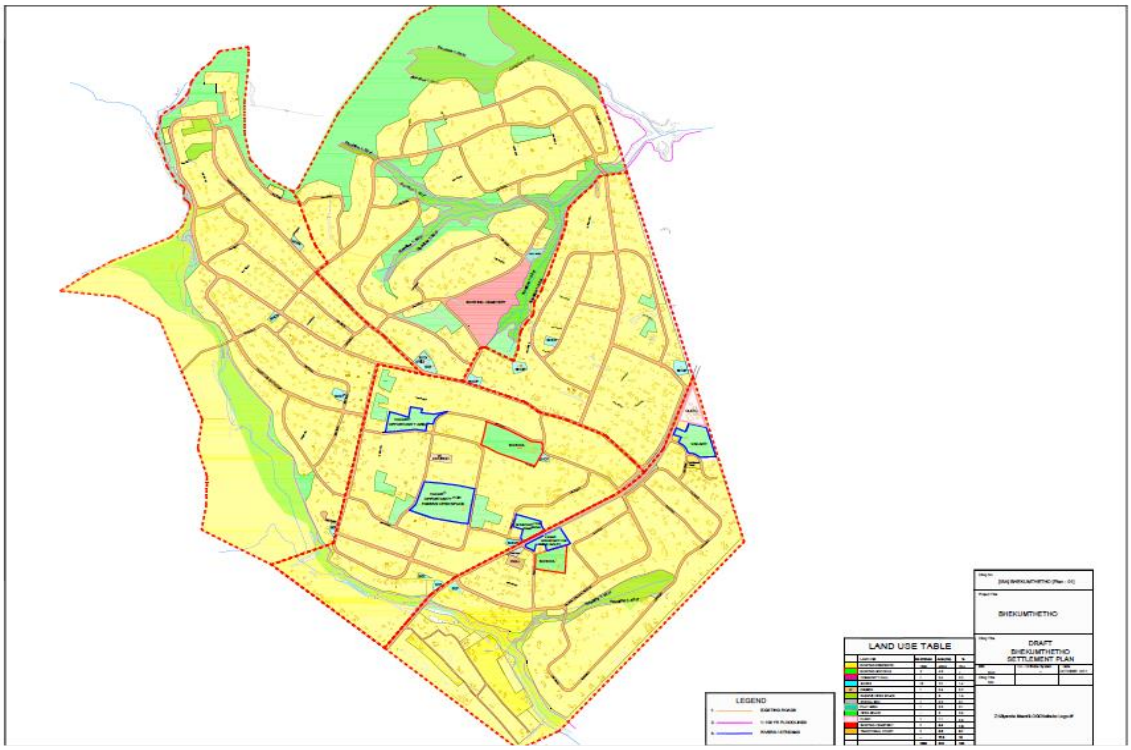


Figure 6 sensitive hydrological corridors within the development footprint

7.4 CURRENT AND COMPETING LAND USES

The current land use pattern in Bhekumthetho has evolved in response to the settlements pattern, the natural environment and the regional access routes. It is also reflects the nature of the region within which Abaqulusi Municipality is located. The main land use categories in the area include settlements, farmlands; conservation; and other miscellaneous uses. No other alternative land use was put forward as at the time of conducting this study.

7.5 CURRENT ZONING

The site has been planned for residential establishment. It was then referred to as a medium to low density residential establishment site.

7.6 EXISTING INFRASTRUCTURE AND SERVICES

7.6.1 ROADS ENERGY AND WATER

Currently the community is be provided with basic infrastructure and services, such as, water and electricity. However the adequacy of these requires further investigation and confirmation, in relation to the volume of residential units or population to be added to this section of the town. Given the intention is to upgrade the existing community, the upgrade of the proposed services may adequately address the water needs of the community.

7.6.2 Water supply

Bulk water supply is available in the community. Both bulk and reticulation infrastructure is provided. This development however noted the inadequacy of the supply to some areas. It is therefore proposed that more reticulation will be provided to extend the service to all households.

7.6.3 SANITATION FACILITIES

The community is currently provided with lined pit latrines, provided as part of the Zululand Municipality's sanitation development project (Engineering Report). The adequacy of this

however requires further investigation, given the topographical and hydrological sensitive nature of some of the areas. An appropriate sanitation infrastructure is thus required and this development offers an opportunity to put in these serivces. It is envisaged that the reticulation system will also address the sanitation needs of the community adequately.

7.7 THE SOCIO-ECONOMIC ENVIRONMENT

7.7.1 EDUCATION, HEALTH AND EMPLOYMENT

The proposed site is situated within the existing urban community of Bhekumthetho which has been provided with basic services such as educational facilities and clinic. It is unlikely that there would be a significant change in the demand for educational facilities in the area than it is now.

7.7.2 WASTE MANAGEMENT AND DISPOSAL

It is noted that the onus of waste removal lies with the local municipality. This service was noted to be impeded due to the fact that the phase one of the development was lodged as "rural" housing development, without the formalisation an improvement of the road network. Now that internal roads and the entire roads network is to be improved, it should be possible for the local municipality to include waste removal services in its plans, whether to be done within the municipal resources or to the outsourced is to be decided. The improvement of the roads network will form a foundation for such other services to be provided.

7.8 HERITAGE AND ARCHAELOGICAL CHARACTERISTIS

The area does not reveal any site or landmarks of provincial or national significance. However, one of dominant cultural materials that need to be noted are the graves. It is known that communities are invariably culturally attached to burial sites due to various cultural beliefs. Potential disturbances of these sites could results in social and cultural conflicts. Location of all cultural materials and other materials of heritage significance should be determined prior to or during the planning of developments. It is noted in the precinct plan that the current cemetery in the community is located within the residential areas and is currently running out of space. The location and extend of this cemetery may need to be carefully demarcated to avoid any

social conflicts. Otherwise, being an insitu upgrade, and with the community involved, it is unlikely that such areas will be disturbed.

AMAFA Kwazulu Natal needs to be the key stakeholder in all developments planning processes. A heritage impact studies may need to be undertaken to establish archaeological facts about the site and to confirm the heritage potential of the site during the EIA phase of the planning process.

IMPACT IDENTIFICATION AND ASSESSMENT

7.9 IMPACT ASSESSMENT AND RATING CRITERIA /FRAMEWORK

The impacts identified have been assessed and rated based on the rating criteria outlined by the Department of Environmental Affairs, as per the guideline documents to the EIA regulations (1998) as amended. This took into consideration the extent, duration, magnitude and probability of the impact occurring, in arriving at the overall significance of the identified impact. Below is a description the methodology utilized in ranking the identified impacts**.**

ASPECT	SCORE/DESCRIPTION	IMPLICATION
(a) Status		Negative impact i.e. at cost to the environment)
		Positive impact i.e. at benefit to the environment
		Neutral effect
(b) Extent	1 Site	Within the boundaries of the site
	2 Local area	Within 10km of the site
	3 Municipal Area	Within the Waterberg District Municipality and areas less than 100km
	4 Regional	Within the Province of Limpopo (or neighbouring Mpumalanga)
	5 National	South Africa
	6 international	Southern Africa

(c) Duration	1 Immediate / temporal	- < 1 year
	2 Short Term	1 – 5 years
	3 Medium term	6 -15 years
	4 Long term	The impact will cease when the operation stops
	5 Permanent	No mitigation measure will reduce the impact after construction
(d) Magnitude	0 None	Where the aspect will have no impact on the environment
	2 Minor	Where the effects of the environment is in such a way that natural, cultural and social functions or processes are not affected
	4 Low	Where the effects of the environment in such a way that natural, cultural and social functions or processes are slightly affected
	6 Moderate	Where the effects of the environment in such a way that natural, cultural and social functions or processes continue but in a modified way
	8 High	natural, cultural and social functions or processes are altered in such a way that they will temporarily cease or operate in a different ways from usual for the duration of the activity
	10 Very high	natural, cultural and social functions or processes will cease or be altered permanently

(e) Possibility of resulting in Irreplaceable loss of resources	0 Very Low	Will not result in any irreversible or irreplaceable loss in resources
	1 Low	Likely to result is preventable and localized loss to resources
	2 Moderate	Most likely to cause loss if the project is implemented but can be moderately mitigated or avoided.
	3 High	Highly likely to cause long term loss as long as the project remains but can be reverted after decommissioning
	4 Very High	Will result in Permanent loss to resources
	6 Extremely High	Southern Africa and beyond (international)
(f) Probability of occurrence	0 None	Impact will not occur
	0.1 Improbable	Possibility of the impact materializing is very low as a result of design, historic experience or by virtue of implementation of adequate mitigation measures.
	0.25 Possible but unlikely	The is moderate chance that the impact will occur
	0.5 Probable	Impact may occur
	0.75 Highly probable	Occurrence is most likely
	1 Definite / unknown	The impact will occur regardless of the implementation of preventive or corrective actions, or where the probability that the impact will occur is unknown due to lack of information

(g) Significance weighting of the impact (S)

From the above descriptions, the potential impacts are assigned a significance weighting (S). This weighting is arrived at by adding the assigned scores of the extent (E), duration (D), possibility to cause Irreplaceable Loss of Resources (I) and magnitude (M) and multiplying the sum by the probability score (P).

Thus: S = (E+D+M+I) x P

The overall significance weightings scores are categorized below:

SCORE	**Description**	**Interpretation**	**Colour Code**
≤ 2	Very Low		
2-5	Low		
5-10	Medium		
11 - ≤16	High		
	Positive		
	Negative		
	Positively High		

7.10 DESCRIPTION OF IMPACTS IDENTIFIED

IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

In terms of the criteria for identifying potential project impacts, it is important to list the potential direct, indirect and cumulative property/activity/design/technology/operational alternative related impacts (as appropriate) that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning and closure phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed.

For this proposed development at Bhekumthetho, the anticipated impacts associated with the proposed development have been identified and analysed using the mixed method approach. This includes site visits, consultation or interaction with key stakeholders, consultation of secondary information or literature, and independent assessment by the project environmental personnel and project officials. Direct impacts that may result from the proposed development include impacts on the biophysical environment, from construction activities such as site clearing, digging, building and installations of reticulation infrastructure.

Social impacts include, employment and business opportunities that may open up to the local and neighbouring communities as well as satisfaction that may be derived from the upgrade in the community's outlook. Other impacts may result from the operational stages of the development. The list below includes the potential identified impacts of the proposed development.

Some of these impacts may occur at the various stages but with different intensities and extent, and significance. These are assessed in relation to the various stages of the development, specifically construction and operational stages. It is noted that no decommissioning is envisaged in the proposed activities of this development. From this context, no decommissioning impacts are identified.

Construction stage Impacts

Direct impacts

1) Potential loss of biodiversity during construction stage, due to vegetation especially along the drainage lines
2) The loss of riparian vegetation
3) Impacts on Fauna
4) Noise impacts
5) Dust generation and Air pollution
6) Possible water pollution / Surface runoff /Stormwater pollution
7) Soil disturbance and possible erosion activities
8) Heritage/Cultural /historical surface sites
9) Visual /aesthetic view disruption
10) Hydrocarbon (oil) Spills
11) Traffic generation and disruption in normal community life
12) Health and Safety issues
13) Job Creation

Indirect / cumulative Impacts

14) Improvement in the livelihood of local community members
15) Potential impacts on local services
16) Assistance in the stimulation of local economy
17) Potential contamination from improper waste management

Operational Stage Impacts

1) Noise
2) Water pollution /watercourses
3) Soil and wetland disturbance and erosion activities
4) Dust and air pollution issues
5) Stormwater Management
6) Job creation
7) Visual and aesthetic impacts

8) Traffic issues
9) Health & Safety Issues
10) Impacts on local services
11) Benefits to the community.

7.11 CONSTRUCTIONAL STAGE

7.11.1 SUMMARY RATING OF POTENTIAL IMPACTS AND THEIR RATINGS ALTERNATIVE A (PREFERRED ALTERNATIVE)

	Impact	Mitigation Required	Nature of Impact	Extent	Duration	Magnitude	Irreplaceable Loss of resources	Probability	Significance Score	
	CONSTRUCTION STAGE									
1	Potential disturbance of wetland and riparian areas	Yes		1	5	6	4	0,50	**7,5**	
2	Loss of indigenous vegetation (Flora Impacts)	Yes		1	5	5	4	0,5	**7,5**	
3	Impact on fauna	Yes		2	5	4	0	0,25	**2,75**	
4	Noise Impacts	Yes		2	1	6	0	0,75	**6,75**	
5	Dust / Air Pollution	Yes		3	2	4	0	0,75	**6,75**	
6	Water Pollution/Surface runoff/Stormwater pollution	Yes		1	2	8	4	1	**15**	
7	Soil disturbances and possible degradation	None Required		3	2	6	0	1	**11**	
8	Cultural or historical surface sites	Yes		1	4	5	0	0,25	**2,5**	
9	Visual / Aesthetic impact	Yes		1	2	2	2	0,5	**3,5**	
10	Hydrocarbon Spills	Yes		2	1	8	2	0,5	**6,5**	
11	Traffic	Yes		2	2	4	0	0,5	**4**	
12	Health & Safety issues	Yes		2	2	6	0	0,5	**5**	
13	Job Creation	None required		3	2	6	0	0,75	**8,25**	

14	Improvement in livelihood of local community	None required		3	2	6	0	0,75	**8,25**	
15	Impact on Local services	Yes		3	2	4	0	0,5	**4,5**	
16	Benefits to local economy stimulation	None required		2	2	6	0	0,5	**5**	
17	Potential contamination from improper waste management	None required		2	2	6	1	0,5	**5,5**	
									93,5	
	Mean Significance Rating								**5,84375**	

7.11.2 DETAIL SIGNIFICANCE RATING OF IDENTIFIED IMPACTS

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Potential loss of critical biodiversity/habitat • The community to be upgraded is an existing settlement. The existence of areas of high biodiversity integrity to accommodate critical habitats is very limited to mostly the riparian zones. These are mainly located along the drainage lines and streams within the area on the western and northern outskirts of the community. These areas may be home to several, (including microscopic aquatic) organisms. • Roadworks across the drainage lines may be potential activity that me	7.5 =moderately High	• Though site does not constitute a high biodiversity zone, most of the vacant portions especially along the riparian areas have relatively good land cover and sensitive corridors. Vegetation removal should be restricted to only what is necessary to accommodate the proposed development. These areas need to be incorporated in the open space plan of the community and considered no-development zones. • During construction period, it	Moderate to Low	• Should the vegetation removal be extended to areas not covered by the additional infrastructure, these areas might be left bare and become susceptible to erosion activities and land degradation. • Unnecessary encroachment on the riparian zones may lead to degradation of wetlands, and disturbance of aquatic life in those areas.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
disturb the watercourses if care is not taken.		is important to demarcate these areas off, to reduce any incidents of encroachment • Any work within wetlands, or their buffers need to be done with care to not disturb the wetlands. Where it is impossible to avoid working within the wetlands, any disturbance E.G digging trenches or water diversions should be immediately rehabilitation after that section is completed. • Rehabilitation plan should be submitted to the Engineer and		

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
•		ECO for approval, and the ECO should audit / inspect post rehabilitation to ensure proper rehabilitation is undertaken and to satisfaction. •		•
• Loss of indigenous vegetation • Most of the indigenous vegetation in the community have been severely	7,5=Mediu	• Vegetation removal should be restricted to only the development footprint.	Low	• Should the vegetation removal be undertaken in areas other than the

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
degraded. The most significant indigenous vegetation remains along the riparian corridors. These are mainly within the valley lines and along the streams. • Disturbance of these surface cover, may pave the ways for alien encroachment. Any increase in alien encroachment may lead to loss of any pieces of indigenous vegetation in the area.	m	• It is important that all the areas identified as riparian zones be excluded from active development to maintain the integrity of such areas. • All areas that may be left bare during construction should be rehabilitated immediately with suitable vegetation (and approved by ECO and site Engineer) to avoid any alien species encroachment. This must be monitored during construction and post construction.		development footprint, more land cover or grassland on the underdeveloped and uncultivated are will be lost unnecessarily. • If all recommendations are adhered to, and monitoring of construction is strictly done, these issues should be avoided, bringing the potential impact to moderate to low.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Impact on fauna • The area is settled community, hence the presence of any significant fauna, other than domestic animals and few birds are present in the area. • In view of this, impact on fauna is expected to be very minimal. Limited impacts may occur in the form of noise from machinery but this is not expected to significantly disturb any fauna significantly.	2.75 = Low	• Machinery with low noise levels to be used. • Site activities will be conducted during daytime hours to avoid night time noise disturbances. • .	Low	• This impact is expected to be limited, given that the community is an existing one, and with the current density, so significant fauna is expected other than riparian organisms. • If the riparian areas are not preserved, disturbances may occur. Excessively laud noises from machines, may be nuisance to the environment.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Noise • Construction stage noise will consist of noise and vibrations by vehicles moving materials and also construction workers. This is likely to cause some irritation to nearby households.	6,75 = Medium	• Machinery should be kept in good working order to reduce noise emission. Noise reduction mechanisms should be equipped if necessary. • The construction activities should be restricted to normal working hours and during the day.	Low	• Should the mitigation not be implemented, for instance where work is carried out into the night, then the nearby households may get irritated.
• Dust / Air pollution • Air pollution during the construction stage is likely to stem from dust and perhaps fumes and noise from vehicles.	6.75 = medium	• Clearance of the site vegetation should be kept to a minimum, and uncovered soil should be kept moist to avoid dust generation.	Low	• Polluted air, from dust and fumes or other sources is likely to be a nuisance to the community members. This may also pose a health risk if not mitigated.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• The air pollution will affect the employees and surrounding community. However this air pollution can be controlled or mitigated		• Construction vehicles and machinery utilised on site should be maintained and always be kept in good working order. • Protective construction gears should be worn on dust days, and watering should be applied where necessary.		
• Underground water • There is also the Possibility of contamination of underground water as a results of soil pollution due to the usage of hazardous substance on the	15 = High	• Equipment or tools with oil or grease is not allowed to be placed on bare ground. • These must always be placed on a lined surface. Cement mixing will take place on a	Low	• Inappropriate handling of waste and hazardous substance on the site can reduce the quality of underground water

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
site. • Mixing of cement and striped soils may pave the ways for siltation into underground water, especially on rainy days during the construction phase. • Surface runoff pollution • Impact on surface water may be as a result of uncontrolled waste handling, including stockpiles.		lined surface. No Cement will be mixed on a bare surface.		
		• Stockpiles of rubble and topsoil should not be left piled for more than a reasonable time, as may be stipulated in the EMP, but generally not more than 14 days on site. These should be recycled where possible.	Low	• Should there be no mitigation measures, possibility of storm water pollution during constructionism likely to result. This however, is likely to be localized.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Storm water management • Given the proposed development regards the removal of land cover, the potential to create more hardened surfaces is eminent. Storm water acceleration and localised ponding is likely to occur. In addition, spillage and waste could be other sources of pollution of storm water. This may lead to contamination of water bodies and underground water.		• A storm water management system, in terms of the National Building regulations needs to be implemented by the contracture in the building of the structures. Onsite, drainage systems will be provided. In addition, a stormwater management plan should be designed and approved by the engineer prior to the commencement of construction works on the site.	Very Low	• Should no mitigation be implemented, this may constitute poor stormwater management which may result in Issues such as localized ponding, sedimentation, erosion and pollution among other things.
• Soil disturbance/erosion	11=High	• Cleared areas will be mostly	medium	• Should the mitigation measures not be

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• The proposed activity will result in the vegetation clearance, soil removal, which decreases soil stability and lead to loss of soil resources by erosion, contamination and sterilisation. • Soil degradation will also cause an indirect impact on the loss of micro habitats. • Soils that are left bare and rehabilitated, may become susceptible to erosion activities. It is noted that some areas within the drainage already shows signs of severe erosion occurring. Further removal of land cover without any		occupied by residential units. • In the case of areas cleared for pipes and other reticulation work, these need to be revegetated with indigenous vegetation following construction activities, and all excavations will be backfilled with sub soil and top soil in the reverse order to which the soil profiles were removed. • All visible weeds should be removed from top soil and placement area before replacing top soil.		implemented, and then there is possibility of the impacts discussed occurring. There will also be additional impacts including air pollution by dust as results of diggings and top soil removal, and soil erosion will be high given the fact that soil will be left bare exposed to wind and rain.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		• Contaminated soil by spills should be removed and disposed of as hazardous waste at a licensed hazardous landfill facility.		
• Cultural and Historical surface sites • Given the fact that no critical heritage sites were readily identified within the site, or within its environs, the impact on such features is likely to be insignificant. • The most significant cultural site is the cemetery within the community. This needs to be carefully protected during construction to ensure no	2,5=Low	• The boundary of the cemetery should be fenced off, prior to construction activities occurring. • If any additional cultural or historical features discovered during the construction, the construction must stop immediately and the remaining must be reported	Very low	• The risk of the impact and mitigation not being implemented include loss or damage of cultural or historical features.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
disturbances are caused.		to the AMAFA KwaZulu-Natali		
• Visual / Aesthetic Impacts • Visual impacts are likely to emanate from construction activities such as storage of materials, and neglected excavations. • Construction of roads may also result in considerable altering of the current looks of the areas along such footprints.	3.5=Medium	• Material storage during operations should be done at designated areas, in order not to constitute any aesthetic nuisance. • Soil stockpiling and excavations should be worked on and the areas restored within reasonable time frames, to reduce the length of visual impacts. • Roadworks should be	low	• Visual Impacts is most likely to occur if mitigations are not considered which will disturb the eyes and mind of the community. This may cause nuisance also to road users etc.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		undertaken according to construction standards, and no unnecessary blockings and erecting of structures should occur. Where such are necessary, they should be removed as soon as work is complete in that area. Visual friendly materials should be used in all cases.		
• Hydrocarbon spill/fuel • Oil and fuel leaks and spills from construction vehicles is highly possible during construction phase.	6.5 = medium	• Mitigation measures for this kind of risk includes prevention and management. Ideally, the spillage of such oils and fuels should be	low	• If all the mitigation measures are implemented, the impact should remain low. However should this not be the case the risk of potential

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
This is likely to contaminate storm water and also source possible contamination or pollution of the soil, if not properly managed or prevented.		prevented at all cost. • But where any of such incidents occur, prompt remedial actions should be taken. Examples of which include cutting the site and disposing appropriately, say in a registered landfill. • Where necessary all vehicles suspected with leakages should be undersealed with drip pans. • Fuels and petroleum product storage should be undertaken and sealed hard surfaces,		contamination is high. This may lead to contamination of underground water, soil pollution and disturbance of the bio-equilibrium among other negative effects

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		which are possibly lined, to prevent any dripping into the soil and grass. • All foremen of operators of such vehicles should be educated on this, and the vehicles should be well maintained and checked regularly for any such leakages. The health and safety rules as stipulated by the department of health should be well enforced during the construction and operational faces.		

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Traffic • Traffic during construction stage is likely to stem from the construction vehicles moving materials to and from the site, via the existing road networks and also the blocking of some roads, of lanes for construction work on such roads. • This may cause some inconvenience to local residents. However, this is likely to be minimal given that the site can be accessed via different routes.	4=Low	• Traffic control officers should be appointed to control the flow of traffic on the road to avoid such inconvenience. • This kind of inconvenience can also be avoided by using alternative routes and proper planning of road diversions is necessary. • Road closures and diversions and traffic disruption should be avoided as much as possible, and where such are necessary, should be within minimal durations to allow	Very low	• If the mitigation measures are not implemented, there will be a high chance of unnecessary traffic disruption.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		normal flow of traffic. • Proper signage should company any planned roadworks, and disruption of traffic		
• Health & Safety • The movement of machinery, storage of materials, and excavations are possible sources of safety issues during construction stage. • Neglect to any health and safety measures may result in injury to both workers and any other persons who may find themselves on this site. This	5 =Low	• The risks of accidents and injury can be minimized by the implementation of safety procedures. Proper health and safety measures should be put in place during the implementation of the proposed development. • Health and safety plan should be prepared and approved by	Very low	• Should these mitigation measures not put in place, these may constitute violation of the health and safety regulations. This may also leave workers exposed to all kinds of risks. Should any incident occur, this may leady to prolonged waiting for help, which may lead to loss of property for, instance

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
requires a strict enforcement of the national health and safety regulations pertaining to construction sites.		the engineer prior to construction. The Occupational health and safety procedures as outlined by the department of Health should be put in place prior to the commencement of work. Safety equipment such as fire extinguishers, • First Aid boxes, and other safety appliances should be readily available and administered by a trained safety officer. • Proper safety measures also need to be implemented with		in the case of fire.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		areas of dug trenches barricaded off.		
• Job creation • The construction phase of the proposed development is likely to create temporary additional jobs for the local area. Jobs will be created during construction as labours, masons and other workers may be required. • This is likely to impact positively on the local economy as more people getting employment may spiral some level of livelihood improvement	8.5 =medium	• No mitigation is required	High	• N/A

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Improvement in livelihood of local community • The temporal income generated may contribute to household life improvement in the short term. • In the long term however, local people will gain skills that will help them on their future and they will stand a better chance of being hired when the development of this kind happens again.	8,5=Medium	• None required	Medium	• N/A

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Impact on Local services • Given that the development includes an upgrade of the existing community, most of the local services such as water and electricity resources are expected to aid the development process. • Also some services such as road usage and water connections may be disrupted temporarily during construction.	4.5 = Low	• Given the proposed technology that involve mostly manual or human labour and auto-powered machines and construction vehicles, the impact is expected to be low. • Any disruption in services, should be preceded with ample and adequate notifications of the affected areas. • Services should be restored within the shortest possible time.	Low	• Disruption in services without adequate notification may be a source of irritation for affected community. However, with proper mitigation measures, these should be mitigated.

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
• Benefits to local Economy • The spill over of the construction stage employment and sourcing of materials from local suppliers will go a long way in providing socio-economic benefit to the community as a whole. • More income in the pocket of community members means, more purchasing power, leading to the stirring of economic acidity in the local economy. • In addition, access and improvement of bus routes will also empower easy	5=Medium	• None required	Medium	• N/A

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
movements within the community making people go about their daily business with much ease, thereby improving efficiency of any existing economic activities.				
• Potential Contamination from improper waste management	5 = medium	•		•
•		•		•
•		•		•
•		•		•

• POTENTIAL IMPACTS	1 SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE)	• PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	• RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
•		•		•

7.12 OPERATIONAL STAGE

7.12.1 SUMMARY OF POTENTIAL IMPACTS AND THEIR RATINGS

	OPERATIONAL STAGE								

	Impact	Mitigation Required	Nature of Impact	Extent	Duration	Magnitude	Irreplaceable Loss of resources	Probability	Significance Score
1	Noise	Yes		1	1	2	0	0,25	1
2	Water pollution (water courses)	Yes		3	4	4	1	0,25	3
3	Soil disturbance /Erosion	Yes		1	1	4	1	0,5	3,5
4	Air Pollution	Yes		2	3	2	1	0,5	4
5	Stormwater management	Yes		3	2	6	1	0,25	3
6	Job Creation	None Required		3	4	6	0	0,5	6,5
7	Visual / Aesthetic impact	Yes		1	4	0	0	0,5	2,5
8	Traffic	Yes		2	1	4	0	0,5	3,5
9	Safety	Yes		1	2	4	0	0,5	3,5
10	Impact on Local services	Yes		3	4	4	0	0,5	5,5
11	Benefits to local economy	None Required		4	4	6	0	0,5	7
									43
	Mean impact rating								**3,909090909**

7.12.2 DETAILS OF IMPACT ASSESSMENTS AT OPERATIONAL PHASE PROPOSAL (PREFFERED ALTERNATIVE)

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT** AND **MITIGATION NOT BEING IMPLEMENTED**

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT** AND **MITIGATION NOT BEING IMPLEMENTED**
1. Noise Noise levels are likely to be back to normal during the operational stage. Given that no additional people from outside the existing community will be moved into the community, and also that not noisy installations are expected as part of this development, noise levels are expected to be at normal levels for the community.	**Score 1 = Low**	No mitigation required for noise during operational stage as life would have returned to normal as construction machines would have been withdrawn.	**Low**	None mitigation hence required.
2. Water pollution (water courses) • During operational stage, the handling of waste and other chemicals such as disinfectants could be possible sources of surface water pollutions. • Improper stormwater management may result in contamination of surface water and siltation and	**Score 3** **Low**	• Waste management should be included in the responsibilities of the local authority and carried out regularly to avoid any contamination of the	Low	Should there be no mitigation measures; possibility of stormwater pollution during the operation is likely to result. This is likely to be localized. Local water systems and drainage systems may be contaminated if not properly managed.

POTENTIAL IMPACTS:	SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):	PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
subsequent blocking of drains and disturbances of watercourses.		environment. . • Given the improvement in road network, it is expected that waste management services will also improve.		
3. Soil disturbance /Erosion At operational stages, potential disturbances to the soil are likely to stem from the areas left bare from construction stage, not rehabilitated. These if not properly monitored and attended to may be prone to erosion activities. Soil erosion activities may cause degradation in the land if not checked in time.	**Moderate 3.5**	Striped surfaces should be utilized immediately. Stormwater management mechanisms need to be put in place to reduce or attenuate the possible effects of surface runoff. Land cover within the open spaces an riparian zones should be maintained to serve as a reduction mechanism for	Low	Should the mitigation measures not be implemented, and then there is possibility of the impacts discussed occurring. What could happen will be ponding and also or stagnation if the bare land is left for a longer time without any mitigation measures. Erosion may also occur as a result of improper discharge of stormwater.

POTENTIAL IMPACTS:	SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):	PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
		surface runoff.		
4. Air Pollution Possible pollution sources during the operational phase may stem from waste left uncollected and on any unpaved roads within the area, generating dust.	**Low 4**	Speed regulating mechanisms should be applied on any unpaved roads, in such a way that reduces any potential dust generation. Waste collection as emphasised in the previous sections, should be regularly carried out by the local authority.	Low 5	The identified impacts may occur, should no long term mitigation measures not be put in place. People may have unrests and discomfort from such impacts.
5. Storm water management • Given the proposed development regards the removal the land cover, the potential to create more hardened surfaces is eminent. Stormwater	**Score 3** **Medium**	• A stormwater management system, in terms of the National Building regulations needs	**Low 6**	• Should no mitigation be implemented, this may constitute poor stormwater management which may result in Issus such as localized

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED**
acceleration and localised ponding is likely to occur. In addition, spillage and waste could be other sources of pollution of storm water. This may lead to contamination of water surface bodies and underground water.		to be implemented. Onsite, drainage systems will be provided. • In addition, a stormwater management plan should be designed and approved by the engineer prior to the commencement of construction works on the site. • Proper stormwater discharge points should be identified and implemented as part of the stormwater		ponding, sedimentation, erosion and pollution among other things.

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT** AND **MITIGATION NOT BEING IMPLEMENTED**
		channelling mechanism.		
6. Job Creation Both the construction and operational phases of the proposed development are likely to create additional jobs for the local community. Jobs will be created during construction as labours, masons and other workers may be required. Operational phase of the development may however see fewer jobs. Potential jobs may include maintenance staff and skilled labour work such as engineers overseeing and monitoring operation of services. Waste collection is also likely to generate some form of job avenues for some local community	**6.5Medium**	**N/A**		Should the development no be implemented, then the iterated or envisaged positive impacts are not likely to occur.

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED**
members.				
7. Visual impact At operational stage, visual impacts are expected to normalise. The new structures should have interested into the new view of the area and become the new reality. • Aesthetic view or the new view of the community is rather expected to improve, as new residential structures are put in, and roads are well structured and well formalised.	**2.5 = Low**	Any materials left during construction should be cleared, as part of site closure, before contractors leave site. Waste should be organised in such a way to reduce any aesthetic nuisance. Waste storage sites should be properly designated during operation to ensure minimal aesthetic discomfort to community members.	**Very low**	Aesthetic or visual impacts are expected to normalize drastically during operation if all care is taken during stockpiling of materials and waste.
8. Traffic • Traffic during operation may be from vehicles	**3.5 =**	• Proper signage should be applied, to ensure most	•	• Improper signage and traffic control measures such as speed limits may

POTENTIAL IMPACTS:	SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):	PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
moving goods to and fro the farm. Traffic should return to normal and rather improved, with additional and improved road network systems.	**Moderate**	efficient traffic situation during operational stage of eh development.		result in traffic situations, inconvenience and in some cases possible accidents**.**
9. Safety Safety during operation should improve significantly, now that services are improved, and houses are well demarcated, people can fence their houses and put in other safety measures. Improvement in the road network should improve safety in terms of traffic issues and accidents, if proper and traffic calming measures are implemented.	**3.5 Low**	Traffic calming measures should be implemented on road networks, accompanied by proper signage.	4 Very Low	
10. Impact on Local services Local services, should improve significantly during operational stages. Residential unites would've	**5.5 = Medium**	Potential impacts on local services during operation are expected to be rather		

POTENTIAL IMPACTS:	SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):	PROPOSED MITIGATION:	SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:	RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED
been upgraded, and water and sanitation services provided. Road networks would have improved also. Also as more parts of the community are accessible, other additional services such as emergency and security services such as police, services can now access the various parts of the community to deliver valuable services.		positive, if services such as waste and stormwater management are handled efficiently.		
11. Improvement in livelihood of local Economy • At operational stage, the improvement in the local economy would stem from the improvement in services to the community. for instance, water connection will be readily available for domestic and commercial activities. • Improvement in road networks, mean people can go about their daily duties with much easy. Cumulative	**6 = Medium**	None required	**NA**	**NA**

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT** AND **MITIGATION NOT BEING IMPLEMENTED**
effect of all these improvements is expected to stimulate the local economy, though indirectly.				

7.13 NO GO ALTERNATIVE

Potential impacts:	**Significance rating of impacts (positive or negative):**	**Proposed mitigation:**	**Significance rating of impacts after**	**Risk of the impact** and **mitigation not being implemented**

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT** AND **MITIGATION NOT BEING IMPLEMENTED**
			mitigation:	
The impacts of no go alternative are most likely to be felt from a socio economic development perspective. No go alternative, may imply that the community remain with the current issues of poor services. The envisaged job creations and economic stimulation may also not occur. All possible employment opportunities that are likely to arise from the proposed development construction and operational stages will be lost, or at least stunted. Socio economic benefits of the proposed development	**Moderately High**	Mitigation for this impact, is to find ways of implementing this development as planned, in an environmentally friendly and responsible manner, adhering to all legislations and guidelines as well as recommendations of this assessment.	Low	Should the mitigation not be implemented, then the issues described in the impacts section will continue as they currently are. More service delivery protests may rather occur. Also there may be dissatisfaction and conflict within the community as some residential unit hopefuls would have been denied houses, leading to social conflicts.

POTENTIAL IMPACTS:	**SIGNIFICANCE RATING OF IMPACTS (POSITIVE OR NEGATIVE):**	**PROPOSED MITIGATION:**	**SIGNIFICANCE RATING OF IMPACTS AFTER MITIGATION:**	**RISK OF THE IMPACT AND MITIGATION NOT BEING IMPLEMENTED**
to the community are also likely to be lost. A no go alternative however; will keep the environment the way it currently is. Possible construction stage impacts as well may be avoided. Production levels will remain same, or increase gradually.				

The purpose of this is to provide an overview of the assessment undertaken, taking the assessment of potential impacts into account, to give an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

The impact assessment and significance rating shows that the construction state impacts and operational stage impacts are of medium significance. Construction stage impacts at an overall mean of 6.64, which is Medium, while operational stage impacts have a mean of 3.9, which are considered low. If all the proposed mitigation are implemented, these impacts should be reduced further.

Alternative A (preferred alternative) _ The Proposal

Biophysical environment

It is noted that the development is an in-situ upgrade of service infrastructure within the existing community. Most of the vegetation on the site is already largely degraded. Only patches of grasslands remain on the open spaces and at along the valley lines. These however, act as flood attenuation mechanisms and protection against erosion which is noted to be a problem currently for the community. The proposed development will result in the clearing of landcover where it exists on the proposed site for the construction of houses and service infrastructure such as roads, and water reticulation. The clearing of vegetation is likely to result in the exposing the land and possible surface runoff pollution. This can be mitigated by implementing appropriate stormwater management strategies, including proper channelling of the stormwater during construction and operational phases. The upgrading of roads infrastructure including stormwater channels will help address some of the issues with stormwater management including flooding and erosion.

Construction stage impacts on any wetland crossings can be mitigated by immediate rehabilitation of such areas after any excavations and pipe laying.

Other impacts that were identified, for the construction phase are noted to be mitigatable. Noise and dust, and oil spillage can be mitigated by avoiding and managing the occurrences. Impacts during the construction stage may be short term and may end when construction is completed.

Operational stage impacts on the natural environment can also be mitigated if proper strategies are put in place. The possibility of mitigating these impacts reduces their significant

levels considerably, to low significance. The neglect of mitigation measures, such as waste management could result in severe health hazards. This therefore infers the need to take the recommendations made herein and in all applicable regulations and guidelines seriously.

A synoptic view of the environment in terms of biodiversity, on the physical site and relevant biodiversity literature and databases and as assessed herein, indicated the critical biodiversity features are located within the outskirts of the site, but the potential impacts on these are rated to be low (refer to wetland report) within the development boundaries or within the immediate environments. It is therefore concluded that the development as proposed, may not impact significantly on these biodiversity resources, given the type of development proposed being in-situ-upgrade of the already disturbed areas.

Socio economic impacts during the construction stage will include employment opportunities, for both labours and suppliers of construction materials. The spiral effect of these will contribute to the improvement of economic activities during this period.

During operational stage, few people are likely to be employed on permanent basis, like in waste collection and maintenance services of the municipality. This may reduce the unemployment in the area further, and also bring improvement in livelihoods of the local community.

From this assessment, it is observed that most of the negative impacts can be readily mitigated. Also, the positive impacts from the proposed development outweigh the identified negatives (if properly mitigated). A no go alternative may therefore be unwarranted, given the absence of fatal flaws with the proposed development on this farm.

No-go alternative (compulsory)

The No-development option will mean that the anticipated effects of impacts of the development will not occur. All the envisaged construction stage impacts, such as dust, noise and so forth will not occur as a result of the proposed development. Given that portions of the farm are being ploughed for crop production, the activities of noise and dust may still occur at those times where these activities are being carried out.

In addition, even though the removal of land cover may not occur as a result of development, if a no-go alternation is the case, some form of degradation may still occur, as the community expands in an uncontrolled manner, without proper infrastructure to management potential impacts.

Road networks may still be improperly designed, and some parts of the community may not have proper access. Emergency services may not have access to vital areas of the community.

From a socio-economic perspective, the no-development option may rather avert the potential economic benefits that were envisaged. From this perspective, it can be asserted that the potential positive impact far outweigh the envisaged negative impacts, hence a no-go alternative may not be necessary.

9 RECOMMENDATIONS

From this assessment of the biophysical environment, given that there are no fatal flaws that will hinder the proposed development it is concluded that the proposed development is feasible. The specialist studies undertaken to assess the potential impacts on wetlands and sensitive ecological areas also concludes that the potential impacts are low (refer to wetland report). The proposed development is possible as long as all impacts are duly mitigated as proposed. In addition, the following recommendations are provided:

- It is recommended that the mitigation measures suggested in this report herein be taken seriously and considered during the implementation of the proposed development to minimize the effects of the identified impacts.
- Wetland areas along the rivers and bridge and their buffer zones should be excluded from the proposed development as much as possible.
- Any of those wetland areas that may be disturbed in any way for excavations and piping's should be rehabilitated immediately to avoid losing wetland functionality.
- It is important that an independent environmental control officer be appointed to monitor the construction activities, in terms of the EIA regulations requirements.
- Project implementation audit report should be regularly submitted to the competent authority to ensure all conditions and mitigation measures and proper due diligence is being applied.
- The development may be allowed to proceed given the socio-economic benefits it may yield to the community and the environment as a whole.

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WETLAND HABITAT IMPACT ASSESSMENT

PROPOSED BHEKUMTHETHO PHASE 2 HOUSING DEVELOPMENT AND SERVICE INFRASTRUCTURE UPGRADE WITHIN THE EMONDLO RURAL COMMUNITY SITUATED NEAR VRYHEID TOWN WITHIN THE ABAQULUSI LOCAL MUNICIPALITY, KWAZULU-NATAL

04 December 2019

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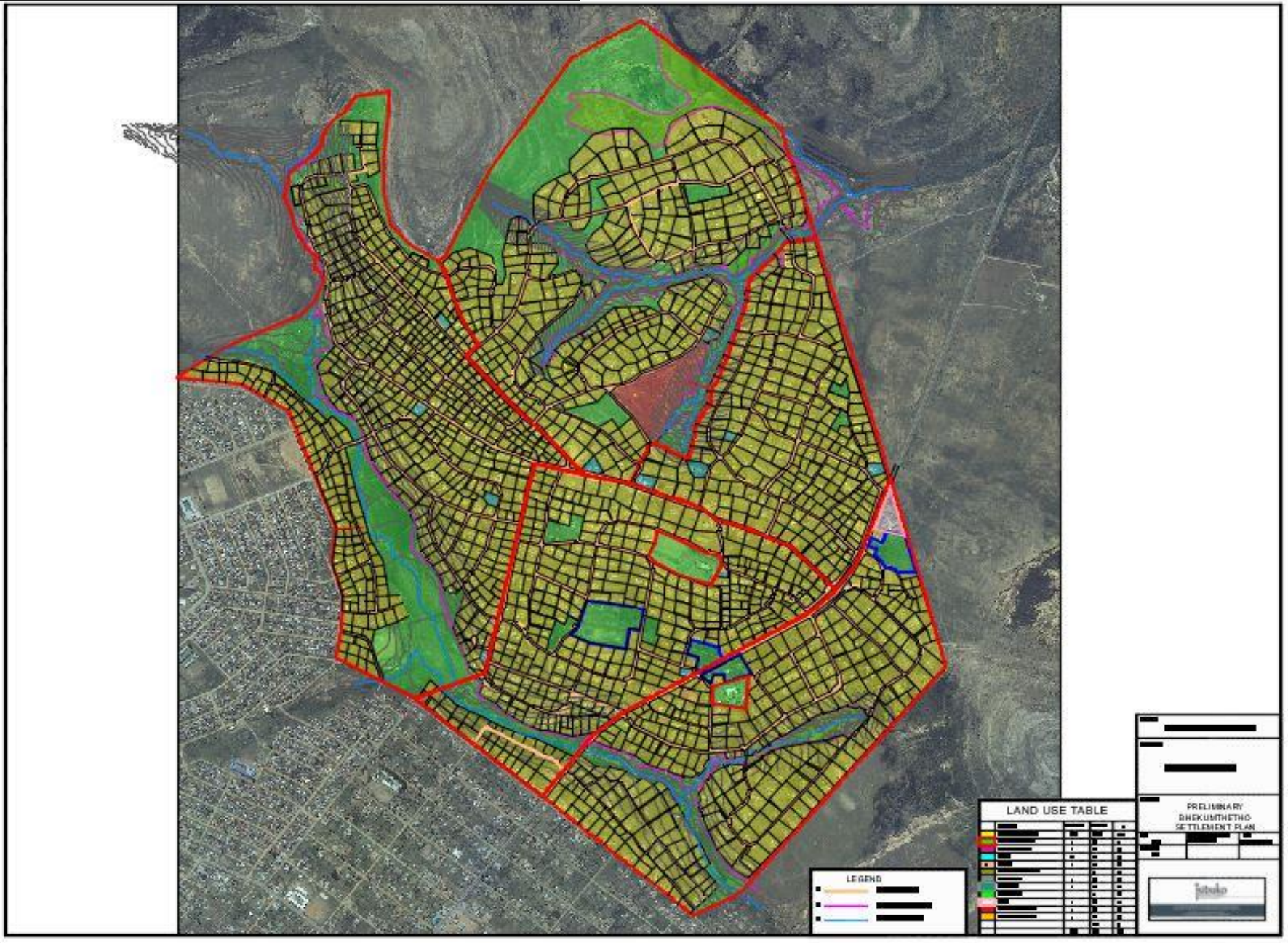
10 APPENDIXES

Appendix 1. Proposed Development Layouts

Appendix 2 Wetland Habitat assessment report

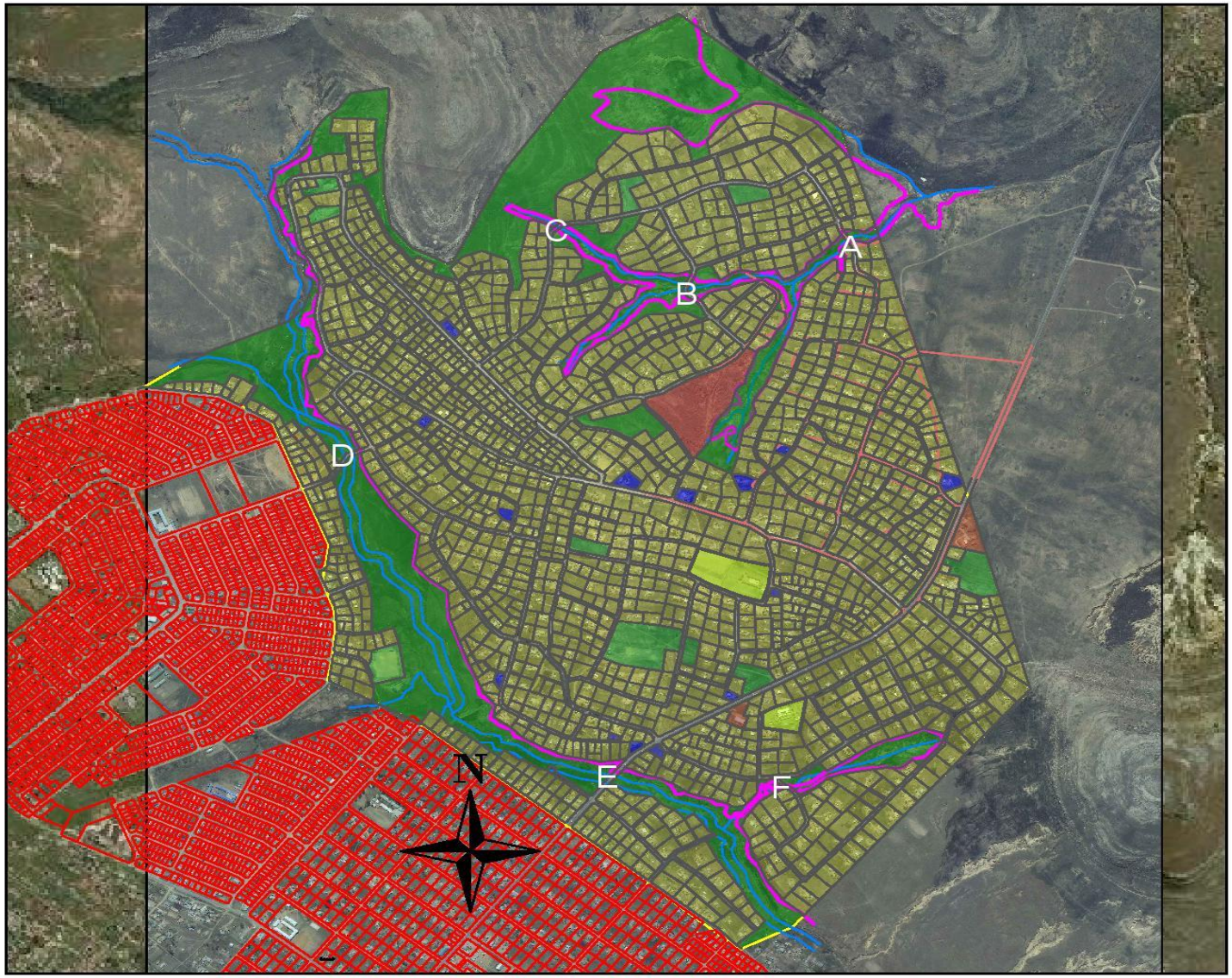
APPENDIX 1: DEVELOPMENT LAYOUTS

DEVELOPMENT LAYOUT



Propose

DEVELOPMENT LAYOUT WITH POINTS WHERE ROADWORKS CROSS WATERCOURSES



human settlements
Department:
Human Settlements
PROVINCE OF KWAZULU-NATAL

LAND USE TABLE

ZONE KEY	LAND USE ZONE	No. OF ERVEN	AREA (Ha)	%
	RESIDENTIAL	1 655	384.6	64.3
	BUSINESS	11	116.5	18.5
	ADMINISTRATION	2	12.8	2.1
	EDUCATION	2	3.3	0.5
	CEMETRY	1	5.0	0.8
	PUBLIC OPEN SPACE	11	6.3	1.1
	PASSIVE OPEN SPACE	7	1.8	0.3
	PUBLIC ROADS	-	67.5	11.3
	TOTAL	1 689	597.8	100

NOTE:

1) 20m CONTOUR INTERVALS
2) ROAD HIERARCHY: 18m, 15m, 12m and 10m
3) FLOODLINE BUFFER: 50 years floodlines

COORDINATES OF WATERCOURSE CROSSINGS

POINT		
A	27°57'45,63"S	30°44'02,57"E
B	27°57'51,24"S	30°43'42,81"E
C	27°57'44,11"S	30°43'26,90"E
D	27°58'12,23"S	30°43'01,97"E
E	27°58'52,56"S	30°43'33,48"E
F	27°58'54,17"S	30°43'54,66"E

HOUSING PROJECT

BHEKUMTHETHO FORMALIZATION
DRAFT LAYOUT

SIGNATURE/APPROVAL BY CLIENT

DESIGNATION :
DESIGNATION :

Town planners:

isibuko

Drawing No :	IBI-PLAN 02	Date : NOVEMBER 2018	
Drawn : Nokuphiwa Hlongwa		Co-Ordinate System :	HARTEBEESTHOEK 94
Checked : Sibongiseni Maseko		Scale : 1:120	Date : NOVEMBER 2018

REVISION

Rev. No	Date	Description	Rev. by

SIGNATURE BY :

PROF. TOWN PLANNER _____ REG No: _____
SIGNATURE
PROF. ENGINEER _____ REG No: _____
SIGNATURE
PROF. LAND SURVEYOR _____ REG No: _____
SIGNATURE

APPENDIX 2: WETLAND HABBITAT ASSESSMENT AND ECOLOGICAL REPORT

Afzelia ENVIRONMENTAL CONSULTANTS

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PO Box 37069, Overport, Durban, 4067

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WETLAND HABITAT IMPACT ASSESSMENT

PROPOSED BHEKUMTHETHO PHASE 2 HOUSING DEVELOPMENT AND SERVICE INFRASTRUCTURE UPGRADE WITHIN THE EMONDLO RURAL COMMUNITY SITUATED NEAR VRYHEID TOWN WITHIN THE ABAQULUSI LOCAL MUNICIPALITY, KWAZULU-NATAL

04 December 2019

Prepared by:
Afzelia Environmental Consultants (PTY) Ltd.
P.O. Box 37069, Overport, DURBAN, 4067
Tel: 031 303 2835
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Prepared for:
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Declaration (Author)

I, **Brian Mafela,** declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Brian Mafela

Specialist:	Brian Mafela		
Company:	Afzelia Environmental Consultants		
Qualification:	BSc. (Hons) Forest Resources and Wildlife Management		
Postal address:	P.O. Box 37069, OVERPORT, Durban		
Postal code:	4067	**Cell:**	(+27) 74 325 8961
Telephone:	(031) 303 2835	**Fax:**	086 692 2547
E-mail:	brian@afzelia.co.za		
Professional affiliation(s) (if any)	SACNASP *Cand.Sci.Nat.* (Ecological Science: 100214/15)		

Declaration (Sign-off)

I, **Ntandokazulu Kumalo** declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Ntandokazulu Kumalo

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Executive Summary

Afzelia Environmental Consultants (PTY) Ltd (Afzelia) was appointed by Bizycon (PTY) Ltd to undertake a Wetland Habitat Impact Assessment for the proposed Bhekumthetho Phase 2 Housing Development and Service Infrastructure Upgrade within the eMondlo rural community. eMondlo is situated approximately 35km south of Vryheid, within the AbaQulusi Local Municipality which is located in the northern area of the KwaZulu-Natal Province. The proposed development comprises several developments which include:

i. Construction of 3000 housing units measuring 40 – 50m^2 each;
ii. Construction of a water reticulation pipeline. The pipeline will be constructed using 160 – 250mm diameter UPVC pipelines. The length of the pipeline is currently unknown;
iii. Construction of a sewer reticulation pipeline to link the new houses to the existing bulk sewer pipeline. The length of the pipeline is currently unknown;
iv. Construction of a stormwater management infrastructure to handle road stormwater;
v. Upgrade of bus routes to a 6m wide road with a 13.5m road reserve; and
vi. Upgrade of internal roads to a width of 4.5m with a 10m wide road reserve.

Following the completion of the desktop delineation exercise the specialist undertook a ground truthing exercise on the 11th and 12th of November 2019. This entailed undertaking infield wetland delineation which focused on soil and vegetation sampling as well as recording of diagnostic topographic features such as breaks in slope, river banks, toe of road embankments etc. A total of 8 watercourse units were delineated within and around the development site. These include 5 wetland units (i.e. 3 channelled valley bottom wetlands and 2 seep wetlands) and 3 river habitats. A list of all delineated watercourses is provided below:

Wetland Habitats
1) **CVB1**: Channelled Valley Bottom Wetland
2) **CVB2**: Channelled Valley Bottom Wetland
3) **CVB3**: Channelled Valley Bottom Wetland
4) **S1**: Seep Wetland (Includes 2 sub-units S1-A and S1-B)
5) **S2**: Seep Wetland

River Habitats
6) **R1**: Upper Foothills River
7) **R2**: Mountain Stream (Includes 3 sub-units R2-A, R2-B and R2-C)
8) **R3**: Upper Foothills River

The results of the WET-Health assessment indicated that Wetland Unit S2 was 'moderately modified' (C PES Class) in terms of its PES whilst Units CVB2 and CVB3 were 'largely modified' (D PES Class) and Units CVB1 and S1 were 'seriously modified' (E PES Class). The results of the EIS assessment indicate that all wetland units were of low EIS. With regards to ecosystem service delivery, all wetlands were found to provide most ecosystem services at a low to moderate level. Key services provided include flood attenuation, streamflow regulation and water quality enhancing services (such as phosphate trapping, nitrate removal, toxicant removal). As for river assessments, the results of the IHI assessment indicated that River Unit R1 was 'largely natural' (B PES Class) in terms of its PES whilst River Unit R2 and R3 were 'largely modified' (D PES Class). River Unit R1 was assessed as having an EIS score of 2.0 which indicates that it is of moderate EIS whilst River Units R2 and R3 were assessed as having an EIS score of 1.00 and 1.20, respectively, which indicates that both rivers are of low EIS. A summary of all wetland and river assessments is provided in Table A below.

Table A: Summarised PES, EIS and ecosystem services results.

Unit	PES Score & Category	EIS Score & Rating	Notable Ecosystem Services
CVB1	6,3 (E Class)	1.33 (Low EIS)	flood attenuation, streamflow regulation, nitrate removal, toxicant removal and erosion control
CVB2	4,0 (D Class)		

CVB3	4,9 (D Class)		
S1	6,4 (E Class)	1.17 (Low EIS)	flood attenuation, streamflow regulation, phosphate trapping, nitrate removal and toxicant removal
S2	2,3 (C Class)		
R1	90% (B Class)	2.00 (Moderate EIS)	N/A
R2	53% (D Class)	1.00 (Low EIS)	N/A
R3	58% (D Class)	1.20 (Low EIS)	N/A

Impacts likely to result from the Bhekumthetho Phase 2 housing development and infrastructure upgrade were grouped into the following broad categories for ease of assessment of their impact significance: (a) loss of aquatic habitat and biota, (b) degradation of aquatic habitat and (c) water & soil pollution. These impacts were identified as likely to occur during both the construction and operational phase of the proposed development. Summarised results of the impact significance assessed are provided in Table B below. The assessment results indicate that without mitigation, the construction phase will have a **"high impact significance"** on the "loss of freshwater habitat" and a **"medium impact significance"** on the "degradation of freshwater habitat" and "soil and water pollution." With implementation of effective mitigation measures, the significance of identified construction phase impacts can be reduced to a **"low to medium"** level. Without mitigation, the operational phase will have a "**medium impact significance**" on the aquatic environment but if best practice mitigation measures are implemented, the significance of operational phase impacts will be reduced to a "**low**" level. A suite of mitigation measures has been proposed for implementation during the planning, construction and operational phase of the development. These are included in Section 4.2 – 4.5.

Table B: Summarised impact significance results.

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Loss of freshwater habitat and biota	High (50)	Medium (21)	Medium (24)	Low (12)
Degradation of freshwater habitat	Medium (36)	Low (18)	Medium (36)	Low (14)
Soil and water pollution	Medium (27)	Low (15)	Medium (27)	Low (18)

In accordance with the National Water Act, No. 36 of 1998 (NWA) and Government Notice 509 of 2016 (General Authorisation), the proposed Bhekumthetho Phase 2 housing development and infrastructure upgrade does not qualify for a GA because it entails an activity that is excluded from the provisions of the GA. According to the Government Notice 509 of 2016, "*the GA does not apply (e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works.*" Therefore, an application for a Water Use Licence must be submitted to the Department of Water and Sanitation (DWS). A suite of special conditions listed in Section 5.2 have been recommended for inclusion in the Water Use Licence to be issued by the DWS.

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INDEMNITY

Although Afzelia Environmental Consultants (Pty) Ltd exercises due care and diligence in rendering services and preparing documents, the Consultants do not accept any liability, and the Client by receiving this document, indemnifies the Consultants (directors, managers, agents and employees) against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered directly or indirectly by the Consultants and by the use of the information contained in this document.

1 Introduction

1.1 Project Locality & Description

Afzelia Environmental Consultants (PTY) Ltd (Afzelia) was appointed by Bizycon (PTY) Ltd to undertake a Wetland Habitat Impact Assessment for the proposed Bhekumthetho Phase 2 Housing Development and Service Infrastructure Upgrade within the eMondlo rural community. eMondlo is situated approximately 35km south of Vryheid, within the AbaQulusi Local Municipality which is located in the northern area of the KwaZulu-Natal Province (Figure 1.1). The proposed development site is situated along the north-eastern boundary of eMondlo (Figure 1.2). GPS co-ordinates of the site are 27° 58' 15" South; 30° 43' 30" East.

The proposed development comprises several developments which include:

vii. Construction of 3000 housing units measuring 40 – 50m^2 each;
viii. Construction of a water reticulation pipeline. The pipeline will be constructed using 160 – 250mm diameter UPVC pipelines. The length of the pipeline is currently unknown;
ix. Construction of a sewer reticulation pipeline to link the new houses to the existing bulk sewer pipeline. The length of the pipeline is currently unknown;
x. Construction of a stormwater management infrastructure to handle road run-off;
xi. Upgrade of bus routes to a 6m wide road with a 13.5m road reserve; and
xii. Upgrade of internal roads to a width of 4.5m with a 10m wide road reserve.

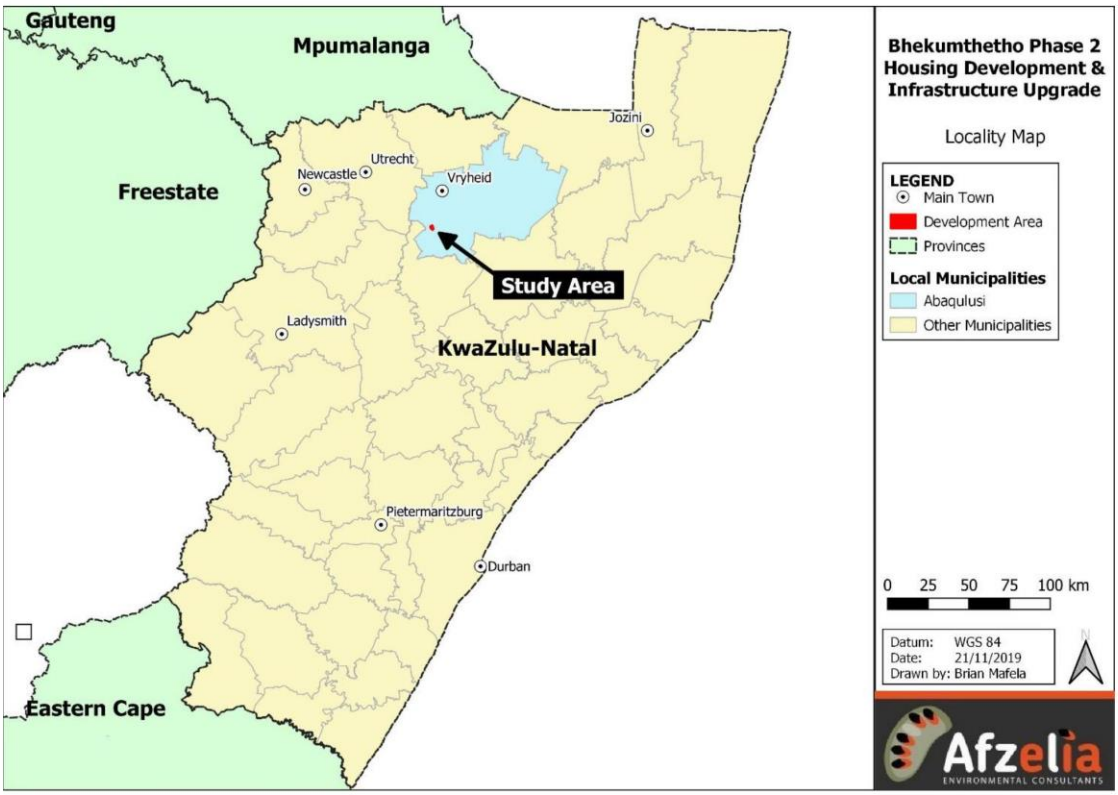

Figure 1.1: Location of eMondlo rural town within the KwaZulu-Natal Province.

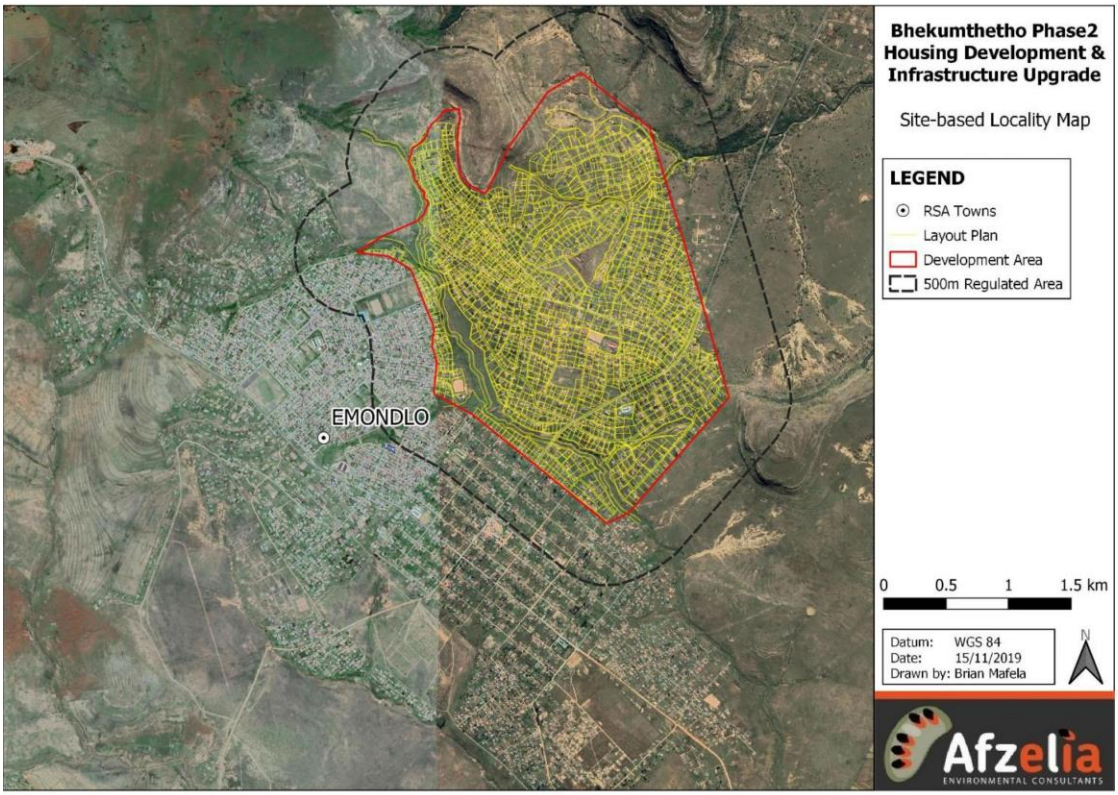

Figure 1.2: Location of the proposed development area within the rural town of eMondlo.

1.2 Terms of Reference

This assessment was undertaken as per the following terms of reference:

i. Undertake a desktop review of the site's biophysical attributes using available literature and GIS information.
ii. Review conservation planning tools such as NFEPA datasets, KwaZulu-Natal Systematic Conservation Assessment and provide a discussion on how they impact the proposed development.
iii. Undertake infield delineation of wetlands within the study area using techniques detailed in the delineated guideline: A practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1 (DWAF, 2005).
iv. Undertake an assessment of the present ecological state (PES) of wetlands using a WET-Health Level 1 Assessment (Macfarlane *et al.,* 2008).
v. Undertake an assessment of the functions and ecosystem services provided by wetlands using the WET-EcoServices Level 2 Assessment (Kotze *et al.,* 2007).
vi. Undertake an assessment of the ecological importance and sensitivity (EIS) of wetlands using the EIS Assessment tool (Rountree & Kotze, 2013).
vii. Identify potential construction and operational phase impacts to delineated watercourses.
viii. Provide construction-phase and operational-phase mitigation measures.
ix. Undertake an impact significance assessment.
x. Undertake a Department of Water and Sanitation (DWS) Risk Assessment in order to determine the risk level of the proposed development and whether the proposed development requires General Authorisation (GA) or a Water Use Licence (WUL).

2 Methodology

2.1 Desktop Review

Prior to undertaking fieldwork, the specialist undertook a desktop review of the site and associated watercourses (wetlands, streams and rivers). This entailed reviewing available literature and GIS data on water resource conservation, reviewing site details and undertaking desktop mapping of all watercourses within and around the study area. All desktop-mapped watercourses were revised following an infield wetland delineation process. The following information was used in completing the desktop assessment:

i. The latest Google Earth imagery was used to identify likely wetland vegetation and delineate the wetland boundary at a desktop level.
ii. NFEPA GIS dataset was used to identify prioritised catchments, rivers and wetlands.
iii. KZN Biodiversity Spatial Planning GIS dataset was used to identify biodiversity conservation areas.
iv. Threatened Ecosystem GIS dataset was used to identify conservation important vegetation types.
v. KZN Geological GIS dataset was used to identify the underlying geology at the site.

2.2 Wetland Assessments

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act as:

> *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

Below is a list of assessments undertaken as well as assessment tools, methodologies and protocols that were used to assess wetland habitats:

i. **Wetland Delineation:** A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (Department of Water Affairs, 2005). Additional information is provided in Appendix 8.1.1.
ii. **Wetland Classification:** Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013). Additional information is provided in Appendix 8.1.2.
iii. **Present Ecological State (PES):** WET-Health Level 1 Assessment tool (Macfarlane *et al.* 2008). Additional information is provided in Appendix 8.1.3.
iv. **Wetland Functional Assessment:** WET-EcoServices Level 2 Assessment tool (Kotze *et al.*, 2007). Additional information is provided in Appendix 8.1.4.
v. **Ecological Importance and Sensitivity (EIS):** DWAF EIS tool (Rountree & Kotze, 2013). Additional information is provided in Appendix 8.1.5.

2.3 Riparian Assessments

Below is a list of assessments undertaken as well as assessment tools, methodologies and protocols that were used to assess riparian habitats:

i. **Riparian Delineation:** A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005). Additional information is provided in Appendix 8.2.1.
ii. **Index of Habitat Integrity (IHI):** Rapid IHI Assessment tool (Kleynhans, 1996). Additional information is provided in Appendix 8.2.2.
iii. **Ecological Importance and Sensitivity (EIS):** EIS tool (Kleynhans, 1999). Additional information is provided in Appendix 8.2.3.

2.4 Impact Significance Assessment

The significance (quantification) of potential environmental impacts identified during the Wetland Habitat Impact Assessment has been assessed as per the "Guideline Documentation on EIA Regulation" (Department of Environmental Affairs and Tourism, 2014). To determine the significance of impacts identified for a project, there are several parameters that need to be assessed. These include four factors, which, when plugged into a formula, will give a significance score. The four

parameters are described as follows:

i. **Duration**, which is the relationship of the impact to temporal scale. This parameter determines the timespan of the impact and can range from very short term (less than a year) to permanent.
ii. **Extent**, which is the relationship of the impact to spatial scales. Each impact can be defined as occurring in minor extent (limited to the footprint of very small projects) to International, where an impact has global repercussions (an example could be the destruction of habitat for an IUCN Critically Endangered listed species).
iii. **Magnitude**, which is used to rate the severity of impacts. This is done with and without mitigation, so that the residual impact (with mitigation) can be rated. The Magnitude, although usually rated as negative, can also be positive.
iv. **Probability**; which is the likelihood of impacts taking place. These include unlikely impacts (such as the rate of roadkill of frogs, for example) or definite (such as the loss of vegetation within the direct construction footprint of a development).

Each of the abovementioned aspects are rated according to Table 2.1 below.

Table 2.1: Table of evaluation criteria ranking.

	Score	Label	Criteria
Duration	1	Very short term	0 -1 years
	2	Short term	2 – 5 years
	3	Medium term	5 – 15 years
	4	Long term	>15 years
	5	Permanent	Permanent
Extent	1	Minor	Limited to the immediate site of the development
	2	Local	Within the general area of the town, or study area, or a defined Area of Impact
	3	Regional	Affecting the region, municipality, or province
	4	National	Country level
	5	International	International level
Magnitude	0	Negligible	Very small to no effect on the environment
	2	Minor	Slight impact on the environment
	4	Low	Small impact on the environment
	6	Moderate	A moderate impact on the environment
	8	High	The impacts on the environment are large
	10	Very high	The impacts are extremely high and could constitute a fatal flaw
Probability	1	Very improbable	Probably will not happen
	2	Improbable	Some possibility, but low likelihood
	3	Probable	Distinct possibility
	4	Highly probable	Most likely
	5	Definite	The impact will occur

Once each of these aspects is rated, the overall significance can be scored (based on the score for effect). The significance is calculated as per the following formula:

Significance Points = (Magnitude + Duration + Extent) x Probability

The results of the assessment are then interpreted using the below rating system which categorises the scores into 5 categories ranging from low to high impact significance. A description of each category is provided in Table 2.2. with the layout of all possible scores and their overall significance presented in Table 2.3.

Table 2.2: Significance weighting.

Score	Label	Motivation

<10	Negligible	The impact is very small to absent
10-20	Low	where this impact would not have a direct influence on the decision to develop in the area
20-50	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
50 -70	High	where the impact must have an influence on the decision process to develop in the area
>70	Very high	Where the impact may constitute a fatal flaw for the project

Table 2.3: Possible significance scores based on Effect and Likelihood ratings.

Likelihood	Effect																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Very improbable (1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Improbable (2)	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Probable (3)	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
Highly probable (4)	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
Definite (5)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Each impact was assessed based on the methodology above, and a table produced, indicating the scores and the overall significance rating both without and with mitigation. Where relevant, mitigation measures are recommended.

2.5 Assumptions and limitations

The following assumptions and limitation are applicable to this study:

i. Desktop delineation was undertaken using 20m contours, latest aerial imagery and the latest Google Earth Imagery. Vegetation changes may have influenced the accuracy of the delineation.
ii. The gradient of slope was calculated using 20m contour lines which may not be accurate.
iii. The handheld GPS device which was used has an accuracy of 3m.
iv. All literature and datasets used were accurate at the time of compiling this report.
v. Vegetation descriptions provided for each wetland unit are not comprehensive but serve to provide a general description of the wetland habitat.

3 Results and Discussion

3.1 Results of Desktop Investigations

3.1.1 Biophysical Attributes

The biophysical attributes of the study area are summarised in Table 3.1 below.

Table 3.1: Summary of the biophysical attributes of the study area.

Attribute	Value	Reference
Ecoregion	14.02 (North-eastern Uplands) Irregular undulating lowlands with hills.	DWAF, 2007
MAP	781.3 – 874.9 mm	Schulze, 1997
MAT	18 °C (Zone 3)	DWAF, 2007
Rainfall intensity	52.4 – 55.0 mm (Zone 4)	Schulze, 2007
Potential Evaporation	1850.8 – 1895.3 mm	Schulze, 1997
Median Annual Simulated Run-off	82.7 – 162.8 mm	Schulze, 1997
Geology	Shale and Sandstone belonging to the Pietermaritzburg Formation	Council of Geoscience, 2008
Soil	Sandy to clay-loam	Site observation
Soil Erodibility Score (K-factor)	0.36 - 0.54 (moderate to moderately high erodibility)	Schulze, 2007

3.1.2 Quaternary Catchment and Drainage Setting

The development site is situated on a catchment divide between quaternary catchments W21C and W21D. Quaternary catchment W21C is drained by a perennial river, the Mvunyane River whilst W21D is drained by a perennial river, the Sandspruit River. Both rivers discharge into the White Mfolozi River situated about 30km south-east of the proposed development site. The drainage network within the quaternary catchments is shown in Figure 3.1. At a site scale, the north-eastern boundary of the development area is bordered by a small seasonal river that feeds the Sandspruit situated north-east whilst the south-western boundary is bordered by a small seasonal river that feeds the Mvunyane River located south-west. A network of minor streams and drainage lines drain the north-east facing and south-west facing slopes of the development site.

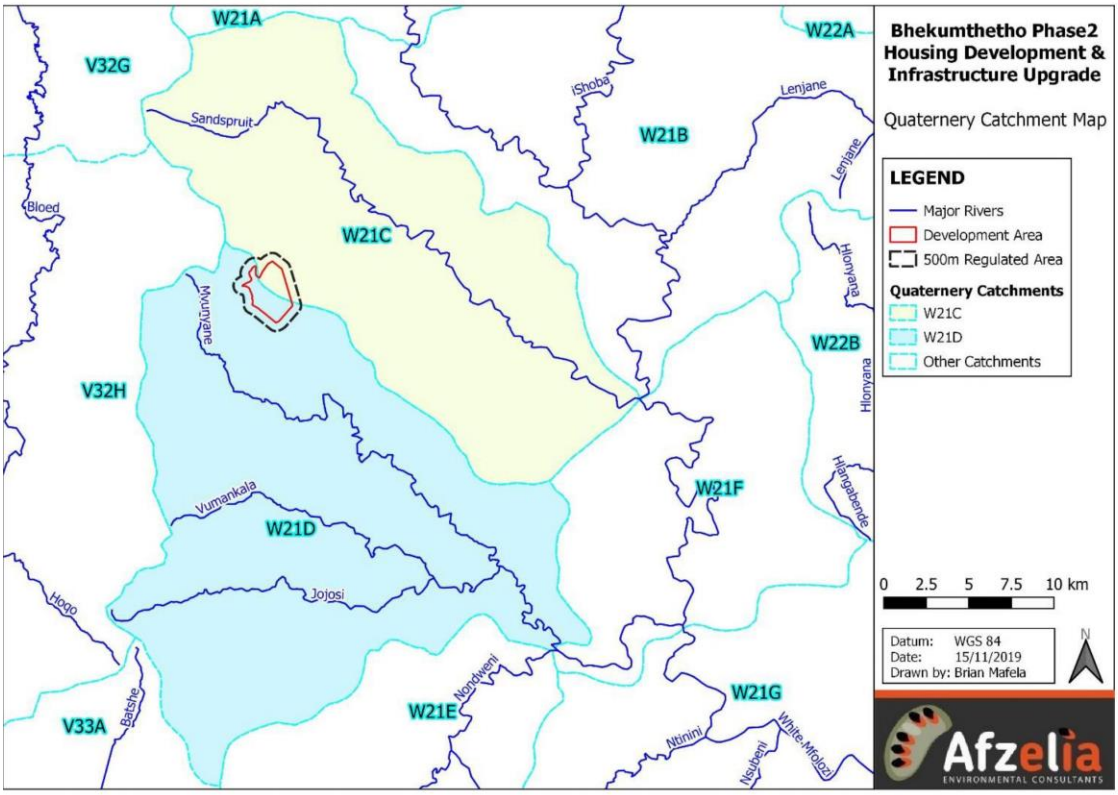

Figure 3.1: Quaternary catchment and drainage setting of the study area.

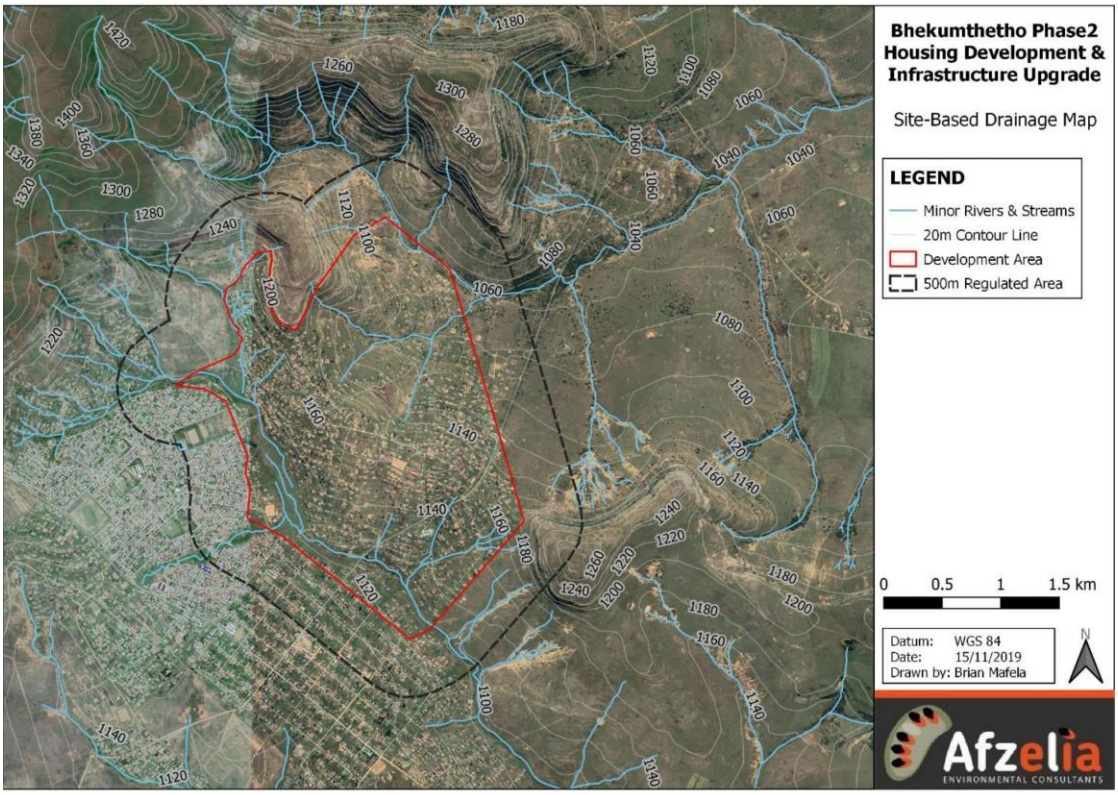

Figure 3.2: Site level drainage setting of the study area.

3.1.3 National Freshwater Ecosystem Priority Area

According to the National Freshwater Ecosystem Priority Areas (NFEPA) GIS dataset (CSIR, 2011) the development area falls within 2 sub-catchments (No. 2599 and 2676) identified as "Upstream Management Areas." Upstream Management Areas are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs (particularly sub-catchments 2727 and 2815) and Fish Support Areas (CSIR, 2011). The proposed development will therefore need to minimise any adverse impacts to the aquatic environment. The NFEPA GIS dataset did not flag the presence of any wetland FEPA or wetland cluster within a 500m radius of the development area (CSIR, 2011). A FEPA map is provided as Figure 3.3 below.

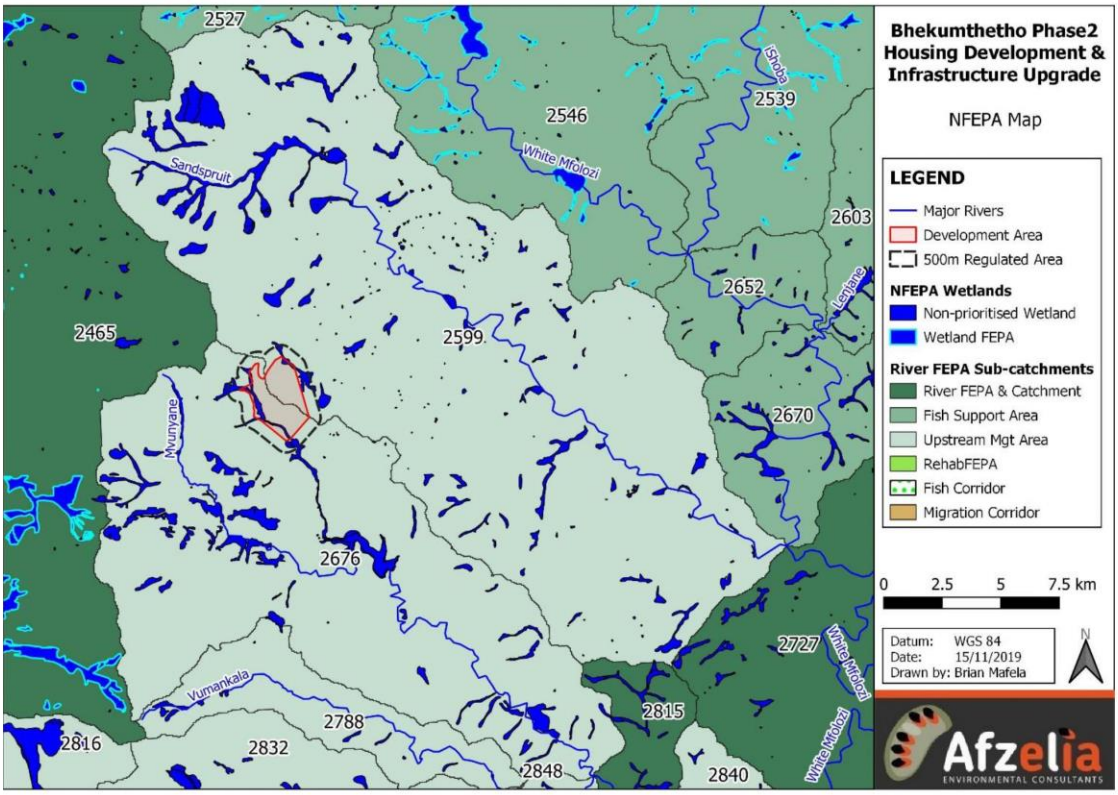

Figure 3.3: Freshwater Ecosystem Priority Area map.

3.1.4 Threatened Ecosystems: Vegetation Types

The development area is characterised by 2 terrestrial vegetation types namely the Northern KwaZulu-Natal Moist Grassland (Gs 4) and Income Sandy Grassland (Gs 7) (Scott-Shaw and Escott, 2011) (Figure 3.4). Both vegetation types have a provincial threat status of **Vulnerable** (Jewitt, 2014). A freshwater vegetation type namely "Alluvial Wetlands: Temperate Alluvial Vegetation" was flagged as present on the valley floor of the north-east bound and south-west bound rivers (Scott-Shaw and Escott, 2011) (Figure 3.4). The vegetation type has a provincial threat status of **Vulnerable** (Jewitt, 2014).

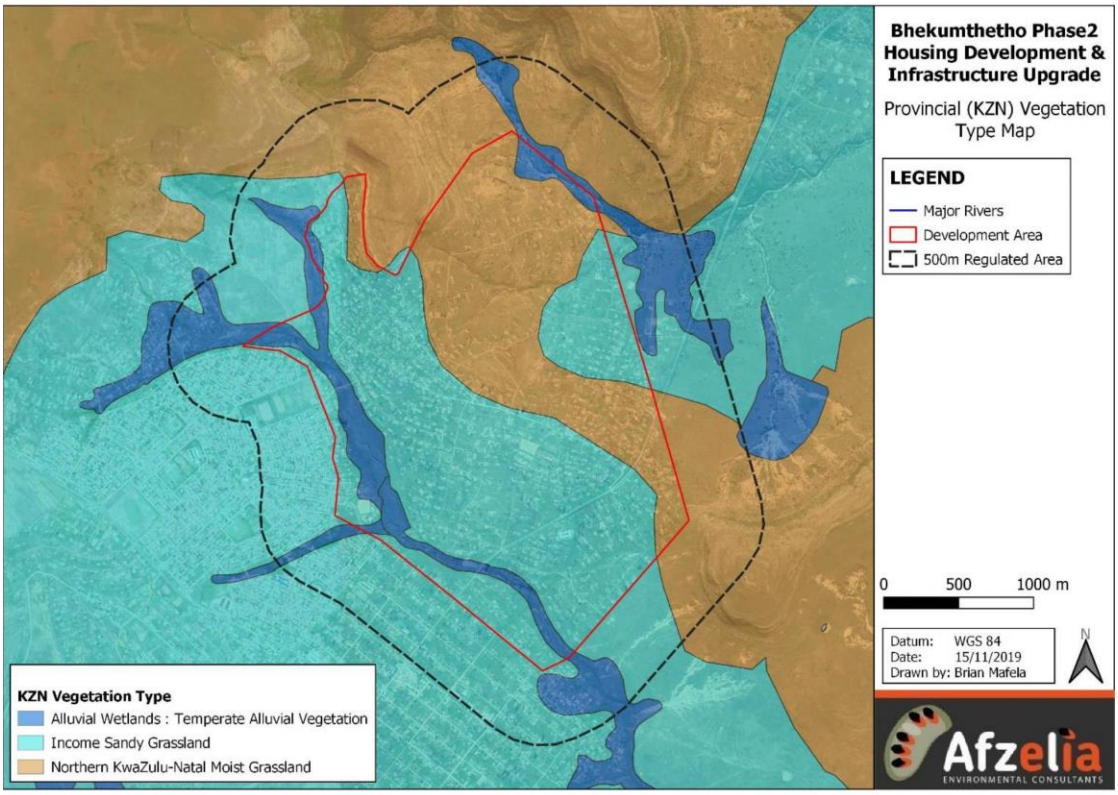

Figure 3.4: Terrestrial and freshwater vegetation types within and around the development area.

3.2 Provincial Conservation Guidelines

3.2.1 KwaZulu-Natal Biodiversity Spatial Planning

The KwaZulu-Natal Biodiversity Spatial Planning (KZN BSP) defines the areas of land in the form of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) required to ensure the persistence and conservation of biodiversity within the province (EKZNW, 2016). The spatial plan then provides a tool to guide conservation and protected area expansion as well as informing economic sectors involved in alien plant control, conservation officer priorities and guiding the nature of development (EKZNW, 2016).

The spatial guidelines provided by the plan outline two main categories of areas that are required to meet conservation targets for the province (EKZNW, 2016). These two main categories include CBAs and ESAs, including corridors. These are further divided into smaller categories, which are outlined in Table 3.2.

Table 3.2: Description of subcategories of CBAs and ESAs.

Critical Biodiversity Areas (CBAs) – Crucial for supporting biodiversity features and ecosystem functioning and are required to meet biodiversity and/or process targets	
Critical Biodiversity Areas: Irreplaceable	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Areas: Optimal	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible (Category driven primarily by process, but is informed by expert input).

Ecological Support Areas (ESAs) – Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within Critical Biodiversity Areas.	
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of Ecosystem Services.
Ecological Support Areas: Species Specific	Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites.
Ecological Support Areas: Buffers	Terrestrial areas identified as requiring land-use management guidance not necessarily due to biodiversity prioritisation, but in order to address other legislation/ agreements which the biodiversity sector is mandated to address, e.g. WHS Convention, Triggers Listing Notice criteria, etc.

According to the KZN BSP, the proposed development site was not identified as a CBA. However, the eastern portion of the 500m regulated area was identified as CBA:Irreplaceable whilst the western portion of the 500m regulated area was identified as a CBA:Optimal (Figure 3.4). The area identified as a CBA:Irreplaceable is a critical area for the meeting biodiversity targets and therefore should not be impacted by the proposed development. The CBA:Optimal, however, means the area is not critical for the support of conservation important biota, but the area serves as an alternate habitat for conservation important biota should their preferred habitat be compromised.

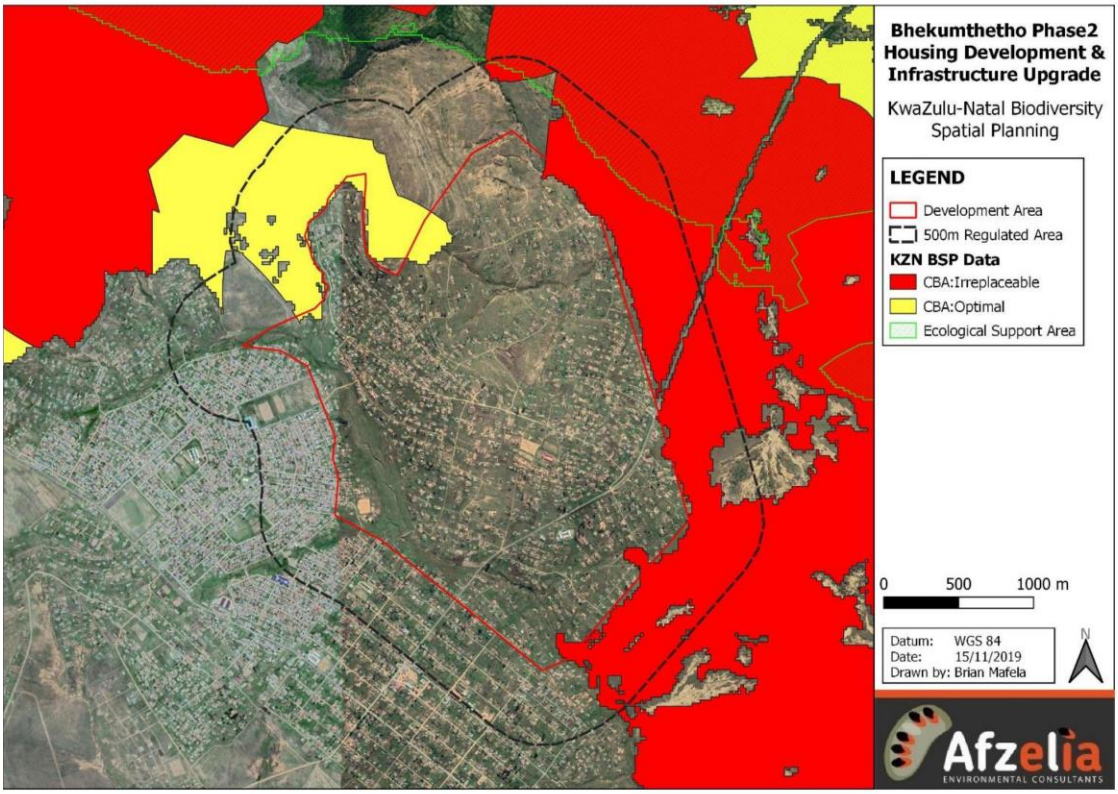

Figure 3.5: KZN Biodiversity Spatial Planning map for the study area.

3.3 Wetland Delineation

Following the completion of the desktop delineation exercise the specialist undertook a ground truthing exercise on the 11th and 12th of November 2019. This entailed undertaking infield wetland delineation which focused on soil and vegetation sampling as well as recording of diagnostic topographic features such as breaks in slope, river banks, toe of road embankments etc. Numerous soil samples and topographic features were recorded using a handheld GPS device and used to delineate wetland habitats and development a wetland delineation map. Delineated wetland habitats were then sub-divided and classified into hydrogeomorphic (HGM) units as per *Ollis et. al*. (2013). A total of 8 watercourse units were delineated within and around the development site. These include 5 wetland units (i.e. 3 channelled valley bottom wetlands and 2 seep wetlands) and 3 river habitats. A list of all delineated watercourses is provided below. The spatial distribution of delineated watercourse units is shown in Figure 3.5, on the next page.

List of infield delineated watercourses include:

Wetland Habitats

9) **CVB1**: Channelled Valley Bottom Wetland
10) **CVB2**: Channelled Valley Bottom Wetland
11) **CVB3**: Channelled Valley Bottom Wetland
12) **S1**: Seep Wetland (Includes 2 sub-units S1-A and S1-B)
13) **S2**: Seep Wetland

River Habitats

14) **R1**: Upper Foothills River
15) **R2**: Mountain Stream (Includes 3 sub-units R2-A, R2-B and R2-C)
16) **R3**: Upper Foothills River

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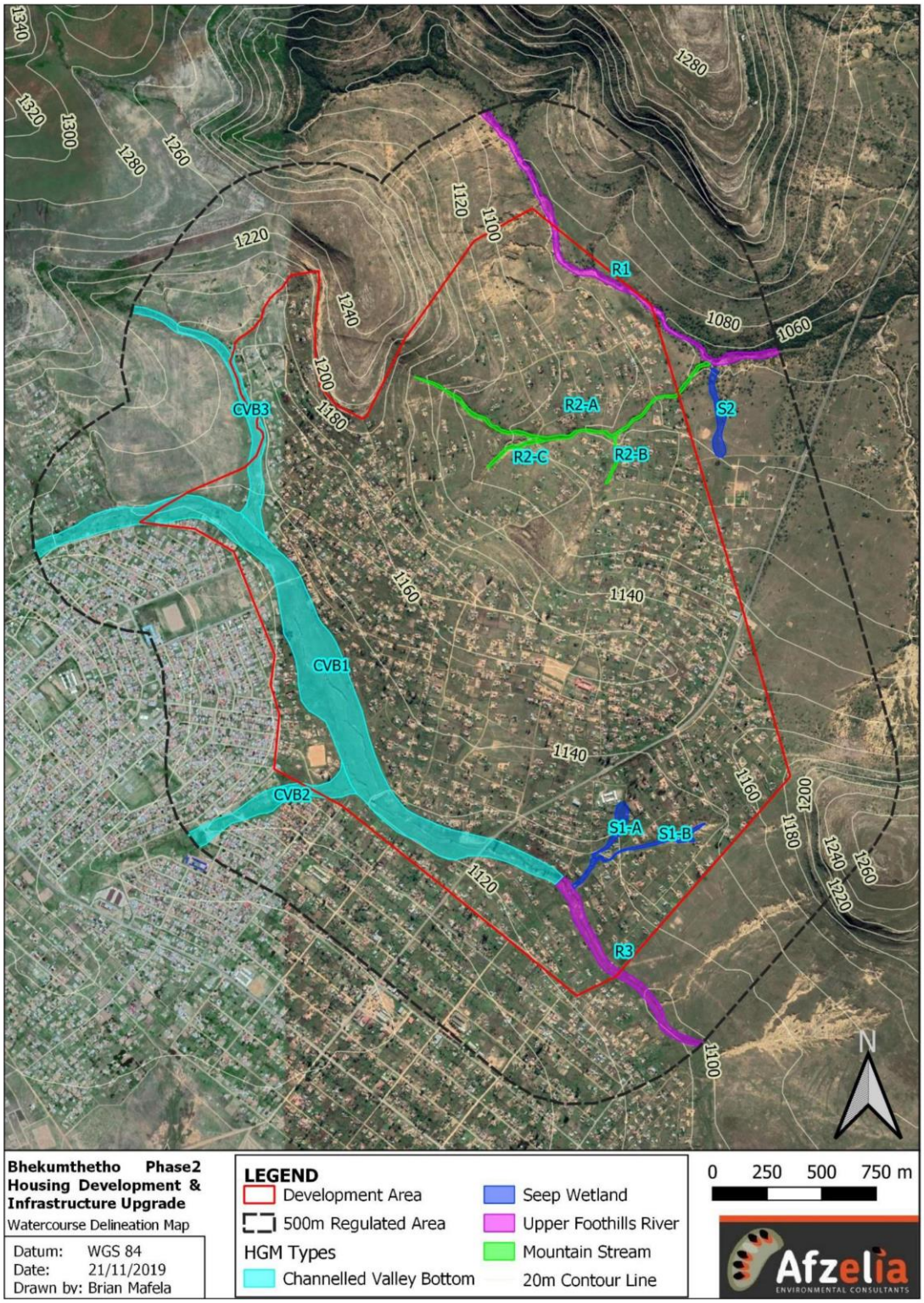

Figure 3.6: Desktop and infield delineated watercourses.

3.4 Wetland Description and Classification

The general characteristics and classification of the HGM units are described in Tables 3.3 – 3.10 below.

Table 3.3: General characteristics and classification of Wetland Unit CVB1.

HGM ID	CVB1	**HGM Type**	Channelled Valley Bottom Wetland	**Size**	39.78 Ha
Aspect	**Description**				
General Description	Wetland Unit CVB1 is a channelled valley bottom wetland situated along the south-western boundary of the study area. It occurs largely on the valley floor linked with a minor river characterised by seasonal flows. The width of the wetland broadens from 50m to 200m before narrowing to 50m wide and eventually transforming into a river habitat (River Unit R3). The wetland is characterised by a longitudinal slope of 1%. At the mid-section of the wetland, an artificial dam was breached, resulting in extensive channel incision (particularly upstream of the dam wall) as the river returned to its base level after years of sedimentation. At the time of assessment, the water in the river was highly polluted by sewage, however the source of wastewater could not be established.				
Hydrology	Water inputs are mainly in the form of concentrated surface flows from upstream and interflow from the valley side slopes. During high flow periods, water moves through the wetland mainly as both diffuse and concentrated surface flow whilst during low flow periods it moves through the wetland as concentrated surface flow limited to the river channel. Water exits the wetland as concentrated surface flow.				
Soil	Soil samples extracted from the wetland habitat were dominated by sand and loamy sand with a light pink or light grey soil matrix and distinct orange mottles. The upper layer (0 – 10cm) was generally characterised by alluvial material with no sign of mottling. Mottles were generally encountered below 10cm. In contrast, terrestrial soils were characterised by brown loam to loamy sand soil with no sign mottling. Based on the analysis of soil samples, the wetland was likely dominated by seasonally saturated soils (50 – 70%).				
Vegetation	The wetland habitat was characterised by a short grassland dominated by rhizotomous grasses such as *Cynodon dactylon, C. nlemfuensis*, and *Paspalum spp*. The grassland was degraded and overgrazed which made identification of grass species very difficult. The edge of the active river channel exhibited a higher diversity of plants which includes *Cyperus latifolius, C. textilis, Cynodon dactylon, C. nlemfuensis, Paspalum spp*. and *Sesbania puniceous*.				

Photographs of Wetland Unit CVB1 are shown below:

Photo 1: View of the active channel within Wetland Unit CVB1.

Photo 2: Typical vegetation community recorded within the wetland habitat. The photograph shows the central area of the wetland which is characterised by a broad and flat valley floor.

Photo 3: Soil sample extracted from a seasonally saturated zone. Note the grey soil matrix and orange soil mottles.

Photo 4: Soil sample extracted from a temporary saturated zone. Note the orange soil mottles.

Table 3.4: General characteristics and classification of Wetland Unit CVB2.

HGM ID	CVB2	**HGM Type**	Channelled Valley Bottom Wetland	**Size**	5.64 Ha
Aspect	**Description**				
General Description	Wetland Unit CVB2 is a channelled valley bottom wetland linked with Wetland Unit CVB1 discussed above. The width of the wetland ranges between 40 and 90m wide. Urban development generally marked the extent of the wetland in terms of its width. A small river runs through the full length of the wetland. The wetland has a gradient of 2.2%. Flow impoundment and inundation were recorded immediately upstream of road crossing which indicates poor drainage of the culverts.				
Hydrology	Water inputs are mainly in the form of concentrated surface flows from upstream and interflow from the valley side slopes. During high flow periods, water moves through the wetland mainly as both diffuse and concentrated surface flow whilst during low flow periods it moves through the wetland as both diffuse and weakly channelled surface flow. Water exits the wetland as concentrated surface flow and evaporation particularly in inundated areas upstream of the road crossings.				
Soil	Soil samples extracted from the wetland habitat were generally dominated by sand and loamy sand with dark grey soil matrix and distinct orange mottles. Mottles were generally encountered through the 50cm soil profile. Gleyed soil samples were encountered in permanently saturated areas. In contrast, terrestrial				

	soils were characterised by brown loam to loamy sand soil with no sign mottling. Based on the analysis of soil samples, the wetland was likely dominated by seasonally and permanently saturated soils.
Vegetation	Areas characterised by seasonal and temporary saturated zones were characterised by a short grassland dominated by rhizotomous grasses such as *Cynodon dactylon, C. nlemfuensis*, and *Paspalum spp*. Permanently saturated areas, however, where characterised by rush beds dominated by obligate wetlands[1] plants such as *Typha capensis, Leersia hexandra* and *Canna indica*. The vegetation was degraded and overgrazed.

A photograph of Wetland Unit CVB2 is presented below:

Photo 5: Rush bed dominated by *Typha capensis.* The orange flowered plant in the foreground is *Canna indica*, an invasive alien plant.

Table 3.5: General characteristics and classification of Wetland Unit CVB3.

HGM ID	CVB3	**HGM Type**	Channelled Valley Bottom Wetland	**Size**	6.14 Ha
Aspect	**Description**				
General Description	Wetland Unit CVB3 is a channelled valley bottom wetland linked with Wetland Unit CVB1 discussed above. The wetland is generally narrow ranging between 30 - 50m wide. A deep but narrow river channel runs through the wetland habitat. The wetland has a gradient of 2.2%.				
Hydrology	Water inputs are mainly in the form of concentrated surface flows from upstream and interflow from the valley side slopes. During high and low flow periods, water moves through the wetland mainly as concentrated surface flow confined to the river channel. Water exits the wetland as concentrated surface flow.				
Soil	Soil samples extracted from the wetland habitat were dominated by loamy sand with a light pink or light grey soil matrix and distinct orange mottles. The upper layer (0 – 10cm) lacked any sign of mottling. Mottles were generally encountered at depth of 30cm and below. In contrast, terrestrial soils were characterised by brown loamy sand soil with no sign mottling. Based on the analysis of soil samples, the wetland was likely dominated by temporary saturated soils.				
Vegetation	The wetland was characterised by a medium tall grassland dominated by a mix of tufted grasses such as *Aristida congesta, Eragrostis spp*. and rhizotomous grasses such as *Cynodon dactylon, C. nlemfuensis*, and *Paspalum spp*. The grassland was degraded and overgrazed.				

A photograph of Wetland Unit CVB3 is presented below:

[1] Obligate wetlands plants are plants that grow only in wetland areas.

Photo 6: View looking upstream of Wetland Unit CVB3.

Table 3.6: General characteristics and classification of Wetland Unit S1.

HGM ID	S1	**HGM Type**	Seep Wetland	**Size**	1.92 Ha
Aspect	**Description**				
General Description	Wetland Unit S1 is a (valley head) seep wetland comprising 2 sub-units namely S1-A and S1-B. The wetlands occur on a longitudinal slope of approximately 5%. Sub-unit S1-A is 400m long and extends all the way to River Unit R3 (discussed in sections that follow). The upper half of sub-unit S1-A occurs on a concave valley head setting with limited erosion. Homesteads extend into the wetland habitat. The lower half of the wetland is completely eroded and characterised by a 4 – 12m wide and up to 5m deep gully. Sub-unit S1-B occurs within a shallow gully and the wetland habitat is confined to the floor of the gully. The current setting suggests that the wetland habitat has been slightly eroded down.				
Hydrology	Water inputs are mainly in the form of interflow from an up-slope direction. Water moves through the wetland as interflow and exits as evaporation and concentrated surface flows.				
Soil	Sub-unit S1-A was characterised by deep soils whilst sub-unit S1-B was characterised by shallow soils overlying saprolite. Soil samples extracted from the wetland habitat were dominated by loam and loamy sand with a grey soil matrix and distinct orange mottles. In contrast, terrestrial soils were characterised by brown soil with no sign mottling. Based on the analysis of soil samples, the wetland was dominated by temporary saturated soils.				
Vegetation	The wetland was characterised by a short grassland comprising a mix of tufted grasses such as *Eragrostis curvular, Juncus spp.*, and rhizotomous grasses namely *Cynodon dactylon* and *C. nlemfuensis.* The grassland was degraded and overgrazed.				

Photographs of Wetland Unit S1 are presented below:

Photo 7: View looking downstream of wetland unit S1-A.

Photo 8: Soil samples extracted from a temporally saturated zone. Note the orange soil mottles.

Photo 9: View of the gully side wall within the upper section of Wetland Unit S1-A. Note the grey colour of the soil and iron minerals (brown stains) that have been leached out of the soil indicating the presence of anaerobic conditions typical of wetland habitats.

Photo 10: Gully which forms the lower half of Wetland Unit S1-A.

Photo 11: View of Wetland Unit S1-B

Table 3.7: General characteristics and classification of Wetland Unit S2.

HGM ID	S2	**HGM Type**	Seep Wetland	**Size**	1.37 Ha
Aspect	**Description**				
General Description	Wetland unit S2 is a seep wetland that is situated on a gentle and even slope. The wetland has a longitudinal slope of 5%, a width of 20 – 50m and a length of 400m. The wetland feeds a small artificial dam located along the edge of River Unit R1.				
Hydrology	Water inputs are mainly in the form of interflow from an up-slope direction. Water moves through the wetland as interflow and exits as evaporation and concentrated surface flows.				
Soil	The wetland habitat was identified by a grey soil matrix with distinct orange mottles whilst the terrestrial habitat exhibited brown soils with no sign of wetness. Soil samples extracted from the wetland habitat had a loam texture. The wetland is dominated by the temporary saturated soils.				
Vegetation	Degraded grassland community characterised by a mix of short grasses.				

Photographs of Wetland Unit S2 are presented below:

Photo 12: View looking downslope of wetland unit S2. Note the high level of degradation.

Photo 13: Soil sample extracted from the wetland habitat. Note the presence of orange mottles which are indicative of high levels of saturation.

Table 3.8: General characteristics and classification of River Unit R1.

HGM ID	R1	**HGM Type**	Upper Foothills River	**Size**	4.82 Ha
Aspect	**Description**				
General Description	River Unit R1 was classified as an Upper foothills River due to having a longitudinal slope of 1.6% and being characterised by sandy reaches. The river is 20 – 40m wide and up to 3m deep.				
Hydrology	Flows are seasonal and largely confined to the active channel.				
Soil	The river was characterised by an alluvial (sandy) river bed with occasional bedrock outcrops whilst the banks was characterised by loam soil.				
Vegetation	The river bed was characterised by rhizotomous grasses and the river banks covered with an Acacia woodland. Dominant species recorded include *A. ataxacantha, A. nilotica, A. robusta, Ziziphus mucronata* and *A. karroo*.				

Photographs of River Unit R1 are presented below:

Photo 14: View of the instream habitat of River unit R1. Note rhizotomous grasses covered the instream habitat.

Photo 15: View of the lower reach of the River Unit R1.

Table 3.9: General characteristics and classification of River Unit R2.

HGM ID	R2	HGM Type	Mountain Stream	Size	2.62 Ha
Aspect	**Description**				
General Description	River Unit R2 was classified as a Mountain Stream due to having a longitudinal slope of 4 - 7% and being characterised by a stepped longitudinal profile. The lower reach of the river has a very gentle slope that qualifies it as a Transitional River but due to its short length the specialist has elected to go with the dominant characteristic which is a Mountain Stream. The river is 5 – 10m wide and up to 2m deep. The floor of the active channel has numerous isolated patches of wetland habitat particularly where drainage is poor. The river unit has been sub-divided into 3 sub-units namely R2-A which is the main river unit, R2-B and R2-C which are tributary river reaches.				
Hydrology	Flows are weakly seasonal and largely confined to the active channel.				
Soil	The river bed is characterised by a mix of alluvial material and loam with occasional bedrock outcrops. The river banks exhibited loamy soil mixed with course gravel.				
Vegetation	The instream habitat was a herbaceous community comprising a mix of small sedges and rhizotomous grasses whilst river banks were covered with a degraded grassland community comprising a mix of tufted and rhizotomous grasses.				

Photographs of River Unit R2 are presented below:

Photo 16: View of the mid-section of River Unit R2.

Photo 17: One of many patches of wetland habitat within River Unit R2.

Photo 18: Bedrock controlled section of River Unit R2-A.

Table 3.10: General characteristics and classification of River Unit R3.

HGM ID	R3	**HGM Type**	Upper Foothills River	**Size**	4.31 Ha
Aspect	**Description**				
General Description	River Unit R3 was classified as an Upper Foothills River due to having a gentle longitudinal slope of 1.2%. The river occurs below Wetland Unit CVB1. The river is 25 – 40m wide and up to 2m deep. The floor of the active channel has numerous isolated patches of wetland habitat particularly where water pools.				
Hydrology	Flows are weakly seasonal and largely confined to the active channel.				
Soil	The river bed is characterised by a mix of alluvial material and loam. The river banks exhibited loamy soil.				
Vegetation	Both the instream and riparian vegetation community were characterised by a mix of small sedges and rhizotomous grasses. The vegetation community was generally degraded owing to poor veld management.				

A photograph of River Unit R3 is presented below:

Photo 17: View looking upstream of River Unit R3.

3.5 Wetland Assessments

3.5.1 Present Ecological State Assessment

The PES of a wetland / wetland health is defined as a measure of the similarity of a wetland to a natural or reference condition and is determined through use of the WET-Health Assessment tool. The tool examines deviation from the natural reference condition for three components of health; hydrology, geomorphology and vegetation separately.

The results of the WET-Health assessment indicated that Wetland Unit S2 was 'moderately modified' (C PES Class) in terms of its PES whilst Units CVB2 and CVB3 were 'largely modified' (D PES Class) and Units CVB1 and S1 were 'seriously modified' (E PES Class). A summary of the assessment results and impact descriptions is provided in Table 3.11 below.

Table 3.11: PES assessment results for all wetland units.

HGM Unit	PES Components			PES Score & Category	Impact Description
	Hydro	Geo	Veg		
CVB1	7,5	3,8	7,0	**6,3 E Class**	**PES: Seriously Modified** Key impacts recorded include (i) increased channel incision resulting from increased water inputs from discharge of wastewater into the river and increased flood peaks from increased catchment hardening (ii) poor vegetation condition resulting from poor wetland management (overgrazing, etc.) (iii) wetland habitat transformation resulting from urban development and (iv) high sediment deposition within the historic dam location situated within the wetland habitat.
CVB2	4,0	2,3	5,7	**4,0 D Class**	**PES: Largely Modified** Key impacts recorded include (i) increased channel incision resulting from increased water inputs from discharge of wastewater into the river and increased flood peaks from increased catchment hardening (ii) increased soil saturation resulting from impoundment of flows by the road infrastructure, (iii) poor vegetation condition resulting from poor wetland management (overgrazing, etc.) and (iv) wetland habitat transformation resulting from urban development.
CVB3	6,0	1,5	6,5	**4,9 D Class**	**PES: Largely Modified** Key impacts recorded include (i) increased channel incision resulting from increased water inputs from discharge of wastewater into the river and increased flood peaks from increased catchment hardening and (ii) poor vegetation condition resulting from poor wetland management (overgrazing, etc.).
S1	6,0	5,0	8,5	**6,4 E Class**	**PES: Seriously Modified** Key impacts recorded include (i) increased flood peaks from increased catchment hardening (ii) poor vegetation condition resulting from poor wetland management (overgrazing, etc.) (iii) wetland habitat transformation resulting from urban development and (iv) high erosion of the wetland habitat (resulting from poor veld management) has significantly impacted the geomorphic integrity of the wetland
S2	2,0	0,1	5,0	**2,3 C Class**	**PES: Moderately Modified** Key impacts recorded include (i)increased water loses from the presence of a within-wetland dam, and (ii) poor vegetation condition resulting from poor wetland management (overgrazing, etc.).

3.5.2 Functional / EcoServices Assessment

The functionality of the wetland in terms of providing ecosystem services was assessed using the WET-EcoServices Level

2 Assessment tool (Kotze *et al.*, 2007). The tool accounts wetland attributes and observed impacts to provide an estimation of the level of ecosystem service supply.

For the purposes of the ecosystem service assessment, all wetland units were placed into 2 groups based on homogenous characteristics. Each group was then assessed as an individual wetland unit. The result of the grouping exercise is presented below:

i. **Group A**: CVB1, CVB2 and CVB3 (Channelled valley bottom wetlands)
ii. **Group B**: S1 and S2 (Seep wetlands)

In generally, all wetland units provided flood attenuation, streamflow regulation and some water quality enhancement benefits at a moderate level. Provisioning services and cultural benefits were supplied at a very low to low level. The moderate supply of flood attenuation and water quality enhancement benefits can be attributed to the wetland being (i) largely fed by sub-surface flows, (ii) characterised by a high water assimilative capacity, (iii) as well as the high demand for these services considering that the existing development has no waterborne sewage infrastructure. Provisioning benefits such as (water supply for human use, natural resources and cultivated foods) were supplied in very low to low level owing to high degradation of the wetland units and lack of surface water. The poor rating of cultural benefits (cultural significance, tourism and recreation, and education and research) can be attributed to lack of use of the wetland units for cultural benefits by locals. A summary of the assessment results is provided in Table 3.12 below.

Table 3.12: Functional / EcoServices assessment results for all wetland units.

Ecosystem Services			Functional / EcoServices Scores & Ratings	
			CVB1, CVB2, CVB3	S1 & S2
Regulating & Supporting Benefits	Flood attenuation		1,7 Moderate	2,0 Moderate
	Streamflow regulation		2,0 Moderate	1,8 Moderate
	Water Quality Enhancement Benefits	Sediment trapping	1,1 Low	1,3 Low
		Phosphate trapping	1,4 Low	1,8 Moderate
		Nitrate removal	2,0 Moderate	2,3 Moderate
		Toxicant removal	1,6 Moderate	1,8 Moderate
		Erosion control	1,8 Moderate	1,4 Low
	Carbon storage		1,3 Low	1,0 Low
Maintenance of biodiversity			0,8 Low	0,8 Low
Provisioning Benefits	Water supply for human use		0,7 Low	0,5 Very Low
	Natural resources		1,4 Low	1,4 Low
	Cultivated foods		1,4 Low	1,4 Low
Cultural Benefits	Cultural significance		1,0 Low	1,0 Low
	Tourism and recreation		0,4 Very Low	0,4 Very Low
	Education and research		0,3 Very Low	0,5 Very Low

3.5.3 Ecological Importance and Sensitivity Assessment

Ecological importance (EI) of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scale whilst ecological sensitivity (ES) (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.* 1988; Milner 1994).

For the purposes of the EIS assessment, all wetland units were placed into 2 groups based on homogenous characteristics. Each group was then assessed as an individual wetland unit. The result of the grouping exercise is presented below:

iii. **Group A**: CVB1, CVB2 and CVB3 (Channelled valley bottom wetlands)
iv. **Group B**: S1 and S2 (Seep wetlands)

The results of the EIS assessment indicated that all wetland units were of low EIS. A summary of the assessment results and impact descriptions are provided in Table 3.13 below.

Table 3.13: EIS assessment results for all wetland units.

HGM Unit	EIS Components		EIS Rating & Category	Impact Description
	EI	ES		
Group A CVB1, CVB2 & CVB3	1.10	1.33	**1.33 Low EIS**	**EIS: Low** The overall score for all wetlands, of 1.17 and 1.33, indicated that the wetlands were of low EIS. This was largely driven by anthropogenic impacts such as overgrazing, alternation of flow patterns, alteration of water quality and general wetland disturbances. These impacts have resulted in high degradation of the wetland habitat. The natural wetland habitat has been replaced by ruderal grasses and weeds. Furthermore, high degradation has created an unsuitable habitat for aquatic biota hence the lack of locally important or conservation important aquatic biota.
Group B S1 and S2	1.00	1.17	**1.17 Low EIS**	

3.6 Riparian Habitat Assessment

3.6.1 Present Ecological State Assessment

The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans 1996). The assessment of habitat integrity is based on an interpretation of the deviation from the reference condition (Kleynhans *et al.*, 2008).

The results of the IHI assessment indicated that River Unit R1 was 'largely natural' (B PES Class) in terms of its PES whilst River Unit R2 and R3 were 'largely modified' (D PES Class). A summary of the assessment results and impact descriptions are provided in Table 3.14 below.

Table 3.14: PES assessment results for River Units R1, R2 and R3.

Unit	Instream	Riparian	PES Score & Rating	Impact Description
R1	92/100	88/100	**90% B Class**	**PES: Largely Natural** Key impacts recorded include (i) poor veld management which has resulted in degradation of the vegetation community particularly herbaceous plants (ii) limited channel erosion resulting from increased flood peaks caused by catchment hardening and poor veld management, and (iii) limited water pollution from agricultural activities (livestock rearing) and urbanisation within the catchment.
R2	54/100	41/100	**53% D Class**	**PES: Largely Modified** Key impacts recorded include (i) poor veld management which has resulted in degradation of the vegetation community (ii) significant channel erosion resulting from increased flood peaks caused by catchment hardening and poor veld management, (iii) habitat degradation and transformation resulting from urbanisation (road crossings, footpaths, etc.) and (iv) water pollution from agricultural activities (livestock rearing) and urbanisation within the catchment.
R3	61/100	55/100	**58% D Class**	**PES: Largely Modified** Key impacts recorded include (i) poor veld management (overgrazing and vegetation trampling) which has resulted in degradation of the vegetation community (ii) significant channel erosion resulting from increased flood peaks caused by catchment hardening and poor veld management, (iii) bank erosion caused by vegetation trampling, and (iv) water pollution from agricultural activities (livestock rearing) and urbanisation within the catchment.

3.6.2 Ecological Importance and Sensitivity Assessment

Ecological importance of a river is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scale whilst ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al*., 1988; Milner, 1994).

River Unit R1 was assessed as having an EIS score of 2.0 which indicates that it is of moderate EIS whilst River Units R2 and R3 were assessed as having an EIS score of 1.00 and 1.20, respectively, which indicates that both rivers are of low EIS. A summary of the assessment results and rationale are provided in Table 3.15 below.

Table 3.15: EIS assessment results for River Units R1, R2 and R3.

Unit	EIS Score & Rating	Rationale
R1	2.00 Moderate EIS	**EIS: Moderate** The EIS score of 2.00 indicated that River Unit R1 was of moderate EIS owing largely to the 'largely natural' present ecological state of the river unit as discussed in 3.6.1. Low degradation levels mean (i) the river unit is still characterised by a good quality vegetation community that is of conservation importance, (ii) the river still has a good diversity of riparian and instream habitats which support a good diversity of aquatic biota and (ii) the river is an important migratory route for aquatic biota.
R2	1.00 Low EIS	**EIS: Low** The EIS score of 1.00 for the tributary river (Unit R2) indicated that the river is of low EIS. This is largely attributed to high degradation which has reduced the quality and diversity of riparian and instream habitats and thus reduced the ability of the habitat to sustain a higher diversity of aquatic biota. The small size of the river channel and the fact that it is characterised by ephemeral flows renders it less likely to support aquatic biota during times of environmental stress (e.g. drought).
R3	1.20 Low EIS	**EIS: Low** The EIS score of 1.20 for River Unit R3 indicated that the river was of low EIS. This is largely attributed to high levels of degradation which has reduced the quality and diversity of riparian and instream habitats and thus reduced the ability of the habitat to sustain a higher diversity of aquatic biota. High degradation has also reduced the sensitivity of the aquatic habitat to changes in water quality and flow patterns.

4 Impact Assessment & Mitigation

4.1 Impact Identification and Description & Significance Assessment

4.1.1 IMPACT 1: Loss of Freshwater Habitat & Biota Impact

Impact Description

The preliminary layout design provided to the specialist indicates that some targeted homesteads and the road infrastructure occur within the wetland habitat particularly (Wetland Units CVB1, CVB2, S1 and River Unit R2). It is also expected that the water and sewage pipeline would also cross both the delineated wetland habitats and river habitats. Due to the lack of information regarding the pipeline routes, wetlands and rivers to be crossed by the proposed pipelines could not be identified as the proposed designs for crossing the wetland and river habitats were not provided. Nevertheless, it is anticipated that a limited amount of wetland habitat would be transformed. Wetland habitats falling within existing homesteads are heavily degraded and are of lower functionality in comparison to areas falling outside existing homesteads. The loss of such wetland habitats would therefore have a low impact on the functionality of the residual wetland habitats.

Impact Significance Assessment

With some existing homesteads being situated within the delineated wetland habitat, there is a definite probability that in-situ housing and road upgrades as well as construction of new river crossings will result in the loss of freshwater habitat. The extent of freshwater habitat loss, however, could not be estimated due to lack of specific project details. Nevertheless, during the construction phase of the proposed development it is anticipated that the loss of freshwater habitat will be of high impact significance (55 impact significance points) under a poor or without mitigation scenario. Implementation of good mitigation measures will likely reduce the impact to a medium rating (27 impact significance points). During the operational phase, there is unlikely to be any significant loss of wetland habitat. Under a poor or without mitigation scenario, the loss of freshwater habitat will likely be of low impact significance (12 impact significance point). With implementation of good mitigation measures, the impact significance rating will likely be reduced (6 impact significance points). Tabulated results of the impact significance assessment are provided in Table 4.1 below.

Table 4.1: Summarised impact significance results for IMPACT 1: Loss of freshwater habitat and biota.

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Loss of freshwater habitat and biota	High (55)	Medium (27)	Low (12)	Negligible (6)

4.1.2 IMPACT 2: Degradation of Freshwater Habitat Impact

Impact Description

Degradation of freshwater habitat impact is likely to occur during both the construction and operational phases of the proposed development. Key activities likely to result in degradation of freshwater habitat include (i) undertaking earthworks for the bridge/culverts, houses and the water and wastewater pipelines, (ii) failing to rehabilitate disturbed areas appropriates, and (iii) poorly designing infrastructure such as stormwater management system, pipeline-river crossings, bridges and culverts. Removal of vegetation within the construction footprint during the construction phase will increase the risk of erosion and sedimentation of freshwater habitat. The development of erosion channels will promote concentrated flows and increased throughflows resulting in desiccation of the affected wetland habitat whilst increased sedimentation will raise the surface of the wetland and thus alter within-wetland water flows patterns. Failure to rehabilitate disturbed areas adequately following the completion of construction would increase the risk of the establishment of the undesired invasive alien plants which would reduce the quality of the wetland habitat. Invasive alien plants likely to pose a problem include the following plants which were recorded on site; Red sesbania (*Sesbania punicea*) and Indian shot (*Canna indica*). Poor designed infrastructure such as bridges, culverts and pipeline crossings could (i) block flows in the river resulting in increased inundation and blocking of migratory aquatic biota or (ii) lead to increased channel incision and loss of sediment from the wetland habitat and sedimentation of the low-lying wetland habitat. On the whole, affected freshwater habitat would experience a decline in the functionality and ecological integrity.

Impact Significance Assessment

Under a poor or without mitigation scenario of the construction phase, the degradation of freshwater habitat will likely be of medium impact significance (40 impact significance points) owing to increased disturbance, erosion and sedimentation of the freshwater habitat. If adverse impacts are managed well, the impact significance will likely be reduced to a low rating (18 impact significance points). The same is anticipated for the operational phase. Without mitigation, degradation of freshwater habitat will be of medium significance (45 impact significance points) but can be reduced to a low rating (18 impact significance points) if best practice mitigation measures are implemented. Tabulated results of the impact significance assessment are provided in Table 4.2 below.

Table 4.2: Summarised impact significance results for IMPACT 2: Degradation of freshwater habitat.

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Degradation of freshwater habitat	Medium (40)	Low (18)	Medium (45)	Low (18)

4.1.3 IMPACT 3: Water and Soil Quality Pollution Impact

Impact Description

Two major activities pose a pollution risk to the freshwater habitat. These are (i) undertaking earthworks with and in close proximity to the freshwater habitat and (ii) the operation of a wastewater pipeline that will construction across freshwater habitat. The earthworks are poorly done, the activity will likely to result in (a) soil erosion which will lead to increased turbidity of open water within the freshwater habitat and (b) contamination of the freshwater habitat by hydrocarbons resulting in the mortality of aquatic biota and affected aquatic vegetation. Leakage of the wastewater pipeline within or in the vicinity of watercourses would result in eutrophication. Both these activities will result in the degradation of wetlands and associated rivers. Whilst aquatic ecosystems have the natural tendency to adapt and compensate for changes in water quality parameters through dilution and biodegradation of some organic compounds, water pollution results when their capacity is exceeded, Consequently, eutrophication results due to nutrient overload. Given the ephemeral to seasonal nature of flows characteristic of delineated watercourses, the risk of eutrophication is high. Eutrophication will cause structural changes to the ecosystem such as algal bloom, excessive growth of invasive plants (e.g. water hyacinth), abundance of particulate substances (phytoplankton, zooplankton, bacteria, fungi and debris) that determine the turbidity of the water, deterioration of water quality (particularly depletion of dissolved oxygen concentration and increase of inorganic chemicals such ammonia, nitrites, hydrogen sulphide etc) and depletion of fish species. The health of the aquatic ecosystem can be negatively affected by the presence of toxic substances. This can further exacerbate the high population of pathogens in the water.

Impact Significance Assessment

During the construction phase, it is anticipated that soil and water pollution impacts will be of medium impact significance (40 impact significance points) under a poor mitigation scenario with the possibility of reducing the significance to a low rating (18 impact significance points) if best practise mitigation measures are implemented. Soil and water pollution impact likely to occur during the operational phase under a poor mitigation scenario were assessed to be of high impact significance (55 impact significance points). With implementation of good mitigation measures, the impact will be reduced to a low impact significance (18 impact significance points). Tabulated results of the impact significance assessment are provided in Table 4.3 below.

Table 4.3: Summarised impact significance results for IMPACT 3: Soil and water pollution.

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Soil and water pollution	Medium (40)	Low (18)	High (55)	Low (18)

4.2 Stormwater Management Recommendations

Stormwater is generally a major problem in urban developments due to increased hardened surfaces which restrict infiltration but promote increased runoff. It is therefore of paramount importance that sustainable stormwater management

methods are implemented for developments with hardened surfaces. The general principle for stormwater management is to reduce the rate of runoff to a pre-development state and ensure that runoff is adequately attenuated at all discharge points. In this regard the following mitigation measures are recommended::

Point-Source Mitigation Measures

i. Hardened surfaces such as driveways, paved walkways, paved yards etc. must be kept to a minimum. If required, porous paving such as block paving must be used in favour of impervious blocks
ii. All units must have rainwater harvesting infrastructure. A common and acceptable technology is diverting stormwater from the gutter into Jo-jo tanks for storage. Harvested water can then be used for gardening purposes as an example. The acceptable storage ratio for rainwater tanks is 60% of the volume of the tank. In other words, when calculating the volume of storage required (on the 1 m^3 to 40 m^2 area) then 60% of the rainwater tank volume may be claimed on the assumption that the tank is 40% full at any given time.
iii. Runoff generated by arterial roads must be handled through use of grassed swales. Where required grassed swales can be reinforced with gabion mattresses to prevent erosion. Short runner grasses are preferred for this technology.
iv. Grassed swales must be designed to divert runoff away from the road and into the veld at regular intervals. This reduces discharge quantities at each discharge point and thus minimising the risk of erosion.
v. Stormwater must never be discharged into the sewer infrastructure. The two must always be kept separate.

End-point Mitigation Measures

In the event that point-source mitigation measures are not adequate to handle stormwater end-point mitigation measures will need to be implemented. These include:

vi. Stormwater over flows from rainwater harvesting infrastructure and any other infrastructure must be discharged into grassed swales or a water retaining structure such as a soak pit if the soil and geological profiles allow.
vii. Soak pits must be constructed at least 3m away from buildings to avoid any water damage to infrastructure.
viii. All soak pits must be designed to allow for removal of accumulated silt, organic material and any other wind-blown material from the soak pit in order to ensure continued effective functioning.
ix. All stormwater collection, detention, attenuation, conveyance and outlet structures must be established outside delineated watercourses and their buffer zones. This is necessary to allow the buffer zone to dissipate and filter stormwater before it reaches downstream watercourses.
x. A series of smaller stormwater outlets should be considered over a few large outlets.
xi. All stormwater discharges into watercourses must be attenuated at discharge points prior to entering the watercourse. Such attenuation infrastructure must ideally be located outside delineated watercourses. The longer the distance the better.
xii. Appropriate outlet structures and energy dissipater blocks are to be specified at all discharge points to break the energy of the storm water.
xiii. Where concrete side drains are to be specified (with motivation), the design team should consider disconnecting the impervious sections at regular intervals with vegetated sections to reduce flow velocities and promote infiltration.

4.3 Culvert Design Recommendations

The following best-practice environmental design considerations are to be considered in culvert design and construction:

i. Culverts should ideally be installed during the dry season to reduce the risk of erosion and sedimentation during construction. This is especially pertinent to culvert where large seasonal flows are likely to be encountered.
ii. Culverts should ideally be sized to transport not only water, but the other materials that might be mobilized, as well as provide passage of aquatic species such as fish.
iii. Box / portal culverts should be used where possible rather than large diameter pipes.
iv. The culvert outlet apron must be established at the same level as the river bed.
v. Many large culverts are preferred over fewer small culverts. This ensures that these structures cater for the maximum flow volumes experienced by the river. To prevent culvert plugging, one large culvert is typically more effective than several smaller ones.
vi. Erosion protection measures (e.g. Reno-mattresses) or energy dissipaters must be established below all culvert outlets.

vii. The base (invert) of the new portal/box culvert must be at the exact same elevation as the existing one so that there are no significant upstream and downstream adjustments in channel form.
viii. The inlet of the culvert base must match the elevation of the river bed so that there is no culvert base perching (if culvert inlet higher than river bed) or a drop into the culvert (if culvert inlet lower than river bed).
ix. The culvert must be designed to adequately allow for the natural through flows without impeding and focusing flows.
x. A headwall should be installed at the inlet of the culvert to protect crossing fill from saturation and scour and direct flow into the culvert. The stream should flow straight into the culvert inlet at all stream discharges without any ponding, eddying or abrupt changes in flow path which could result in increased potential for culvert blockage by woody material.
xi. In situations where the base of the culvert is below natural ground level, a concrete drop inlet structure or chute must be constructed at the inlet of the culvert to drop the water level without causing head cut erosion of the upstream watercourse.

4.4 Watercourse Buffer Recommendations

Given that existing infrastructure is situated within wetland habitats, proposing development setbacks (particularly buffers) is not feasible and therefore has not been undertaken. The contractor is however, encouraged to minimise any impacts when working within delineated watercourses.

4.5 Additional Mitigation Measures

4.5.1 Development Setback

i. All proposed development activities with the exception of pipeline crossings must be established outside the 1 in 100-year flood line.
ii. A 1 in 100-year flood line assessment must be commissioned prior to finalisation of the development layout.

4.5.2 Construction Footprint Limit & Demarcation

i. Prior to commencement of construction all watercourses (wetland and river habitats) occurring within the proposed development area must be demarcated using wooden pegs and an orange safety net or danger tape.
ii. The demarcation fence must be signed off by the Environmental Control Officer (ECO).
iii. In the event that the homestead to be developed occurs within the mapped wetland habitat, all new buildings must be constructed on high ground or previously disturbed areas within the homestead.
iv. The fence must be maintained throughout the construction phase.

4.5.3 Recommendations for Wastewater Pipeline Crossing Water Resources

i. All major watercourses must be crossed using above-ground pipeline crossings. Preferable the pipeline must be strapped to existing river crossing structures such as bridges.
ii. Watercourse crossings must be kept to a minimum.
iii. Where feasible, the wastewater pipeline must be constructed at least 30m from delineated watercourses.

4.5.4 Wastewater Disposal Recommendations

The following wastewater disposal methods are recommended:
i. Only full waterborne sanitation must be provided for each housing unit.
ii. Linking to an existing sewer infrastructure must be given priority over setting up an onsite treatment plant.

4.5.5 Soil Management

i. Prior to commencing with earthworks, the topsoil must be stripped and stockpiled separately from subsoil.
ii. Topsoil must be kept for use during rehabilitation of landscaped areas.

iii. Topsoil stockpiles must not exceed 2m in height.
iv. All stockpiles must be kept free of weeds and invasive alien plants.
v. If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile.
vi. All stockpiles must be established outside the 30m buffer of all watercourses and on flat ground.

4.5.6 Pollution Prevention Measures

i. Any soil contaminated by hydrocarbons (fuel and oils) must be removed and the affected area rehabilitated immediately.
ii. Chemical toilets must be provided to workers during the construction phase. A single chemical toilet must be provided for every 10 employees.
iii. Chemical toilets must be serviced regularly by a registered service provider and waybills must be retained as proof of servicing.
iv. Fuel must be stored in a bunded structure with a roof. The bund must be able to contain at least 110% of the volumes of fuel.
v. Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface.
vi. Drip trays must be utilised at all dispensing areas.
vii. A chemical spill kit must be present onsite at all times and once used it must be disposed of at a registered hazardous landfill site.
viii. All solid waste must be collected and placed in bins.

4.5.7 Dewatering of Excavations

i. If any excavation requires dewatering, water pumped from the working areas must be diverted into an appropriate filtering area to handle dewatering.
ii. Dewatering of trenches and excavated pits shall be undertaken in a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any downstream wetland/river.
iii. Pumped water must be passed through a series of silt traps prior to flowing back to the watercourse. The location of the filtering area should be approved by the ECO with aim of minimising erosion risks.

4.5.8 Invasive Alien Plant Control

i. The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs in.
ii. All invasive alien plants must be removed from the construction area.
iii. Mechanical control methods such as digging, hoeing, pulling out of weeds and invasive plants are recommended.
iv. Use of chemical treatment methods must be kept to a minimum.
v. Where chemical treatment methods are used, the contractor must ensure that he uses watercourse friendly herbicides.
vi. The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

5 Water Use Authorisation

5.1 Applicable Water Use Authorisation

The General Authorisation (GA) for the impeding or diverting the flow of water in a watercourse (Section 21 c) or altering the bed, banks, course or characteristics of a watercourse (Section 21 i) as contemplated in the National Water Act (Act No. 36 of 1998) was implemented to replace the need for a water user to apply for a licence provided that the water use is within the limits and conditions of this GA. However, according to the Government Notice 509 of 2016, *"the GA does not apply:*

a) to the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009;
b) to the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the Risk Matrix;
c) in instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;
d) where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse; and
e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works."

As per exclusion (e) from above-mentioned exclusions from the GA, the installation of sewer pipelines does not qualify for a GA. Therefore, the entire project will need to be authorised through an application for a Water Use Licence.

5.2 Special Conditions for the Water Use Licence

Special conditions listed below are recommended and must be included in the Water Use Licence to be issued by the Department of Water and Sanitation.

a) The water user must ensure no development is located:
   i. within the 1 in 100-year flood line of the river; and
   ii. within the wetland habitat and associated wetland buffer zone.
b) The water user must ensure that:
   i. impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse does not detrimentally affect the resource quality;
   ii. the construction and operation of the proposed development does not cause a detrimental change in the quality of water in the watercourse.
c) The water user must ensure that any structure constructed within or on close proximity to any watercourse:
   i. is structurally stable (structural integrity must be assessed as required);
   ii. does not induce sedimentation, erosion or flooding;
   iii. does not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse;
   iv. does not cause a detrimental change in the quality of water in the watercourse; and
   v. does not cause a detrimental change in the stability or geomorphological structure of the watercourse.
d) Prior to the carrying out of any works, the water user must ensure that all persons entering the construction site, including contractors and casual labourers, are made fully aware of the conditions and related management measures specified in the General Authorisation, Environmental Authorisation and EMPr.
e) The water user must ensure that any construction camp, storage, washing and maintenance of equipment, storage of construction materials, or chemicals, as well as any sanitation and waste management facilities:
   i. are located outside the 1 in 100-year flood line or 30m from any delineated wetland habitat; and
   ii. are removed within 30 days after the completion of any works.
f) The water user must ensure that no vegetation is cleared or damaged within the wetland habitat.
g) The water user must ensure that measures are taken to prevent increased turbidity, sedimentation and detrimental chemical changes to the composition of the water resource as a result of carrying out the works, including for emergency alterations or the rectification of reportable incidents.

h) The water user must ensure that adequate erosion control measures (bund, berms, sand bags etc.) are installed on all areas susceptible to erosion or runoff.
i) All roofed structures must have rainwater harvesting infrastructure. A common and acceptable technology is diverting stormwater from the gutter into Jo-jo tanks for storage. Harvested water can then be used for gardening purposes for example. The acceptable storage ratio for rainwater tanks is 60% of the volume of the tank. In other words, when calculating the volume of storage required (on the 1 m^3 to 40 m^2 area) then 60% of the rainwater tank volume may be claimed on the assumption that the tank is 40% full at any given time.
j) Clean stormwater must never be discharged into the sewer infrastructure. The two must always be kept separate.
k) Stormwater over flows from rainwater harvesting infrastructure associated with the commercial and light industrial buildings must be discharged into a water retaining structure such as a soak pit.
l) All stormwater generated by the commercial and light industrial must be attenuated onsite and within the property boundary. This means all stormwater collection, detention, attenuation, conveyance and outlet structures must be established within the proposed boundary.
m) The entire development must have a full waterborne sewer system which is linked to the municipal sewer infrastructure.
n) During the construction phase of the project, the water user must appoint an Environmental Control Officer to undertake bi-monthly site visits (one to undertake an environmental audit and another to check on progress). The environmental audit report must discuss non-compliances of the Water Use License, Environmental Authorisation and the approved Environmental Management Programme (EMPr).
o) All environmental audit reports must be made available to the responsible authority upon written request.

6 Conclusion

This assessment has enabled the identification, delineation and assessment of 5 wetland units and 3 river units likely to be impacted by the proposed development. All wetland and river units were found to be moderately modified (C PES Class), largely modified (D PES Class) or seriously modified (E PES Class) and of low EIS. These ratings were largely attributed to high degradation linked with anthropogenic impacts. River Unit R1 was an exception in that it was assessed as largely natural (B PES Class) and of moderate EIS. With regards to ecosystem service delivery, all wetlands were found to provide most ecosystem services at a low to moderate level. Key services provided include flood attenuation, streamflow regulation and water quality enhancing services (such as phosphate trapping, nitrate removal, toxicant removal).

The proposed development was assessed as likely to have a **"medium to high impact significance"** on the aquatic environment, but if best practice mitigation measures are effectively implemented, the impact significance will be reduced to a "**low to medium**" level (Table 6.1). A suite of mitigation measures has been proposed in the report to mitigate identified impacts. The "low to medium" impact significance rating is considered environmentally acceptable and therefore the project should be granted environmental authorisation provided recommended mitigation measures are implemented.

Table 6.1: Summarised impact significance results.

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Loss of freshwater habitat and biota	High (50)	Medium (21)	Medium (24)	Low (12)
Degradation of freshwater habitat	Medium (36)	Low (18)	Medium (36)	Low (14)
Soil and water pollution	Medium (27)	Low (15)	Medium (27)	Low (18)

In accordance with the National Water Act, No. 36 of 1998 (NWA) and Government Notice 509 of 2016 (General Authorisation), the proposed Bhekumthetho Phase 2 housing development and infrastructure upgrade does not qualify for a GA because it entails an activity that is excluded from the provisions of the GA. According to the Government Notice 509 of 2016, "*the GA does not apply (e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works.*" Therefore, an application for a Water Use Licence must be submitted to the Department of Water and Sanitation (DWS). A suite of special conditions listed in Section 5.2 have been recommended for inclusion in the Water Use Licence to be issued by the DWS.

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8 Appendices

8.1 Wetland Assessments

8.1.1 Wetland Delineation

Onsite wetland delineation was undertaken as per procedures described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (Department of Water Affairs, 2005). This document requires the delineator to give consideration to the following 4 indicators in order to find the outer edge of the wetland zone:

i. The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur.
ii. The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
iii. The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. Signs of wetness are characterised by a variety of aspects. These include marked variations in the colours of various soil components, known as mottling; a gleyed soil matrix or the presence of Fe/Mg concretions. It should be noted that the presence of signs of wetness within a soil profile is sufficient to classify an area as a wetland area despite the lack of other indicators.
iv. The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

8.1.2 Wetland Classification

All natural-occurring wetland units were classified according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013) which categorise wetlands into 6 distinct hydrogeomorphic (HGM) units. See Table 8.1 for a description of each HGM Unit.

Table 8.1: Description of wetland HGM units.

HGM Type	Description
Channelled valley bottom wetland	A mostly flat wetland area with a river channel running through it located along a valley floor, often connected to an upstream or adjoining river channel.
Unchanneled valley bottom wetland	A mostly flat wetland area without a river channel running through it located along a valley floor, often connected to an upstream or adjoining river channel.
Floodplain	A wetland area on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by overtopping of the channel bank.
Seep	a wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend onto a valley floor.
Flat	A level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.
Depression	a wetland or aquatic ecosystem with closed (or near-closed1) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.

Illustrations of the different wetland HGM types is provided in Figure 8.1.

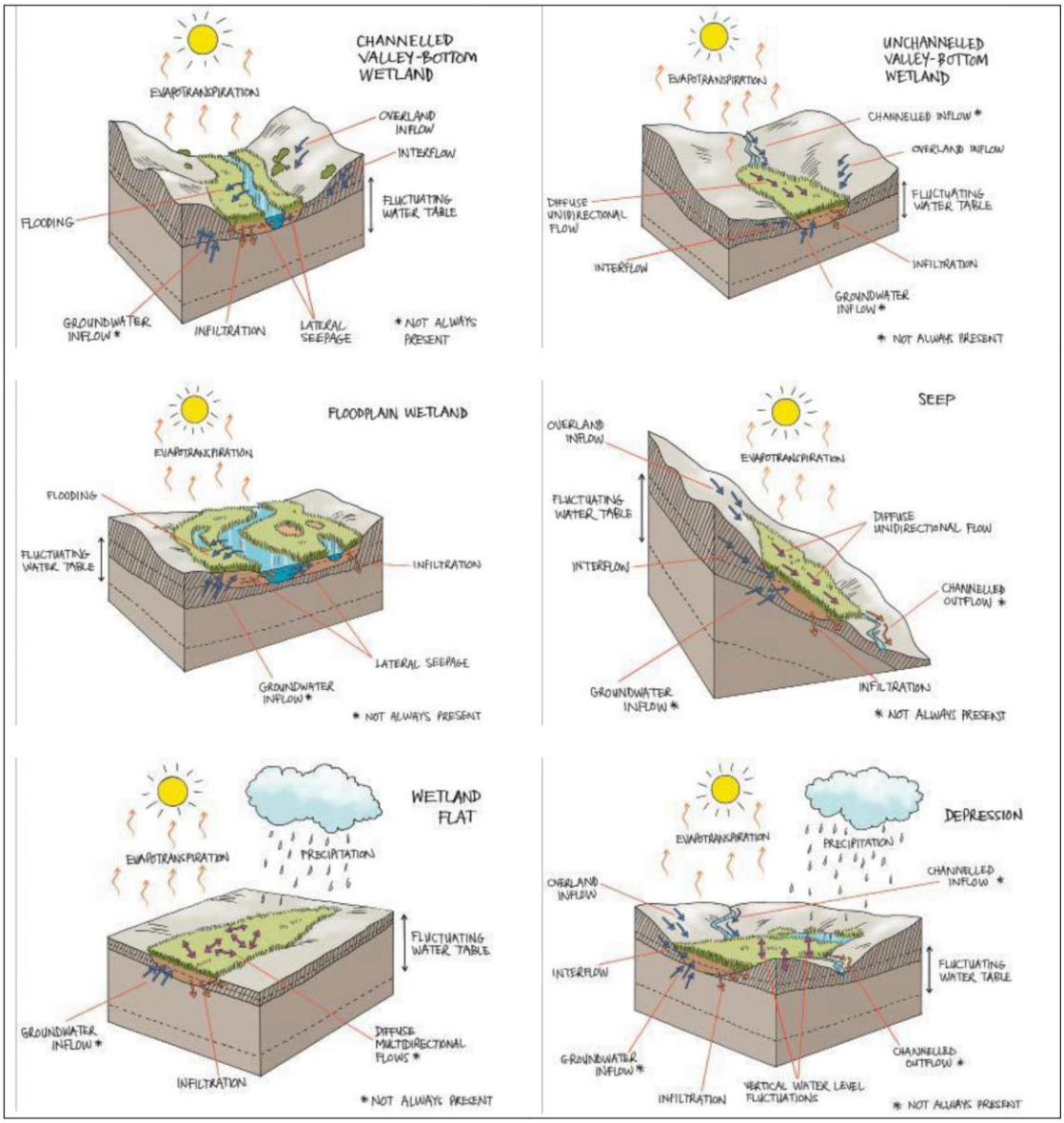

Figure 8.1: Illustrations of the different wetland HGM types.

8.1.3 Wetland Present Ecological State Assessment

The health or integrity of wetlands was assessed using WET-Health Level 1 Assessment tool. The tool attempts to assess the deviation of 3 key wetland components from their reference state prior to human induced degradation (Macfarlane *et al.* 2008). These components namely hydrological, geomorphological and vegetation are assessed separately and the results are integrated to obtain and overall score (Macfarlane *et al.* 2008). An overall wetland health score is calculated by weighting the scores obtained for each component using the following formula:

$$\textbf{Overal Health Score} = \frac{(\text{Hydrology X } 3) + (\text{Geomophology X } 2) + (\text{Vegetation X } 2)}{7}$$

The overall health score is then interpreted using a categorised system ranging from A to F with "Category A" signifying that the wetland is in a natural / unmodified state whilst the other end of the gradient "F" signifying that the wetland is critically modified. Details of the scoring system are presented in Table 8.2 below.

Table 8.2: Impact scores and categories of Present State used in WET-Health for describing the integrity of wetlands.

Impact Category	Description	Range	PES Category
None	Unmodified, natural.	0 – 0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

8.1.4 Wetland Functional Assessment

The functionality of the wetland in terms of providing ecosystem services was assessed using the WET-EcoServices Level 2 Assessment tool (Kotze *et al.*, 2007). The tool accounts wetland attributes and observed impacts to provide an estimation of the level of ecosystem service supply. Table 8.3 lists all ecosystem services assessed and also provide a description of each service.

Table 8.3: Description of each ecosystem service assessed.

Indirect Benefits	Flood Attenuation		*Refers to the effectiveness of wetlands at spreading out and slowing down storm flows and thereby reducing the severity of floods and associated impacts.*
	Regulating and Supporting Services	Stream Flow Regulation	*Refers to the effectiveness of wetlands in sustaining flows in downstream areas during low-flow periods.*
		Sediment Trapping	*Refers to the effectiveness of wetlands in trapping and retaining sediments from sources in the catchment.*
		Nutrient & Toxicant Retention and Removal	*Refers to the effectiveness of wetlands in retaining, removing or destroying nutrients and toxicants such as nitrates, phosphates, salts, biocides and bacteria from inflowing sources, essentially providing a water purification benefit.*
		Erosion Control	*Refers to the effectiveness of wetlands in controlling the loss of soil through erosion.*
	Carbon Storage		*Refers to the ability of wetlands to act as carbon sinks by actively trapping and retaining carbon as soil organic matter.*
Direct Benefits	Biodiversity Maintenance		*Refers to the contribution of wetlands to maintaining biodiversity through providing natural habitat and maintaining natural ecological processes.*
	Provisioning Benefits	Water Supply	*Refers to the ability of wetlands to provide a relatively clean supply of water for local people as well as animals.*
		Harvestable Natural Resources	*Refers to the effectiveness of wetlands in providing a range of harvestable natural resources including firewood, material for construction, medicinal plants and grazing material for livestock.*
		Cultivated Foods	*Refers to the ability of wetlands to provide suitable areas for cultivating crops and plants for use as food, fuel or building materials.*
		Food for Livestock	*Refers to the ability of wetlands to provide suitable vegetation as food for livestock.*

	Cultural Benefits	Cultural significance	*Refers to the special cultural significance of wetlands for local communities.*
		Tourism & Recreation	*Refers to the value placed on wetlands in terms of the tourism-related and recreational benefits provided.*
		Education & Research	*Refers to the value of wetlands in terms of education and research opportunities, particularly concerning their strategic location in terms of catchment hydrology.*

8.1.5 Wetland Ecological Importance and Sensitivity Assessment

The ecological importance and sensitivity (EIS) of wetlands was assessed using an unpublished revision of the DWAF EIS tool by Rountree & Kotze, 2013. The tool assesses 3 aspects of the wetland including:

i. The Importance of the wetland in providing habitat to biodiversity,
ii. Landscape importance, and
iii. The sensitivity of the wetland to changes in flow regime and water quality.

The results of the assessment are interpreted as per the following guideline presented in Table 8.4.

Table 8.4: Ecological importance and sensitivity scores, ratings and description.

EIS Score	EIS Rating	EIS Category Description
0 - 0.5	Very Low	Wetlands that are not ecologically important and sensitive at any scale due to high degradation levels.
0.6 - 1.5	Low	Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers
1.6 - 2.7	Moderate	Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers
2.8 - 3.5	High	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers
<3.5	Very High	Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers

8.2 River Assessments

8.2.1 Riparian Habitat Delineation

Onsite riparian zone delineation was undertaken as per procedures described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005). This document requires the delineator to give consideration to the following 3 indicators in order to delineated the riparian zone:

i. Topography associated with the watercourse;
ii. Vegetation; and
iii. Alluvial soils and deposited material.

8.2.2 Index of Habitat Integrity Assessment

The riparian habitat was characterised and assessed according to Section D of the "Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems" (Kleynhans, 1999). The assessment works by estimating the extent of impacts to the instream and riparian habitat separately and then computing the final result to get the overall health score for each riparian unit. Attributes considered in both the instream and riparian habitat are presented in Table 8.5 and the final

IHI scores and categories are presented in Table 8.6.

Table 8.5: Criteria and weights used for the assessment of habitat integrity.

Instream Criteria	Weight
Water abstraction	14
Flow modification	13
Bed modification	13
Channel modification	13
Water quality	14
Inundation	10
Exotic macrophytes	9
Exotic fauna	8
Solid waste disposal	6
TOTAL	**100**

Riparian Zone Criteria	Weight
Indigenous vegetation removal	13
Exotic vegetation encroachment	12
Bank erosion	14
Channel modification	12
Water abstraction	13
Inundation	11
Flow modification	12
Water quality	13
TOTAL	**100**

Table 8.6: Index of Habitat Integrity categories.

Score	Category	Description
90 - 100	A	Unmodified, natural.
80 - 89	B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
60 - 79	C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.
40 - 59	D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
20 - 39	E	The loss of natural habitat, biota and basic ecosystem functions is extensive.
0 - 19	F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

8.2.3 River Ecological Importance and Sensitivity Assessment

The ecological importance and sensitivity of rivers was assessed using the EIS tool by Kleynhans (1999). This approach estimates and classifies the ecological importance and sensitivity of rivers in a catchment by considering a number of components surmised to be indicative of these characteristics. These components are described in Table 8.7 and the final scores, ratings and description of categories are presented in Table 8.8.

Table 8.7: Description of biota and habitat determinants for assessment of EIS.

	Determinant	Description
Biotic determinants (instream and riparian)	Rare and endangered biota	Considers rare or endangered biota on a local, Provincial and National scale.
	Unique biota	Considers endemic or uniquely isolated species populations (or taxa, i.e. in the case of invertebrates) that are not rare or endangered should be included here. It also considers local, Provincial and National scales and is treated separately from rare and endangered species (i.e. the same species is not considered).
	Intolerant biota	Considers intolerant biota includes those species (or taxa in the case of invertebrates) that are known (or derived or suspected) to be intolerant to decreased or increased flow conditions as well as changed physical habitat and altered water quality conditions related to decreased or increased flows.

	Species/taxon richness	Species/taxon richness is assessed on a comparative basis according to a local, Provincial or National scale.
Habitat (instream and riparian) determinants	Diversity of aquatic habitat types or features	Diversity of habitat types in a river delineation is assessed according to local, Provincial and National scales (riffles, rapids, runs, pools and backwaters and the associated marginal areas and substrate types, lotic wetlands (source sponges, floodplain habitat types) and the riparian zone).
	Refuge value of habitat types	The functionality of the habitat types present is assessed in terms of their ability to provide refugia to biota during periods of environmental stress on a local, Provincial and National scale.
	Sensitivity of habitat to flow changes	Takes into account the size of the stream as well as the habitat types available. The presumption is that only a limited decrease or increase in the flow (and the related depth and width) of certain rivers (often "smaller" streams) will result in particular physical habitat types (i.e. riffles), becoming unsuitable for biota as compared to "larger" streams.
	Sensitivity to flow related water quality changes	This assessment should also consider the size and flow of the stream in terms of its sensitivity to water quality changes. A decrease in the natural flow volume may, for example, result in a diminished assimilative capacity (in the situation where effluent forms part of the total flow volume) or may cause natural water quality variables (i.e. water temperature and oxygen) to reach levels detrimental for biota (also applicable to increases in flow). The assumption regarding the sensitivity of "smaller" streams is also applicable here. In terms of organic pollution load, it has been pointed out that slow flowing deep rivers would be impacted over greater distances than fast flowing shallow rivers where re-aeration rates would be high.
	Migration route/corridor for instream and riparian biota	The importance of a specific stream delineation in terms of the link it provides for the upstream and downstream biological functioning of other sections of the stream, is indicated here (i.e. connectivity). In essence the biological connectivity provided by a particular stream delineation can influence its ecological importance and result in an adapted (i.e. higher) rating than it would have had if was assessed only on its own.
	National parks, Wilderness areas, Nature reserves Natural Heritage sites Natural areas	The presence of conservation (i.e. National Parks, Wilderness areas and Nature Reserves) and natural areas (i.e. un-proclaimed, relatively unmodified/undisturbed areas) within a stream delineation will logically place an additional emphasis on the ecological importance and sensitivity of a stream.

Table 8.8: Ecological importance and sensitivity scores, ratings and category description.

EIS Score	EIS Rating	EIS Category Description
0 - 0.5	Very Low	Wetlands that are not ecologically important and sensitive at any scale due to high degradation levels.
0.6 - 1.5	Low	Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers
1.6 - 2.7	Moderate	Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers
2.8 - 3.5	High	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers
<3.5	Very High	Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers

8.3 Detailed Impact Significance Assessment Results

Detailed impact significance assessment results are provided in Table 8.5 below.

Table 8.9: Detailed impact significance assessment results for the construction and operational phases of the project.

Construction Impact		Without Mitigation					With Mitigation				
		Magnitude	Duration	Extent	Probability	Significance	Magnitude	Duration	Extent	Probability	Significance
C 1	Loss of aquatic habitat and biota impact	4	5	1	5	High (50)	1	5	1	3	Medium (21)
C 2	Degradation of aquatic biota impact	4	3	2	4	Medium (36)	2	3	1	3	Low (18)
C 3	Water and soil pollution impact	4	3	2	3	Medium (27)	2	2	1	3	Low (15)

Operational Impact		Without Mitigation					With Mitigation				
		Magnitude	Duration	Extent	Probability	Significance	Magnitude	Duration	Extent	Probability	Significance
O 1	Loss of aquatic habitat and biota impact	4	3	1	3	Medium (24)	2	3	1	2	Low (12)
O 2	Degradation of aquatic biota impact	4	3	2	4	Medium (36)	2	3	2	2	Low (14)
O 3	Water and soil pollution impact	4	3	2	3	Medium (27)	1	3	2	3	Low (18)

BHEKUNTHETHO PHASE 2 HOUSING & SERVICES UPGRADE PROJECT

Abaqulusi Local Municipality

Construction & Operational Stage

ENVIRONMENTAL MANAGEMENT PROGRAMME

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Table of Contents

I. Glossary of Terms and Abbreviations (See Annexure A)

II. Key to Acronyms

- EDTEA Economic Development Tourism and Environmental Affairs
- DME Department of Mineral and Energy
- ECO Environmental Control Officer
- EMPr Environmental Management Programme
- EA Environmental Authorisation
- ARC Agriculture Research Council
- BA Basic Assessment
- BAR Basic Assessment Report
- BID Background Information Document
- DEA Department of Environmental Affairs
- DWS Department of Water & Sanitation
- EIA Environmental Impact Assessment
- EIR Environmental Impact Report
- EAP Environmental Assessment Practitioner
- I&APs Interested and/or Affected Parties
- LRAD Land Reform for Agricultural Development
- NEMA National Environmental Management Act, 1998(Act 107 of 1998)
- NHRA National Heritage Resources Act
- SAHRA South African Heritage Resource Agency
- SANBI South African National Biodiversity Institute

EMP: SECTION 1: INTRODUCTION

1.1. Background

The National Environmental legislation requires that an assessment of potential environmental issues is undertaken as an important component of development projects. The Environmental Impact Assessment process identifies potential impacts that may arise at various stages of the development process and how these impacts can be mitigated. An Environmental Management Plan serves as a guideline.

Bizycon Pty Ltd (PTY) LTD conducted a Basic Assessment environmental investigation regarding the Bhekhumthetho in-situ upgrade and formalisation which include service installations such as roads upgrades, water reticulation and sewer reticulation. This process identified potential environmental impacts that may arise and made recommendations in the report on how these impacts can be managed, especially during construction stages of the development. It also identified issues that should be considered during the operational phase of the development.

This EMP is a key environmental document, the content of which the line contractor must comply with during the construction process with the assistance of an environmental control officer and the site engineer and all relevant role players. This is to include any post construction rehabilitation work, which may be needed, and which would be carried out by the contractor or specialist subcontractor who he may appoint to do such rehabilitation when needed.

This EMPr is also developed in accordance with the requirements of the National Environmental Management Act (NEMA, Act 107 of 1998).

1.2 Aims and objectives of the EMPr

1.2.1 Aim

This EMP outlines measures to be implemented in order to minimize the potential environmental impacts associated with construction works along the drainage lines, rivers and associated wetlands. It serves as a guide for the contractor and the construction workforce on their roles and responsibilities concerning environmental management on site, and it provides a framework for environmental monitoring throughout the construction period.

1.2.2 Objectives

The EMP becomes a legally binding document upon granting of an environmental authorisation. The objectives of this EMP include:

- Encourage good management practices through implementation of the proposed development and ensure commitment to environmental issues;

- Define how the management of the environment is reported and performance evaluated;
- To point out necessary mitigation measures to be carried out
- Develop waste management practices based on prevention, minimization, recycling, treatment or disposal of wastes;
- Follow all monitoring procedures required to identify impacts on the environment; and;
- Provide guidance to the employees and contractors regarding their environmental and legislative obligations.

SECTION 2: REGULATORY / LEGISLATIVE CONTEXT

The EPMr is prepared taking into cognizance relevant legislative instruments that relate to the proposed development. The on us lies on the applicant to ensure adherence to all necessary regulations. Contractors must be alerted of the existence of the EMPr and its legislative implications and the need to comply and **a copy of the EMPr must always be kept on site.**

DEALING WITH NON-COMPLIANCE WITH THE EMPr (Penalties/ Incentives)

The contractor shall put in place procedures to motivate his staff to comply with the EMPr and to ensure that the work force is sufficiently aware and understand all necessary legal requirements related to the construction process. It is also important for the contractor to ensure that the workforce understands the implications of acts of non-compliance, or deliberate and malicious damage to the environment by any staff member.

2.1 Key Legislation and Regulatory Requirements

The following legislations are instrument for the construction process of the poultry houses. Noncompliance will lead to the penalties as set by the relevant sections of the related legislations:

2.1.1 National Environmental Management Act No. 107 of 1998

The National Environmental Management Act of 1998, Chapter 7 Part 1 Section 28 States that:

- 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, and is responsible for the costs and repair of the environment.

2.1.1.1 Penalties for non-compliance

Chapter 7 of the National Environmental Management Act of 1998 indicates explicitly under subsections 8, 9, and 10 the steps that may be taken to recover environmental protection costs from any manager, agent or employee who omits or goes against this Act.

2.1.2 National Heritage Resources Act No. 25 of 1999

Chapter II Part 1 Section 27 (18) on Protection and Management of Heritage Resources provides guidelines that state that;

- No person will be allowed to destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage sites without a permit issued by the heritage resources authority responsible for the protection of such site.

2.1.2.1 Penalties for noncompliance

Section 51 of National Heritage Resources Act of 1999, set penalties to non-compliance as follows:

- A fine or imprisonment for a period not exceeding five years or to both such fine and imprisonment.
- A fine or imprisonment for a period not exceeding three years or to both such fine and imprisonment.
- A fine or imprisonment for a period not exceeding two years or to both such fine and imprisonment.

2.1.3 Occupational Health and Safety Act No. 85 of 1993

Section 14 (a) of the Occupational Health and Safety Act of 1993 makes the contractor responsible for the health and safety of persons who may be affected by any acts of omissions and the safety of the working environment under his jurisdiction.

2.1.3.1 Penalties for noncompliance

Section 38 (1)(2) (3) and (4) of this Act explicitly explain the offence and penalties to any employer who does or omits an act thereby causing any person to be injured at workplace.

2.1.4 Other necessary legislations but not limited to:

Environmental safety requirements in other legislative instruments such as the National Veld and Forest Fire Act, (No.101 of 1998), National water Act, (No.36of 1998) and Hazardous Substances Act, 1973, the National Air Quality Act, 39 of 2004, need to be taken into consideration and conditions observed during the implementation of his development.

2.2 KEY ROLE PLAYERS AND THEIR RESPONSIBILITIES

The successful implementation if the EMPr hinges heavily on the proper identification, definition and allocation of roles to responsible persons or role players.

SECTION 3: SENSITIVE AREAS OF THE PROJECT AREA

Although the broad environment within and around the proposed development area is important in general consideration of construction impacts, the contractor shall ensure that his workforce are aware of the key sensitive sites within the project area and that they understand how their activities could impact directly or indirectly on environmental resources of these areas. The following descriptions need to be particularly understood and adhered to in the implementation of this EMP.

3.1 The Development site

The most likely activities that may impact on sensitive areas is the roadworks across these watercourses. The main points of these crossings are listed on Map in Figure 2 below. These areas require extra care during the construction period.

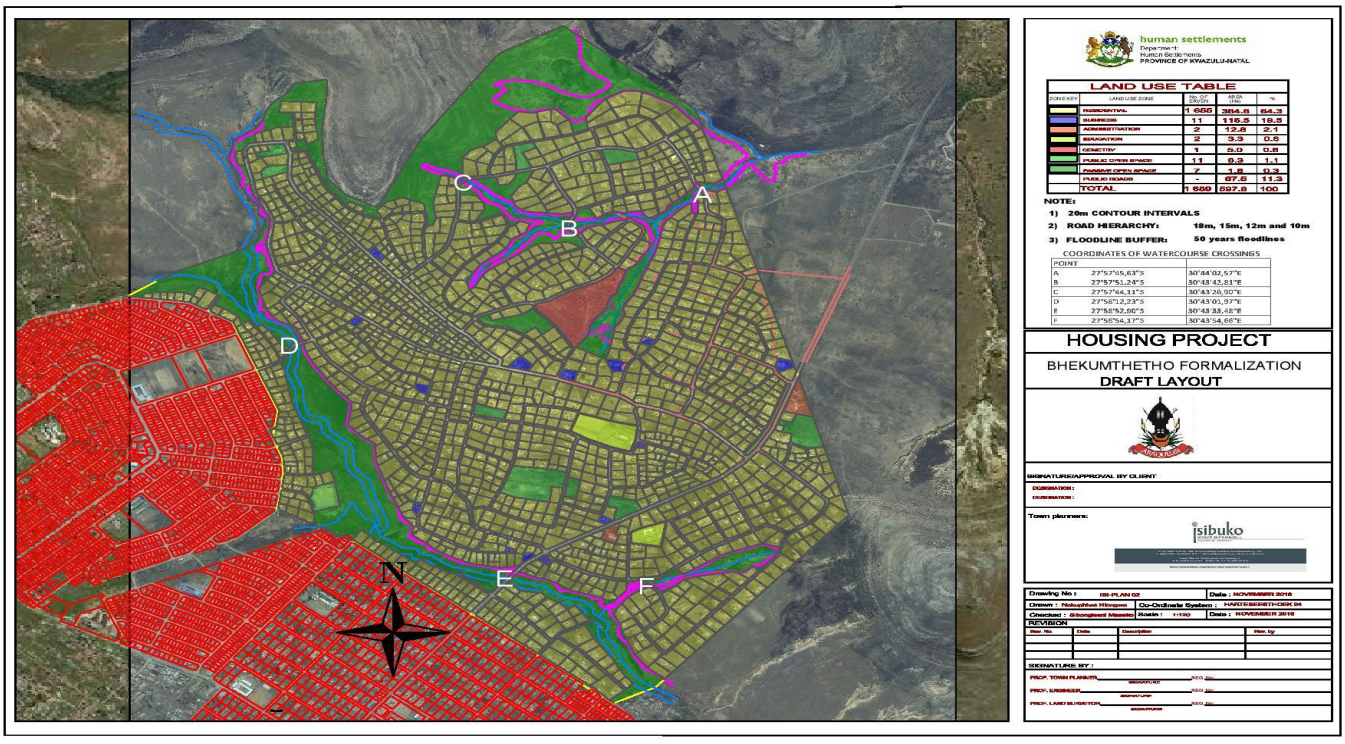

Figure 7 Site layout with sensitive areas that may be impacted (work across watercourses).

3.2 Protecting the Integrity of the Ecosystem of the project site

- As part of conserving biological diversity and protecting the integrity of the ecosystem within development areas, sites that are typically rich in species diversity, contain the presence of rare or endangered species, function as a unique or intriguing habitat, or are heritage sites, are often mapped as "sensitive sites". The sensitivity refers broadly to sites being sensitive to the activities of man, and therefore, qualifying for additional protection over and above that of the surrounding areas.
- In the case of the site for the proposed community upgrade such sensitive areas such as wetlands and associated buffer areas are noted and mapped out. As shown in Figure 7 and work around these areas should be planned to avoid or at least reduce any negative impacts.

3.3 Potential development activities

- Potential development activities that may impact on receiving environment include:
  a. Clearing of the site unto surrounding areas and into the river systems or working within watercourses, such as road upgrades and pipe laying across rivers ,
  b. Storage of equipment and material unto surrounding areas
  c. Driving and turning of construction vehicles outside the designated area of construction
  d. Indiscriminate location of construction camp
  e. Excavations for foundations for buildings
  f. Mixing of mortar and concrete
  g. Structure assembly and erecting
  h. Transport of materials /supplies
  i. Waste generation and management
  j.

As a general principle to observe in conducting activities:

- In order to make it easier to avoid, minimize or contain, the occurrence of the above impacts, all construction activities should be restricted to within the boundary of the development footprint.
- Though the vegetation on the site is severely transformed, the site is surrounded by river systems and which could be the receiver of any environmental malpractices on the site. Thus the buffer zones between the site

development footprint and the river should be strictly maintained as no-development zones as mapped on the layout.

3.4 Ensuring Health and safety

- Although development in whatever form it takes is expected to benefit mankind, it in the process, could also cause disruptions to the established livelihood system and the general day-to-day operations of affected beneficiary communities or as in this case the surrounding houses, road users, and also workers/construction staff.
- The purpose of this EMPr in this regard is to provide guidelines that would ensure that the health and safety needs of residents are taken into consideration during the construction and operation period and that, every necessary and possible step is taken to ensure that the normal social life of the community is not disrupted significantly during the period of construction and operation but rather improved in a positive manner.

SECTION 4: IMPACTS, MITIGATION MEASURES, AND MONITORING

- This section covers the core of the EMPr detailing potential environmental impacts, impacts sources and objectives are described, and environmental management mitigation measures to be implemented during construction are specified. **The contractor shall always adhere to these measures**. A checklist that may be used for internal monitoring of environmental performance is contained in Appendix 1.

The table below details the potential impacts, management objectives and proposed management actions required for mitigation.

Table 2 EMPr Impacts and Management Actions (Template adapted from CSIR, 2016).

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
Site Clearing and Vegetation Removal						
Clearing of vegetation through dining of trenches or working within watercourses	To ensure safety of the surrounding environment and the River systems are not disturbed	• Vegetation removal within the drainage lines and buffer zones should be strictly avoided, as this will serve as storm water control mechanism for the river systems. • All areas where vegetation is tripped off, for any reason, should be re-vegetation immediately after construction in that section or spot is complete.	• Site visit monitoring of construction period and before handover to ensure environment is properly taken care of.	Visual Observations	Continuous	Constructor, Site Engineer and ECO
Clearing of the vegetation during site establishment fencing and construction.	To ensure safety of the surrounding environment and the River systems are not disturbed	• Vegetation removal within the buffer zones should be strictly avoided, as this will serve as storm water control mechanism for the river systems. • All areas where vegetation is tripped off, such as camp site etc, should re-vegetation immediately after construction is complete.	• Site visit monitoring of construction period and before handover to ensure environment is properly taken care of.	Visual Observations	Continuous	Constructor, Site Engineer and ECO

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
Noise Impacts						
Noise is likely to be generated from the use of equipment and from construction workers on site.	Ensure that noise does not become nuisance to surrounding environment and neighbours	• Construction activities should be limited to daytime hours (i.e. 07:00- 17:00, as defined in South African National Standards (SANS) 10103). The noise generated during construction and operational phases must adhere to the relevant SANS standards.	Construction times to be monitored and managed (as well as included in the tender contract).	Records of complaints register and visual observations	Continuous	Contractor and ECO /EHS Officer
Traffic Impacts						
Traffic, congestion and potential for collisions during the construction phase.	Prevent unnecessary impacts on the surroundings road network by supplying parking for construction	• Road barricading should be undertaken where required and road safety signs should be adequately installed at strategic points within the construction and operational vehicles site must be adhered to • During the construction phase, suitable parking area should be created and designated for construction trucks and vehicles.	Monitor, Record and report non-compliance.	Records of complaints register and visual observations	Continuous	Contractor EHS Manager

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
	vehicles on site. Managing the flow of traffic at critical areas where necessary.	• A construction supervisor should be appointed to coordinate construction traffic during the construction phase (by drawing up a traffic plan prior to construction).				
Safety, Health and Environment						
Potential impact on the safety of construction workers due to construction activities (such as welding cutting, use of hot metals, working at heights, lifting of heavy items etc.).	Prevention of injuries to and fatalities of construction personnel during the construction phase.	• Ensure that skilled, licensed and competent Contractors, riggers and crane operators are appointed during the construction phase, along with the use of certified. Equipment and scaffolding. • Ensure that roads are not closed during construction, which may restrict access for emergency services. • Ensure that construction and operational staff members adhere to the relevant health and safety standards of the Occupational Health and Safety Act 181 of 1993	Monitors activities and record and report non-compliance by undertaking inspections.	Records of complaints register and visual observations	Continuous	Health and Safety Officer /contractor /ECO

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
Pollution caused by spillage or discharge of construction wastewater into the surrounding environment	Prevention unnecessary pollution impacts on the surrounding environment	• No mixing of cement directly on the ground. • All spills to be reported to the ECO. • Ensure that adequate containment structures are provided for the storage of construction materials on site. • Ensure the adequate removal and disposal of construction waste and material. • Oil containers must be stored on lined platform covered by disposable sand.	Monitor activities and record and report non-compliance by undertaking inspections.	Incident registers	Continuous	Project Developer, ECO and contractor
Heritage Resources (Archaeology and Palaeontology)						
Impact on Archaeology and Palaeontology	Prevent damage and destruction to fossil, artefacts and material of heritage significance	• Carry out general monitoring of excavations for potential fossil heritage, artefacts and material of heritage importance as per the Chance Find Protocol (Refer to Heritage Report in BAR) • All work must cease immediately, if any human remains and /or other Archaeology, Paleontology and	Monitor excavations and construction activities for archaeological and paleontological material.	Visual observation	Daily during excavation work. As required/ necessary during construction.	Contractor and ECO.

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
		historical material are uncovered. Such material, if exposed, must be reported to the nearest museum, archaeologist/ palaeontologist and to AMAFA (or the South African Police Service), so that a systematic and professional investigation can be undertaken. Enough time should be allowed to remove/collect such material before construction recommences.	Contact AMAFA/SAHRA and identified paleontological/ Archaeology if any heritage features are uncovered.			
Groundwater Management						
Contamination of soil and ground water through spillage of concrete and cement	To control concrete and cement batching actives to prevent spillages and contamination of soil, groundwater and the marine environment.	• Concrete mixing must be carried out on an impermeable surface (such as on boards or plastic sheeting and/or within a banded (lined) area with an impermeable surface). • Concrete mixing areas must be fitted with a containment facility for the collection of cement-laden water. This facility must be impervious to prevent soil groundwater contamination. • A washout facility must be provided for washing of concrete associated	Monitor the handling and storage of sand, stone and cement as instructed	Register of incident	Daily	Project Developer, Contractor and EHS Manager.

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
		equipment. • Empty cement bags must be secured with adequate binding material if these will be temporarily stored on site. Sand and aggregates containing cement must be kept damp to prevent the generation of dust. • Any excess sand, stone and cement must be removed from site at the completion of the construction period and disposed at a registered disposal facility.				
Wastewater Management						
Pollution caused by spillage or discharge of construction wastewater into the surrounding environment	Reduce construction wastewater discharge into the environment and the resulting impact	• Implement proper construction site management actions such as the installation of containment structures, good on-site housekeeping (regular sweeping of roadway and work areas, reporting system and environmental awareness training), and spillage management	Monitor via site audits ad records non-compliance and incidents.	Register of incidents Visual observation	Monthly	EHS Manager

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
Storm water Management						
Pollution of the surrounding environment because of contamination of storm water. Contamination could result from chemicals, oil, fuels, sewage, solid waste, litter etc.	Reduce the contamination of storm water	• The appointed Contractor should compile a Method Statement for Storm Water Management during the construction phase. • Provide secure storage for oil, chemicals and other waste materials to prevent contamination of storm water runoff. • Regular inspections of storm water infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds. • Erosion prevention structures should be placed to reduce water velocity within the drainage system. • Only essential (what cannot be avoinded) vegetation should be removed and no disturbance to surrounding vegetation should be permitted. • Accumulation of water on the surface must be avoided always.	Compile Method Statement Monitor the banding and containment structures. Monitors via site audits and record non-compliance and incidents (i.e. by implementing walk through inspections.)	Register of incidents Visual observation	Once off (and thereafter updated as required). Weekly Weekly	Contractor ECO/ EHS Manager Contractor

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
Waste Management						
Pollution of the surrounding environment because of the handling, temporary storage and disposal of solid waste (general and hazardous).	Reduce soil and groundwater and river contaminations because of incorrect storage, handling and disposal of general and hazardous waste.	• General waste and hazardous waste should be sorted temporarily on site in suitable (and correctly labelled) waste collection bins and skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate. • Should on-site storage of general waste and hazardous waste exceed 100m^3 and 80m^3 respectively, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under Government Notice 926) must be adhered to. • Ensure that the construction site is kept cleans always and that construction personnel are made aware of correct waste disposal methods. • No solid waste may be burned or buried on site.	Inspection of the temporary waste storage area. Monitor waste generation and collection throughout the construction phase	Register of incidents Visual observation	Daily	ECO & EHS Manager
Air Quality Management						

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
Increased dust level and Air Quality Impact: Emissions from construction vehicles and generations of dust because of earthworks, as well as the delivery and mixing of construction material.	Reduce dust emissions during construction activities.	• Ensure that cleared (excavated) areas and unpaved surfaces are sprayed with water (obtained from an approved source) to minimise dust generation. • Ensure that construction vehicles travelling on unpaved roads do not exceed a speed limit of 40km/hour. • Limit construction activities to daytime hours.	Monitor dust suppression mechanisms and record non-compliances.	Register of incidents Visual observation	During complaints/incidents	EHS Manager, ECO and Contractor
Socio-Economic Impacts Management						
Employment creation and skills development opportunist during the	Maximise local employment and local business opportunities to promote and improve the	• Enhance the use of local labour and local skills as far as reasonably possible. The project will employ approximately 20 people from the area. • Where the required skills do not occur locally, and where appropriate and	Maximize local employment for unskilled labour and provincial/national skilled labour.	Records of staff members Number of Local people employed	During the construction phase	Contractor and ECO.

Impact	Management Objectives	Management /Mitigation Actions	Monitoring			
			Indicator	**Methodology**	**Frequency**	**Responsibility**
construction	local economy.	applicable ensure that relevant local individuals are recruited. • Ensure that goods and services are sources from the local and regional economy as far as reasonably possible.	Visual observation Procurement source documents			

MANAGEMENT PLAN FOR OPERATIONAL PHASE

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
Alien Vegetation Management						
Potential re-establishment of alien plants on site	Ensure the removal of alien invasive vegetation from the proposed projects area and prevent	• Ensure that any alien invasive plants that become re-established on site are removed promptly. The removal of these species must have carried out in line with relevant municipal and provincial procedures, guidelines and recommendations.	Monitor the removal of the alien invasive vegetation Visual observation		During the removal process	EHS Manager / Municipal Environmental Officer in Charge

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
	the establishment and spread of alien invasive plants.	• The removed species should be immediately disposed of correctly and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.				
Land rehabilitation	Ensure land (neighbours) impacted during construction phase is sufficiently rehabilitated.	• Infilling of all excavation work. • Remove all rubble from construction site and disposal of it at a registered landfill site.	Infill of excavation ensuring sub soil is filled first. Removal rubble to a registered	Visual observation	When /If complaints are received.	Project Developer
Safety, Health and Environment						
Soil and Water pollution	Prevent unnecessary pollution impacts on the surrounding environment	• Storm water should not be allowed to encounter effluent. • Monitoring water qualify of onsite borehole should be conducted. • Ensure that excrement,	Carry out though inspection of piping, loading hoses, and banding for leaks, using a checklist.	Incident reports Visual observation	Daily	Project Applicant (municipal Environmental Officers)

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
		carcasses, feed and other operational waste and hazardous materials are appropriately and effective contained and disposed of without detriment to the environment	Proof of attendance to training sessions to be kept on file at the terminal.			
Air Pollution Environmental contamination of the surrounding environment from organic waste and Operation of Crematorium	Prevent unnecessary air pollution impacts because of the improper / inadequate / negligent operational procedures.	• Ensure that operational waste are appropriately and effectively contained and disposed without detriment to the environment. • Adhere to the best practice guidelines for managing farm operations. • Ensure that the development is designated and lined with impermeable substances (concrete) in accordance with advice from international best practice norms. • Establish appropriate emergency producers for accidental contamination of the surroundings. Waste recycling should be	Assurance of functionally of fire extinguishers via inspections and certification by an accredited fire service company. Regularly check and record Air quality , and functionality of furnace strappers Regular records of crematorium, as per facility specifications	Complaints report Maintenance register /Signed by operating engineer and Municipality environmental Officer /Inspector	As needed	Project Applicant

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
		incorporated into the facility's operations as far as possible. • The relevant standards for air quality must be adhered to.				
Potential impact on the health of operating personnel, especially in the crematorium resulting in potential health injuries.	To ensure that there are no adverse effects on the health of operating personnel	• Operational personnel must wear basic (i.e. gloves) are necessary during the operational phase. • Fire extinguishers should be easily accessible on site.	Medical investigations or surveillance to be undertaken for the operating personnel. Keep a register of the medical records for the operating personnel.	Visual observation	As necessary	EHS Manager and Project Developer.
Increase in vertebrate and invertebrate pests.	Highly localized pest invertebrate control that does not affect non-target populations or taxa	• Detect and control pest infestations before they become a problem though frequent and careful cleaning, monitoring and control. • Poultry legislation guidelines should be adhered to. • Applicant to adhere to Best Practise Guild lines and Animal Disease Act (Act 35 of		Visual observation	As necessary	EHS Manager and Project Developer

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
		1984)				
Storm water Management						
Increased storm water discharge into the surrounding environment which may end up in the rivers	Reduce the impacts of increased storm water discharge to the environment	• Regular monitoring of stormwater quality and river health	Implement surface water quality monitoring programme, based on consultation with the landowner	Incident reports	As agreed during the operational phase.	Project ECO Project Applicant (Municipal Environmental Officer)
		• Regular inspections of storm water infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds. • Accumulation of water on the surface must be avoided. • Waste traps in storm water system should be cleaned at regular intervals. • Run off to roads must avoided.	Undertake regular inspections of the storm water infrastructure (i.e. by implementation walk through inspections).		Weekly	Site Manager and EHS Manager

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
Socio-Economic Management						
Additional employment opportunities	Maximise local employment and local business opportunities to promote and improve local economy	• Enhance the use of local labour and local skills as far as reasonably possible. • Where the required skills do not occur locally, and where appropriate and applicable, ensure that relevant local individual are trained. • Ensure that goods and services are sourced from the local and regional economy as far as reasonably possible.	Maximise local employment for unskilled labour and provincial/ national skilled labour		During the operational phase	Project Developer
Boost in the economy of Region 2	Maximise positive impacts through ensuring produce is sold to local markets	• Ensure that the proposed project has secured local buyers	Seek out local markets and secure formal trade agreement	Monthly supplier reports	Monthly	Project developer
Environmental Awareness`						

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
Increased energy consumption during the operational phase	Reduce energy consumption where possible	• Encourage the use of energy saving equipment (such low voltage light and low-pressure taps) and promote recycling. Operational personnel must be made aware of energy conservation practices as part of the environmental awareness training programme.	Monitor energy usage via site investigations. Conduct training for all operational personnel		Monthly	EHS Manager / Municipality
		• Firefighting equipment must be made available at various appropriate locations				
Safety, Health and Environment						
Pollution of the surrounding environment as a result of the handling, temporary storage and disposal of solid waste	Prevent unnecessary pollution impacts on the surrounding environment	• General waste (i.e. building rubble, demolition waste, discarded concrete, bricks, tiles, woods, glass, plastic, metal, excavated material, packaging material, paper and domestic waste etc.) and hazardous waste (i.e. empty tins, paint and paint cleaning liquids, oils, fuel spillage and chemicals etc.) generated during the decommissioning	Monitor activities and record and report non-compliance by undertaking inspections.	Compliance reports Visual observations	Throughout the decommissioning phase	Project applicant, ECO and Contractor

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
		phase should be stored temporarily on site in suitable (and correctly labelled waste collection bins and skips (or similar). • Ensure that enough general waste disposal bins are provided for all personnel throughout the site. These bins must be emptied on a regular basis.				
Spill contingency, Management and Handling of Chemicals/Dangerous Goods						
Potential spillage of effluent to the surrounding environment from chemicals used in crematorium and ablution facilities of the cemetery	Reduce the spillage of domestic effluent and the impact thereof on the environment.	• Ensure that normal sewage management practices are implemented during usage	EHS Manager to monitor via site audits and record non-compliance and incidents	Incident reports Visual observations	Monthly	EHS Manager and Environmentalist
		• Ensure that the toilet/sanitation facilities are maintained in a clean, orderly a sanitary condition.	Monitor via site audits and record non-compliance and incidents	Incident reports Visual observations	Daily	EHS Manager and Contractor

Impact	Management Objectives	Management Actions	Monitoring			
			Indicator	Methodology	Frequency	Responsibility
Waste Management						
Pollution of the surrounding environment as a result of the handling, temporary storage and disposal of solid waste	Reduce soil and ground water contamination as a result of incorrect storage. Handling and disposal of general and hazardous waste	• Include regular waste collection from the facility into the municipal waste stream.	Carry out monitoring throughout the operational phase	Compliance reports Visual observations	Continuously thought-out life of project	Project Developer and EHS Manager
		•	•			

5. EMP CONCLUSIONS AND RECOMMENTATIONS

The significance of most of the issues identified may be effectively reduced after mitigation should this environmental management plan be carefully followed. The proposed development will be undertaken as part of the in-situ upgrade which requires that care be taken to not unnecessarily inconvenient the community during construction. The concluding recommendations are:

- Contractors need to follow the environmental management plan;
- A copy of the EMP should always be placed on site, and the contractor and team should be workshopped on the requirements of the EMP.
- The development needs to benefit the community in a tangible manner, and therefore, attempts need to be made to integrate community needs and aspirations into the implementation processes of the development.
- Where appropriate, the contractor must use local labour as much as possible;
- The contractor needs to show concerns for health in general and the health safety of the employees in particular;
- In terms of the National Environmental Management Act 107 of 1989 everybody is required to take reasonable measures to ensure that they do not pollute the environment. Reasonable measures include informing and educating employees about the environmental risks of their work and training them to operate in an environmentally acceptable manner;
- Furthermore, in terms of the Nation Environmental Management Act 107 of 1998 the cost of repair for any environmental damage shall be borne by the person responsible for the damage.
- Operational stage recommendations should be also implemented and the onus is on the applicant to ensure adherence to the mitigation measures proposed. Regular maintenance and monitoring is required from the municipality and to ensure smooth operations.
- The competent authority may also pay random visits to the facility to monitor compliance during construction and operation stages.

Annex A: Glossary

- **1.3.1 General**
- The contractor shall actively engage himself and workers (if necessary) on this project to knowing and understanding of relevant terms, descriptions, and abbreviations in this EMP as indicated below:
- ***Contractor (CT)***
- For the purpose of this EMP: "CT" refers to the main contractor(s) appointed for the construction activities of the project or portion of the project. The main contractor(s) are required to adhere to the EMP and are responsible for ensuring that all subcontractors, suppliers and staff appointed by them, also adhere to the EMP.
- ***All Staff***
- This is the entire workforce. Workers employed by the contractor or persons involved with activities related to the project, or persons present or visiting the construction area, including permanent, contract, or casual labour and informal traders.
- ***Environmental Control Officer (ECO)***
- An individual or representative of an organization appointed to act on matters concerning the day-to-day implementation of the EMP, and for liaison with the DAEA&RD, and the public affected by construction.
- ***EDTEA***
- Department of Economic Development, Tourism, and Environmental Affairs – who is the competent authority in the case of this application.
- ***Local Community***
- People residing in the region and near the construction activities, including the owners and/or managers of land affected by construction, small holdings, workers on the land, and the people in nearby towns and villages.
- ***Public***
- Any individual or group of individuals concerned with or affected by the project and its consequences, - including the local community, local, regional, and national authorities, investors, workforce, customers, consumers, environmental interest groups, and the general public.
- ***Relevant Authority***
- This refers to the environmental authority on national, provincial or local level with the responsibility for granting approval to a proposal or allocating resources.

- **1.3.2 About the Construction Activities**
- ***Alternatives***
- A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternative can refer to any of the following but are not limited to hereto: alternative sites for development, alternative site layouts, alternative design, alternative process and materials.
- ***Construction Areas/Site****:*
- This is land area on which the project is to be located. It includes the sites of individual stands, construction campsites, access roads and tracks, as well as any other area affected or disturbed by construction activities. The EMP (particularly) the specifications for rehabilitation) is relevant for all areas disturbed during construction.
- ***Development***
- This is the act of altering or modifying resources in order to obtain potential benefits.
- ***Access Roads and Tracks***
- Access Roads and Tracks refers exiting and newly established roads and tracks, and areas cleared or driven over to provide access to/from the construction areas, and for the transportation of the construction workforce, equipment and materials.
- **1.3.3 About the Environment**
- ***Receiving / Affected environment***
- Those parts of the socio-economic and biophysical environment impacted on by the development.
- ***Assessment***
- The process of collecting, organizing, analysing, interpreting, and communicating data that is relevant to some decision.
- ***Environment***
- The surrounding within which humans exist that are made up of: - the land, water and atmosphere, fauna and flora, including any part, combination or interrelationships among these; and all the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human wellbeing.
- ***Environmental Impact***

- This is the degree of change in an environment resulting from effect of an activity whether desirable or undesirable. Impacts may be direct consequences of an organization's activities or may be indirectly caused by them.
- ***Environmental Impact Report***
- A report describing the process of examining the environmental effects of a development proposal, the expected impacts and the proposed mitigation measures.
- ***Evaluation***
- The process of weighing information, the act of making value judgments or ascribing values to data in order to reach a decision.
- ***Hazards***
- Hazardous substances in this regard are anything that constitutes a source of, or exposure to danger. Some examples of hazardous sources or materials are:
- Diesel, petroleum, oil, bituminous products;
- Cement;
- Solvent based paints;
- Lubricants;
- Explosives;
- Drilling fluids;
- Pesticides, herbicides.
- ***Hydrological Features***
- Hydrological features include, but not limited to:
- Rivers and Wetlands;
- Open water;
- Vegetated drainage channels;
- Subterranean water;
- ***Life Support Systems***
- Life support systems include, but are not limited to:

- An ecological system in which its outputs are vital for sustaining specialized habitats;
- An ecological system in which its outputs are vital for sustaining human life (e.g. water purification).
- ***Mitigation***
- Measures designed to avoid, reduce or remedy adverse impacts.
- ***Monitoring***
- This is the repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period to assess the efficiency of control measures.
- ***Negative Impact***
- A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, property or by causing nuisance.
- ***Rehabilitation***
- Measures implemented to restore a damaged Environment to an acceptable level.
- ***Significant impact***
- This is an impact that, by its magnitude, duration or intensity alters an important aspect of the environment.