PROPOSED ENYATHI HOUSING DEVELOPMENT LOCATED ON THE REMAINDER OF THE FARM BLOEMENKRANS NO. 853

DRAFT BASIC ASSESSMENT REPORT

Reference Number: DC26/0002/2021

APRIL 2021

PROJECT APPLICANT:

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DETAILS OF THE INDEPENDENT ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

THE REPORT WAS COMPILED BY:

Environmental Assessment Practitioner:

Ms Prisantha Govender

Qualifications:

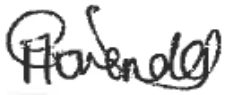
- BSc Honours (Environmental Management) – University of South Africa
- BSc (Environmental Science) – University of KwaZulu Natal
- Short Course in Environmental Impact Assessment Law
- Short Course in Environmental Law

Work Experience:

- October 2019 - Present: Environmental Assessment Practitioner at K2M Environmental
- October 2017- September 2018 - Intern at the Built Environment Training Academy (BETA)

Independence:

I, Prisantha Govender declare that this report has been prepared independently of any influence or prejudice as may be specified by the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA). A record will be kept of all comments received from Interested and Affected Parties (I&APs) and will be submitted in the Final Basic Assessment Report to KZN DEDTEA in the form of a Comments and Responses Report.



Ms. Prisantha Govender
K2M Environmental (Pty) Ltd

April 2021
Date

THE REPORT WAS REVIEWED BY:

Environmental Assessment Practitioner:

Mr Gert Watson

Qualifications:

- B.Art. et. Scient. (Planning) - University of Potchefstroom
- Advance Project Management (Project Management Body of Knowledge Methodology)
- IEMA Approved Environmental Impact Assessment Course: The National Environmental Management Act Regulations – A Practical Approach
- IEMA Approved Environmental Auditors Course

Work Experience:

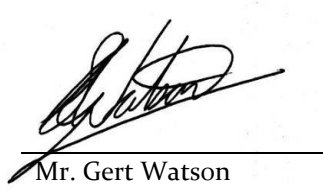
- 2009- Present: Director for K2M Environmental
- 2005- 2009: Senior Environmental Consultant for K2M Environmental (Durban Office)
- 2002- 2005: Environmental Consultant for K2M Technologies (Rustenburg Office)

Expertise to undertake Environmental Impact Assessments:

K2M Environmental is an established environmental consultancy since 2008. The consultancy has been involved with more than 100 Environmental Impact Assessments and other environmental related projects in KwaZulu Natal, Mpumalanga, Gauteng and the North-West Province over the last 10 years.

Independence:

I, Gert Watson declare that this report has been prepared independently of any influence or prejudice as may be specified by the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA). A record will be kept of all comments received from Interested and Affected Parties (I&APs) and will be submitted in the Final Basic Assessment Report to KZN DEDTEA in the form of a Comments and Responses Report.



April 2021

Mr. Gert Watson
K2M Environmental (Pty) Ltd
Director

Date

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1 BACKGROUND INFORMATION

1.1 INTRODUCTION AND BACKGROUND

The Abaqulusi Local Municipality has, through its IDP process, and extensive consultation with respective communities residing within the municipality, identified the need to provide a housing development within its area of jurisdiction. This process was initiated as a means to address the municipality's housing need due to the growth of the population. The Abaqulusi Municipality has appointed Fezeka Business Services as the Implementing Agent for the proposed Enyathi Housing Development. Subsequently, Fezeka Business Services appointed K2M Environmental (Pty) Ltd, as the independent Environmental Assessment Practitioner (EAP), to undertake the Environmental Impact Assessment for the proposed housing project.

Historically, the Enyathi Area was known for its coal mine operation, however between 1997 and 1998, the mining operation was terminated which negatively impacted the local economy. The Remainder of the Farm Bloemenkrans No. 853 makes up the project area which is situated within Ward 50 of the Abaqulusi Local Municipality. The property has a total extent of 255.03 hectares with a development footprint of approximately 62.26 hectares. It should be noted that the development footprint of approximately 62.26 ha is inclusive of existing building / structures as well as the proposed residential units. Furthermore, of the 62.26 ha development footprint, approximately 10.98 ha is greenfield where infill development is proposed. As stated above, the site currently contains existing residential structures, municipal community and educational facilities. Portions of the site contains agricultural land and there are several watercourses that traverse the site.

The proposed development will entail the following:

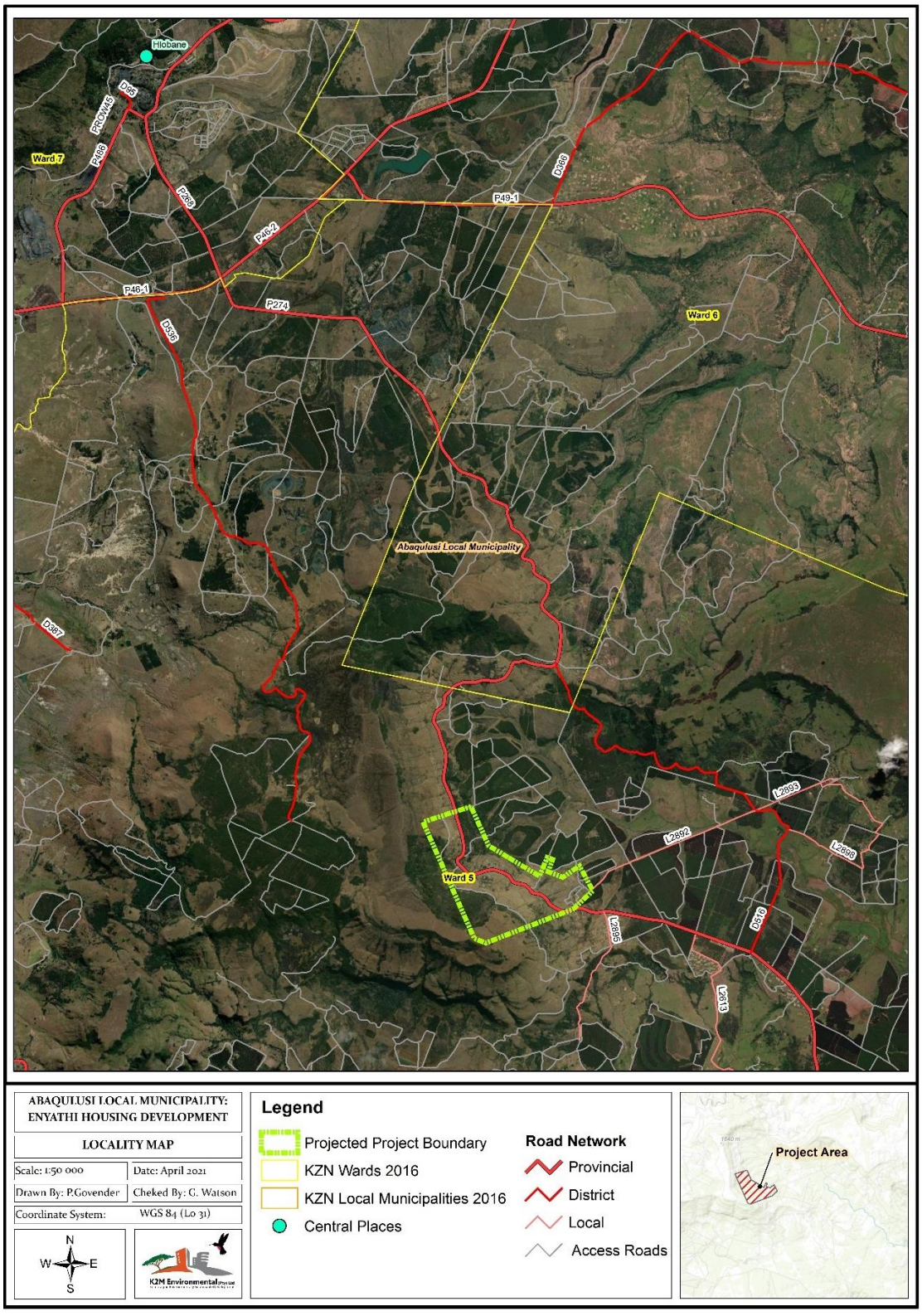
- The formalisation and subdivision of approximately 666 residential erven. It should be noted that this will include the existing residential structures and the proposed infill development which will be approximately 10.98 ha of greenfield development.
- Construction of internal pipelines for the transportation of water supply and waterborne sewage. The diameter of the water supply pipelines and sewage pipelines will be 75mm and a minimum of 160mm, respectively.
- Construction of internal roads and stormwater infrastructure. The proposed internal roads will have road widths ranging from 2m to 7m with road reserves raging from 6m to 16m.

- Formalisation of the existing cemetery.

It should be noted that erven will be set aside for a place of worship, commercial, community as well as passive open space land uses.

The locality map of the project area in relation to the Municipal Wards is illustrated in Map 1.1 below and is attached as **Appendix B**.

Map 1.1: Project Area



1.2 ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS

The Environmental Impact Assessment Regulations of 2014 (as amended) promulgated in terms of Section 24(5) of the National Environmental Management Act, (Act No. 107 of 1998) as amended, requires Environmental Authorisation from the competent authority (KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs) for activities listed in Government Notices R324, R325 and R327. Table 1.1 below identifies the activities that has been triggered for the proposed development.

Table 1.1: Triggered Activities

Activity No.	Description of Activity	Relevance to Project
Activity 12 of GN.R. 327	The development of – (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs – (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; - excluding – (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	The proposed development will entail the construction of infrastructure or structures with a physical footprint of 100m² within 32m of a seepage area/watercourse.

Activity 19 of GN.R. 327	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging of, excavation, removal of soil, sand, shells, shell grit, pebbles or rocks of more than 10 cubic metres from a watercourse: but excluding where such infilling, depositing, dredging, excavation, removal or moving – (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies. (d) occurs within existing ports or harbours that will not increase the development footprint of the port or habour; or (e) where such development is related to the development of a port or habour, in which case activity 26 in Listing Notice 2 of 2014 applies.	The proposed development will entail the infilling or depositing of material as well as the removal and excavation of sand from a seepage area/watercourse (with specific reference to the seepage and artificial wetland areas).
Activity 27 of GN.R. 327	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance if indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The proposed development will entail the clearance of approximately 10.98 ha of indigenous vegetation.
Activity 28 of GN.R. 327	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	A portion of the site is currently being used for agricultural plantations, no development is proposed on this portion of the site. As per the Draft Development Layout, this portion is earmarked as Public Open Space.
Activity 4 of GN.R. 324	The development of a road wider than 4 metres with a reserve less than 13,5 metres. **(d) <u>In Kwazulu-Natal:</u>**	The proposed development will entail the development of internal roads with road widths ranging from 2m to 7m with road reserves

	viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; x. Areas designated for conservation in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purposes; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas: (aa) Areas within 10km from national parks or world heritage sites or 5km from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; or	raging from 6m to 16m within CBAs.
Activity 12 of GN.R. 324	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **(d) <u>In KwaZulu-Natal</u>:** iv. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Areas designated for conservation in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; xii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; or	The proposed development will entail the clearance of approximately 10.98 hectares of indigenous vegetation within CBAs.
Activity 14 of GN.R 324	The development of – (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs – (a) within a watercourse;	The proposed development entails the construction of housing units within 32m of a seepage area/watercourse within CBAs.

	(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. **(d) <u>In KwaZulu-Natal:</u>** vii. Critical biodiversity areas or ecological support as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; x. Outside urban areas: (aa) Areas within 10km from national parks or world heritage sites or 5km from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; or	Sewerage pipelines will be constructed across the watercourse, within areas classified as CBAs.

1.3 TERMS OF REFERENCE

Regulation 19 of the Environmental Impact Assessment Regulations of 2014 determines that a Basic Assessment Procedure must be followed for all activities listed in Government Notice R327 and R324. K2M Environmental (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner (EAP) and will therefore be responsible for the Basic Assessment procedures concerned with the proposed development as specified in Sections 19 and 20 of Government Notice R326 promulgated in terms of Section 24(5) of the National Environmental Management Act, (Act No. 107 of 1998), as amended.

K2M Environmental has submitted the completed Application Form for Environmental Authorisation to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN DEDTEA) (see **Appendix C1**). KZN DEDTEA registered the project with **Reference Number: DC26/0002/2021** in their letter **(Appendix C2)** dated 17th of February 2021. This reference number is to be quoted in all correspondence with KZN DEDTEA for ease of reference.

1.4 APPROACH AND METHODOLOGY

The overall approach to this assignment included the following activities:

- Apply for Environmental Authorisation to KZN DEDTEA regarding the Enyathi Housing Development.
- A detailed analysis of the proposed development, the area where it will take place, and the identification of potential impacts.
- Identification of specialist input required and the facilitation of the studies.
- All legislative requirements in terms of the EIA Regulations and to provide KZN DEDTEA with sufficient information to take a decision regarding the development.

1.5 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply to the EIA:

- The environmental authorization application has been initiated during the conceptual design and planning stages of the development.
- It is assumed that the information provided by the various specialists and project engineers are accurate.
- The EIA project team is of the view that an adequate level of information is provided in order to facilitate the required assessment of potential impacts of the proposed project alternatives and decision-making in this regard.
- The study involves the assessment of impacts on the current conservation value of affected land and not on either the historic or potential future conservation value.

1.5.1 Baseline Information

Sufficient baseline information for the Draft Basic Assessment Report was available from a variety of desktop data sources, reports and relevant data bases. This was supplemented by site visits to the project area and inputs from other professionals involved in the project.

1.5.2 Time Constraints

There were no time constraints and sufficient time was available for the Basic Assessment Process.

1.6 REPORT STRUCTURE

The report is structured as follows:

Section 2 consists of a summary description of the proposed activity.

Section 3 provides a description of the environment that may be affected by the activity.

Section 4 consists of the Engineering Services

Section 5 consists of a summary of the potential **impacts of the proposed activity** on the environment.

Section 6 provides describes the **public participation** process conducted during the scoping phase.

Supporting documents, reports, correspondence and other relevant information are contained in various Appendixes attached to this report. Table 1.2 has been included to assist the reader to find the relevant sections in the report.

Table 1.2: 2014 EIA Requirements for the Basic Assessment Report

Information Required	Document Section
Details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Just after cover page, **Appendix M** & **Appendix N**
The location of the activity, including: (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2.1
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 (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 2.1 & **Appendix D**
A description of the scope of the proposed activity, including (i) all listed and specified activities triggered and being applied for; and (ii) a description of the activities to be undertaken including associated structures and infrastructure;	Sections 1.2 & 2.3
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;	Section 1.7

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;	Section 5.3.2
A motivation for the preferred site, activity and technology alternative;	Section 2.5
A full description of the process followed to reach the proposed preferred alternative within the site, including: (i) details of all the alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (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; (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (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) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, 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; (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; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) the outcome of the site selection matrix; (x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Sections 2.5, 3, 5 & 6.
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 impact 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;	Section 5
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 the 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;	Section 5

Where applicable, a summary of the findings and impact management 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;	Sections 3.6, 3.7, 3.8 & 3.9
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 superimposes 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;	Section 5.3.1 and 2.3.2
Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Not Applicable
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 authorization;	Section 7
A description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1.5
A reasoned opinion as to whether the proposed activity should or should not be authorized, and if the opinion is that it should be authorized, any conditions that should be made in respect of that authorization;	Section 7
Where the proposed activity does not include operational aspects, the period for which the environmental authorization is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalized;	Not Applicable
An undertaking under oath or affirmation by the EAP in relation to: the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and l&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 and any responses by the EAP to comments or inputs made by interested and affected parties; and	Just after cover page
Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not Applicable
Any specific information that may be required by the competent authority; and	Not Applicable
Any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not Applicable

1.7 APPLICABLE LEGISLATION, POLICIES AND GUIDELINES

In addition to the Environmental Impact Assessment Regulations of 2014 (as amended), Table 1.3 below indicates other applicable legislation that has been considered in the preparation of this Draft Basic Assessment Report.

Table 1.3: Applicable Legislation

Legislation	Relevance to the development
Constitution of the Republic of South Africa (Act No. 108 of 1996)	All environmental aspects should be interpreted within the context of the Constitution. The Constitution has enhanced the status of the environment by virtue of the fact that environmental rights have been established in terms of Section 24.
National Environmental Management Act (No. 107 of 1998)	This development requires a Basic Assessment to be conducted in terms of the 2014 EIA Regulations, as amended. The purpose of the Basic Assessment is to ensure that the development does not impact on the natural environment.
National Environmental Management: Biodiversity Act (No. 10 of 2004)	A Biodiversity Assessment was undertaken to identify sensitive areas within the project area and to ensure that proper mitigation measures are in place to protect any endangered flora or faunal species that may be identified (See **Appendix G** for the Biodiversity Assessment Report).
National Water Act (No. 36 of 1998)	The proposed development will entail development within 500m of wetlands. A pre-application meeting will be arranged with the Department of Water and Sanitation to discuss the way forward in terms of the Water Use License.
KwaZulu-Natal Heritage Act (No. 4 of 1998)	This Act has been put into place to conserve, protect and conserve heritage resources within KwaZulu Natal. Documentation was submitted to AMAFA for their comment. In their interim comment, AMAFA indicated that a HIA is required for the proposed Housing Development. See **Appendix I1** for interim comments from AMAFA and **Appendix I2** for the HIA Report, respectively.
Agricultural Land Act (Act 70 of 1970)	The land for the proposed development belongs to the Abaqulusi Local Municipality; therefore, Act 70 of 1970 does not apply to this project.
National Environmental Management: Waste Act (No. 59 of 2008)	The overall purpose of the Waste Act is to manage waste in a manner that can protect the health of people as well as the environment (plants, animals, land, air, water etc). The management of waste during the construction phase has been taken into consideration and included into the Environmental Management Programme.
National Environmental Management: Air Quality Act and National Dust Control Regulations	Mitigation measures have been included into the EMPR which provides recommendations on how to manage pollution and dust during the construction phase.
Noise Regulations R2544	The EMPR provides recommendations on how to manage noise during the construction phase of the proposed development.
National Building Regulations and Building Standards Amendment Act no 45 of 1995	The purpose of this Act is to provide for the promotion of uniformity in the law relating to the erection of buildings in the areas of jurisdiction of local authorities.
Occupational Health and Safety Act (No. 85 of 1993)	The contractor needs to manage his staff and crew in strict accordance with the Occupational Health and Safety Act in order to prevent injuries to the staff.

Provincial Growth and Development Plan	The proposed development is aligned with the PGDP as it addresses the first goal of the PGDP which is that of job creation, which will take place during the construction phase and operational phase.
Polluters Pay Principal	The Polluters Pay Principal has been included into the preparation the EMPr.
Abaqulusi Integrated Development Plan	The implementation of the envisaged housing project would contribute towards achieving IDP vision of the municipality which is primarily aimed at improving the quality of life of the community. The proposed housing development is identified and included in the Municipal IDP.
Abaqulusi Municipality Spatial Development Framework	The proposed development is in line with the Abaqulusi Local Municipality's current SDF as the Municipal SDF identifies the Enyathi as an area in need of urban housing.

1.8 THE APPLICANT

The details of the applicant are as follows:

Applicant name: Abaqulusi Local Municipality

Contact Person: Mr J.S Landman (Director of Development Planning)

Tel: 034 982 2133

Email: municipalmanager@abaqulusi.gov.za

records@abaqulusi.gov.za

Address: PO Box 57, Vryheid, 3100

1.9 THE INDEPENDENT ENVIRONMENTAL ASSESSMENT PRACTITIONER

K2M Environmental (Pty) Ltd was appointed as the Independent EAP responsible for the following tasks:

- Processes, information, plans and reports produced in complying with the Regulations
- Ensuring that the relevant authority has access to all information
- Public Participation Process

The contact details of the independent Environmental Assessment Practitioner are as follows:

Name: K2M Environmental (Pty) Ltd
Contact Person: Mr Gert Watson
Telephone: 082 776 0881
Fax: 086 622 7276
E-mail: gert@k2m.co.za
Postal Address : PostNet Suite #509, Private Bag X4, Kloof, 3640

2 DESCRIPTION OF PROPOSED ACTIVITY

2.1 PROJECT LOCATION

2.1.1 Co-ordinates

Table 2.1 below indicates the co-ordinates of the project area.

Table 2.1: Co- ordinates of the projects area

Latitude /Longitude	Degrees	Minutes	Seconds
South	27°	49'	37.11"
East	31°	3'	0.77"

2.1.2 21 Digit Surveyor General Code

Table 2.2 below indicates the 21-digit surveyor general code.

Table 2.2: Surveyor General Code

Property Description	21- Digit Surveyor Code
Remainder of the Farm Bloemenkrans No. 853	NoHU00000000085300000

2.2 ZONING OF PROPERTY

According to the Planning Unit of the Abaqulusi Local Municipality, there is currently no Land Use Management Scheme for the Enyathi area. As such, the project area does not have a zoning.

2.3 ACTIVITY DESCRIPTION

2.3.1 Extent of Development

The total project area is approximately 255.03 ha in extent with a development footprint of approximately 62.26ha. The proposed development layout was prepared by Terraplan in February 2021 and is attached as **Appendix D** and is indicated below on Map 2.1. The land uses as per the proposed draft development is tabulated below:

Table 2.3: Land Uses

Land Use		Area (HA)	Percentage	Units
	Residential (existing and proposed)	39.59	15.5	666
	Community Facility	7.03	2.8	7
	Municipal	2.34	0.9	4
	Business	3.48	1.4	8
	Roads	9.82	3.8	0
	Public Open Space	192.76	75.6	0
Total		**255.03**	**100**	**685**

As indicated in Table 2.3 above, approximately 39.59 ha has been set aside for residential (which is inclusive of existing dwelling structures as well as proposed infill units), 7.03 ha for community facilities, 2.34 ha for municipal land uses and 3.48ha for business land uses. Approximately 9.82 ha is set aside for the proposed and existing internal road network and as much as 192.76 ha of the site will be earmarked as public open space.

2.3.2 Description of the proposed activity

The Remainder of the Farm Bloemenkrans No. 853 makes up the project area which is situated within Ward 50 of the Abaqulusi Local Municipality. The property has a total extent of 263.9 hectares with a development footprint of approximately 62.26 hectares. It should be noted that the development footprint of approximately 62.26 ha is inclusive of existing building / structures as well as the proposed residential units. Furthermore, of the 62.26 ha development footprint, approximately 10.98 ha is greenfield where infill development is proposed.

The site currently contains existing residential structures, municipal community and educational facilities. Portions of the site contains agricultural land and there are several watercourses that traverse the site. The proposed development will entail the following:

- The formalisation and subdivision of approximately 666 residential erven. It should be noted that this will include the existing residential structures and the proposed infill development which will be approximately 10.98 ha of greenfield development.
- Construction of internal pipelines for the transportation of water supply and waterborne sewage. The diameter of the water supply pipelines and sewage pipelines will be 75mm and a minimum of 160mm, respectively.
- Construction of internal roads and stormwater infrastructure. The proposed internal roads will have road widths ranging from 2m to 7m with road reserves raging from 6m to 16m.
- Formalisation of the existing cemetery.

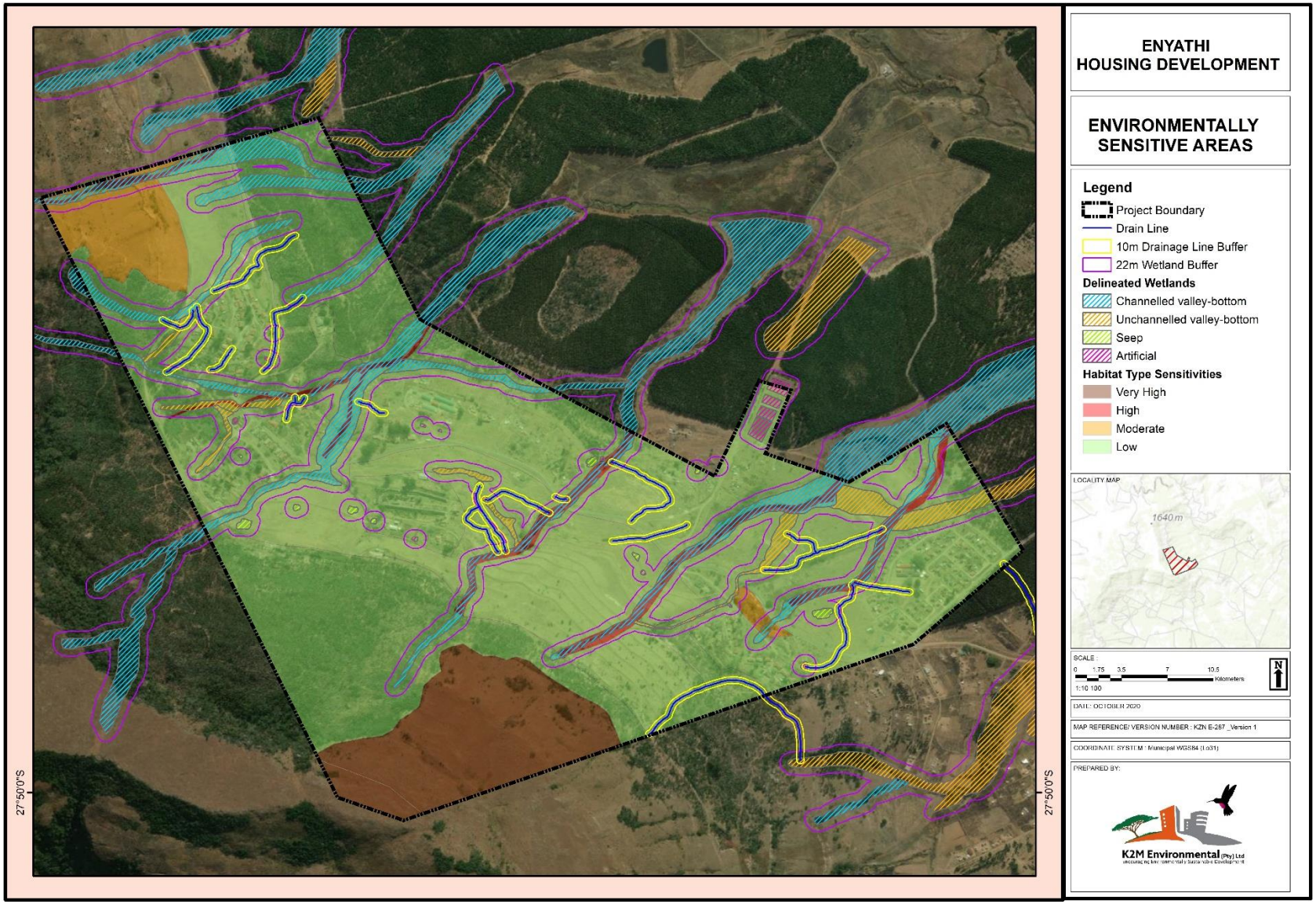
It should be noted that erven will be set aside for a place of worship, commercial, community as well as passive open space land uses.

Map 2.2 and **Appendix E1** illustrates the environmentally sensitive areas that were identified within the project area. The map depicts the following environmental attributes within the project area: the delineated wetlands (channelled valley-bottom, unchanneled valley-bottom and seepage areas); the habitat types sensitivities (ranging from very high to low sensitivities).

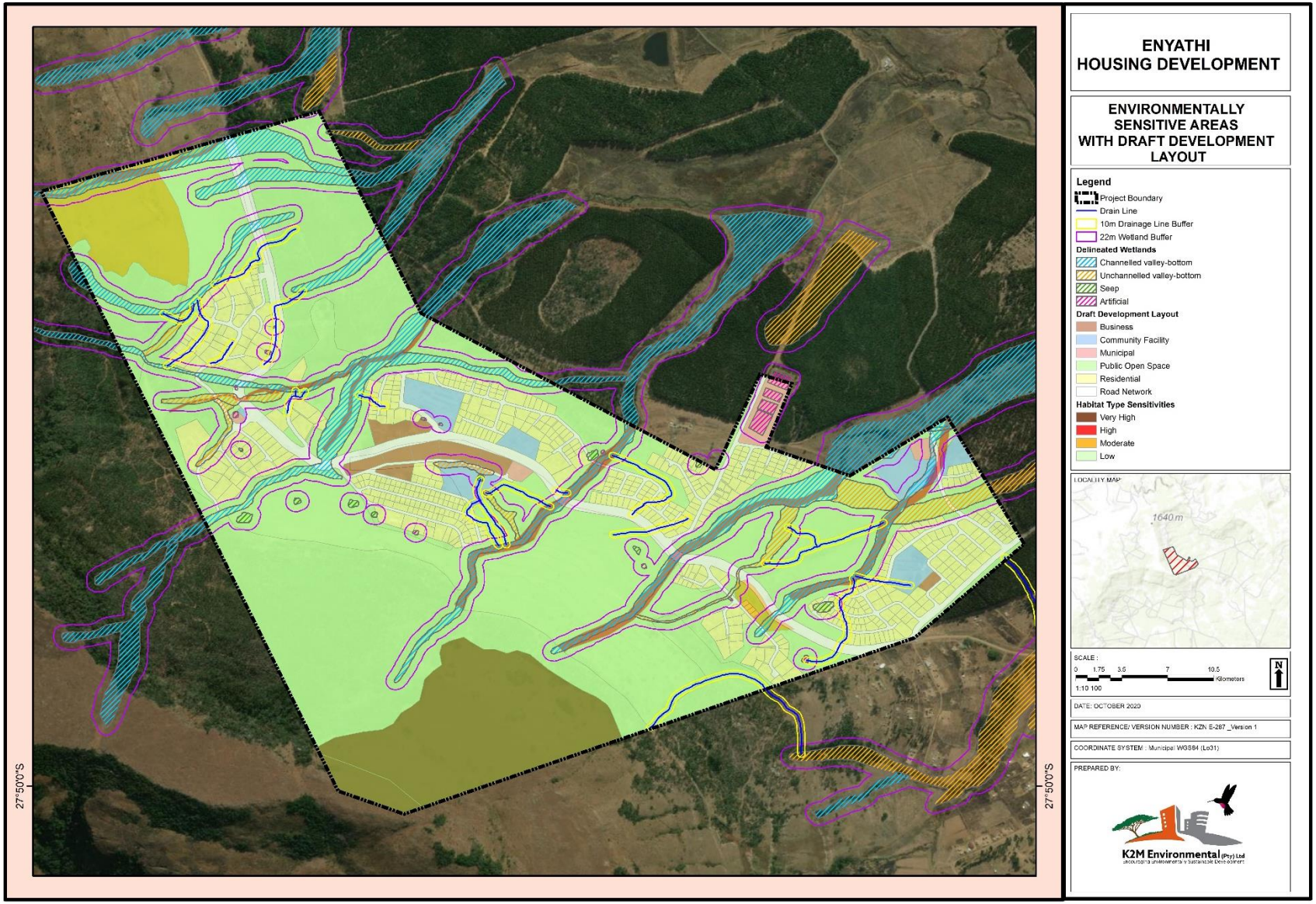
Map 2.3 below and **Appendix E2** illustrates the environmentally sensitive areas within the project area overlain with the draft development layout. As can be seen, significant environmental attributes within the project are taken into account with regards to the proposed development layout. Some wetlands (artificial and seepage areas) will be infilled to accommodate the proposed development, some of the existing residential structures are also located within the proposed buffer. Water crossing will be constructed where the proposed internal roads cross watercourses.

Map 2.1: Proposed Draft Development Layout

Map 2.2: Environmentally sensitive areas on site



Map 2.3: Environmentally sensitive areas overlain with Draft Development Layout



2.3.3 Access to the proposed development

From Vryheid CBD head south onto Hoog Street towards Utrecht Street. Turn left onto Suid Street. Travel for approximately 4.3km and continue on the R69. After approximately 17.5km, turn right. Travel for a further 6.4km and turn right again. After approximately 9 km, the site will be entered.

2.3.4 Existing Situation

As indicated in Figure 2.1 below, the Enyathi project area contains existing residential structures as well as community, business and municipal buildings and a cemetery. The P274 runs through the project area which will enable to the site. The photos below depict the existing situation within the project area.

Figure 2.1: Existing situation within the site

Source: Google Earth Imagery, 2021

Photo 2.1: Existing dwellings within the project area

Photo 2.2: Existing traditional dwellings, vacant pockets of land and wastewater treatment plan

Photo 2.3: Existing pump station and sports field within the project area

Photo 2.4: Existing cemetery, dwellings and school

Photo 2.5: Channelled valley-bottom wetland

Photo 2.6: Channelled valley-bottom wetland

2.4 PROJECT PHASING AND CONSTRUCTION PROGRAM

The construction of the project is scheduled to commence as soon as all the processes to comply with applicable legislation are completed. There will only be one phase in terms of construction, which will be completed from start to finish in one phase.

2.5 CONSIDERATION OF ALTERNATIVES

Alternatives are seen as different means of meeting the general purpose and need of a proposed activity. Alternatives could include, amongst others, the following:

- Activity Alternatives: This requires a change in the nature of the proposed activity. This alternative is most appropriate at a strategic decision-making level.
- Location Alternatives: Alternative locations for the entire project proposal, or for components of the project proposal.
- Layout Alternatives: This alternative allows different spatial configurations of an activity on a specific site.
- Scheduling Alternatives: also refer to alternative phasing options for the development. This alternative considers different phasing options during the implementation of the development.
- Infrastructure/ Input Alternatives: Also referred to as technological or equipment alternatives. This option considers various alternatives that will result in the same end result.

Layout and Infrastructure (technology) alternatives are the most pertinent to this EIA process, however all the above-mentioned alternatives are briefly explored in the subsections below as well as the alternative of maintaining the status quo, commonly known as the “no-go” option.

2.5.1 Activity Alternatives

Activity alternatives refer to the consideration of alternatives requiring a change in the nature of the proposed activity to be undertaken. Given the need for housing within the municipality, housing has been the preferred activity. One alternative is to leave the site in its current status quo, however this would not beneficial to the community to the poor housing conditions and lack of infrastructure for internal services.

2.5.2 Location Alternatives

The location for the project area was identified by the Applicant (the Abaqulusi Local Municipality) for the proposed housing development prior to commencement with the EIA Process.

2.5.3 Layout Alternatives

The preferred draft development layout was prepared by Terraplan Town Planners. The preferred draft development layout and the Urban Design Framework is attached as **Appendix C1.**

2.5.4 Scheduling Alternatives

The detailed time frame for implementation and completion of the proposed residential development is not currently available. However, given the extent of demand for housing within the Municipality it is anticipated that construction will commence as soon as approval of necessary statutory processes and authorizations (including environmental authorization) is obtained. No scheduling alternatives were therefore considered.

2.5.5 Input Alternatives

Various types of materials can potentially be utilized during the construction phase of the project for both infrastructure and top structure purposes. This may include different material types (e.g. brick types, roof types and furnishings as well as green building designs. Green Building Guidelines have been recommended in this report to encourage sustainable development. It should be noted that the sections below have been adopted from the *Green Building Guideline: Medium Density Affordable Housing* and the *Msunduzi Green Building Guidelines.*

2.5.5.1 Hot Water Systems

SANS 10400-XA refers to SANS 10252: At least half of the annual average hot water heating requirements shall be provided by means other than electrical resistance heating. The alternative means could be via but not

limited to heat pumps, solar water heating, heat recovery from other processes or heating via gas. Hot water installations need to comply with further SANS requirements as provided in section 4.1 of SANS 10400-XA:

- All hot water pipes must be clad with insulation
- Solar hot water systems must comply with the following standards which govern the quality and functioning of these systems: SANS 1307, SANS 10106, SANS 10254 and SANS 10252-1.

2.5.5.2 Insulation for Roof and External Walls

The installation of insulation lowers the thermal conductivity of a building element. Once the thermal conductivity of the building element decreases its insulating properties increase. The thermal conductivity of the building is defined to be the quantity of heat that flows through a unit area in a unit of time, per unit difference in temperature. It is expressed in Watts per square meter Kelvin (W/m2K). It provides an indication of how much heat is transmitted through a material, but also includes losses due to convection and radiation. Insulation reduces the heat gained during warm summer months and reduces the heat lost during cold winter months.

2.5.5.3 High Efficiency Geyser for Hot Water

This initiative investigates the different energy sources that can be used to deliver hot water to a development. For this purpose, three fuels or sources of energy were investigated these include: electrical resistance, Liquid Petroleum Gas (LPG) and Natural Gas. The water heater selected must have a high efficiency. The different sources of energy are discussed further below:

- Electrical Resistance: This is a standard storage tank style water heater that suffers inefficiencies or losses in energy due to standby loss. As the hot water sits in the tank, heat may escape through the walls of the tank. Therefore, when considering increasing geyser efficiencies, a geyser blanket would be a good addition
- LPG and Natural Gas: Water heaters that utilise gas can operate within both a conventional storage tank and tank less application. In the case of storage tanks, they may suffer the same heat losses as experienced with a conventional electric option unless a sealed combustion vent is included.

The purpose of having a high efficiency geyser specified is to reduce the demand for electricity that would otherwise, be required.

2.5.5.4 Solar Photovoltaics: Renewable Energy Generation

Photovoltaics (PV) utilises solar radiation to produced electrical energy. The outputted Direct Current (DC) voltage requires a solar panel array provision of 10m² for 1kWp/day (required for 25% of project annual consumption). The DC can be converted to standard mains Alternating Current (AC) via an invertor for residential consumption. PV has a reduction in cost per kWh a proportion of the difference can be utilised to finance the uplift via alternative financing. It will also reduce the CAPEX associated with upfront electrical connection charges and provide a resilience buffer to power shortages.

2.5.5.5 Internal Lighting – Energy Savings Bulbs

Energy efficient lighting is commonly available in South Africa in the form of Compact Fluorescent Lamps (CFLs) and these have largely replaced traditional incandescent lighting as the preferred lighting choice due to reduced energy consumption and heat generation and longer life spans. While 75W incandescent bulbs require electrical resistance to heat a metallic element 'white hot', a 13W CFL bulb contains a gas mixture of argon and mercury which is excited by a small electric current. In 4W Light Emitting Diodes (LEDs) electrons are encouraged to 'jump' between energy levels releasing photons.

2.5.5.6 Low Flow Fixtures and Fittings

In order to reduce the water demand per unit, it is recommended that low flow water fixtures and fittings be utilised. This includes low flow showerheads, hand basin taps, water closets and kitchen taps. The difference between these fixtures and normal fixtures would be the application of a flow restrictor that determines the flow rate of the fixture or fitting.

2.5.6 Infrastructure Alternatives

The subsections below summarise the options to be considered in terms of sanitation.

2.5.6.1 Sanitation

For the purposes of this project three potential sanitation levels of services will be considered, such as:

- Onsite septic tanks
- Ventilated Improved Pit Latrines
- Waterborne sewage system

A brief description has been provided.

Onsite Septic Tanks (Alternative Option)

The option of an onsite septic tank to treat sewage on site was considered as an option, rather than the construction of a sanitation network to drain/pump the sewage to the WWTW. However, the disadvantage of a septic system is that it poses the risk of ground water contamination. Furthermore, once the tank has reached the end of its life cycle the sludge needs to be pumped out or a new system needs to be constructed.

VIP Sanitation (Alternative Option)

The household latrine used in low income communities varies enormously in design. Improved versions of the traditional pit latrine include a ventilation pipe or a cover plate for the squat hole. The collection chamber may vary from an unlined pit to a septic tank, a composting chamber or a connection into a sewer. The superstructure may be a crude shelter or an attractive brick or thatch construction with or without a vent pipe and with or without a seat.

Waterborne Sewage System (Preferred Option)

Just as 'the in-home connection is viewed as the ultimate goal for water supply planners, utilities and households, the private sewer connection represents the highest level of service for household sanitation. Waste moves from the household toilet into sewers laid underground, then is discharged into a treatment facility and thereafter to the environment and classified as stream save.

2.5.7 "No-go" alternative

The "no-go" alternative should in all instances be considered as part of the EIA process. It assumes that the activity does not proceed, implying a continuation of the current situation of status quo. Should this development not go through, the following will apply:

- The housing demand will remain the same within the municipality unless there are other housing operations where construction has commenced or has been completed.
- The vacant pockets of land will be left vulnerable to illegal occupation, dumping and informal housing.
- The existing residential units will remain in a poor condition and continue to lack infrastructure for internal services such water supply and sanitation.

2.5.8 Motivation for preferred site alternatives

2.5.8.1 Preferred Site

No site alternatives were considered for the proposed since the project area was identified by the Abaqulusi Local Municipality (Applicant).

2.5.8.2 Preferred Activity

The proposed development will entail the following:

- The formalisation and subdivision of approximately 666 residential erven. It should be noted that this will include the existing residential structures and the proposed infill development which will be greenfield and under 20 hectares.
- Construction of internal pipelines for the transportation of water supply and waterborne sewage.
- Construction of internal roads and stormwater infrastructure.
- Formalisation of the existing cemetery.

It should be noted that erven will be set aside for a place of worship, commercial, community as well as passive open space land uses.

The preferred activity as stated above will be beneficial to the community as well as to the Municipality as a whole as it will assist in reducing the housing backlog within the Municipality as well as provide basic infrastructure services such was water, sanitation and stormwater infrastructure.

2.5.8.3 Preferred Layout

The total project area is approximately 255.03 ha in extent with a development footprint of approximately 62.26 ha. The proposed development layout was prepared by Terraplan in February 2021 and is attached as **Appendix D**. The land uses as per the proposed draft development is tabulated below:

Proposed Land Uses

Land Use		Area (HA)	Percentage	Units
	Residential (existing and proposed)	39.59	15.5	666
	Community Facility	7.03	2.8	7
	Municipal	2.34	0.9	4
	Business	3.48	1.4	8
	Roads	9.82	3.8	0
	Public Open Space	192.76	75.6	0
Total		**255.03**	**100**	**685**

As indicated in the Table above, approximately 39.59 ha has been set aside for residential (which is inclusive of existing dwelling structures as well as proposed infill units), 7.03 ha for community facilities, 2.34 ha for municipal land uses and 3.48ha for business land uses. Approximately 9.82 ha is set aside for the proposed and existing internal road network and as much as 192.76 ha of the site will be earmarked as public open space.

2.5.8.4 Preferred Technology

The existing area in Enyathi currently uses sewer ponds to treat all sewage effluent. The proposed development can be connected to the exiting sewer system. The capacity of the treatment works will be adequate for the proposed development.

The area is serviced with water from the Enyathi Water Supply Scheme, which extracts water from the Enyathi dam and two springs. This is treated at the exiting water treatment works that has a capacity of 0.9Ml/day. The water is pumped to one 600kl and one 900kl storage reservoirs in the project area. All indications are that the current bulk water infrastructure will be adequate to supply the proposed development, if operated at full capacity.

3 SITUATION ASSESSMENT OF PROJECT AREA AND AFFECTED ENVIRONMENT

3.1 PHYSICAL AND LANDSCAPE CHARACTERISTICS OF THE SITE

Moderate to undulating hillsides occur across the majority of the project area with topography typically gently sloping to generally flat-lying. Variation in elevation range between approximately 1430m MSL in the elevated area to approximately 1190m MSL along the generally flat lying north eastern portion of the site.

No primary drainage courses are present within the boundary of the site. Secondary drainage emanating from the dolerite ridge area located beyond the western boundary of the site generally drains to the east/northeast towards the Swart-mflozi River.

3.2 CLIMATE

According to the Abaqulusi Local Municipality's IDP, the Municipality falls in varied climatological zones. The mean annual rainfall range from 640 mm and 800 mm then rises up to between 800 mm and 1000 mm. The mean annual temperature lies between 17 °C and 19 °C. Summers are generally warm to prolonged hot spells reaching 30 °C. Winters are cold to very cold. Very cold winter periods are often associated with moderate to severe frost.

3.3 SURROUNDING LAND USES

As illustrated in Figure 3.1 below, the site is predominately surrounded by tree plantations to the north, residential structures to the east and vacant land to the south and west of the site.

Figure 3.1: Surrounding Land Uses

Source: Google Imagery, 2021

3.4 WETLAND ASSESSMENT

A Wetland Assessment was undertaken by the Biodiversity Company in December 2020. A copy of the report is attached as **Appendix F**.

3.4.1 Wetland Description

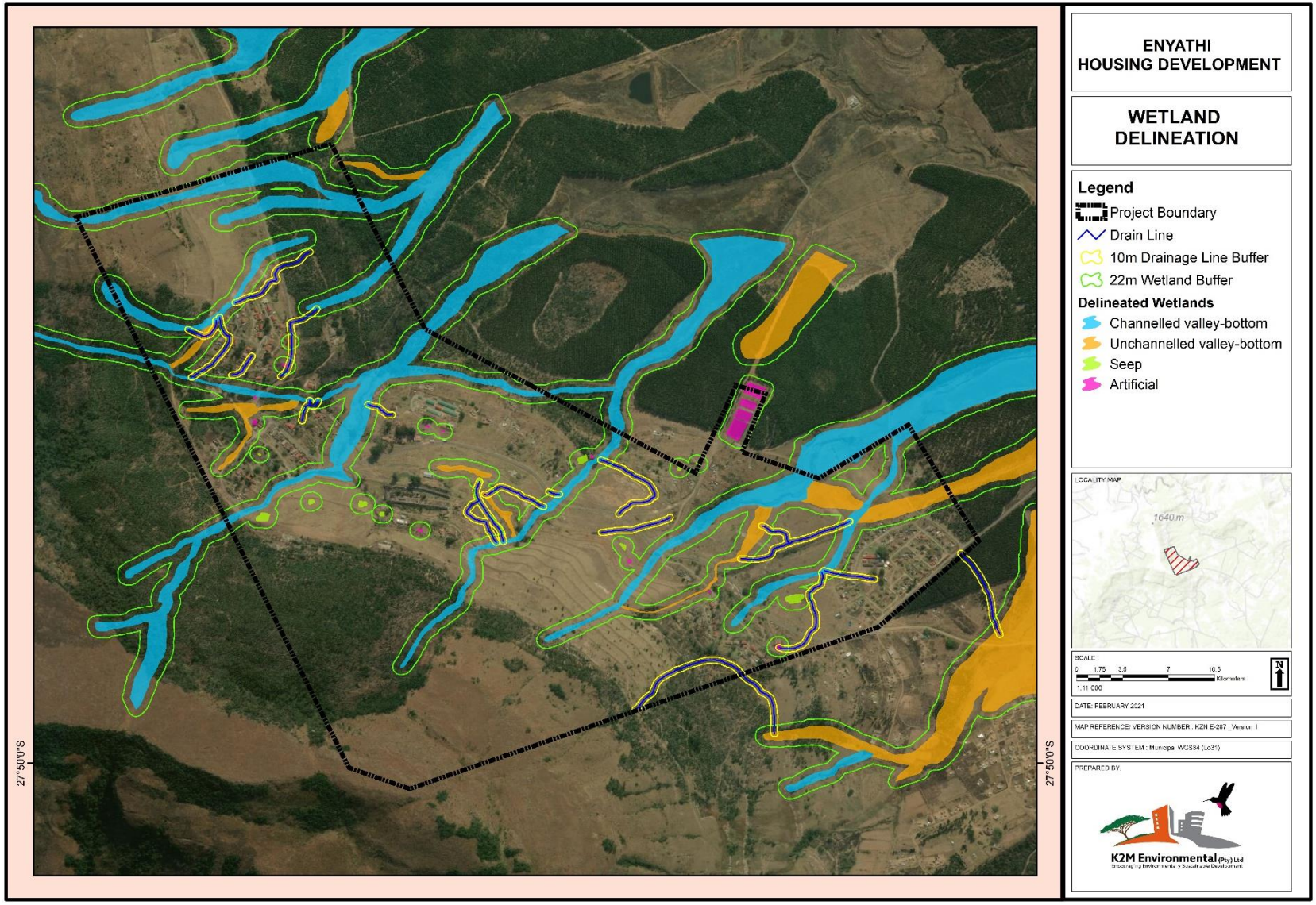
3.4.1.1 Delineated Wetlands

The three HGM unit types that were identified within the project area include:

- Channelled valley-bottom
- Unchanneled valley-bottom
- Seep

Map 3.1 and Photo 3.1 below provides an illustration of the wetlands found on site.

Map 3.1: Delineated Wetlands



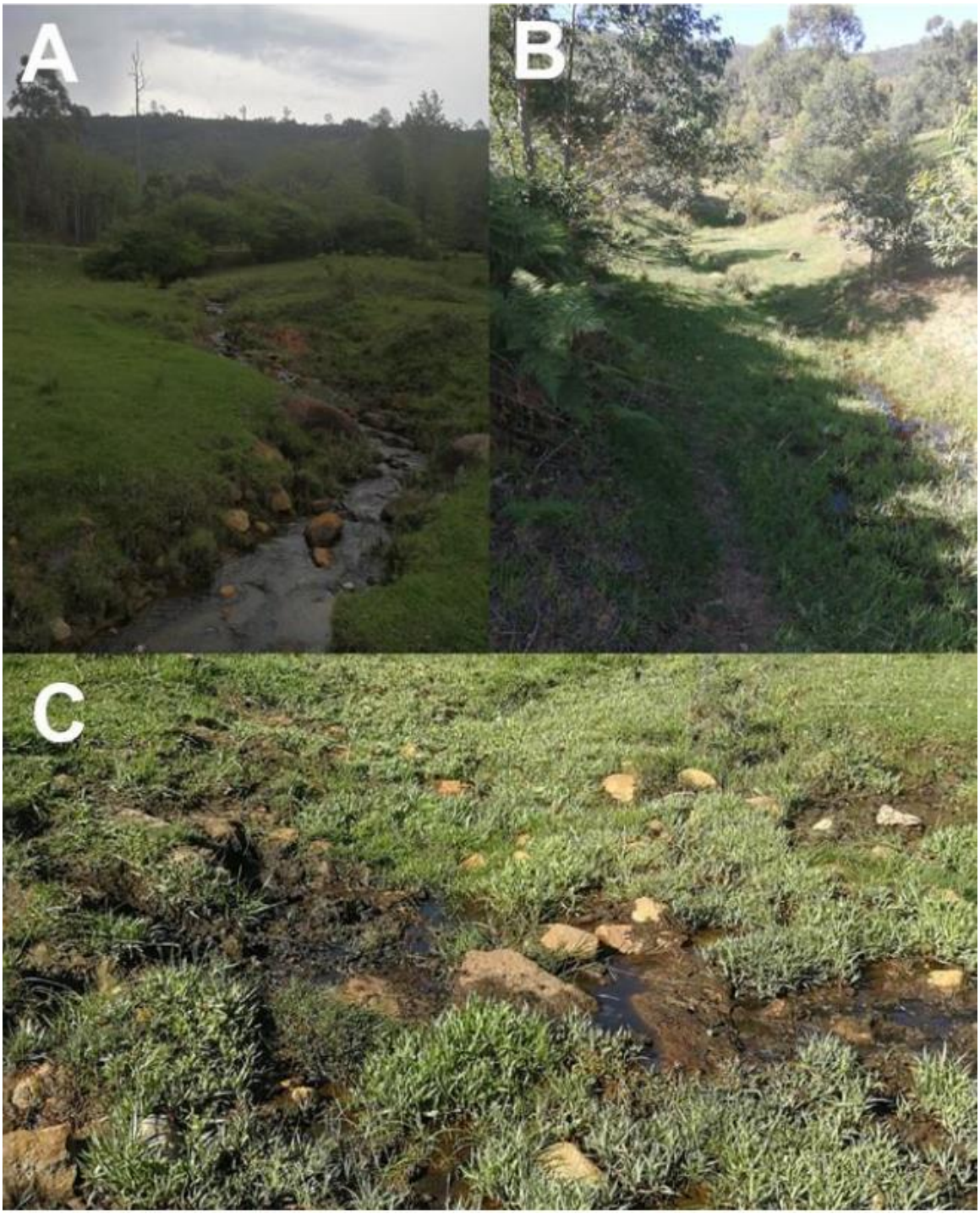
Channelled valley-bottom wetlands are the dominant wetland type within the project area. Four main HGM units or systems comprised of seven individual channels bisect the project area, draining the hillside in a north-easterly direction. This type of wetland has a clearly defined, finite stream channel and typically lack floodplain features such as meander cut-offs and depressions that are typical of floodplains. These wetlands are known to undergo a loss of sediment in cases where the wetlands slope is high and the deposition thereof in cases of low relief or as in this instance where large dams and other impeding features concentrate flows and deprive the system of sediment. In the project area all of these wetlands show signs of erosion which will intensify over time if the current land use practices (mainly livestock grazing) continue unchanged.

Unchanneled valley-bottom wetlands are less common in the project area. These wetlands occur towards the bottom of the hillside where the gradient is less steep, allowing for more diffuse flows. Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes.

Hillslope Seeps are scattered throughout the project area. These seeps are primarily isolated hillslope seeps. Seeps generally lack channels. In these wetlands diffuse subsurface flows characterise the hydrological regime.

Photo 3.1 below depicts examples of the HGM types within the project area.

Photo 3.1: Example of the three HGM unit types within the project area namely A) channelled valley-bottom, B) unchanneled valley-bottom and C) seep



Source: Wetland Assessment Report, December 2020

3.4.1.2 Soils

At a broad scale, from a soils / geology perspective, the site is situated in an area characterised by sandstone of the Vryheid Formation interspersed with doleritic hills. At a regional scale the majority of the site (the hillslope and its associated channelled valley-bottom wetlands) is zoned under Land type Fa369. In this landtype hillcrests / higher up on the catena are comprised mostly of exposed rock but also Mispah and Glenrosa soil forms while those lower down on the catena are characterised by Katspruit and streambeds (Land Type Survey Staff, 1972 - 2006). The foot slope to the east (the area associated with the unchanneled valley-bottom wetlands) is zoned as Ac127.

At a site scale, most of the non-wetland areas are dominated by deep friable, yellow Clovelly soil forms. The channelled valley bottom wetlands are characterised by Glenrosa soil forms. Further downslope the wetland soils are characterised by a dark loamy orthic A horizon with mottles underlain by gleyed G horizon referred to as a Katspruit soil form. Other soil forms in the lower lying areas include Milkwood and, in the more saturated parts of the uchannelled valley-bottoms, Champagne soil forms.

3.4.1.3 Vegetation

The vegetation on site changes with the topography. The plateau areas on the crest are the most natural and undisturbed. In the concave enclaves the wetland vegetation is dominated by woody tree species with ferns lining the channels while the convex slopes are grass dominated with a wetland vegetation dominated by sedges and hydromorphic grasses. The mid-slope areas are characterised by short heavily grazed grassland. Here the wetland vegetation has been reduced to a narrow strip dominated by hardy sedges such as Juncus effusus. As saturation and wetland width increases downslope, the vegetation becomes more luscious. The more intact wetlands to the south are characterised by species such as Cyperus sexangularis, *Zantedeschia aethiopica* and *Alsophila dregei*. The more disturbed wetlands to the north are, in contrast, comprised of a dense tangle of alien and invasive species.

3.4.2 Wetland Ecosystem Services

All six wetland HGM units scored Intermediate for their overall ecosystem services provision (Table 3.1). The ecosystem services provided by the wetlands identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al.* 2008). The valley bottom wetlands (HGMs 1-5) all provide important flood attenuation services.

This is because of the large opportunity for these systems to receive high velocity stormflows due to their steep, sparsely vegetated catchment. The unchanneled-valley-bottom wetlands with their shallower slope and their various impeding features created by road crossings help to attenuate flows and allow for sediment deposition. This wider, more diffuse and depositional flow environment not only helps to stem erosion but also allows for the proliferation of wetland vegetation. This in turn makes the unchanneled valley-bottom wetlands particularly effective at trapping sediment and assimilating nutrients and toxicants, thereby assisting in water quality enhancement.

In terms of biodiversity maintenance only the southern, less disturbed wetlands (HGM 1) are considered important, while the more northerly wetlands are too heavily disturbed and encroached by alien plants to be considered important for biodiversity in their current state.

Due to their rural setting all of the wetlands (except for the seeps) are considered important for provision of water for human use as well as the provision of cultivated foods and naturally harvestable resources. However, none of the wetlands are considered important from a cultural heritage or educational perspective. All of the wetlands have a low aesthetic value and are not considered valuable for tourism in their current state.

Table 3.1: Ecosystem Services provided by each HGM Type

				Wetland Unit	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits		Flood attenuation	2.3	2.3	2.3	2.3	2.7	2.0
				Streamflow regulation	2.0	1.8	1.8	1.8	2.0	2.0
			Water Quality enhancement benefits	Sediment trapping	2.1	2.1	2.1	2.1	2.8	2.0
				Phosphate assimilation	1.8	1.7	1.7	1.7	2.2	1.9
				Nitrate assimilation	1.8	1.6	1.6	1.6	2.2	2.0
				Toxicant assimilation	2.0	1.8	1.8	1.8	2.3	2.1
				Erosion control	1.8	1.5	1.5	1.5	2.2	1.5
				Carbon storage	1.7	1.3	1.3	1.3	1.7	1.7
	Direct Benefits			**Biodiversity maintenance**	3.0	1.9	1.8	1.7	1.8	1.6
		Provisioning benefits		Provisioning of water for human use	2.7	2.5	2.5	2.5	2.7	1.8
				Provisioning of harvestable resources	2.2	2.2	2.2	2.2	1.0	1.0
				Provisioning of cultivated foods	1.8	1.8	1.8	1.8	0.8	0.8
		Cultural benefits		Cultural heritage	1.0	1.0	1.0	1.0	0.3	0.3
				Tourism and recreation	1.0	0.9	0.9	0.9	0.3	0.3
				Education and research	0.8	1.0	0.8	0.8	0.8	0.8
				Overall	27.9	25.4	25.1	25.0	25.7	21.6
				Average	1.9	1.7	1.7	1.7	1.7	1.4
				Wetland Unit	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
				Threats	3.0	3.0	3.0	3.0	3.0	3.0
				Opportunities	4.0	4.0	4.0	4.0	4.0	4.0

Source: Wetland Assessment Report, December 2020

3.4.3 Wetland Health

The present ecological state (PES) of the six wetland HGM units within the project area are provided in Table 3.2. Overall, the southern-most wetlands are the least impacted with the degree of degradation increasing northwards.

HGM 1 in the south (the least impacted) was rated as Largely Modified. The grassland remains relatively intact and devoid of infrastructure. However, entire catchment has been terraced in the past for cultivation and has a greatly decreased grass sward density due to overgrazing. This has increased the intensity of floodpeaks delivered to the wetland. Geomorphologically the system is starting to show signs of channel erosion and the start of gulley erosion. The system is traversed by a road, however, is not adversely impacted

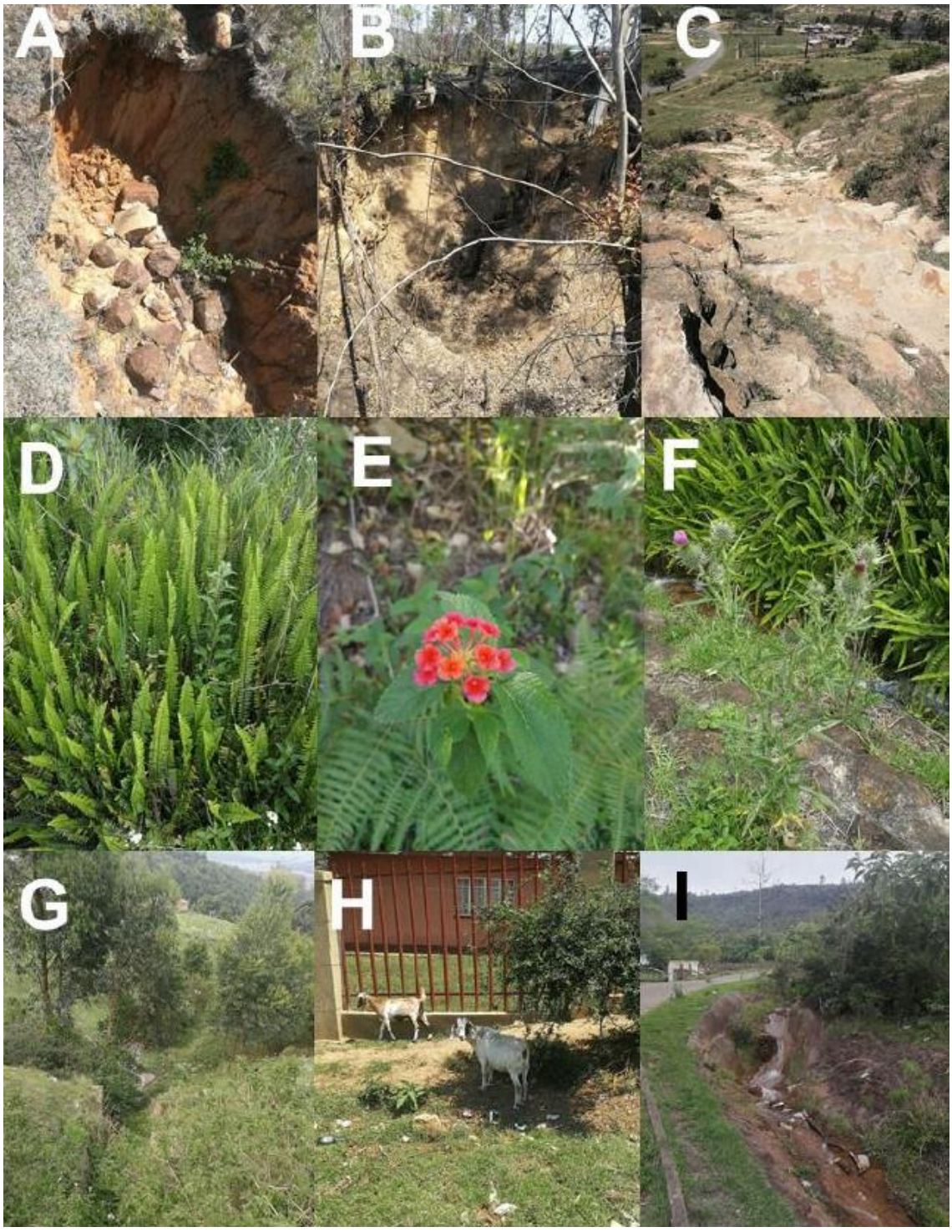
due to the adequate size of the culverts. HGM2 was rated as Seriously Modified. This wetland is subject to the same catchment impacts but is additionally impacted by a large alien bushclump and a small settlement. HGM3 is rated as Seriously Modified. This system is impacted by infrastructure, roads, canalisation. The system shows signs of artificially increased saturation levels as a result of the peri-urban dwellings within the catchment. HGM 4 is rated as Critically Modified. This wetland is heavily impacted by alien and invasive species and by peri-urban settlements. Additionally, the wetland has been impacted by afforestation (Eucalyptus plantations). HGM 5 is also rated as Critically Modified. This system has been straightened and almost completely transformed Eucalyptus plantations. The system is also impacted by roads and is likely a vestige of its former extent.

Table 3.2: Summary of the scores for the wetland PES

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	D: Largely Modified	5.0	D: Largely Modified	4.2	D: Largely Modified	5.5
Overall PES Score	4.9		Overall PES Class		D: Largely Modified	
HGM 2	E: Seriously Modified	6.5	D: Largely Modified	5.0	E: Seriously Modified	7.0
Overall PES Score	6.2		Overall PES Class		E: Seriously Modified	
HGM 3	E: Seriously Modified	6.5	D: Largely Modified	5.4	E: Seriously Modified	7.0
Overall PES Score	6.3		Overall PES Class		E: Seriously Modified	
HGM 4	F: Critically Modified	8.5	E: Seriously Modified	6.2	F: Critically Modified	9.0
Overall PES Score	8.0		Overall PES Class		F: Critically Modified	
HGM 5	F: Critically Modified	9.5	E: Seriously Modified	7.4	E: Seriously Modified	6.3
Overall PES Score	8.0		Overall PES Class		F: Critically Modified	
HGM 6	E: Seriously Modified	7.5	D: Largely Modified	4..2	E: Seriously Modified	6.0
Overall PES Score	6.7		Overall PES Class		E: Seriously Modified	

Source: Wetland Assessment Report, December 2020

Photo 3.2: Examples of some the existing impacts influencing the PES ratings; A) head cut erosion, B) Bed incisement, C) gulley formation and settlements, D) *Polystichum munitum*, E) *Lantana camara*, F) Cirsium vulgare, G) Eucalyptus spp. H) livestock, I) canals and plantations



Source: Wetland Assessment Report, December 2020

3.4.4 The Ecological Importance and Sensitivity

The results of the assessment are shown in Table 3.3. From a regional perspective no NFEPA rivers or wetlands are located within the 500m regulated area. The NFEPA Wetveg database recognises Sub-escarpment Grassland Group 4 Mesic highveld Grassland Group 2 channelled valley-bottom seep wetland types as Least Threatened and Not Protected. However, Unchannelled Valley-bottoms such as HGM 5 are listed as Endangered and Not Protected (Nel and Driver, 2011). At a more local scale, HGM Units 1, 2 and 3 are rated as having a Moderate ecological importance and sensitivity (EIS) respectively on account of their degraded yet functional ecological state. HGMs 4, 5 and 6 are rated as having a Low/Marginal EIS on account of their highly degraded state and the high levels of human disturbance. None of these systems are expected to support resident populations and significant populations of conservation important species. Neither are they likely to support noteworthy concentrations of waterfowl, due to the lack of open water. All the wetlands do however play an important role in providing feeding and movement corridors for wildlife. As all the systems receive high floodpeaks, are eroded and subject to eutrophication from greywater none are considered particularly sensitive to changes in low flow conditions.

Table 3.3: The Ecological Importance and Sensitivity results for the wetland area

Wetland Importance and Sensitivity	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecological Importance & Sensitivity	2.0	1.7	1.3	1.0	1.0	1.0
Hydrological/Functional Importance	1.9	1.8	1.8	1.8	2.3	1.8
Direct Human Benefits	0.5	1.6	1.5	1.5	1.0	1.5

Source: Wetland Assessment Report, December 2020

3.4.5 Buffer Zones

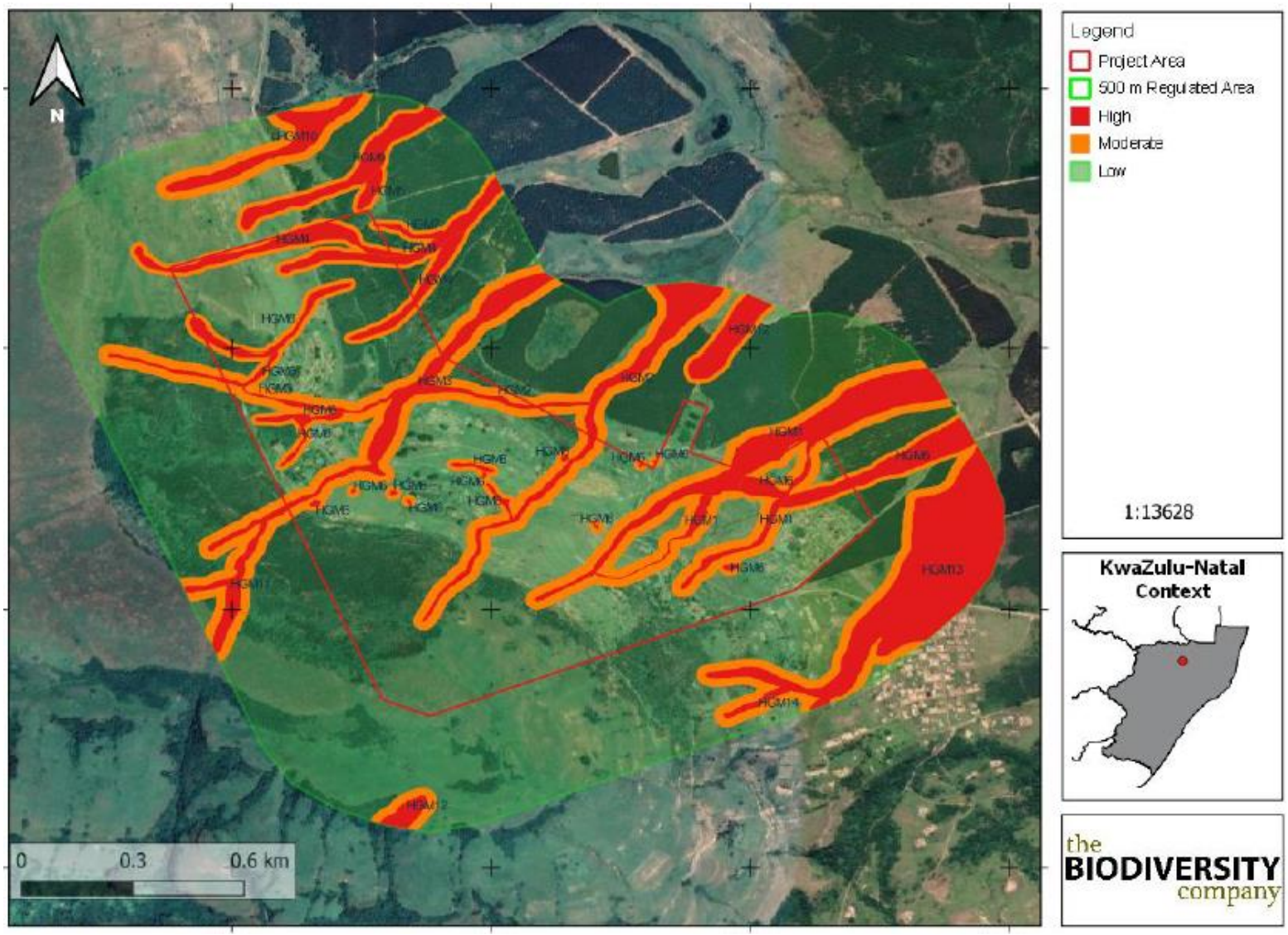
The "Buffer zone guidelines for wetlands, rivers and estuaries" (Macfarlane and Bredin 2017) was used to determine the appropriate buffer zone for the proposed activity. The model shows that the largest risks posed by the housing development are likely to occur during the construction phase. The most potentially significant being alteration to flow volumes, alteration of patterns of flows and increase in sediment inputs & turbidity. During the operational phase, increased sediment inputs have the potential to remain an impact if the site is not appropriately landscaped and re-vegetated. However, the main concern associated with the operational phase shifts to the potential for organic enrichment of the wetlands through inappropriate waste-water and sewerage management. For the sake of this assessment the fourteen HGM units within the

500 m regulated area were classified into one of two disturbance classes namely higher or lower disturbance. All lower disturbance wetlands were assigned a 36 m buffer while all higher disturbance wetlands were assigned an 18 m buffer (post mitigation).

3.4.6 Sensitivity Assessment

A sensitivity map was produced to visually represent the sensitivity of each HGM unit to the proposed development based on the findings of the wetland assessment (Figure 8-1) All identified HGM units were classified as having a High sensitivity while their associated buffers were assigned a Moderate sensitivity. All other non-wetland areas within the 500 m regulated area were assigned a Low sensitivity from a wetland perspective. The site for the proposed development currently overlaps High and Moderate wetland sensitivity areas.

Map 3.2: Wetland Sensitivity



Source: Wetland Assessment Report, December 2020

3.4.7 Wetland Impact Risk Assessment

A risk assessment was conducted in line with Section 21 (c) and (i) of NWA to investigate the level of risk posed by the project, the construction and operation of a housing development.

Six wetlands HGM units occur within the project area. These wetlands have the potential to be impacted by the proposed housing development.

During construction, the most potentially significant risk involves direct wetland loss (especially in the eastern side of the project area). This was assigned a risk significance score of High as this impact would be permanent and result in the direct loss of wetland habitat. The residual risk is rated as Moderate as the room for layout shifts appears very limited. If possible, the wetlands should be considered "no-go" areas for development. These wetlands and their associated buffers should be recognised as open space greenbelt areas and valued for the aesthetic and recreational value. Only non-permanent low intensity eco-orientated developments should be allowed in the wetland buffers which will not only increase the utilisation, value and aesthetic appeal of these open space areas but also promote sustainable maintenance of these wetland areas, improving their health and functionality over time.

The next main impact would be roads, the construction and operation of road crossing. This has the potential to significantly alter the flow dynamics in these wetlands if culverts are not adequately large. If too small they will impede flow upstream and erode the channel downstream of the crossing point.

Other construction-related impacts include degradation of wetland habitat following site clearing, increased bare surfaces accompanied by intensified floodpeaks and potential for erosion. During operation, pre-mitigation risks centre on alteration to flow volumes and patterns, continued sedimentation and increased inputs of organic and chemical contaminants. These impacts were assigned a post-mitigation rating of Moderate given the proximity of the development to the wetlands which triggers a mandatory severity and legal rating of 5.

3.4.8 Mitigation Measures

The following mitigation measures are proposed to be implemented during the construction and operational phases of development:

- Incorporate the delineated wetlands into the master plan and avoid development within them and their associated buffers;
- Incorporate the principles of the Sustainable Urban Drainage Systems (SUDS) into the design philosophy of the housing development. These principles and design concepts are geared towards capturing attenuating and utilising storm and grey water in an effective, environmentally friendly and sustainable manner;
- If encroachment loss of wetlands cannot be avoided then a wetland rehabilitation and offset study will need to be compiled and implemented. On site rehabilitation is recommended as a potential offset;
- Use the wetland shapefiles to demarcate and signpost the edge of the wetlands buffers;
- Ensure that all blockages in drains are promptly fixed;
- Ensure that all sewerage is contained on site and not allowed to flow, whether by accidental spill / blockage or any 'other means into the nearby wetlands;
- If a leak does occur it must be reported to DWS;
- Do not discharge any liquids particularly grey or sewerage water into the wetlands unless treated to acceptable standards and approved by the relevant authorities at DWS;
- Educate staff and relevant contractors on the location and importance of the identified wetlands through toolbox talks and by including them in site inductions as well as the overall master plan;
- Promptly remove / control all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed;
- Limit most of the earth-moving activities to winter when rain is least likely to wash concrete and sand into the wetland;
- Appropriately stockpile topsoil cleared from the project area and ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash;
- Do not situate any of the construction material laydown areas within any wetland and do not park machinery in the wetlands or their buffers;
- Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility;
- Design and implement an effective stormwater management plan;
- Release only clean water into the environment;
- Stormwater leaving the site should not be concentrated in a single exit drain but spread across multiple drains around the site each fitted with energy dissipaters (e.g. slabs of concrete with rocks cemented in); and

- Appropriately re-vegetate all unnecessarily denuded areas by ripping, landscaping and re-vegetating with locally indigenous species.

3.4.9 Specialist Conclusion

Fourteen wetland HGM units were identified within the 500m regulated area surrounding the proposed housing development site. Of these, six occur within the proposed development area and have the potential to be impacted. These wetlands were rated in terms of their PES, EIS and provision of ecosystem services. The health or PERS of the systems is generally best in the south-eastern regions of the study area (mostly Largely Modified wetlands) but deteriorates in a north-easterly direction as the pressures associated with peri-urban settlement, alien bushclumps and overgrazing intensify. The systems provide mainly indirect regulating and supporting services relating to flood attenuation and water quality enhancement but, given their rural setting are also considered important for the direct provision of water and natural harvestable resources. The systems are however degraded and are not considered important from a cultural, tourism, recreational or educational perspective, in their current state. Although some of the southern wetlands are considered to have a Moderate importance and sensitivity most are considered to be of Low/Marginal importance.

In terms of anticipated impacts, the most potentially significant is wetland loss. Although the preliminary layout has made some provision to exclude watercourses the findings of this study show that some wetlands do occur in areas earmarked for development. Without mitigation or layout shifts development in these areas would represent a High risk. The residual (post mitigation) risk rating for this impact is rated as Moderate as the available space to shift the infrastructure, although present, is very limited. Alteration of the bed or banks of any of the identified wetlands will justify a full water use licence. However, if the project planners manage to incorporate the delineated wetlands into the master plan and commit to avoiding development within these wetlands and their associated buffers this residual rating would justify downgrading to Low. In this case the project would warrant only a general authorisation at most (mainly due to the presence of the water reticulation and sewerage systems in such close proximity to wetlands.

If avoidance is not possible the full water use licence application should be accompanied by a commitment to compile and implement an offset strategy to compensate for the losses. In this case it is advised that the offset take the form of in situ rehabilitation as there is much to do in the way of alien clearing and erosion control to improve the functionality of these wetlands. It would be prudent in any event for the developer to plan from the onset, for the in-situ conservation of the existing wetlands identified on site and their

overall improvement through the design and implementation of both soft and hard rehabilitation intervention measures (including swales, bioretention ponds, flow attenuation and dissipation structures, litter traps and slow flowing vlei areas) to improve the overall functionality of the systems. This will increase the aesthetic appeal of the wetlands and the overall quality of lifestyle and value of the development. Another pertinent impact would be roads the construction and operation of road crossing. This has the potential to significantly alter the flow dynamics in these wetlands if culverts are not adequately large. If too small they will impede flow upstream and erode the channel downstream of the crossing point. This impact is rated as High but can be reduced to low if appropriately sized culverts are installed and stormwater effectively dealt with.

In their current state the wetlands are heavily impacted, some critically so. Left as is they are likely to continue to deteriorate providing increasingly lower levels of ecosystem services. Encouragingly however, provided that the recommended mitigation is effectively applied and the stipulated buffers adhered to, the proposed development may provide an opportunity to effect a positive impact on the environment through the conversion of previously eroded, overgrazed, narrow and alien infested wetlands to wider, more stable and functional wetlands that are also more aesthetically pleasing. It is anticipated that through some minor, yet carefully planned rehabilitation efforts, the system can be restored to a state where it represents a valuable greenbelt and open space asset, that is actively utilised by the residents and thereby sustainably preserved and improved.

3.5 ECOLOGICAL ASSESSMENT

An Ecological Impact Assessment was undertaken by The Biodiversity Company in November 2020 and is attached as **Appendix G.**

3.5.1 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the spatial dataset the proposed development is located within two EN ecosystems.

3.5.2 Ecosystem Protection Level

Indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems. The proposed development is located within two PP ecosystems.

3.5.3 Protected Areas

According to the protected area spatial datasets from SAPAD (2019) and Ezemvelo KZN Wildlife, the proposed development does not occur within any protected area. The Vryheid Mountain Nature Reserve is located approximately 23 km to the north-west of the proposed development.

3.5.4 Critical Biodiversity Areas

Conservation of CBAs is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

The proposed development intersects Irreplaceable and Optimal CBAs (Map 3.3 below). The area categorised as CBA – Irreplaceable must be a 'no-go' area which is congruent with the layout plan, i.e. located within the proposed open space.

3.5.5 Hydrological Setting

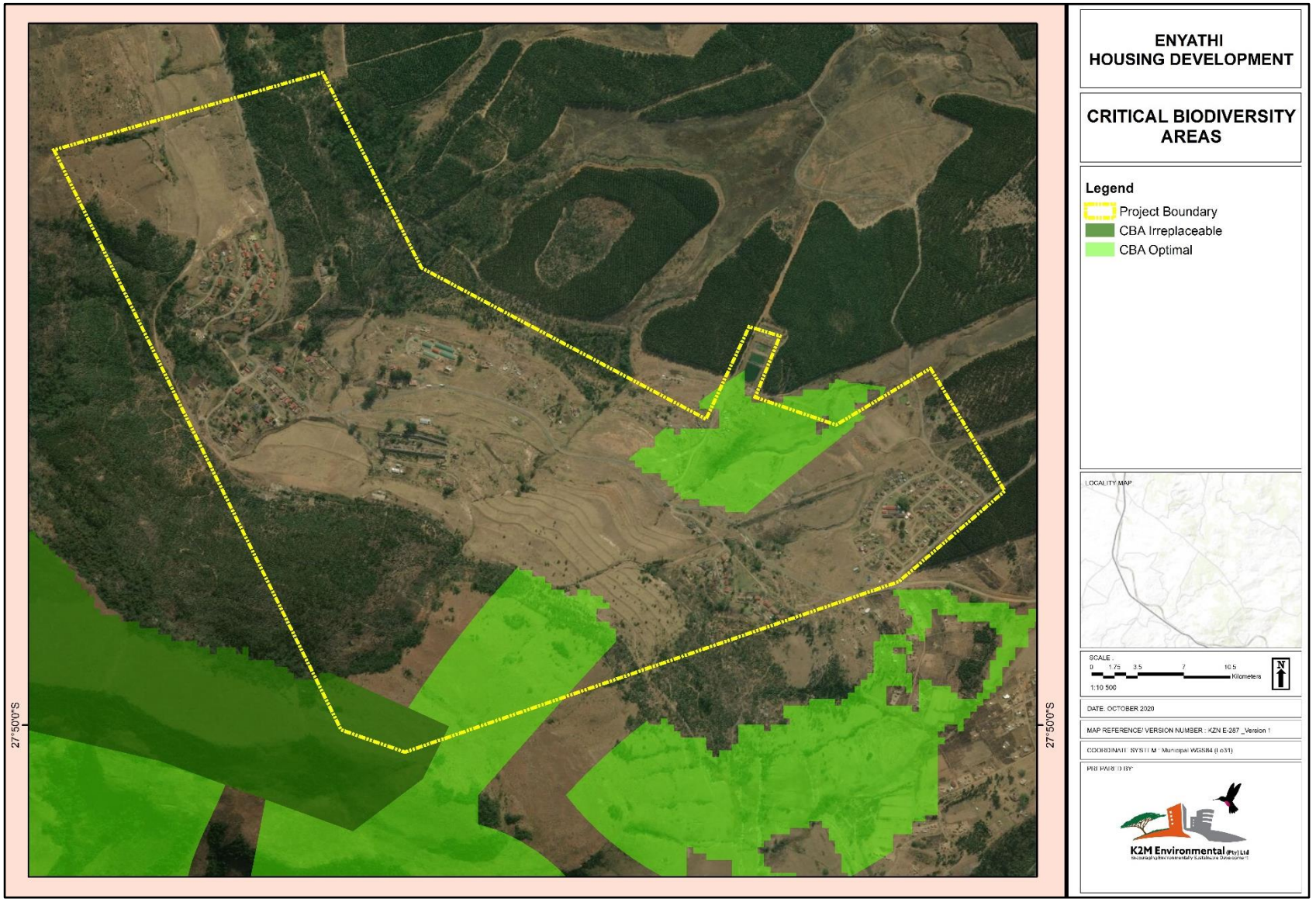
The proposed development is located predominantly within the Mfolozi catchment, specifically quaternary catchment W22A, with minor overlap of catchment W21B. Furthermore, the proposed housing development is located within the Mfolozi Headwaters Strategic Water Source Area (SWSA). There are no major river

systems that overlap with the assessment area, but there are drainage lines that drain into the Black Mfolozi River towards the north-east (Map 3.4 below).

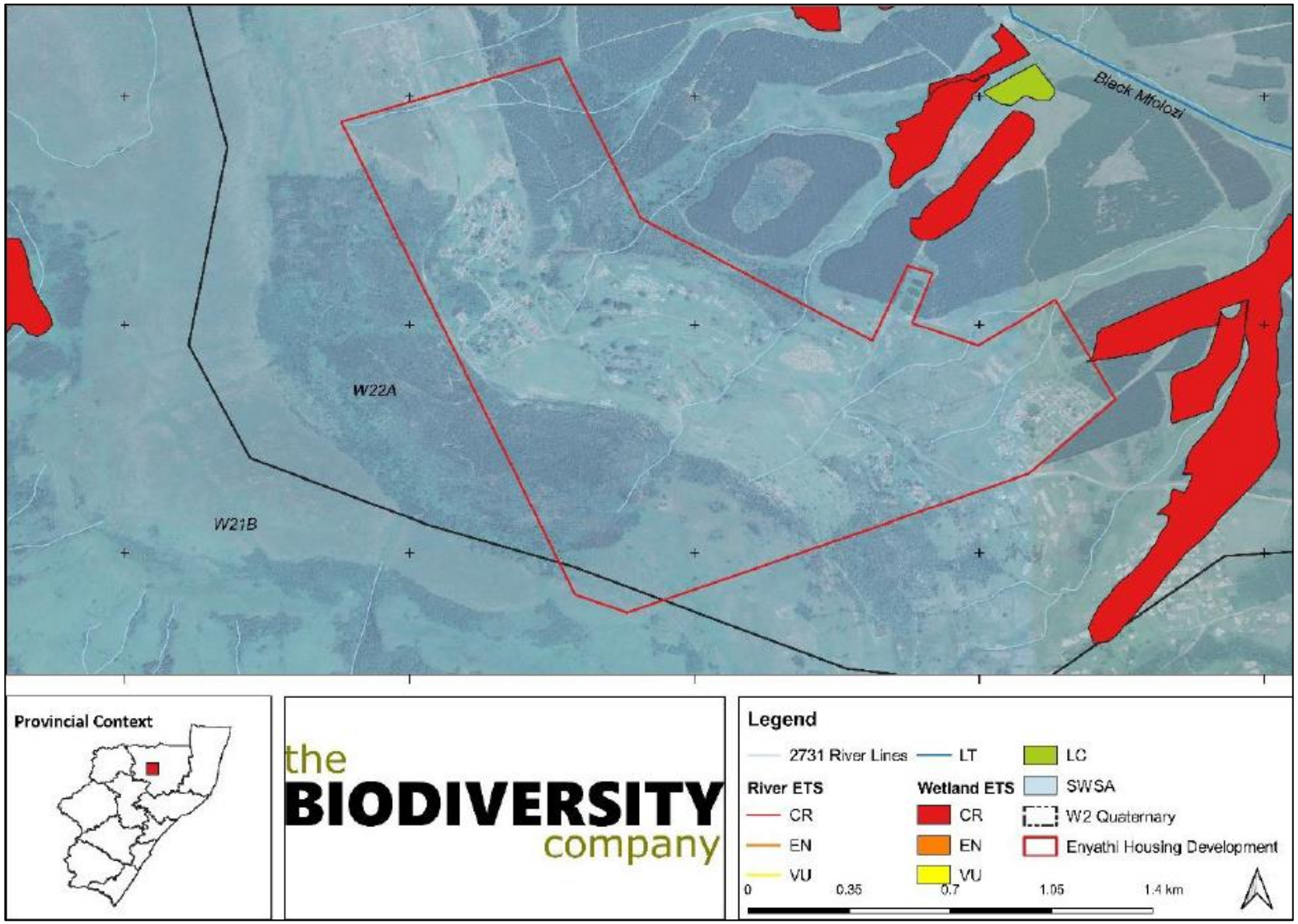
The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the National Biodiversity Assessment (NBA), 2018. Ecosystem threat status (ETS) of river ecosystem types is based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer et al., 2019; Skowno *et al*., 2019). The reach of the Black Mfolozi proximal to the proposed development is regarded as LT. However, the ecosystem threat status of wetlands proximal to the proposed development are regarded as CR (see Map 3.4 below).

The NFEPA spatial layer indicates that the wetlands do not intersect with a Ramsar site and are not within 500 m of a IUCN threatened frog point locality, within 500 m of a threatened waterbird point nor are wetlands with the majority of its area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes (*Bugeranus carunculatus*), Grey Crowned Cranes (*Balearica regulorum*) and Blue Cranes (*Anthropoides paradiseus*).

Map 3.3: Critical Biodiversity Areas



Map 3.4: Hydrological Setting of the proposed site



3.5.6 Floral Assessment

3.5.6.1 Vegetation Assessment

The proposed Enyathi Housing Development is situated within the grassland biome. The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape.

On a fine-scale vegetation type, the proposed Enyathi Housing Development overlaps with two sub-escarpment grassland types, namely the Paulpietersburg Moist Grassland and to a minor extent, Northern Zululand Mistbelt Grassland.

The Paulpietersburg Moist Grassland vegetation type is described as follows:

- Topography – Mainly undulating with moderately steep slopes, but valley basins are wide and flat and mountainous areas occur mostly along the northern and eastern boundary.
- Geology – Underlain by Archaean granite and gneiss partly covered by Karoo Supergroup sediments (Madzaringwe Formation) and intruded by Karoo Dolerite Suite dykes and sills. Dominant soils on the sedimentary parent material are yellow apedal, well drained, with a depth of >800 mm and a clay content of >35%.
- Climate – Summer rainfall, with MAP 900 mm. Warm-temperate climate, MAT close to 17°C, with fairly frequent frosts.
- Conservation – Only very small portion statutorily conserved in Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. About one third already transformed by plantations or cultivated land. Heavy livestock grazing and altered fire regimes have greatly reduced the area of grasslands of high conservation value. Aliens such as species of *Acacia, Eucalyptus* and *Pinus* are of major concern in places. Erosion very low to low.

The Northern Zululand Mistbelt Grassland vegetation type is described as follows:

- Topography – Gentle to steep upper slopes of mountains formed by hard dolerite dykes.
- Geology – Shales and sandstones of the Madzaringwe and Pietermaritzburg Formations (both Karoo Supergroup) as well as intrusive rocks of the Karoo Dolerite Suite. Dominant soil forms are Hutton, Clovelly and Griffin and are well drained, having 15–35% clay in the A-horizon.
- Climate – Summer rainfall, with overall MAP around 960 mm, reaching 1 130 mm in places. Moisture-laden air frequently blows in from the south-east and is forced up 400–500 m over the

mountains, creating 'mistbelt' conditions (particularly in spring and summer) that contribute to precipitation.

- Conservation - Only about 3% statutorily conserved in the Ithala Nature Reserve and in the Ntendeka Wilderness Area of the Ngome State Forest. Approximately 22% has been transformed for plantations or cultivated land. Threats to the remaining grasslands are heavy selective grazing by livestock and extensive annual burning. Spread of alien *Acacia mearnsii* and *Eucalyptus* species is of serious concern.

3.5.6.2 Indigenous Flora

A total of 86 species, representing 38 families, of indigenous flora species were recorded within the assessment area, seven (7) of these species are endemic to South Africa. None of the expected threatened flora species were recorded within the assessment area during the survey period. The most speciose family was Asteraceae with 15 species recorded, followed by Poaceae with 10 species recorded. The families Fabaceae and Rubiaceae were also ubiquitous within the assessment area.

Eleven (11) of the record flora species are of conservation concern as they are either protected by legislation (Schedule 12 of the KZN Nature Conservation Ordination) or threatened. It is important to note that most of these species were recorded within the proposed open spaces and therefore, will likely not be directly influenced by the proposed development. However, *Aloe suprafoliata, A. arborescens* and *Zantedeschia aethiopica* overlap with areas designated for development. *Aloe suprafoliata* overlaps with the road design, however, the specimens are located on a rocky outcrop and vertical cliff and can therefore be avoided. The latter two species, *A. arborescens* and *Z. aethiopica*, were likely planted as landscaping features in their respective localities. The location of the *A. arborescens* was adjacent to the main road and falls within the road reserve, and the *Z. aethiopica* was located within an open space with wetland characteristics and therefore, its location is regarded as unsuitable for construction regardless.

Within a threatened species context, *Drimia elata* is regarded as Data Deficient as it is taxonomically problematic, and hence there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. The species is not endemic to South Africa and widely distributed occurring from the Eastern Cape to Limpopo and west to the Northern Cape. *D. elata* is one of the most widely utilised medicinal plants and used as a blood purifier. The individual observed was located within the CBA, which is designated as an open space, and therefore, is unlikely to be influenced by the proposed development.

3.5.6.3 Invasive Alien Plants

Invasive Alien Plants were prevalent within the assessment area due to the extensive disturbance from anthropogenic influences. Twelve (12) IAP species were recorded within the assessment area. Eight (8) of these species are listed as 1b. In terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA), category 1b invasive species is described as Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.

3.6 GEOTECHNICAL ASSESSMENT

The Geotechnical Investigation was conducted in October 2020 by Davies, Lynn and Partners and is attached as **Appendix H.**

3.6.1 Geology

- Subsurface Conditions: The site is underlain by weathered Shale and Siltstone/Sandstone bedrock of the Vryheid Formation of the Karoo Supergroup.
- Subsoil Variance: In general, the derived subsoil cover capping the bedrock is thick along the concave slopes of the hills and valley bottoms. Shallow soils occur above the weathered bedrock beneath the hilltop and high ground areas. The typical subsoil profile comprises an upper dark brown silty SAND horizon varying between 0.1m and 2.7m in thickness (colluvium). Weathering of the Vryheid Formation, comprising a sequence of erodible silty SANDS with residual silty SANDS or SANDY CLAYS overlying bedrock.
- Vryheid Formation:
    - The soil cover comprises an upper, generally thick colluvium layer overlying potentially expansive silty sands derived from the in-situ decomposition of the shale/sandstone bedrock.
    - The soil cover is typically deep (approximately 1,0m to 2,7m below existing ground levels) along the convex hillsides with isolated zones of shallow soil cover ranging in depth from 0,0m to 0,6m below existing ground levels.
    - The shale bedrock comprises a uniform succession of dark grey, laminated silty shales containing occasional indurated bands. Jointing is generally in all azimuths causing the shale

to break into slabs or blocks according to joint spacing and bedding. Large areas underlain by light brown, fine- to medium grained sandstone bedrock were encountered with this bedrock material showing slightly lower grades of weathering compared to the typical shale bedrock material.

- The colluvial and residual soils generally comprise silty sands occasionally sandy clays typically greater than 1,0m deep in the range 0,6m to 2,7m across portions of the site. These soils are categorised as compressible and/or potentially collapsible in terms of the NHBRC classification system with an expected range of total soil movements of the order of 10 – 20mm. The classification therefore is deemed to be designated Site Class C1 and/or S1 due to the variable nature of the soils across the site.
- In zones of thicker colluvium and/or residual soils Site Class C2 and S2 characterises the subsoil conditions.
- Where active clayey soils occur Site Class H2 is applicable.
- Composite site classes (R/C2 or R/S2, R/H2) will be required where higher differential movements are anticipated i.e. Typically, where bedrock is exposed over portion of the building platform and colluvial and/or residual soils occur across the balance of the building platform.

3.6.2 Groundwater Seepage

Below the dolerite ridge line, located just beyond the western boundary of the site, hillside topographical areas in the vicinity of valley lines, shallow seasonal and perennial groundwater seepage activity is anticipated. Within the secondary valley lines, clays and alluvial soils may occur with a relatively shallow ground water table. Seepage may also occur over a broad portion of the site as localized seepage zones due to the highly fractured nature of the Shale and Sandstone bedrock especially within topographical low-lying areas.

3.6.3 Slope Stability

The site of the proposed Enyathi Rural Housing project is located in a moderately undulating to flat lying area and therefore in general, slope stability hazards should not be encountered during the construction phase.

3.6.4 Physical Planning Considerations

The ease of development across the site is related to the landforms and the underlying geology. Accordingly, cut to fill platform are common to accommodate the existing houses. The variation in geological conditions similarly has a significant impact on the ease of development. This is illustrated in Table 3.4 below.

Table 3.4: Geotechnical Assessment

LANDFORM	ROCK TYPE	TYPICAL SITE CONDITIONS	DEVELOPMENT PRACTICE	EASE OF DEVELOPMENT
HILLTOP (HT)	Sandstone/Shale	Gently sloping, well drained, elevated area generally with a shallow soil cover	Good founding into the Residual soils or bedrock	***Moderate for Zone 1*** Topography does allow minimal earthworks and is suitable for larger community buildings
HILLSIDE (HS)	Sandstone/Shale	Gently to moderate sloping, well drained areas with a moderate soil cover and occasional bedrock exposures	Differential founding conditions on slope (good on cut side and poor on fill side)	***Moderate to Good*** Moderately conditions for development
STEEP HILLSIDE (SHS)	Sandstone/Shale	Very steeply sloping (>1:3), well drained land with a moderate soil cover	Poor due to very steep slope and differential founding and Boulder removal	No development recommended
VALLEY HEAD (VH)	Sandstone/Shale	Moderate to very steep slopes with potential seepage and a moderately thick to thick clayey soil cover in the more deeply weathered areas	Subsoil drainage required and deep founding measures	***Poor*** Moderate to low housing densities. Significant earthworks required. Expensive to develop
VALLEY BOTTOM (VB)	Sandstone/Shale	Moderate to steep sloping, with potential seepage and a moderate to thick soil cover with incised, eroded stream courses	Poor, requiring special founding measures, subsoil drainage and erosion protection	***Poor*** Moderate housing densities, but required founding, drainage and erosion protection measures make these areas expensive to develop

Source: Geotechnical Investigation Report, 2020

3.6.5 Development Recommendations

Due to the scale and the dispersed nature of the housing areas; the geotechnical conditions encountered during construction may be at variance in places to the current findings, it is considered that the geotechnical professional be appointed to review the final planning and engineering design proposals prior to tendering for construction.

3.6.5.1 Excavatability / Trenchability

Excavation using conventional plant (eg. Backacter, payloader or light dozer) is considered feasible to a depth of between 1.00m and 1.50m below e.g. within areas underlain by weathered Shale and Sandstone/ Siltstone bedrock. In terms of SABS 1200 DA criteria, excavations to these depths can be expected to classify as soft to intermediate generally. In hillside areas underlain by dolerite, the prevalence of boulders necessitates Boulder Class B for excavation to depths of typically 1m below ground level in certain localities.

3.6.5.2 Design of Building Terraces

- The design of platforms should take account of the varying slopes which would suit the development of either:
  - Cut platforms on the limited shallow slopes (<1: 8 grade) present in the hilltop and ridge saddle areas.
  - Cut to fill platforms on moderate slopes (average grade of between 1 : 8 and 1 : 5); or
  - Cut to fill platforms with retaining walls on locally steep slopes (slope grades >1: 5) and on wet Sites. Pad foundation are likely to be required on the fill portion of the platforms in these steep areas.
- In terms of the terrain, every attempt should be made to ensure the design of platforms suits a cut to fill configuration with retaining measures in limited cases. Existing cuts on site are generally/ unretained and in most instances require to be battered back to safe, stable angles.
- Where possible, construction should be concentrated over the cut portion of platform to limit soil stability related problems and foundation / floor construction costs associated with development on fill. From practical and cost considerations, construction should not occur where only filled conditions prevail.

3.6.5.3 Development of Building Platforms

- Given the topography and underlying geology it is clear that cut and fill terraces will be formed on which to support some of the proposed developments. To this end, it is recommended that all earthworks are carried out in accordance with the current SANS 1200.
- Fills for the proposed platforms may be constructed using the materials available, subject to the precautionary measures specified, practicing due caution with the existing poor quality clays where these occur. Due to the clayey nature of the colluvial and residual soils in places, difficulties with compacting these materials when wet, may be experienced. Furthermore, these clays will soften

significantly, when saturated, which could lead to excessive settlement of any supporting structure or paving. It is therefore considered that cuts and fills be restricted in extent to promote stability.

- All vegetation should be cleared from the areas over which fills are to be built. In addition, the upper 150mm of colluvium should be removed and stockpiled for reuse as topsoil. In the event that fills are built over deep, very soft clays, the natural ground surface should be improved by providing a well compacted pioneer rock layer before fill placement commences.
- Where the natural ground slopes are steeper than 1 vertical to 6 horizontal (9 degrees), the fill should be benched into the insitu material to promote compaction and founding stability. Benches should be a minimum 0,5m deep and 3m wide.
- Boulders larger than 200mm in diameter or 10% of the layer thickness, when loose, should be removed from the fill material as these could complicate the compaction works, and also cause piping within fills. Furthermore, large boulders in fills could cause later problems during construction of foundations. Wet, alluvial and / or highly fissured soils and boulder / rock inclusions should be screened out, and the clayey materials are compacted in layers not exceeding 300mm when loose to a density of between 90% and 93% modified AASHTO Maximum Dry Density (MAASHTO) at Optimum Moisture Content (OMC).
- Slopes for cut embankments in stable soil and competent bedrock should be formed to batters of 1v: 1,5h (34 degrees) and to a height not exceeding 2m. Fill embankments should be sloped throughout the project area to not exceed 26 degrees and to a height not greater than 2,0m where retaining walls are not provided.
- Compaction density control tests should be undertaken at regular intervals during the development of fills.
- The final platform levels should be evenly graded to direct surface run off away from buildings into low points, ensuring that topping of embankment crests is avoided.

3.6.6 **Subsoil Drainage**

- It is anticipated that some form of subsoil drainage to facilitate construction within, for instance, any poorly drained slopes affected by perennial and seasonal shallow groundwater activity, will be required. In this regard, the requirement for subsoil drains along the cut layout of terraces and as a protection for the road prism from groundwater ingress should be confirmed on site during construction.

- Owing to the presence of variable subsoils on the site, different drainage solutions to maximize effect and optimised cost, may prove judicious.
- It is therefore recommended that the details of any potential drainage measures are confirmed with the geotechnical professional prior to implementation.

3.6.7 Stormwater Management

Although the housing developments are of relatively low density due to the rural nature of the community, it is important to dispose of stormwater effectively as uncontrolled runoff can cause damage to property and may erode and destabilize fill banks.

3.6.8 NHBRC – Site Classification

The colluvial and residual soils generally comprise silty sands occasionally sandy clays typically greater than 1,0m deep in the range 0,6m to 2,7m across portions of the site. These soils are categorised as compressible and/or potentially collapsible in terms of the NHBRC classification system with an expected range of total soil movements of the order of 10 – 20mm. The classification therefore is deemed to be designated Site Class C1 and/or S1 due to the variable nature of the soils across the site.

In zones of thicker colluvium and/or residual soils Site Class C2 and S2 characterises the subsoil conditions.

Where active clayey soils occur Site Class H2 is applicable.

Composite site classes (R/C2 or R/S2, R/H2) will be required where higher differential movements are anticipated i.e. Typically, where bedrock is exposed over portion of the building platform and colluvial and/or residual soils occur across the balance of the building platform.

In terms of the terrain across much of the site, building platforms are likely to be formed as a cut to fill platform. Since it is likely that weathered bedrock is likely to be exposed across the cut portion of the platform and colluvial and residual soils exposed towards the cut/fill line the site class designation is indicated as either R/C1 or R/S1 or alternatively R/H2.

Differential settlements for structures subject to those conditions are therefore likely to be higher for these composite site conditions eg. R/S1 may be described as a Class S2 site, or a R/H2 site may be described as a class H3 site etc. Consideration for these differential conditions need to be accounted for in the raft foundation design. Mass concrete pad supports towards the fill side of the platform will be beneficial in this regard.

3.6.9 Specialist Conclusion

Characterization of the general geology and subsoil conditions has been undertaken across the site. Confirmation of the geotechnical characteristics of the major subsoil materials has been obtained following field investigation at specific beneficiary site inspection with sampling of subsoils for laboratory testing.

The ease of development across the site is related to the landforms and underlying geology. The undulating topography typical of the area does not place any real restriction for development. Steeper slopes, valley heads and valley lines provide only moderate development potential as they require more extensive earthworks and more elaborate founding measures. Much of the study area will encounter shallow bedrock during earthworks in operations when constructing housing platforms.

The subsoil materials encountered necessitate that care is exercised in the use of the range of insitu materials to cater for potential movement associated with cyclical heave/shrinkage following moisture fluctuation and compressible and collapse potential in the colluvial and residual soils. Similarly, precautions are required during construction in material selection and placement within platforms to ensure optimum moisture levels and compaction densities.

Earthworks to construct cut to fill platforms are likely to be required across much of the area. Preference should be given to locating structures in the cut portion of the layout to reduce costs associated with foundation construction wherever possible.

Any potential cut embankment exceeding 2m in height should be reported to the Geotechnical Engineer conversant with site conditions in order that separate stability assessments can be made at these specific sites prior to earthworks proceeding. However, in order to obviate any potential for slope instability at the site a maximum design cut height of 2.0m is recommended. Fill heights not exceeding 1,5m are similarly indicated.

The option of either a stiffened reinforced concrete (RC) raft or RC strip footings/ground beam foundation to Engineer's design is recommended to cater for the range of subsoil conditions encountered across the site. To counteract the effects of active clays and differential conditions arising on cut to fill platforms, the strategic use of isolated concrete pads is recommended at this site.

Disposal of stormwater and wastewater by subsoil percolation methods would require specialized design. Adequate stormwater control of the erven should be planned.

3.7 SITES WITH ARCHEALOGICAL INTEREST

The KwaZulu-Natal Heritage Act requires that AmafaAkwazulu-Natali (Heritage KwaZulu Natal) is to comment on the need for an archaeological assessment for proposed development if:

- Development area is larger than 10 000m²
- Development is longer than 300m
- The development area contains known archaeological sites.

Documentation was submitted KZN Amafa and in their interim comment (**Appendix I1**), KZN Amafa indicated that due to the heritage value of the project area, a Heritage Impact Assessment is required for the proposed project.

A Heritage Impact Assessment was undertaken for the proposed development in March 2021 by Umlando: Archaeological Surveys and Heritage Management; and is attached as **Appendix I2**.

The findings from the Heritage Impact Assessment Report are summarised below:

- No known heritage sites occur within the study area.
- The Surveyor General maps indicate that Langkrans was surveyed in 1892 and 1906, and Bloemendal in 1892. Of interest is that two existing coalmines are shown on the 1906 map. The Enyati Colliery Ltd operated from 1918 to 1979 (van Zyl 1993). The implication of this is that there could be buildings dating to these mines in the study area.
- Palaeontological Sensitivity: The site is in an area of very high palaeontological sensitivity. However, the upgrade will occur in areas that have already been disturbed by other building activities. Any excavations beyond 2m in depth will require a PIA.

- Several of the buildings and other built features may be older than 60 years in age and are thus protected by the heritage legislation.
- Any other buildings or built features, such as terracing, walling, bridges, etc., will require a permit from KZNARI Built Environment section.

3.8 AGRICULTURAL COMPLIANCE STATEMENT

An Agricultural Compliance Statement was prepared by The Biodiversity Company in April 2021 and is attached as **Appendix O.**

3.9 MINERAL DEPOSITS

Historically, Enyathi was known for its coal mines however, there are currently no mining operations within the project area.

3.10 SOCIO ECONOMIC IMPACTS

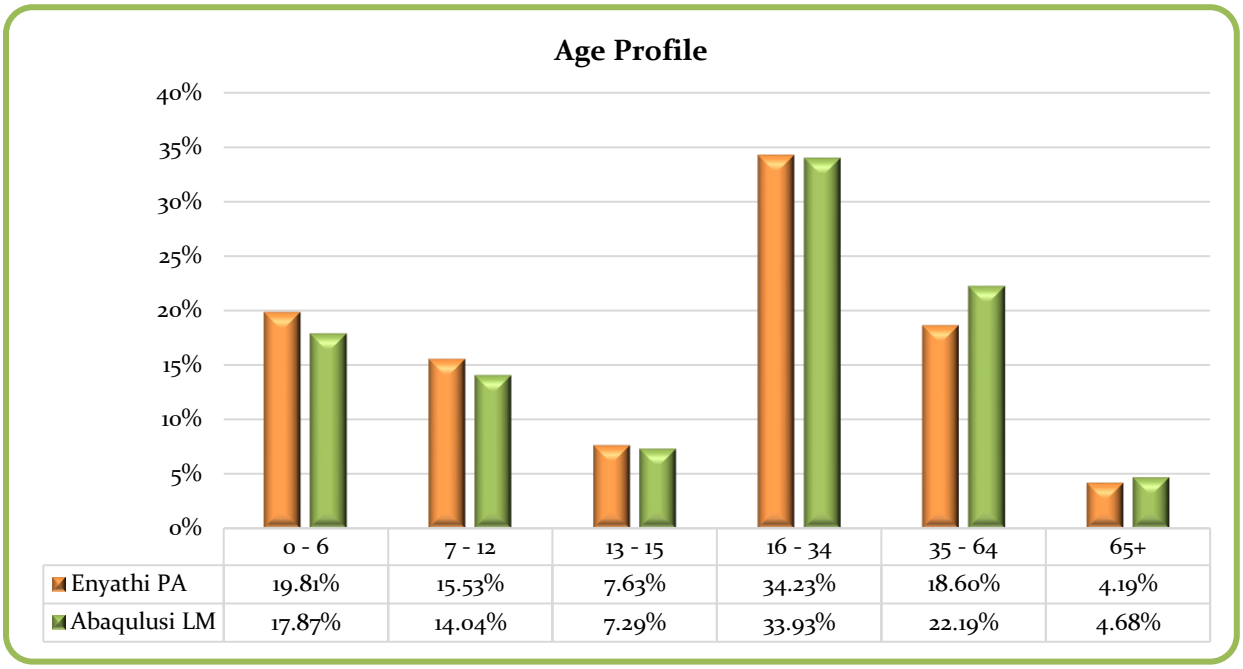
Given that this project is an Infill Development, the small area layers (SAL), within the project area were utilised to present a socio-economic overview of the area, as the project area will benefit from the similar services. Two SALs were selected with the area name KwaMnyathi SP. The Enyathi Housing project area falls within the jurisdiction of the Abaqulusi Local Municipality; therefore, the figures of the project area are presented together with the overall figures of the municipality to yield a comparative socio-economic overview for the study area. The total population of the surrounding area is approximately 1 075 persons and the population of the municipality is estimated at 211 059 persons.

3.10.1 Age Profile

According to Census 20211, the age profile displayed in Figure 3.2 below shows that majority (42.97%) of the population are 15 years and younger, whilst 34.23% are between the age of 16-34 years of age. When compared to the local municipality, there is a slight difference in the number of people who are aged

between 0 to 15 years (39.2%) and 16 to 35 years of age (33.93%). Furthermore, the locality municipality has a slightly higher percentage of the population (22.19%) who are aged between 35 to 64 years of age.

Figure 3.2: Age Profile



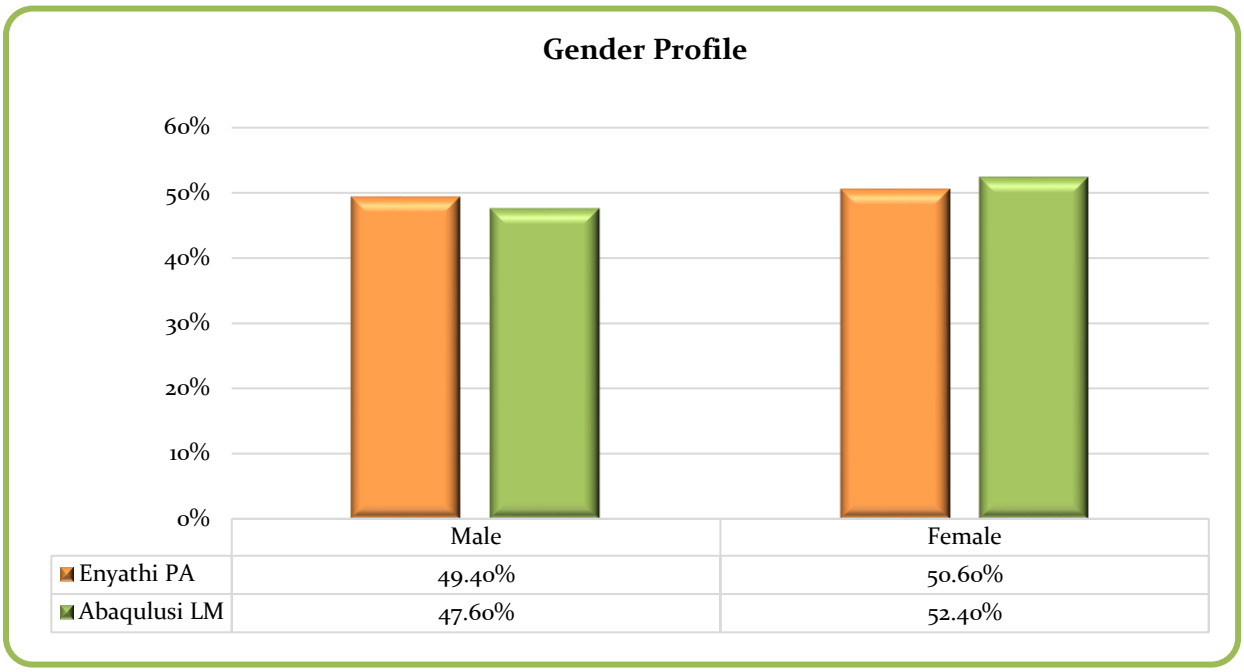
	0 - 6	7 - 12	13 - 15	16 - 34	35 - 64	65+
Enyathi PA	19.81%	15.53%	7.63%	34.23%	18.60%	4.19%
Abaqulusi LM	17.87%	14.04%	7.29%	33.93%	22.19%	4.68%

Source: Stats SA, 2011

3.10.2 Gender Profile

Figure 3.3 below provides a comparison between the study area and the local municipality in terms of gender. It can be seen that the study area has a higher percentage in the study area (50.60%) and local municipality (52.40%).

Figure 3.3: Gender Profile

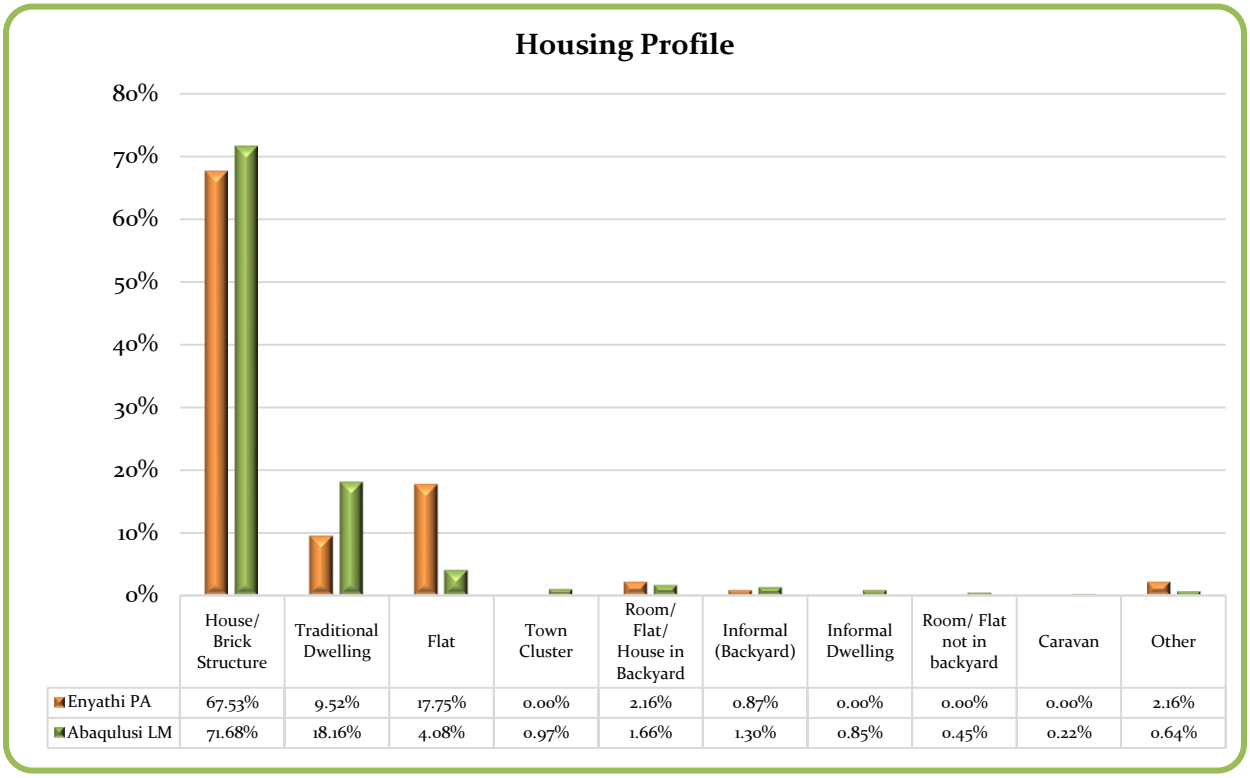


Source: Stats SA, 2011

3.10.3 Housing Profile

As indicated in the figure below, the most prominent housing type within the study area is "house/brick structures" with approximately 67.53% of houses falling into this category. The next prominent housing type within the study area is "flat", with as much as 17.75% of houses falling into this category. The housing profile for the Abaqulusi Local Municipality in comparison indicates that as much as 71.68% of houses fall within "house/brick structure" and 18.16% fall within the "traditional dwelling" housing types.

Figure 3.4: Housing Profile



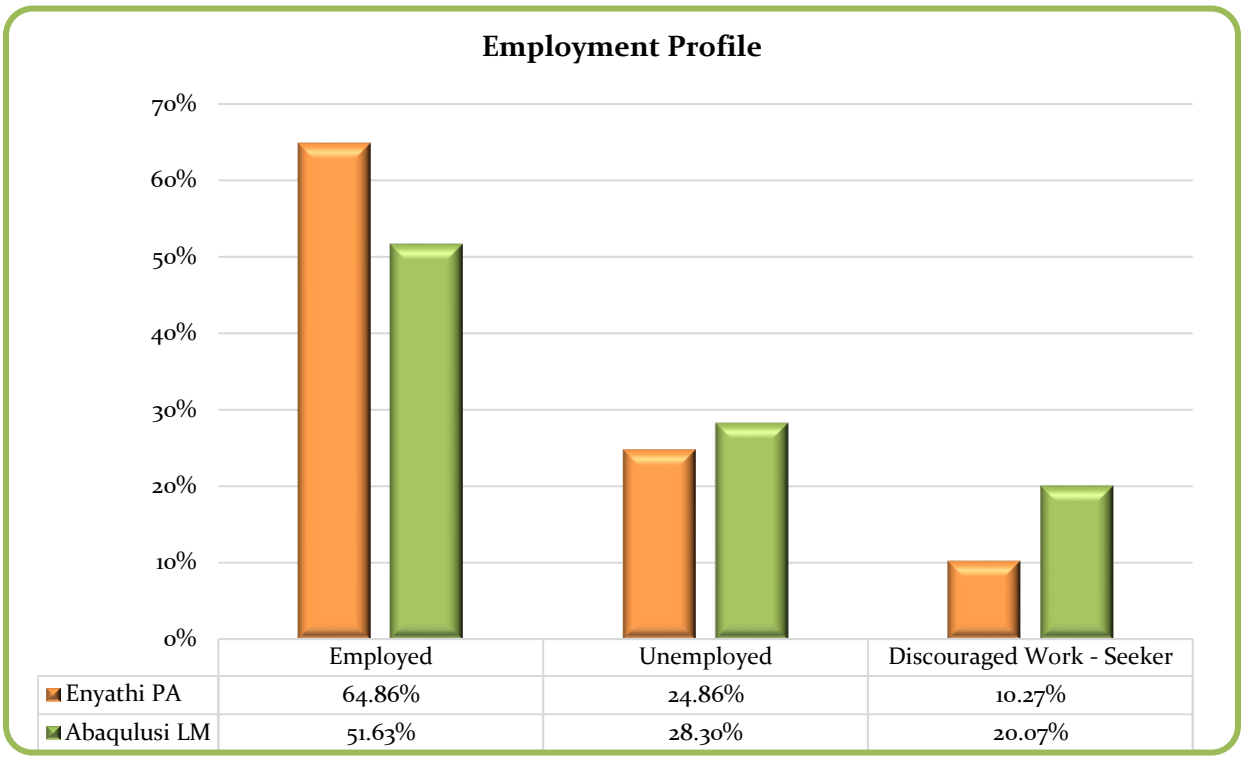
	House/ Brick Structure	Traditional Dwelling	Flat	Town Cluster	Room/ Flat/ House in Backyard	Informal (Backyard)	Informal Dwelling	Room/ Flat not in backyard	Caravan	Other
Enyathi PA	67.53%	9.52%	17.75%	0.00%	2.16%	0.87%	0.00%	0.00%	0.00%	2.16%
Abaqulusi LM	71.68%	18.16%	4.08%	0.97%	1.66%	1.30%	0.85%	0.45%	0.22%	0.64%

Source: Stats SA, 2011

3.10.4 Employment Profile

The Census data, 2011 presented in Figure 3.5 indicates that within the study area, majority (64.86%) of the population are employed whilst 24.86% are unemployed. The Abaqulusi Local Municipality in comparison indicates that there is a difference in the percentage of the population that is employed (51.63%) and a higher percentage that is unemployed (28.30%).

Figure 3.5: Employment Profile



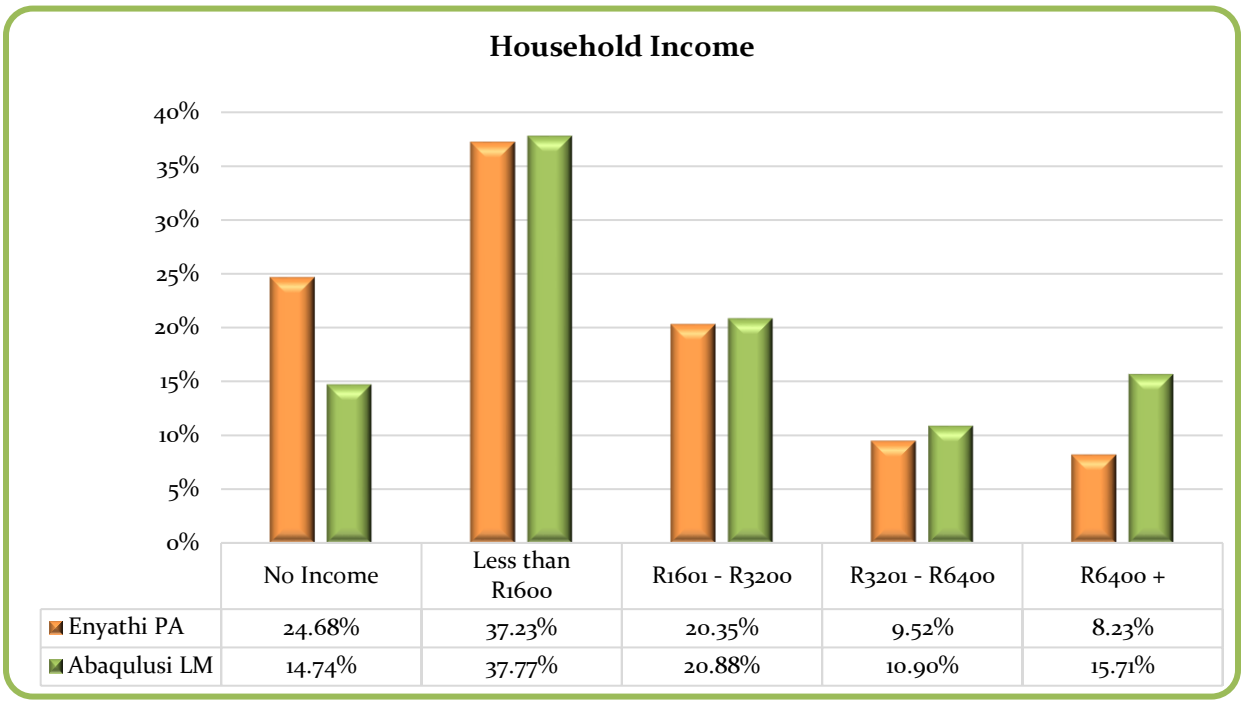
	Employed	Unemployed	Discouraged Work - Seeker
Enyathi PA	64.86%	24.86%	10.27%
Abaqulusi LM	51.63%	28.30%	20.07%

Source: Stats SA, 2011

3.10.5 Household Income

Figure 3.6 below provides an indication of the of the monthly household income for the study area and the local municipality. It can be seen that majority (37.23%) of households within the study area earn a monthly income of less than R 1600 whilst as much as 24.68% of households do not earn any monthly income. Approximately 20.35% of households earn a monthly income between R 1601 and R 3200 and 8.23% of households earn more than R 6400. The figures also indicated that within the local municipality, majority (37.77%) of households earn less than R 1600 and approximately 20.88% of households earn between R 1601 and R 3200. Approximately 14.74% of households within the local municipality do not earn any monthly income whilst 15.71% earn a monthly income of over R 6400.

Figure 3.6: Household Income



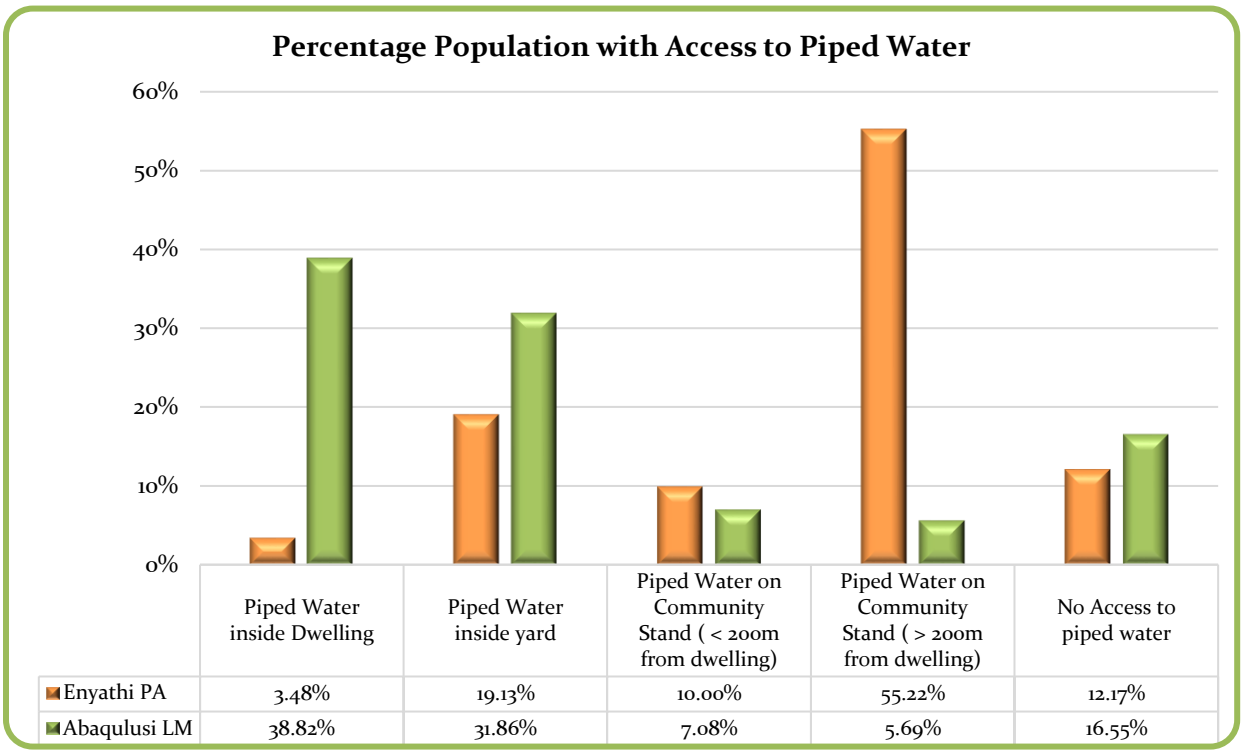
	No Income	Less than R1600	R1601 - R3200	R3201 - R6400	R6400 +
Enyathi PA	24.68%	37.23%	20.35%	9.52%	8.23%
Abaqulusi LM	14.74%	37.77%	20.88%	10.90%	15.71%

Source: Stats SA, 2011

3.10.6 Access to Piped Water

From Figure 3.7 below, the Census 2011 data indicates that majority of the households within the study area have access to piped water on a community stand that is located more than 200m away from their dwelling whilst as little as 3.48% of the households have access to piped water inside their dwelling. Approximately 12.17% of households within the study area have no access to piped water. In comparison, majority (38.82%) of households within the Abaqulusi Local Municipality have access to piped water inside the dwelling and 31.86% of households have access to piped water inside their yard. Approximately 16.55% of households within the local municipality do not have access to piped water.

Figure 3.7: Access to Piped Water



	Piped Water inside Dwelling	Piped Water inside yard	Piped Water on Community Stand (< 200m from dwelling)	Piped Water on Community Stand (> 200m from dwelling)	No Access to piped water
Enyathi PA	3.48%	19.13%	10.00%	55.22%	12.17%
Abaqulusi LM	38.82%	31.86%	7.08%	5.69%	16.55%

Source: Stats SA, 2011

3.10.7 Access to Sanitation

As indicated in Figure 3.8, majority (43.04%) of households within the study area have access to flush toilets that are connected to the sewer and 11.74% of households have access to flush toilets that are connected to a septic tank whilst as much as 40% of households do not have access to any form of sanitation infrastructure. Within the overall local municipality, 40.93% have access to flush toilets that are connected to the sewer and 23.60% of households make use of unimproved pit latrines.

Figure 3.8: Access to Sanitation

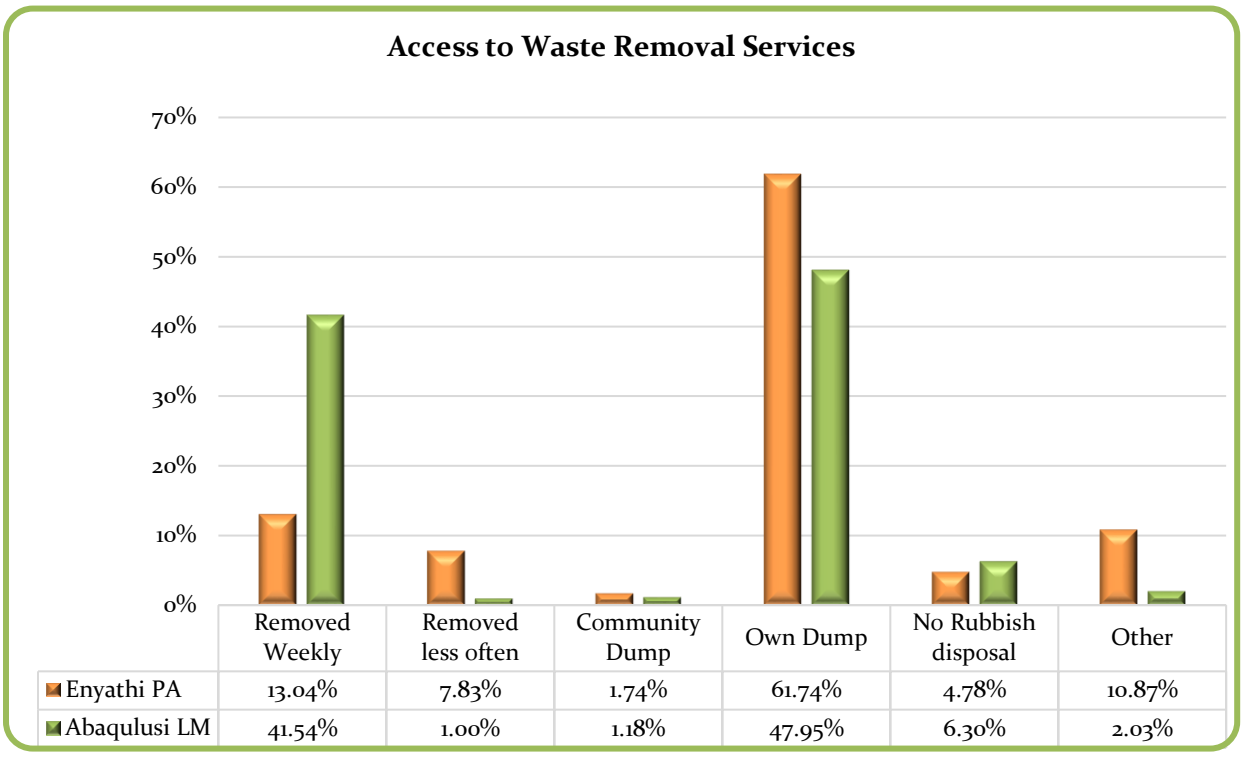
	Flush - sewer	Flush - septic	Chemical	Improved Pit Latrine	Unimproved Pit Latrine	Bucket	None	Other
Enyathi PA	43.04%	11.74%	0.00%	0.00%	3.48%	0.43%	40.00%	1.30%
Abaqulusi LM	40.93%	2.83%	5.18%	10.16%	23.60%	0.46%	12.73%	4.11%

Source: Stats SA, 2011

3.10.8 Waste Removal Services

Figure 3.9 below presents the waste removal services data for the study area as well as the Abaqulusi Local Municipality. Majority (61.74%) of households within the study area make use of their own dump and 13.04% have their waste removed weekly. The figures also indicate that within the Abaqulusi Local Municipality, as much as 47.95% of households make use of their own dump whilst 41.54% of household have their waste removed on a weekly basis.

Figure 3.9: Access to Waste Removal Services



	Removed Weekly	Removed less often	Community Dump	Own Dump	No Rubbish disposal	Other
Enyathi PA	13.04%	7.83%	1.74%	61.74%	4.78%	10.87%
Abaqulusi LM	41.54%	1.00%	1.18%	47.95%	6.30%	2.03%

Source: Stats SA, 2011

4 ENGINEERING SERVICES

A Preliminary Engineering Design Report was undertaken for the proposed development in April 2021 by Zamimpilo Consulting and is attached is **Appendix J1.**

4.1 BULK SERVICES

4.1.1 Bulk Sewage

4.1.1.1 Existing bulk sanitation infrastructure

The Zululand District Municipality, as the statutory water and sanitation services authority responsible for the treatment and disposal of wastewater.

The existing area in Enyathi currently uses sewer ponds to treat all sewage effluent. The proposed development can be connected to the exiting sewer system, provided that it is in good working condition. The capacity of the existing ponds is 2904kl/day.

4.1.1.2 Required bulk sanitation infrastructure

The status and sizes of the exiting outfall sewer will have to be assessed during construction in order to ensure that it is still functioning as expected.

The approximate required waste water flow requirement:

- Normal flow (ADDF): 333 kl/day
- Peak flow (2.0): 9.25 l/s
- Maximum flow with 15% infiltration: 10.64 l/s

The capacity of the treatment works will be adequate.

4.1.2 Bulk Water Supply

4.1.2.1 Existing bulk water supply

The Zululand District Municipality, as the statutory Water Services Authority responsible for the bulk water and sanitation services.

The area is serviced with water from the Enyathi Water Supply Scheme, which extracts water from the Enyathi dam and two springs. This is treated at the exiting water treatment works that has a capacity of 0.9Ml/day. The water is pumped to one 600kl and one 900kl storage reservoirs in the project area.

4.1.2.2 Required bulk water supply

The approximate required water demands are:

- Total Demand: 399.6 kl/day
- Peak Demand: 959.04 kl/day
- 48 hour Storage: 1.92 Ml

All indications are that the current bulk water infrastructure will be adequate to supply the proposed development, if operated at full capacity.

4.1.3 Access to the Development

The access to the site will be mostly via exiting access points along road P274 and other existing local access roads. All intersections with provincial and district road are to conform to the standards and specifications of the Department of Transport KZN and district municipality. All internal residential, commercial and industrial road to conform to the standards and specifications of the local authority and to the minimum design standards.

The access to the development will be via one intersection with Road P274 and other existing local access roads.

4.1.4 Bulk Electricity

Eskom is the bulk electrical supplier to the Abaqulusi Local Municipality. The municipality is the services authority that is responsible for the internal planning, supply and network distribution of electricity within the proposed development area. The project area has existing electrical infrastructure and the proposed development will be included in the current system.

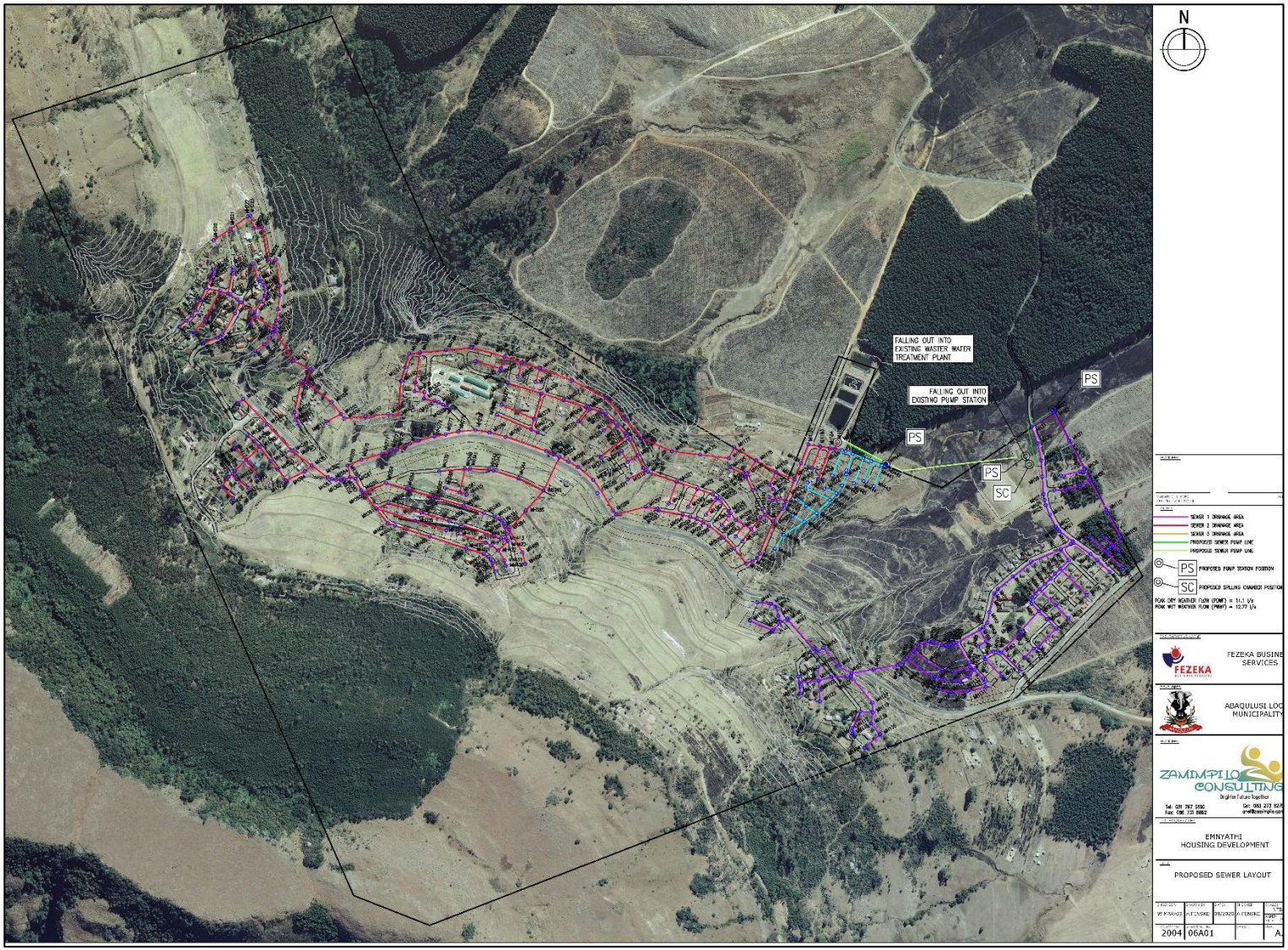
4.2 INTERNAL ENGINEERING SERVICES

4.2.1 Sanitation Scheme

The district municipality indicated that a waterborne sewerage system should be implemented. The sewage will be treated at the existing WWTW.

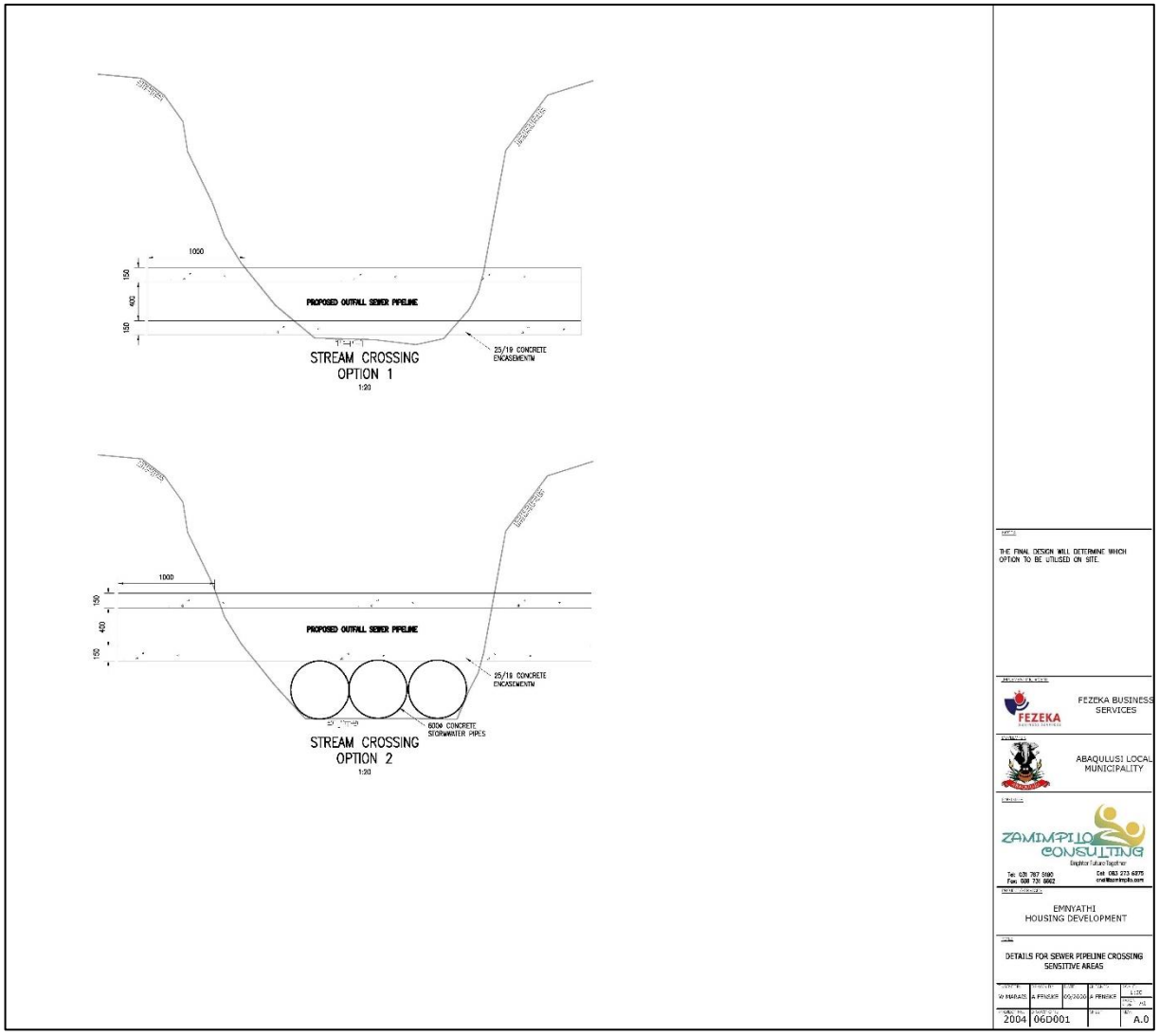
The internal sewerage reticulation shown on the layout drawing, included as **Appendix J2** and depicted below in Figure 4.1, was designed utilizing the design norms. The sewer reticulation will inevitably cross the watercourses throughout the development. The typical details for the crossing of these areas are included in Annexure 4.2 of the Preliminary Engineering Design Report and Figure 4.2 below.

Figure 4.1: Internal Sewer Reticulation Layout



Source: Preliminary Engineering Design Report, April 2021

Figure 4.2: Water crossing design



4.2.1.1 Design Standards

The design of the sewer network will inter alia be based on Municipality's design standards and the design standards and criteria as set out in the "Guidelines for the Human Settlement Planning and Design, compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology" (RED BOOK). Design norms and standards adopted for this project is given below:

Table 4.1: Sanitation Unit Flows

Description Of Consumer	Daily Flow
Residential Households	352 to 525 ℓ per unit
School [1]	15 ℓ per pupil
Crèche	15 ℓ per pupil
Municipal / Community Facility	400 ℓ per 100m² gross floor area
Church	2000 ℓ per stand
General industrial development (dry) per 100 m² floor area	300 ℓ
General business and commercial per 100 m² floor area	800 ℓ
Peak factor (residential flow)	2.00
Peak factor (commercial & industrial flow)	2.00
Allowance for extraneous infiltration	15% of capacity of pipe reserved.

Source: Preliminary Engineering Design Report, April 2021

Table 4.2: Sanitation Design Guidelines

Parameter	Element	Guidelines
Minimum pipe diameter	Gravity sewers	160 mm
Minimum velocity at full flow	Gravity sewers	0,7 m/s
Design capacity	All pipes	d/D = 0,7
Minimum slopes for pipes	Rodding eye to first manhole 160 mm 200 mm 300 mm and bigger	1 : 100 1 : 200 1 : 300 1 : 400
Pipe materials	110mm to 315mm Diameter Larger than 315mm	Solid Wall uPVC Class 34 to SANS 791 Solid Wall uPVC Class 34 to SANS 791
Location of sewers	In road reserves Midblock	(As per Typical Road Cross sections included in Part G2, Section G2.1) 1,0m from boundary
Distance between Manholes	All Sewers	80m (Max)
Minimum Cover over pipe	In road reserves On stands	1,4 m 1,0 m

Source: Preliminary Engineering Design Report, April 2021

4.2.1.2 System Demand

In order to calculate the peak flows expected within the sewer reticulation it is important to note that the land use type will govern the time of day where a peak in sewerage run-off takes place. As a result, peak flows for residential and non-residential stands will not occur at similar time periods in the day. When a peak flow is therefore calculated, only the sewerage run-off from residential stands is used:

Peak Dry Weather Flow (PDWF) = ADWF/(3,6x24) x PF

= 333/(3,6 x 24) x 2

= 9.25 ℓ/s

Peak Wet Weather Flow (PWWF) = PDWF x 1.15

= 9.25 x 1.15

= 10.64 ℓ/s

4.2.2 Water Supply Scheme

4.2.2.1 Design Standards and Specifications

The design of the potable water network will inter alia be based on district municipality's design standards, SANS 10090:2003 and the design standards and criteria as set out in the "Guidelines for the Human Settlement Planning and Design, compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology" (RED BOOK). Design norms and standards adopted for this project is given below:

Table 4.3: Water Supply Unit Demand

DESCRIPTION OF CONSUMER	DAILY DEMAND
Residential Households	440 for 750 ℓ per unit
School	25 ℓ / pupil / day
Crèche	25 ℓ / pupil / day
Municipal / Community Facility(dry) per 100 m² floor area	400 ℓ
Church (dry) per 100 m² floor area	400 ℓ
General business and commercial per 100 m² floor area	400 ℓ
FSR assumed for:	
Commercial / industrial stands	0,7
Municipal (Multi Purpose Centre)	0,5
Offices	0.5
Municipal (Bus & Taxi)	0,5
Government	0,7
Institutional (Churches)	0,4
Utilities and Services	0.5
Public Open Space and Cemetery	No water demand allowed

Source: Preliminary Engineering Design Report, April 2021

Table 4.4: Water Design Guidelines

Parameter	Element	Guidelines
Pressure	Maximum (Static)	90m
	Dynamic Pressure	Min 20m
Flow Velocity	Residential Areas	Max 2 m/s (Excluding Fire Flow)
Losses	Secondary	10%
Fire Flow	Business Area / Cluster Housing (SANS 10090:2003)	
	Flow at Hydrant	20l/s
	Total Flow	31.67l/s
	Pressure	Min 12m (At Abstraction point)
Fire Flow	Single Residential erven(SANS 10090:2003)	
	Flow at Hydrant	20l/s
	Total Flow	47l/s
	Pressure	Min 7m (At Abstraction point)
Fire Hydrants	Spacing	Business Area: 120m Residential Area: 180m
Piping	Size	Min 75mm Dia
	Material	uPVC Class Varies
Pipe Location	All Areas	(As per Typical Road Cross Sections included in Annexure 2)
Cover to Pipes	Sidewalks	Min 1m
	Road Crossings	Min 1m
	Across Erven	Min 0,75m Max 1m
	Other services Present	Min 0,8m Max 1,5m

Source: Preliminary Engineering Design Report, April 2021

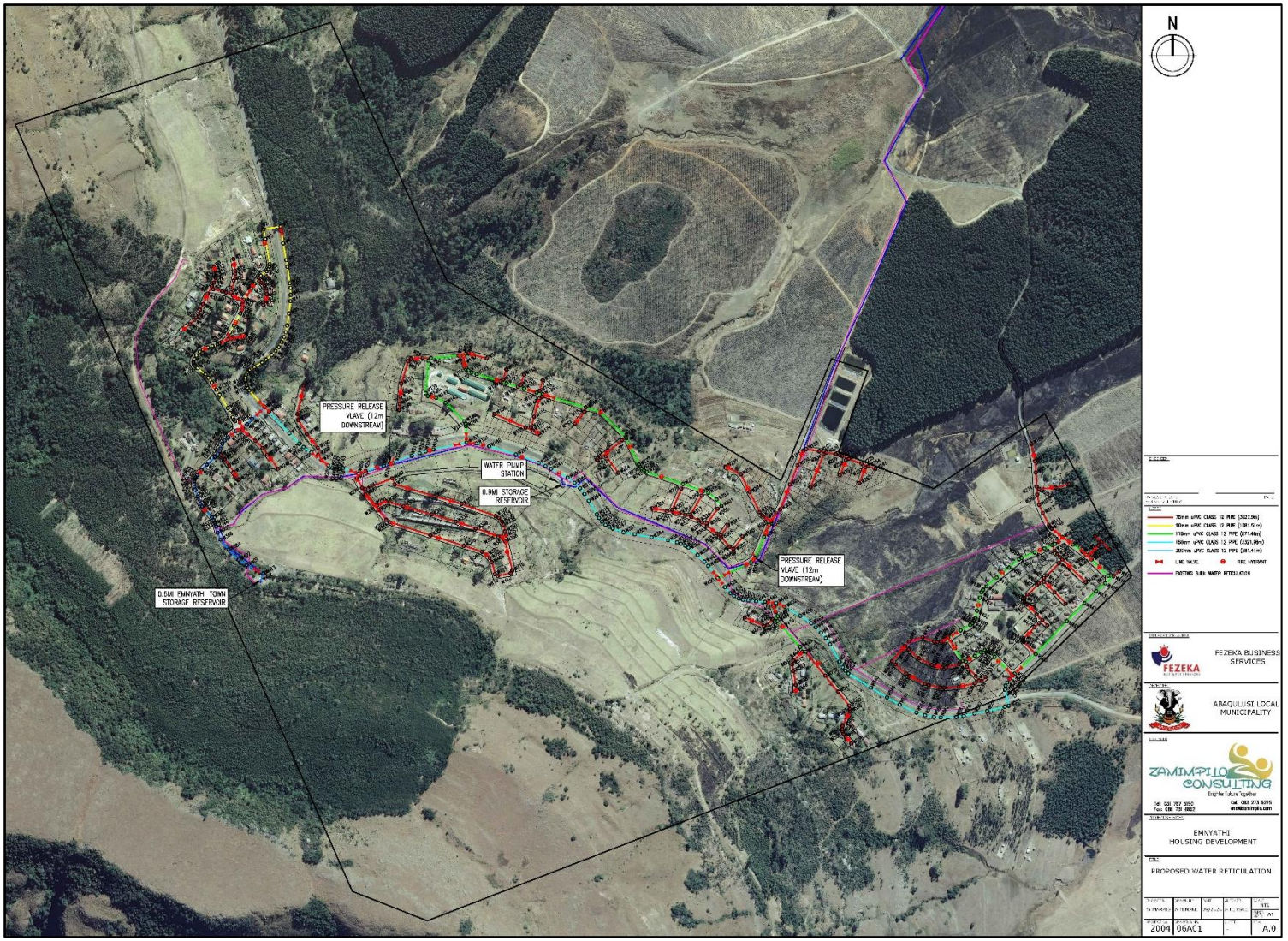
4.2.2.2 Water Demand

Instantaneous peak flow (Peak Factor =2.4) = 11.1 l/s (Whole Development).

4.2.2.3 Internal Water Reticulation

The water reticulation for this development will get water supply from the existing system. The water reticulation is designed to supply water for house connections. Typical details metered house connections, fire hydrants and valve chambers are included in Annexure 3 of the Preliminary Engineering Design Report. The internal water reticulation is depicted in Figure 4.3 below and is attached as **Appendix J3**.

Figure 4.3: Internal Water Reticulation Layout



Source: Preliminary Engineering Design Report, April 2021

4.2.2.4 Water Network Analysis

Utilizing the abovementioned design norms and standards, different operating scenarios for the water reticulation network was evaluated technically by simulating the reticulation network with hydraulic simulation software. The results of the simulations for the normal flow, peak flow and fire flow scenarios are included in Annexure 3 of the Preliminary Engineering Design Report.

4.2.3 Road Infrastructure

The National legislated (RDP) minimum norms and standards in respect of roads in South Africa are considered to be "access to all erven with graded or gravel roads", therefore the additional roads to be constructed will be gravel roads.

Generally, cut and fill embankments will fall within the road reserve. However, there might be some sections of the roads (residential access roads) where cut and fill slopes extends beyond the road reserve, the full extent of this can only be determined during the detail design stage. Refer to **Appendix J4** and Figure 4.4 for the proposed internal roads.

Figure 4.4: Proposed Internal Roads

Source: Preliminary Engineering Design Report, April 2021

Wetland crossings have been kept to an absolute minimum and existing crossings were utilised wherever possible. All wetland crossings will be designed strictly in accordance with the requirements of the stormwater management plan, the environmental impact assessment and the recommendations of the wetland study.

Table 4.5: Design parameters for Class 5 roads (residential access – 16m reserve)

Description	Parameter
Road reserve	16m
Road width	7m
Design speed	60 km/h
Minimum curve radius	120m
Maximum gradient	10%
Minimal vertical curve length	100m
Minimum super elevation	2.5%
Minimum K value for vertical curves	10
Stopping sight distance (SSD)	65m
Barrier sight distance (BSD)	140m
Decision sight distance (DSD)	160m

Source: Preliminary Engineering Design Report, April 2021

Table 4.6: Design parameters for Class 5 roads (residential access – 10.5m reserve)

Description	Parameter
Road reserve	10m
Road width	4.5m
Design speed	60 km/h
Minimum curve radius	120m
Maximum gradient	10%
Minimal vertical curve length	100m
Minimum super elevation	2.5%
Minimum K value for vertical curves	10
Stopping sight distance (SSD)	65m
Barrier sight distance (BSD)	140m
Decision sight distance (DSD)	160m

Source: Preliminary Engineering Design Report, April 2021

Table 4.7: Design parameters for Class 5 roads (residential access – 8m reserve)

Description	Parameter
Road reserve	8m
Road width	4m
Design speed	40 km/h
Minimum curve radius	50m
Maximum gradient	10% (12.5% if not longer than 70m)
Minimal vertical curve length	30m
Minimum super elevation	2.5%
Minimum K value for vertical curves	6
Stopping sight distance (SSD)	50m
Barrier sight distance (BSD)	110m
Decision sight distance (DSD)	130m

Source: Preliminary Engineering Design Report, April 2021

Table 4.8: Design parameters for Class 5 roads (residential access – 6m reserve)

Description	Parameter
Road reserve	6m
Road width	2m
Design speed	40 km/h
Minimum curve radius	50m
Maximum gradient	10% (12.5% if not longer than 70m)
Minimal vertical curve length	30m
Minimum super elevation	2.5%
Minimum K value for vertical curves	6
Stopping sight distance (SSD)	50m
Barrier sight distance (BSD)	110m
Decision sight distance (DSD)	130m

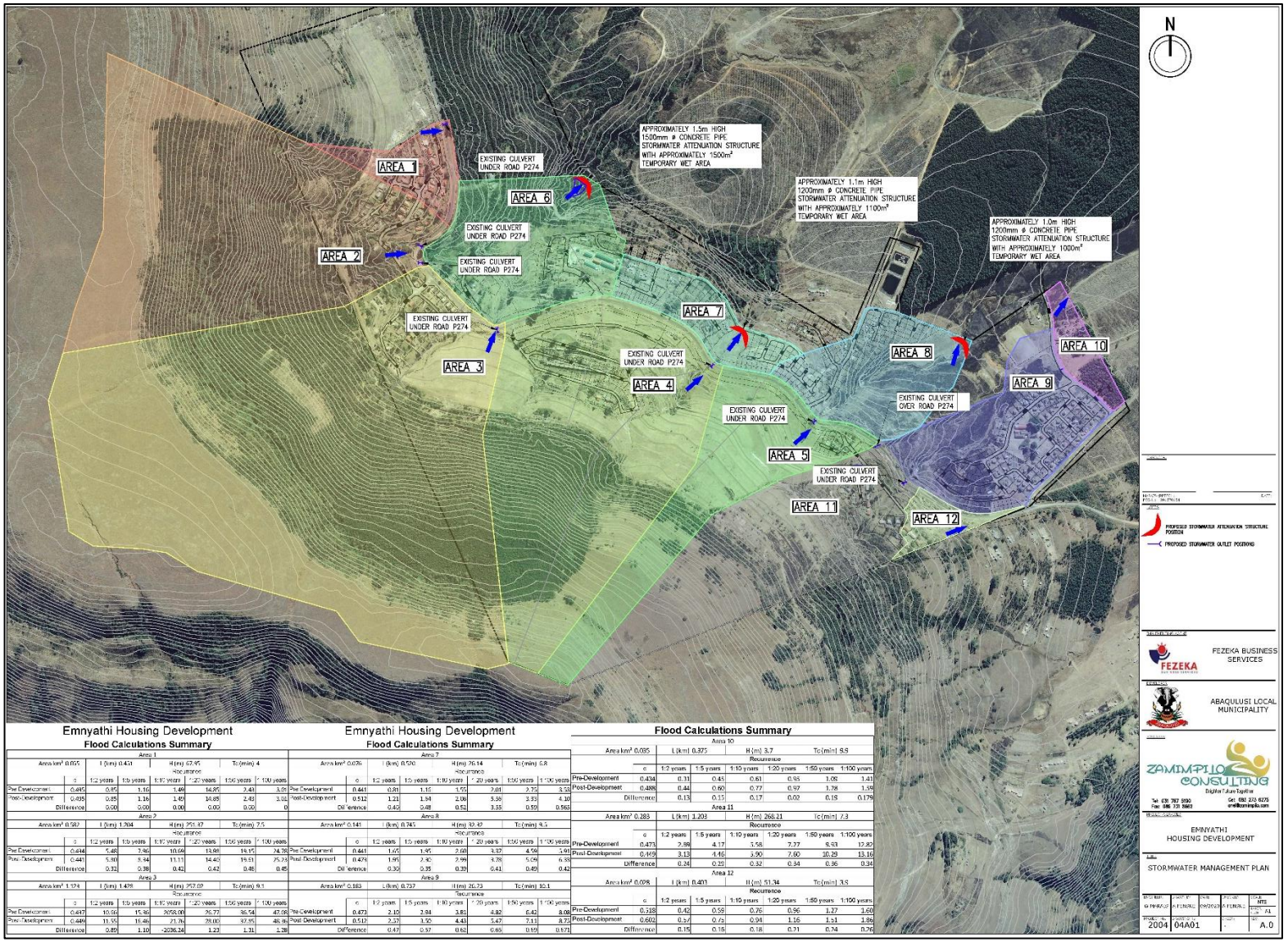
Source: Preliminary Engineering Design Report, April 2021

4.2.4 Stormwater Infrastructure

It is proposed that the design of stormwater drainage facilities be carried out in terms of the "Guidelines for Human Settlement Planning and Design" compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology. These guidelines are commonly known and referred to as the "Red Book" and the Road Drainage Manual. Due cognisance will be taken of the preferences of, as well as the norms and standards set by the Local Municipality and DoT in this regard.

The principles and parameters of the stormwater management plan, as well as the requirements of the environmental management plan must guide the design of the stormwater reticulation system, including the treating of outlet control structures and discharge into the natural drainage courses. The Stormwater Management Plan Report is included in **Appendix J5** and is depicted in Figure 4.5 below.

Figure 4.5: Stormwater Management Plan



Emnyathi Housing Development
Flood Calculations Summary

Area 1

Area km² 0.055	I (km) 0.451	H (m) 67.45	Tc (min) 4
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.495	0.85	1.16	1.49	1.95	2.49	3.09
Post-Development	0.495	0.85	1.16	1.49	1.95	2.49	3.09
Difference		0.00	0.00	0.00	0.00	0.00	0

Area 2

Area km² 0.582	I (km) 1.204	H (m) 251.47	Tc (min) 7.5
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.494	5.48	7.96	10.69	13.98	18.15	24.78
Post-Development	0.441	5.00	6.94	10.13	14.45	19.51	25.33
Difference		0.32	0.38	0.42	0.42	0.48	0.45

Area 3

Area km² 1.174	I (km) 1.478	H (m) 257.09	Tc (min) 9.1
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.447	10.99	15.96	2058.00	26.77	36.54	47.08
Post-Development	0.449	11.55	15.46	21.76	28.00	37.95	48.86
Difference		0.85	1.10	-2036.24	1.23	1.31	1.28

Emnyathi Housing Development
Flood Calculations Summary

Area 7

Area km² 0.076	I (km) 0.526	H (m) 76.14	Tc (min) 5.8
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.441	0.81	1.15	1.55	2.01	2.75	3.32
Post-Development	0.512	1.21	1.34	2.06	2.86	3.35	4.10
Difference		0.40	0.48	0.52	0.85	0.59	0.563

Area 8

Area km² 0.141	I (km) 0.745	H (m) 92.42	Tc (min) 8.5
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.441	1.65	1.95	2.60	3.37	4.58	5.93
Post-Development	0.479	1.95	2.30	2.99	3.78	5.06	6.55
Difference		0.30	0.35	0.39	0.41	0.49	0.62

Area 9

Area km² 0.163	I (km) 0.737	H (m) 26.73	Tc (min) 10.1
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.473	2.10	2.84	3.81	4.82	6.42	8.00
Post-Development	0.512	2.57	3.50	4.43	5.47	7.11	8.77
Difference		0.47	0.67	0.62	0.65	0.69	0.771

Flood Calculations Summary

Area 10

Area km² 0.035	I (km) 0.375	H (m) 3.7	Tc (min) 9.5
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.434	0.31	0.45	0.61	0.85	1.08	1.41
Post-Development	0.488	0.44	0.60	0.77	0.97	1.28	1.59
Difference		0.13	0.15	0.17	0.12	0.19	0.179

Area 11

Area km² 0.283	I (km) 1.203	H (m) 268.21	Tc (min) 7.3
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.473	2.98	4.17	5.58	7.27	9.93	12.90
Post-Development	0.469	3.13	4.46	5.90	7.60	10.29	13.16
Difference		0.24	0.29	0.32	0.34	0.36	0.34

Area 12

Area km² 0.098	I (km) 0.403	H (m) 51.34	Tc (min) 3.5
		Recurrence	

c	1:2 years	1:5 years	1:10 years	1:20 years	1:50 years	1:100 years
Pre-Development	0.318	0.42	0.58	0.76	0.96	1.27	1.60
Post-Development	0.602	0.57	0.73	0.94	1.16	1.51	1.86
Difference		0.15	0.15	0.18	0.21	0.24	0.26

Source: Preliminary Engineering Design Report, April 2021

4.2.4.1 Internal Services

Attenuation facilities will also be required in order to control the pre- and post-development run off into the watercourses.

Once the road geometry has been confirmed a full storm water analysis will be undertaken in order to determine the extents of the storm water management systems to be used. The use of street surface drainage will be accommodated as far as possible. Once the maximum allowable street surface drainage capacity is reached the stormwater will be diverted by means channels and/or below ground stormwater drainpipes which will be routed to the nearest lowest point / wetland area or stream / river.

The Stormwater Management Plan deals with major stormwater flows and flood attenuation. In general, stormwater within the development will be managed and controlled by means of surface drainage as far as possible within the road reserves and hard standing areas, which will, in turn, be fed into a piped stormwater reticulation system via kerb inlets and eventually discharged into natural watercourses via stormwater outlet structures complete with head and wing walls.

It is anticipated that run-off from all the roofs and paved areas such as driveways/parking areas will be fed into the piped stormwater system, which will discharge to the natural drainage lines. Erosion protection will be provided in the form of gabion and reno mattress structure where required.
The Design Criteria used to analyse the stormwater network are as follows:

Table 4.9: Stormwater Drainage Design Criteria

Design Method	Rational Method
Design Storm Frequency	General Piped Reticulation 1 in 5 years return period 15 min time of concentration Critical Areas 1 in 10 years return period 15 min time of concentration
Minimum Pipe Diameter	450mm
Minimum Pipe Gradient	0,5%
Pipe Material	Concrete spigot and socket with rubber rings
Manholes	Brick work
Headwalls	Combination of concrete, brick and gabions

Source: Preliminary Engineering Design Report, April 2021

4.2.4.2 Design Flood Frequencies

The proposed design flood frequency for the minor storm is 5 years on non-critical areas and 10 years in critical areas, whilst 50 years design flood recurrence interval is proposed for the major storm. Whereas, restrictive "no go" flood lines for residential developmental will be determined for the 1:100 year flood.

4.2.4.3 Runoff Calculation Method

The stormwater catchment areas are all relatively small and it is therefore proposed that the rational method be used to determine the peak discharge.

4.2.4.4 Precipitation

Rainfall data as recorded on the Design Rainfall Depths at selected stations in SA from the Langkrans weather station (WB number – 0373080 W) located at Latitude 27°49' Longitude 31°2' was used in the hydrological assessment. The weather station is located closest to the proposed development area.

The mean annual precipitation (MAP) recorded at this weather station is 769 mm.

4.2.4.5 Stormwater Drainage Facilities

Stormwater will be intercepted by the road network, transported on the road surface side drains and ultimately to kerb inlets and then be discharged through an underground pipe system into the drainage path located within public open space.

4.2.4.6 Erosion Protection at Stormwater Outlets

The energy dissipation of water discharged from stormwater outlet structures will be effected in order to prevent or minimise downstream erosion and scouring.

4.2.4.7 Attenuation

Attenuation of stormwater will be effected along the central natural drainage path at the road crossing. This will attenuate the post development flow increase for the whole area of the development to ensure that the

inflow into the downstream watercourses do not change. The stormwater attenuation measures will be planned in consultation with and approved by the Local Municipality.

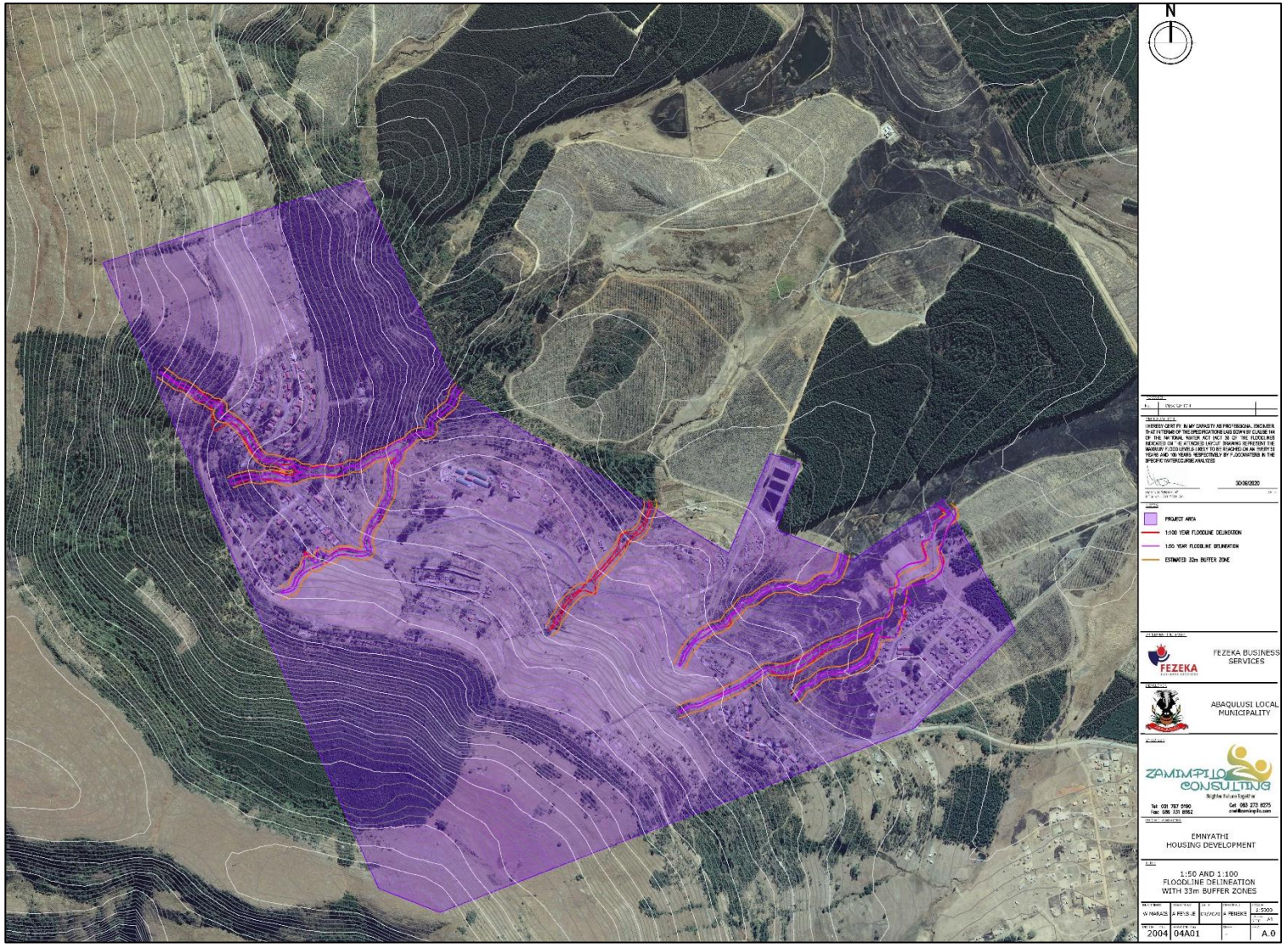
4.3 FLOODLINE ASSESSMENT

A Floodline Assessment for the Enyathi project area was undertaken by Zamimpilo Consulting in September 2020 and is attached as **Appendix K.** The findings from the Floodline Assessment Report are briefly discussed in the paragraph below.

For the analysis of the 1:50 and 1:100 year floodlines, cross-sections were generated from an electronic 1m and 2m interval contour DTM. All other relevant information was obtained by utilizing the appropriate topographical maps and ortho photos applicable, as well as hydrological data acquired from GISap. The floodline assessment was done with current available surface information, from the chief directorate national geo-spatial information office.

It is recommended that no development take place below the calculated flood lines/32m Buffers in terms of the National Water Act and other development legislation. Further, it is hereby confirmed that the 1:50 and 1:100 year floodlines as indicated on the floodline drawing, situated along water courses within the proposed development area, represent the maximum flood levels that is likely to be reached on an average every 100 years, by flood water within the said watercourses.

Figure 4.6: Calculated 1:50, 1:100 year Floodline and 32m Delineation



Source: Floodline Assessment Report, September 2020

5 IMPACT ASSESSMENT

5.1 INTRODUCTION

The impact assessment aims at identifying potential environmental impacts (both positive and negative impacts) and evaluating these impacts in terms of its significance. This assessment is provided in the form of a systematic analysis framework to evaluate the nature, extent, duration, intensity, probability and significance of the various impacts are considered both without and with mitigation and management measures.

5.2 IMPACT ASSESSMENT CRITERIA

The assessment of the potential impacts of the envisaged development is undertaken in accordance with the broad criteria required by the integrated environmental management procedure and includes the following:

5.2.1 Nature of impact

A brief description of the type of impact the proposed development will have on the affected environment.

5.2.2 Extent/Scale

The physical extent of the impact.

i. Footprint
   The impacted area extends only as far as the actual footprint of the activity.

ii. Site
   The impact will affect the entire or substantial portion of the site/property.

iii. Local
The impact could affect the area including neighbouring properties and transport routes.

iv. Regional
Impact could be widespread with regional implication.

v.National
Impact could have a widespread national level implication.

5.2.3 Duration

The duration of the impact.

i. Short term
The impact is quickly reversible within a period of one year, or limited to the construction phase.

ii. Medium term
The impact will have a medium term lifespan (project lifespan 1 – 10 years).

iii. Long term
The impact will have a long term lifespan (project lifespan > 10 years).

iv. Permanent
The impact will be permanent beyond the lifespan of the development.

5.2.4 Intensity

These criteria evaluate intensity of the impact and are rated as follows:

i. Minor
The activity will only have a minor impact on the affected environment in such a way that the natural processes or functions are not affected.

ii. Low
The activity will have a low impact on the affected environment

iii. Medium

The activity will have a medium impact on the affected environment, but function and process continue, albeit in a modified way.

iv. High

The activity will have a high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.

v. Very high

The activity will have a very high impact on the affected environment which may be disturbed to the extent where it temporarily or permanently ceases.

5.2.5 Probability

This describes the likelihood of the impacts actually occurring.

i. Improbable

The possibility of the impact occurring is highly improbable (less than 5% of impact occurring).

ii. Low

The possibility of the impact occurring is very low, due either to the circumstances, design or experience (between 5% to 20% of impact occurring).

iii. Medium

There is a possibility that the impact will occur to the extent that provision must be made therefore (between 20% to 80% of impact occurring).

iv. High

There is a high possibility that the impact will occur to the extent that provision must be made therefore (between 80% to 95% of impact occurring).

v. Definite

The impact will definitely take place regardless of any prevention plans, and there can only be relied on migratory actions or contingency plans to contain the effect (between 95% to 100% of impact occurring).

5.2.5.1 Determination of significance

Significance is determined through a synthesis of the various impact characteristics and represents the combined effect of the extent, duration, intensity and probability of the impacts.

i. No significance
The impact is not substantial and does not require any mitigatory action.

ii. Low
The impact is of little importance, but may require limited mitigation.

iii. Medium
The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

iv. High
The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation and management is essential.

The following assessment scale is used to determine the significance of the identified potential impacts on the environment.

Significance = (probability + duration + scale) x intensity

Probability: 1 – 5
Extent: 1 – 5
Duration: 1 – 4
Intensity: 1 – 10

Significance rating criteria

>75	High environmental significance
50 – 75	Medium environmental significance
<50	Low environmental significance

5.2.5.2 Abbreviations for tables listed below:

WOM: Without Mitigation
WM: With Mitigation
O: Operational
C: Construction

5.2.6 Assessment of Potential Impacts

5.2.6.1 Physical and landscape characteristics

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Impact of development on natural drainage patterns, caused by surface clearance and associated decrease of vegetation cover, leading to increased surface runoff and erosion.	C/O	Negative	Local	Short	Medium	Medium	Medium	1. Construction activities must be restricted to the construction site to minimize the impacts of the construction phase on the wetland area.	Low
2. Degradation, destruction and fragmentation of portions of sensitive habitats, if construction work or waste material is allowed to penetrate these habitats.	C	Negative	Local	Long	Medium	Medium	Medium	1. No construction activity should be undertaken within sensitive habitats such as wetlands. 2. Sensitive areas must be clearly demarcated and regarded as a 'no-go' area. 3. Areas to be developed should be demarcated so that during the construction phase, only the demarcated areas be impacted upon and preventing movement of workers into sensitive surrounding environments.	Low

5.2.6.2 Ecological characteristics

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Introduction and spread of alien invasive vegetation.	C/O	Negative	Local	Permanent	Medium	High	Medium	1. Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs). 2. Limit soil disturbance. 3. The use of herbicides is not recommended in or near wetlands (opt for mechanical removal). 4. Appropriately stockpile topsoil cleared from the transmission line footprint. 5. Minimize unnecessary clearing of vegetation beyond the infrastructure footprints. 6. Lightly till any disturbed soil around the tower footprint to avoid compaction. 7. Continue to remove all alien and invasive plant species as they arise during the operational	Low

								phase (i.e. weedy annuals and other alien forbs). 8. The use of herbicides is not recommended in or near wetlands (opt for mechanical removal).	
2. Nutrient enrichment of wetlands with organic wastes due to inappropriate sewer and greywater management.	O	Negative	Local	Medium	Medium	Medium	Medium	1. Ensure that all blockages in drains are promptly fixed. 2. Make sure that a comprehensive, integrated water plan for is compiled and implemented that takes into account stormwater, leaks and the disposal of sewage the whole development (existing and new infrastructure). 3. Ensure filling station forecourt drains ate fitted with oil separation sumps. 4. Ensure that all sewerage is contained not allowed to flow, whether by accidental spill / blockage or any 'other means into the nearby wetlands. 5. Do not discharge any liquids particularly grey or sewage water into the wetlands unless treated to acceptable standards and approved by the relevant authorities at DWS. 6. If a leak does occur it must be reported to DWS and the local municipality. Document and rectify promptly.	Low
3. Impact on surrounding vegetation during construction (e.g. collection of firewood, veld fires, etc.).	C	Negative	Local	Short	Medium	Low	Low	1. No harvesting of firewood from the site or from the areas adjacent to it. 2. Under no circumstances are the staff allowed to start a fire.	Low
4. Loss and degradation of wetlands.	C	Negative	Local	Long	High	High	High	1. Avoid development within the identified wetlands and their associated buffers. 2. Restrict all other disturbances and clearance to within the current footprint (disturbance) area. 3. Adhere to the prescribed 36 m buffer on the less disturbed wetlands and the 18 m buffer on the more disturbed wetlands. 4. Demarcate and signpost these wetland areas as an environmentally sensitive areas and keep all excavation, soil stockpiling, general access and construction activities out of this area. 5. Attempt to complete the majority of the earthmoving construction activities during winter when flow volumes are lowest. 6. Construction activities in wetlands can become messy following high rainfall events, damaging the wetland and increasing sediment loads	Low

								through vehicles getting stuck and general poaching of the soils.	
5. Disturbance to wetland biota and ecosystem integrity through sensory disturbance, persecution and improper waste management	O	Negative	Local	Long	Medium	Low	Low	1. Demarcate this area and promote good sentiment by educating contractors and the public through informative posters and signs of the importance of wetlands and the biota they support. 2. Increase the aesthetic and recreational value of the rehabilitated wetlands. This will help to maintain a clean healthy wetland environment. Do this by installing walkways (directs foot traffic away from sensitive areas), installing bins, creating hides and points of interest. 3. Prohibit loud noise braaiing, littering, hunting, harvesting and uncontrolled burning. 4. Conduct regular litter clean-ups. 5. Monitor water quality within the wetlands both upstream and downstream of the development.	Low
6. Disruption/alteration of species activities (breeding, migration, feeding) due to noise, vibration, and dust.	C	Negative	Local	Medium	High	High	Medium	1. Appropriate measures must be implemented to prevent excessive noise and vibration. No construction is to occur at night to avoid disturbance to amphibians. 2. Any areas that are excavated should have ramps to ensure that fauna have an opportunity to evacuate. The appropriate expert must be contacted if snakes need to be removed. 3. Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. 4. Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process. The intentional killing of any animals should be strictly prohibited, especially herpetofauna which tend be persecuted. 5. Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to vacate the area.	Low
7. Direct mortality of fauna.	C	Negative	Local	Medium	High	High	Medium	1. Appropriate measures must be implemented to prevent excessive noise and vibration. No construction is to occur at night to avoid disturbance to amphibians.	Low

								2. 2Any areas that are excavated should have ramps to ensure that fauna have an opportunity to evacuate. The appropriate expert must be contacted if snakes need to be removed. 3. Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. 4. Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process. The intentional killing of any animals should be strictly prohibited, especially herpetofauna which tend be persecuted. 5. Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to vacate the area.	
8. Degradation, destruction and fragmentation of very high sensitive grassland due to livestock overgrazing	O	Negative	Local	Permanent	Medium	Medium	Medium	1. All livestock must always be kept out of the project area, especially areas that have been recently re-planted.	Low

5.2.6.3 Soil characteristics and geology

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Increased bare surfaces, floodpeaks and potential for erosion.	O	Negative	Local	Long	Medium	Medium	Medium	1. Impacts to wetlands as a result of the development must be offset on site through rehabilitation. 2. Incorporate the principles of the Sustainable Urban Drainage Systems (SuDS) concept into the design philosophy / master plan of the development as well as the stormwater management plan. 3. Keep scraping / excavation in the footprint area to a minimum and keep soil heaps neat and tidy. 4. Place soil heaps and concrete heaps on eastern side of access road. 5. Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. Mixing of concrete should not take place within the identified wetlands. 6. Scrape the area where mixing and storage of sand and concrete occurred to clean and regrass once finished. 7. Do not situate any of the construction material laydown areas within any wetland.	Low

								8. No machinery should be allowed to parked overnight in the wetlands. 9. Attempt to complete most of earthmoving activities during winter.	
2. Soil pollution (cement powder, diesel, oil etc.) during construction.	C	Negative	Site	Short	Medium	Medium	Medium	1. Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. 2. All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site. 3. No dumping of construction material on-site may take place.	Low
3. Dust pollution due to exposure to loose soils.	C	Negative	Site	Short	Low	Medium	Medium	1. Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.	Low
4. Soil stockpiles that are left unattended during construction.	C	Negative	Site	Short	Medium	Medium	Medium	1. All removed soil and material must not be stockpiled within the watercourse and buffer. 2. Stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.	Low
5. Increased sediment loads to downstream reaches.	C	Negative	Site	Short	Medium	Medium	Medium	1. Re-instate topsoil and lightly till disturbance footprint, re-grass and irrigate. Impacts to wetlands as a result of the development must be offset on site through rehabilitation. 2. Incorporate the principles of the Sustainable Urban Drainage Systems (SuDS) concept into the design philosophy / master plan of the development as well as the stormwater management plan. 3. Keep scraping / excavation in the footprint area to a minimum and keep soil heaps neat and tidy. 4. Place soil heaps and concrete heaps on eastern side of access road. 5. Ensure soil stockpiles and concrete / building sand are sufficiently safeguarded against rain wash. Mixing of concrete should not take place within the identified wetlands. 6. Scrape the area where mixing and storage of sand and concrete occurred to clean and regrass once finished. 7. Do not situate any of the construction material laydown areas within any wetland. 8. No machinery should be allowed to parked overnight in the wetlands. 9. Attempt to complete most of earthmoving activities during winter.	Low

5.2.6.4 Ground and surface water

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Excavating and disturbing the bed and banks of a wetland.	C	Negative	Site	Short	Medium	Medium	Medium	1. At the two proposed crossing points restrict all construction activities to a 10 m corridor on either side of the route. 2. Demarcate the 10 m construction corridor as well as the 20 m buffer with high visibility plastic fencing.	Low
2. Contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as contamination and eutrophication of wetland systems with human sewerage and litter.	C	Negative	Local	Long	High	Medium	Medium	1. Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. 2. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the wetlands. 3. Mixing of concrete should not take place within the seep (wheelbarrow in). 4. Check for oil leaks, keep a tidy operation, and promptly clean up any spills or litter. 5. Provide appropriate sanitation facilities for workers during construction and service them regularly. 6. The contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected must be disposed of at a licensed disposal facility; 7. The contractor must be in possession of an emergency spill kit that must be complete and available at all times on site. 8. Any possible contamination of topsoil by hydrocarbons must be avoided. Any contaminated soil must be treated in-situ or be placed in containers and removed from the site for disposal in a licensed facility.	Low
3. Flow path modification.	C	Negative	Local	Long	High	Medium	Medium	1. Culvert systems must be incorporated into the proposed road crossing wetland areas.	Low

								2. If flow diversion is required, it is recommended that the smallest deviation be made and designed by an appropriately qualified engineer. In-channel construction must proceed quickly to avoid breaching and or failure of temporary flow diversion measures 3. Once completed, remove flow diversion structures including sandbags and re-instate the natural flow path.	
4. Alteration to flow patterns and velocities.	C	Negative	Local	Long	Medium	Medium	High	1. Install appropriate erosion protection measures at the interface between the crossing infrastructure and the riverbanks in the form of gabions or reno mattresses. 2. Install sandbags around soil stockpiles to prevent soils washing into the system. 3. It is recommended that the material surrounding and holding the culverts in place include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability to accommodate flooding and very low flows. 4. The culverts used along the roads should sufficiently large to span the wetlands, partially sunken and energy dissipating material must be placed at the discharge area of each culvert to prevent erosion of these areas. The use of larger culverts will prevent the build-up of debris by allowing the free movement of debris through the large culverts. 5. Culverts should avoid inundation (damming) of upstream areas by facilitating streamflow and catering properly for both low flows and high flows.	Low
5. Excess rubble and construction material in channel.	C	Negative	Local	Short	Medium	Medium	Medium	1. Once the crossing is finished completely remove all building rubble and waste from the channel, re-landscape, stabilize and see the banks.	Low
6. Increased water inputs	O	Negative	Local	Medium	Medium	Medium	Medium	1. Ensure that leaks are promptly fixed to avoid artificially increasing inputs to	Low

								2. Ensure that cut-off valves are installed on major inlets.	
7. Erosion of wetlands	O	Negative	Local	Long	Medium	Low	Medium	1. Surface run-off from the roads flowing down the embankments often scours the watercourse on the sides of the culvert causing sedimentation of the channel. This should be catered for with adequate concreted storm water drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner. 2. A suitable storm water plan must be compiled for the roads. This plan must attempt to displace and divert storm water from the road and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses.	Low

5.2.6.5 Archaeological, historical and cultural significance

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Impact on sites with valuable archaeological, history and cultural significance	C	Negative	Site	Short	Minor	Low	Medium	1. Should any archaeological artifacts be exposed during excavation, work on the area where the artifacts were found, shall cease immediately and the ECO and AMAFA should be notified as soon as possible.	Low

5.2.6.6 Socio-economic impacts

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Direct employment creation, including construction workers, architects, draughtsmen, land surveyors, plumbers, electricians etc.	C	Positive	Local	Short	Minor	High	Medium	No mitigation required	Medium (Positive)
2. Indirect job creation (e.g. building suppliers) and induced job creation (broader local economy).	C/O	Positive	Local	Short	Minor	High	Medium	No mitigation required	Medium (positive)

3.	Job creation during operation phase (domestic workers, maintenance, etc.).	O	Positive	Local	Long	Minor	Medium	Medium	No mitigation required	Medium (positive)

5.2.6.7 Safety and Security

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. The construction phase of the proposed development may result in an increased security risk to adjacent properties and the residents thereof.	C	Negative	Local	Short	Medium	Low	Medium	1. Staff should be informed that access to adjacent properties is strictly off-limits and that it will be deemed a serious offence (i.e. no fences should be jumped at any time and no gates are to be opened without permission from the relevant landowner).	Low
2. Construction activities on the proposed development may pose various risks to workers safety.	C	Negative	Local	Short	Medium	Medium	Medium	1. The site and crew are to be managed in strict accordance with the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations.	Low

5.2.6.8 Engineering Services

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Capacity of road network to handle additional traffic generated from the proposed development.	C/O	Negative	Local	Permanent	High	High	Low	1. It must be ensured that a backlog of traffic does not develop at access points during peak hours, through the implementation of an efficient and effective access control system.	Low
2. Possibility of increased number of road accidents due to increased traffic volumes. Accident risk may be highest at the point where the site is accessed from.	C/O	Negative	Local	Long	Medium	Medium	Low	1. Employ people to help alert oncoming traffic and regulate the traffic during construction hours so that residents and visitors know about the construction taking place. 2. The transportation of infrastructure should be limited, and equipment should be stored on site, thus mitigating the number of trips.	Low
3. The area will be covered with impermeable surfaces (paving, roofs, parking areas), leading to an increase in stormwater volume and intensification of stormwater peak flow.	C/O	Negative	Local	Permanent	Medium	Medium	Medium	1. A Stormwater Management Plan prepared and is attached as **Appendix J5.** The Plan will be included as part of the EMPr wherein conditions will be provided for the proposed development with regards to run-off and stormwater management.	Low
4. Increased soil erosion due to increased quantity and flood peak intensity of stormwater	C/O	Negative	Site	Long	Medium	Medium	Medium	1. A Stormwater Management Plan is prepared and is included as **Appendix J5**. The Plan will be included as part of the EMPr wherein conditions will be	Low

flow, most significantly at stormwater outlets.								provided for the proposed development with regards to run-off and stormwater management	

5.2.6.9 Potential Environmental Impacts

Nature	Phase	Type	Extent	Duration	Intensity	Probability	WOM	Mitigation	WM
1. Increase in air pollution (dust) during construction (e.g. construction vehicles, excavation, earthworks, burning of waste products etc.). 2. Some phases of construction may cause odours that are detective over some distance (e.g. burning of plastic containers and bags). 3. Impact on the ambient air quality due to vehicle tailpipe emissions from increased traffic volumes.	C/O	Negative	Local	Short	Medium	High	Medium	1. Air filters on all mechanized equipment must be properly designed and maintained. 2. Onsite burning of waste is not permitted. 3. A dust suppression programme should be implemented by means of periodic water sprinkling. 4. All industrial activities are subject to operating within the conditions of national legislation, including the National Environmental Management: Air Quality Act No. 39 of 2004.	Low
1. Increase in ambient noise level affecting surrounding properties during construction.	C/O	Negative	Local	Short	Low	High	Medium	1. Silencers on diesel-powered equipment must be properly designed and maintained. 2. Construction activities should be limited to normal office hours. 3. Adjacent landowners should be notified of extremely noisy activities at least 24 hours prior to such activities commencing. 4. Construction should take place between 07:00- 17:00. Mondays to Fridays.	Low
1. Visual impact of development on landscape ("sense of place").	C/O	Negative/ Positive	Local	Long	Medium	High	Medium	1. Ensure that the Architectural design is sympathetic to the surrounding areas. 2. All construction material must be stored in one place out of the direct eyesight of pedestrians. 3. The Architectural code must be adhered to during construction.	Low
1. Impact of lighting on surrounding properties, including light trespass and over-illumination. Apart from being a visual impact, over-illumination is also a waste of energy.	C/O	Negative	Local	Long	Medium	High	Medium	1. Avoid shiny metals in structures. If possible shiny metal structures should be darkened or screened to prevent glare. 2. Night-time light sources must be directed away from residential areas. 3. Incorporate measures for visual screening (e.g. using shade cloth) in the EMPr. 4. Avoid construction activities outside of normal working hours.	Low

5.3 ENVIRONMENTAL IMPACT STATEMENT AND SUMMARY ON NEED AND DESIRABILITY

5.3.1 Environmental Impact Statement

The major environmental impacts, which are likely to result from this development, may be assessed according to the potential impacts of the proposed development on the surrounding land uses. Such impacts therefore include visual, noise, and biophysical impacts. The proposed project may result in short term negative impacts to the wetlands and surrounding landowners; however, these negative impacts are only expected during the construction phase. Whilst these impacts can be rated as significant especially on the watercourses, they can be reduced to an acceptable level provided that the mitigation measures as proposed in this Draft BAR, Wetland Report and EMPr are effectively implemented.

Through the implementation of suitable mitigation measures associated with each of the possible impacts on surrounding land uses the effect thereof can to a large extent be mitigated to acceptable levels. Table 5.1 considers both the advantages and disadvantages of the proposed development.

Table 5.1: Advantages and Disadvantages of the proposed development

Advantages	Disadvantages
The proposed housing development will assist in reducing the housing backlog of the Municipality.	Possibility of increased runoff into the wetland if proper Storm Water Management is not in place.
The proposed development will assist in reducing the establishment of informal settlements within the Municipality through the provision of affordable housing opportunities.	
Basic services such as water and sanitation will be provided.	
Employment opportunities during the construction phase.	
Optimal development on the site will reduce security risks and prevent illegal dumping on vacant pocket on land within the project area.	

5.3.2 Need and Desirability

The need and desirability for the Enyathi Housing Development is evident in the Abaqulusi Local Municial IDP whereby Enyathi has been identified as an area for urban housing development. The implementation of the housing development will reduce the housing backlog within the municipality as the proposed land for development can include approximately 666 residential units. Apart from reducing the housing backlog, the proposed development will enable the provision of water networks and proper sanitation infrastructure. By providing water and sanitation services to the proposed housing development, it will indirectly assist in reducing surface water and groundwater pollution.

Table 5.2 below was adapted from the 2014 BAR Template of the Department of Environmental Affairs. This table was inserted to motivate for the need and desirability of the proposed development.

Table 5.2: Need and Desirability

1. Is the activity permitted in terms of the property's existing land use rights?		YES
The property contains existing dwelling structures together with supporting municipal, community and business facilities.		
2. Will the activity be in line with the following?		
(a) Provincial Spatial Development Framework (PSDF)	YES	
The proposed development addresses two spatial principles, namely the Principal of Sustainable Communities and the Principal of Spatial Concentration. The proposed development will provide subsidised housing units which will include municipal services such as water and sanitation.		
(b) Urban edge / Edge of Built environment for the area	YES	
As per the Municipal SDF, the Enyathi site was identified as an area in need of urban housing.		
(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	YES	
The proposed housing project is in line with the Municipal IDP, as it has been identified as one of the Housing Projects within the Municipal IDP. Furthermore, the Municipal SDF has identified Enyathi as an area in need of urban housing. The proposed development will therefore not compromise the integrity of the IDP and SDF but would rather enhance the objectives of the policies.		
(d) Approved Structure Plan of the Municipality	To be determined	

(e) An Environmental Management Framework (EMF) adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)		To be confirmed
(f) Any other Plans (e.g. Guide Plan)	YES	
Please refer to the specialist studies undertaken for the proposed development.		
3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)?	YES	
Please see above (2c).		
4. Does the community/area need the activity and the associated land use concerned (is it a societal priority)?	YES	
The implementation of the housing development will assist in reducing the establishment of informal settlements and reduce the housing backlog within the Municipality. The proposed development will also include the construction of water networks and proper sanitation infrastructure.		
5. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?		YES
Pipelines and infrastructure for water supply, effluent transportation and stormwater management will be installed as part of the proposed development.		
6. Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?	YES	
The municipality has provided for the infrastructure planning of the development as it has been identified in the Municipal IDP. The Department of Human Settlements together within the Abaqulusi Local Municipality will be responsible for the construction of the subsidised housing units.		
7. Is this project part of a national programme to address an issue of national concern or importance?	YES	
Throughout the country, there are many people without proper housing structures and access to basic services. The aim of this development is therefore to reduce the establishments of informal settlements and construct houses that's can be utilised by low income earners.		

8. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	YES	
There are existing residential structures and supporting building facilities within the site which will be subdivided as part of the is project. Furthermore, vacant pockets that do not contain sensitive environmental attributes will be infilled with proposed residential units. All environmentally sensitive areas are demarcated and included into the development layout.		
9. Will the benefits of the proposed land use/development outweigh the negative impacts of it?	YES	
The purpose of this development is to address the Municipality's housing backlog and need for more houses due to the expanding population and urbanisation.		
10. Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?	YES	
There are many other proposed housing developments within the Abaqulusi Local Municipality.		
11. Will any person's rights be negatively affected by the proposed activity/ies?		NO
This development will not infringe on any person's rights, as the proposed development will entail the construction of subsidised housing which can meet the needs of low income earners.		
12. What will the benefits be to society in general and to the local communities?		
• Provision of housing opportunities • Access to municipal services such as water and sanitation. • Job creation during the construction phase • Prevent illegal occupation of the land which will affect the existing community • Prevention of illegal dumping in vacant pockets of land • Prevention of informal settlements		

6 PUBLIC PARTICIPATION

6.1 REQUIREMENTS OF THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS OF 2014 (AS AMENDED)

Table 6.1 below outlines the requirements for the public participation process set out in Section 41 of the Environmental Impact Assessment Regulations as well as the actions that will be taken by the Environmental Assessment Practitioners (EAP).

Table 6.1: Public Participation Process

2014 EIA requirements (as amended)	Action taken by EAP
a. Fixing a notice board at a place conspicuous to the public at the boundary or on the fence or along the corridor of- i. the site where the activity to which the application relates is or is to be undertaken; and ii. any alternative site;	Notice boards in English will be placed along the site boundary to ensure that it is visible (See **Appendix L1** for site notice board).
b. Giving written notice, in any of the manners provided for in Section 47D of the Act, to – i. the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken; ii. owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken; iii. the municipal councillor of the ward in which the site or alternative site is situated and any organisation of	A Background Information Document will be distributed to the people living adjacent to the site. A copy of the BID is included in **Appendix L2.** The BID included some project background details of the Independent Environmental Assessment Practitioner as well as the process to be followed during the EIA. An invitation to become involved in the project and to register as a stakeholder was also included in the Background Information Document. A copy of the Draft BAR will be submitted to the following: • KwaZulu Natal Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) • Department of Agriculture and Rural Development • Department of Water and Sanitation • Department of Transport • Abaqulusi Local Municipality • Ward Councillor

ratepayers that represents the community in the area; iv. the municipality which has jurisdiction in the area; v. any organ of state having jurisdiction in respect of any aspect of the activity; and vi. any other party as required by the competent authority.	• Ezemvelo KZN Wildlife • KwaZulu Natal AMAFA
c. Placing an advertisement in – i. one local newspaper; or ii. ii. any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations; and	An isiZulu advert will be published in the Illanga on the 22 April 2021 (See **Appendix L3** for a copy of the Advert).

6.1.1 Comments received from the Departments and Stakeholders

The comments received from the Department and stakeholders regarding the Draft Basic Assessment Report will be included into the Final BAR, in the form of a Comments and Response Report.

6.1.2 Register of interested and affected parties

According to the Environmental Impact Assessment Regulations of 2014 (as amended), a register of interested and affected parties must be kept during the EIA process. A copy of the register of interested and affected parties will be included into the Final BAR.

7 SUMMARY RECOMMENDATIONS OF EAP

7.1 RECOMMENDATIONS

- The HIA survey noted that the colliery started in 1908 and some of the original buildings may still occur. Other buildings may be older than sixty years in age and are thus protected by heritage legislation. All buildings that will be affected by the proposed project will need to be assessed by a suitably qualified built environment specialist. It is suggested by the HIA Specialist that a general once-off assessment of the entire village is undertaken to assist planning of the various upgrades.
- A Water Use Licence may be required.
- All recommendations and mitigation measures provided in Specialist Reports that were undertaken for the proposed development must be adhered to.

7.2 OPINION OF EAP

It is the opinion of the Environmental Assessment Practitioner that the project can be supported on condition that the Mitigation and Management measures described in Section 5 and in the Draft Environmental Management Programme (EMPr) (**Appendix A**) be strictly adhered to as well as provided that sensitive planning, design and good environmental management be carried out by the proponent during construction.

A variety of mitigation measures have been identified in the Draft EMPr that will serve to mitigate the scale, intensity, duration or significance of the impacts which have a medium to high significance rating. These include guidelines to be applied during the construction phase of the development. The proposed mitigatory measures, if implemented, will reduce the significance of the majority of the identified impacts to "low", and allow for the proposed project to precede with minimal effect to the environment, local community and surrounding land use practices. The recommendations made within Specialist Reports conducted for the proposed project must also be adhered to so as to ensure that the proposed project imposes as minimal an impact as possible.

Any decision regarding the granting of authorization of this activity should also be subject to the implementation of all the management recommendations as contained in the Draft EMPr.

It is the opinion of the EAP that the information contained in the Draft Basic Assessment Report, and the Specialist studies which have been compiled to address specific areas of concern, provided sufficient information to undertake a sound assessment of the proposal and provide an informed recommendation with a sufficient degree of confidence.