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DRAFT BASIC ASSESSMENT REPORT

EIA REF: 14/12/16/3/3/1/2791

The proposed Construction of the Instream Earth-filled Dam for KZN Department of Agriculture and Rural Development, at ERF No. 1069, Kokstad Research Station, Ward 6 of Kokstad Local Municipality within Harry Gwala District, KZN Province.

08 August 2023

Prepared by:

Emvelo Quality and Environmental Consultant (PTY) Ltd.

Prepared for:

KZN Department of Agriculture and Rural Development

agriculture & rural development
Department:
Agriculture and Rural Development
PROVINCE OF KWAZULU-NATAL

Applicant:

Applicant	**KwaZulu Natal Department of Agriculture and Rural Development**
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Environmental Assessment Practitioner (EAP) Details:

Name of Consultancy	**Emvelo Quality and Environmental Consultant (PTY)Ltd**
Name of EAP's	**Phumzile Lembede (B.Sc. Honours in Environmental Management), Registered: EAP(EAPASA), Pr. Sci.Nat (SACNASP) & IAIAsa.** **Dumisani Myeni (B.Sc. Honours in Environmental Management), Registered: EAP (EAPASA) & Cand. Sci. Nat. (SACNASP).**
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PROJECT TEAM	CLIENT CONTACT PERSON
Phumzile Lembede Dumisani Myeni	Johan Vanrensburg

Overview: Assessment of impacts related to the Proposed Construction of KZN DARD earth filled dam at Kokstad Research Station, in order to ensure the Client's compliance with all relevant environmental legislations.

Project Team Details	
Principal EAP	***Phumzile Lembede*** (BSc. Honours in Environmental Management) Registered: Pr. Sci.Nat (Environmental Science) & EAPASA Field: Environmental Management & Water Resource 11 Years' Experience phumizle@emveloconsultants.co.za
Study Lead	***Dumisani Myeni*** (BSc. Honours in Environmental Management) Registered: Cand.Sci.Nat. Nat (Environmental Science) Field: Environmental Management, Water Resource & Waste Management. 10 Years' Experience dumisani@emveloconsultants.co.za

QMS - INFORMATION

PRINCIPAL EAP	STUDY LEAD
PHUMZILE LEMBEDE	DUMISANI MYENI
ENV. CONSULTANT	ENV.CONSULTANT

QMS-REVISION HISTORY

Revision	Revision Date	Details	Authorized	Name	Position
1	02- 08-2023	DRAFT BAR	Y	Dumisani Myeni	Study Lead Env. Scientist
2	07-08-2023	DRAFT BAR	Y	Phumzile Lembede	Principal EAP Env. Scientist

EXECUTIVE SUMMARY

Emvelo Quality and Environmental Consultant (PTY) Ltd has been appointed by the KwaZulu Natal Department of Agriculture and Rural Development (KZN DARD) (the Applicant), as the independent Environmental Assessment Practitioner (EAP), to facilitate the Basic Assessment Process required in terms of the National Environmental Management Act ,1998 (Act. No. 107 of 1998) (NEMA) for this application.

The KZN DARD owns and operates the Kokstad Research Station (KRS) which is the one of the department's six research stations serving the major agricultural ecological areas within the province, thereby conducting research on-station, as well as to build expertise and for technology transfer. The KRS operates three research components, namely crop production, animal science and grassland science, with farm services as the support component. The farming activities in this area are concentrated mainly on dairy production and extensive to semi-intensive cattle and sheep production, and crops production.

Currently, the water for KRS farm is abstracted from the nearby spring and stored in the reservoir within the farm. This water from spring is currently not sufficient for agricultural u se and consumption, as sometimes the spring dries out during the dry periods, as a result the farm experience sufficient water yield only during wet seasons (summer months). Therefore, in response to the growing urgency to secure adequate and sustainable water supply for the KRS Farm, the KZN DARD proposes the construction of an instream earth filled dam. The proposed in stream earth filled dam will increase the capacity of water supply to KRS farm throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes. Consequently, an environmental impact assessment (EIA) has commenced, assisting the KZN DARD (applicant) in identifying all potential adverse environmental consequences of the project, their extent, significance and to ensure that the environmental management requirements are adequately implemented.

The proposed earth filled dam, is mainly a small stock watering dam which entails the following features: In-channel dam to un-named stream; Area occupied by a dam is 1.6ha; Dam capacity is 20 194m^3; Levelled spillway with 36 width and Freeboard of 1,4 m; Distance overland flow is 80m; Core trench width of 14.1m; Core Trench Volume of 808. 69m^3; Base Water Side of 27.18m; Base Dry Side of 18.62m; Earth banks height of 8.56m; Bank Volume of 13 752.43m^3; Total pitching of 4 746,04m^2 (Pitching of crest, Upstream Stone Pitching, Downstream Stone Pitching).

The project entails construction of 30m(275mmø) class 12 UPVC abstraction pipeline (dam outlet pipeline), and a 220m (63mm Ø) class 6 HDPE which will join the existing pipeline which will join the existing pipeline at ((30°30'41.82"S, 29°25'15.14"E) coming from raw water reservoir to Kokstad Research Station WTW.

The portion to be developed is within KZN DARD Kokstad research station, zoned as agricultural land. The area is made up of open grassland biome, overlain by East Griqualand Grassland, with un-named stream from spring headwater traversing the proposed earth filled dam, making it instream dam, and draining to Kokstad flats.

The construction will take place within a watercourse (un-named stream), resulting in excavation and clearance of area of approximately 1.6ha for development of instream storage dam (the earth filled dam), this will also result in clearance and excavation of approximately 8m (200m length) construction corridor for installation of 200m (200Ø) raw water abstraction pipeline from the earth filled dam, connecting to existing pipeline supply water to the farm. The area classified as CBA1 & CBA2 overlain by East Griqualand Grassland. There are no SAIIAE wetlands and NFEPA wetlands identified by the environmental GIS desktop studies. The study area is located within the foothills and has a relatively gentle sloping terrain with elevation from headwater to flats ranging from 1440mASL to 1360mASL.

The NEMA Environmental Impact Assessment (EIA) Regulations (2014) as amended on 7 April 2017, govern the process of applying for environmental authorization for certain developments. A provision in the EIA Regulations is made for two forms of assessment, namely: Basic Assessment and Scoping & EIA, depending on the scope of the activity. The EIA regulations specify that: Activities identified in Listing Notice 1 and 3 (GNR 327 and 324 of 2017) require a Basic Assessment, while the activities identified in Listing Notice 2 (GNR 325 of 2017) are subject to a Scoping and EIA. The listed activities associated with the proposed development are: Listing Notice 1, Activity 19 and 27; Listing notice 3, Activity 12 and 14. Therefore, this application will follow a Basic ***Assessment process***, as activity in Listing Notice 1 and 3 have been triggered.

The Public Participation Process (PPP) has, to date, included: displaying onsite notices, placing of an advertisement in the *Kokstad Advertiser Newspaper*, distribution of Background Information Documents (BIDs), and Circulation of this Draft BAR.

The preferred alternatives are '*Alternative A: Site Layout Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Location Alternative*'. These preferred alternatives cannot be undertaken in isolation, as their assessment is integrated.

The '*Alternative A: Site Layout Alternatives*', and '*Alternative D: Site Location*' favour the best dam design practices as the proposed dam location is situated within the low-lying area determined through topography of the project site with overland flow average slope of 30% as incorporated into engineering design supporting efficiency of run-off yield from the headwater, and efficient of area occupying 1.6ha suitable to cater for the earth bank with total surface area of 4 746,04m^2 stone pitching for the dam capacity of 20 195m^3. The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

The '*Alternative B: Design Alternative*' has distinctly caters for dam type and design characteristic for 20 years design return period over a 7.8km^2 catchment area, and a total annual run-off of flood water 259 397m^3/a. This design looks at dam characteristics for dam capacity of 20 194m^3, with reference to run-off intensity, overflow land, earth bank, core trench, spillway (***Section 5.2***). The design is linked to the '*Alternative C: Technology Alternative*', as the excavatibility and rippability determine the use of machinery, due to intensive earthwork factor of the earth-filled dam. Therefore, '*Alternative C: Technology Alternative*' provides that for the purpose excavation for instream earth filled dam, the earthworks would be likely achieved, as the proposed dam site comprise of material that can be effectively removed or loaded without prior ripping and will be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width, or by means of bulldozer, tractor scrapper, track type front-end loader back acting excavator.

Three (3) discrete habitat types were delineated within the assessment area, namely, riparian and instream habitat, and grassland habitat. The grassland provides the grazing filed, hence can be considered agricultural. The riparian habitat is dominated by shrubs such as *Leucosidea sericea* and sedges such as *Cyperus obtusiflorus var. flavissimus*. The summary of impacts significant during construction and operation/maintenance phase are outlined by (***Table 1***) below.

Table 1: Summarised Impacts Significance

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Habitat fragmentation: Loss of species habitat	High	Negligible	Medium-High	Negligible
Biodiversity (flora): Loss of plant species of conservation concern (SCC)	Medium-High	Negligible	Negligible	Negligible

Biodiversity (fauna) Loss of animal species of conservation concern (SCC)	Medium-High	Negligible	Negligible	Negligible
Invasive Alien Plant Species	High	Negligible	High	Negligible
Impact on terrestrial surface water resource (rivers, wetlands)	High	Negligible	Medium-High	Negligible
Pollution of Surface Water Resources	Medium-High	Negligible	Medium-High	Negligible
Changes in Natural Flow (Flow regime alteration)	High	Negligible	High	Negligible
Impact on ground water resource (Oil spillages & Ground water contamination)	High	Negligible	Negligible	Negligible
Erosion, slits and compaction/crusting	High	Negligible	Medium-High	Negligible
Impact on Air Pollution: Dust from construction areas and emissions from vehicles and equipment.	Medium	Negligible	Negligible	Negligible
Waste (General, Hazardous Waste and HCW)	Medium-High	Negligible	Negligible	Negligible
Loss of Heritage Resources, fossils and Paleontological resources	Low	Negligible	Negligible	Negligible
Visual Impact	Very Low	Negligible	Negligible	Negligible
Socio-economic Impact	Negligible	Negligible	Negligible	Negligible
Impact on Traffic	Low	Negligible	Negligible	Negligible
Noise Pollution	Medium	Negligible	Negligible	Negligible
Impacts on existing services (properties or utility infrastructure)	Negligible	Negligible	Negligible	Negligible

The findings of this EIA Report as well as the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Six (6) specialist studies were considered for this EIA: Aquatic Biodiversity Impact Assessment (*Appendix G1*); Terrestrial Biodiversity Impact Assessment (*Appendix G2*); Basic Hydrological Assessment Compliance Statement (*Appendix G3*); Archaeological and Cultural Heritage Impact Assessment (*Appendix G4*); Paleontological Impact Assessment (*Appendix G5*); and Soil Resources Assessment (*Appendix G6*), Overall, anticipated adverse impacts linked with the planned activities during construction and operation are expected to be of medium-high impact significance, and with mitigation are rated as negligible or very low.

The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

The proposed development of instream earth-filled dam is in response to KZN DARD need for development of an instream storage dam, has been adopted with focus on a cost effective and environmentally compatible process, to increase the capacity of water supply to Kokstad Research Station throughout the year, thus improve capability of research station to conduct its activities for

future planned research programmes. The EAP is of the view that the Environmental Authorization should be granted on certain conditions that are outlined in this document. After an Authorization has been granted, it is the applicants' responsibility to ensure that all recommendations outlined in this report as well as in the EMPr are properly implemented.

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LIST OF ACRONYMS

BAR	Basic Assessment Report
CFP	Chance Finds Procedure
DFFE	Department of Forestry, Fisheries and Environment
DOT	Department of Transport
DWS	Department of Water and Sanitation
EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EMPr.	Environmental Management Programme
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
HGM	Hydrogeomorphic
MSDS	Material Safety Data Sheet
NEMA	National Environmental Management Act 107 (Act 107 of 1998)
NEMPAA	National Environmental Management: Protected Areas, 2003 (Act 57 of 2003)
I&AP	Interested and Affected Parties
EAP	Environmental Assessment Practitioner
GA	General Authorisation
SCADA	Supervisory Control and Data Acquisition
SCC	Species of Conservation Concern

GLOSSARY OF ITEMS

DEVELOPMENT: the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

BIODIVERSITY: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

BASIC ASSESSMENT: The process of collecting, organizing, analyzing, interpreting and communicating information that is relevant to the consideration of the application, in terms of Listing Notice 1 (GNR 327 and 324 of 2017) of NEMA (as amended).

DEVELOPMENT FOOTPRINT: any evidence of physical alteration because of the undertaking of an activity.

CONTRACTOR: companies and or individual persons appointed on behalf of the client to undertake activities, as well as their sub-contractors and suppliers.

ENVIRONMENTAL CONTROL OFFICER (ECO): an individual nominated through the client to be present on-site to act on behalf of the client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities as prescribed in NEMA.

ENVIRONMENT: in terms of the NEMA (as amended), the "environment" means the surroundings within which humans exist and that are made up of: the land, water, and atmosphere of the earth; micro-organisms, plant and animal life; any part or combination of (i) of (ii) and the interrelationships among and between them; the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

ENVIRONMENTAL IMPACT: the change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

HYDROLOGICAL SYSTEM: water bodies and their connectivity to the welfare of an ecosystem.

MITIGATION: the measures designed to avoid reduce or remedy adverse impacts.

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr): a detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive environmental impacts and limiting or preventing negative environmental impacts are implemented during the lifecycle of the project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.

POLLUTION: NEMA defines pollution to mean any change in the environment caused by the substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people or will have such an effect in the future.

WATER POLLUTION: the National Water Act, 1998 (Act 36 of 1998) defines water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (a) to the welfare, health or safety of human beings; (b) to any aquatic or non-aquatic organisms; (c) to the resource quality, or (d) to property.

REHABILITATION: rehabilitation is defined as the return of a disturbed area to a state which approximates the state (wherever possible) which it was before the disruption.

WATERCOURSE: can be a) a river or spring; b) a natural channel or depression in which water flows regularly or intermittently; c) a wetland, lake or dam into which, or from which, water flows; and/or d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.

WETLAND: the land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and

which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

INDIGENOUS VEGETATION: refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

GENERAL WASTE: waste that does not pose an immediate hazard or threat to health or the environment and includes domestic waste; building and demolition waste; bbusiness waste; and inert waste.

HAZARDOUS WASTE: hazardous waste means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical, or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

ARCHAEOLOGICAL RESOURCES: includes (a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artifacts, human and hominid remains and artificial features and structures; (b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation; wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, 1994 (Act 15 of 1994), and any cargo, debris or artifacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; features, structures and artifacts associated with military history which are older than 75 years and the site on which they are found.

INTERESTED AND AFFECTED PARTY (I&AP): for the purposes of Chapter 5 of the NEMA and in relation to the assessment of the environmental impact of a listed activity or related activity, an interested and affected party contemplated in Section 24(4) (a) (v), and which includes (a) any person, group of persons or organization interested in or affected by such operation or activity; and (b) any organ of state that may have jurisdiction over any aspect of the operation or activity.

ASSUMPTIONS AND LIMITATIONS

Certain assumptions, limitations, and uncertainties are associated with this report. This report is based on information that is currently available and, as a result, the following assumptions and limitations should be noted:

- This report is based on project information provided by the client;
- The description of the baseline environment has been obtained from environmental desktop study and specialist studies;
- The results are based on the outcomes of a single assessment. The risk assessment only included the proposed development and the anticipated activities, no ancillary activities were considered; and
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

1 INTRODUCTION AND BACKGROUND

Emvelo Quality and Environmental Consultant (PTY) Ltd has been appointed by the KwaZulu Natal Department of Agriculture and Rural Development (KZN DARD) (the Applicant), as the independent Environmental Assessment Practitioner (EAP), to facilitate the Basic Assessment Process required in terms of the National Environmental Management Act ,1998 (Act. No. 107 of 1998) (NEMA) for this application.

The KZN DARD owns and operates the Kokstad Research Station (KRS) which is the one of the department's six research stations serving the major agricultural ecological areas within the province, thereby conducting research on-station, as well as to build expertise and for technology transfer. The KRS operates three research components, namely crop production, animal science and grassland science, with farm services as the support component. The farming activities in this area are concentrated mainly on dairy production and extensive to semi-intensive cattle and sheep production, and crops production.

Currently, the water for KRS farm is abstracted from the nearby spring and stored in the reservoir within the farm. The water from spring is currently not sufficient for agricultural use and consumption, as sometimes the spring dries out during the dry periods, as a result the farm experience sufficient water yield only during wet seasons (summer months). Therefore, in response to the growing urgency to secure adequate and sustainable water supply for the KRS Farm, the KZN DARD proposes the construction of an instream earth filled dam. The proposed in stream earth filled dam will increase the capacity of water supply to KRS farm throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes. Consequently, an environmental impact assessment (EIA) has commenced, assisting the KZN DARD (applicant) in identifying all potential adverse environmental consequences of the project, their extent, significance and to ensure that the environmental management requirements are adequately implemented.

1.1 Project Team

In accordance with Appendix 1, Section 3(1)(a) of GN No. 326 (7 April 2017), this section provides an overview of Emvelo Consultant and the company's EIA experience, as well as the details and experience of the EAPs that form part of the Emvelo Consultant project team.

Table 2: Environmental Assessment Practitioners

Name	Qualification	Experience (Years)	Duties
Phumzile Lembede	B.Sc. Honours in (Environmental Management), Registered: EAP (EAPASA) & Pr. Sci. Nat. (SACNASP) in the Environmental Science Field of Practice	11	Principal EAP and Environmental Scientist
Dumisani Myeni	B.Sc. Honours in (Environmental Management), Registered: EAP (EAPASA) & Cand. Sci. Nat. (SACNASP) in the Environmental Science Field of Practice	10	Study Lead/EAP and Environmental Scientist

1.2 Report Structure

This Environmental Basic Assessment has been undertaken in accordance with the requirements of sections 24 and 24D of the National Environmental Management Act, 1998 (Act 108 of 1998) ["NEMA"] and the Environmental Impact Assessment ("EIA") Regulations contained in Government Notice (GN) No. R982 of 2014 as promulgated in terms of the NEMA ["EIA Regulations"] as amended up to and including GN R 326 in GN 40772 of 07 April 2017.

This Basic Assessment Report (BAR) is compiled with accordance to **Appendix 1** of GNR 326 (EIA Regulation (2014) as amended on 07 April 2017). A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in (***Table 3***) below.

Table 3: Basic Assessment Report Structure (Appendix 1 GNR 326)

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Basic Assessment Report Section
Appendix 1. 3.1(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	• Cover page • Section 1.1. • Appendix F
Appendix 1. 3.1(b):	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 3
Appendix 1. 3.1(c):	A plan which locates the proposed activity or activities applied for 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 a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	• Section 3
Appendix 1. 3.1(d):	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	• Section 5 • Section 6
Appendix 1. 3.1(e):	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	• Section 9

Appendix 1. 3.1(f):	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	• Section 7
Appendix 1. 3.1(g):	A motivation for the preferred site, activity and technology alternative;	• Section 8
Appendix 1. 3.1(h):	A full description of the process followed to reach the proposed preferred alternative within the site, including– (i) details of all 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 development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified 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 alternative development footprints for the activity were investigated, the motivation for not considering such; and	• Section 8 • Section 10 • Appendix E5 • Section 11-Section 14 • Section 15 • Section 16 • Section 8.7

	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	
Appendix 1. 3.1(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental 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 15 • Section 16
Appendix1. 3.1(j)	An assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	• Section 15 • Section 16
Appendix 1. 3.1(k):	Where applicable, a summary of the findings and recommendations of 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 assessment report;	• Section 18 • Section 19
Appendix 1. 3.1(l):	An environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report 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 21 • Section 3 • Section 20 • Section 21

Appendix 1. 3.1(m)	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;	• Appendix B
Appendix 1. 3.1(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	• Section 20
Appendix 1. 3.1(0)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	• Assumption and limitation
Appendix1. 3.1(p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	• Section 20
Appendix 1. 3.1(q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
Appendix 1. 3.1(r)	An undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	• Appendix A
Appendix 1. 3.1(s)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
Appendix 1. 3.1(t)	Any specific information that may be required by the competent authority; and	N/A
Appendix 1. 3.1(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

2 PROJECT TITTLE

The Proposed Construction of Instream Earth-filled Dam for KZN Department of Agriculture and Rural Development, at ERF No. 1069, Kokstad Research Station, Ward 6 of Kokstad Local Municipality within Harry Gwala District, KZN Province.

3 PROJECT LOCALITY

The project locality is described in terms of geographic locational context and site context, as explained in (***Section 3.1 & 3.2***) below.

3.1 Geographical Locational Context

The study area falls within the jurisdiction of the Greater Kokstad Local Municipality and situated at approximately 5km North of Kokstad (***Figure 1***). The project area is within Quaternary Catchment T32C of Pongola-Mtamvuma Catchment Management Area.

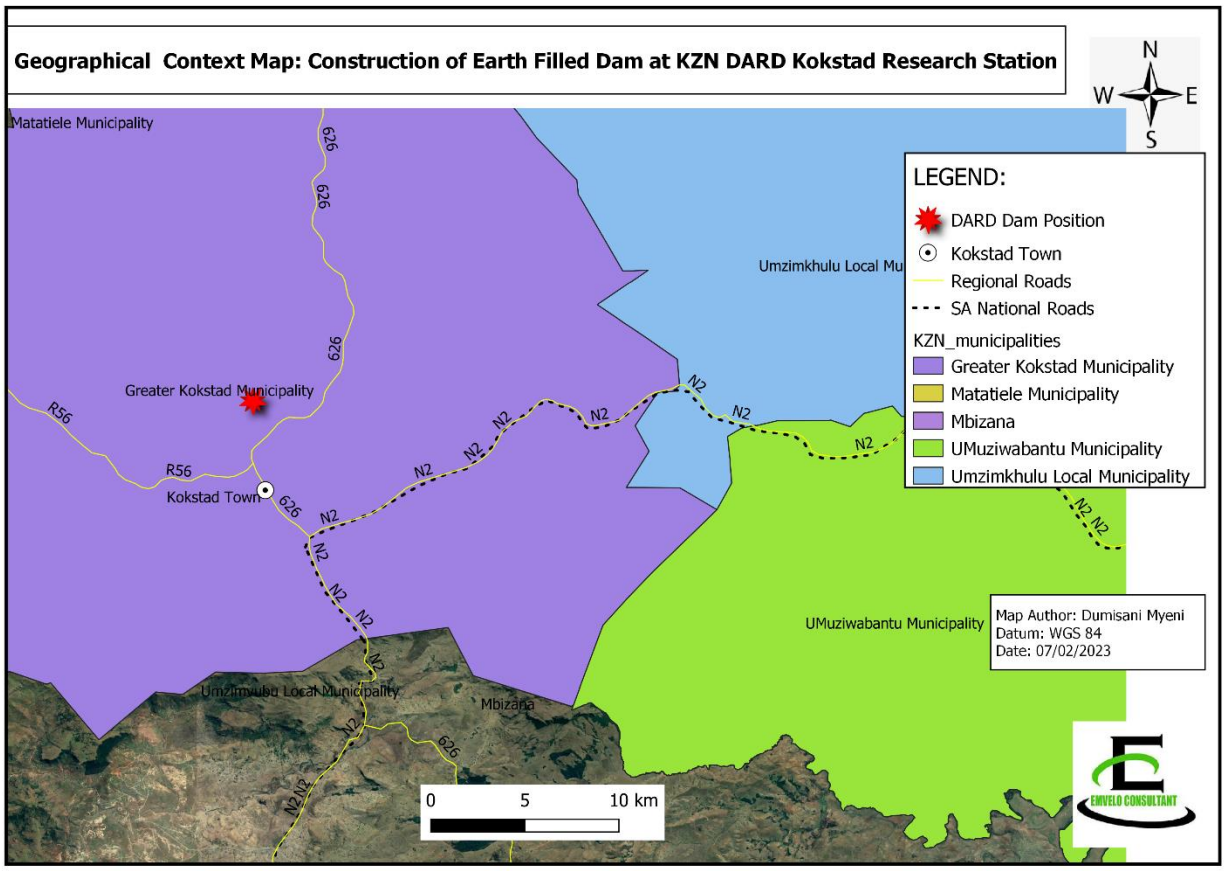

Figure 1: Geographical Context for the study area (Earth-filled Dam)

3.2 Site Locality Context (Site Description)

The project will take place within Erf 1069, Portion 0, Kokstad Research Station, Ward 6 of Greater Kokstad Local Municipality (***Figure 2***).

The (***Table 4***) below, provides the Global Positioning System (GPS) co-ordinates for the proposed development site.

Table 4: Site perimeter co-ordinates

Instream Inlet to Earth filled Dam	
Inlet corner	30°30'33.42"S, 29°25'10.66"E
Western Bank of Earth filled Dam	
1st Corner	30°30'33.42"S, 29°25'10.66"E
2nd Corner	30°30'34.39"S, 29°25'10.24"E
3rd Corner	30°30'34.64"S, 29°25'8.20"E
4th Corner	30°30'35.06"S, 29°25'7.47"E
5th Corner	30°30'35.37"S, 29°25'6.00"E
6th Corner	30°30'36.85"S, 29°25'5.93"E
7th Corner	30°30'37.96"S, 29°25'5.11"E
Southern Bank of Earth filled Dam	
1st Point	30°30'37.96"S, 29°25'5.11"E
Middle	30°30'38.55"S, 29°25'9.07"E
End Point	30°30'38.93"S, 29°25'12.41"E
Natural Spillway	30°30'39.73"S, 29°25'12.41"E
Eastern Bank of Earth filled Dam	
Spill Way Corner	30°30'38.93"S, 29°25'12.41"E
Levelled Spillway	30°30'38.20"S, 29°25'11.91"E
Middle	30°30'36.62"S, 29°25'10.23"E
End Point	30°30'33.42"S, 29°25'10.66"E
200m(600mmø) abstraction pipeline	
Abstraction point (Start)	30°30'38.01"S, 29°25'9.62"E
Connection to existing pipeline (End)	30°30'41.81"S, 29°25'15.10"E

The (***Table 5***) below, provides the 21-digits Surveyor General Code (SGC).

Table 5: SG 21-digit codes for the proposed site

Farm name/s, Portions, and number/s	SG 21-digit code
Kokstad ERF 1069, Portion 0	N0ES02490000106900000

Three (3) discrete habitat types were delineated within the assessment area, namely, riparian and instream habitat, and grassland habitat. The grassland provides the grazing filed, hence can be considered agricultural. The riparian habitat is dominated by shrubs such as *Leucosidea sericea* and sedges such as *Cyperus obtusiflorus var. flavissimus*. (***Refer to Section 10.6***).

As depicted in (***Figure 2***) below, the portion to be developed is within KZN DARD Kokstad research station, zoned as agricultural land. The area is made up of open grassland biome, overlain by East Griqualand Grassland, with un-named stream from spring headwater traversing the proposed earth filled dam, making it instream dam, and draining to Kokstad flats.

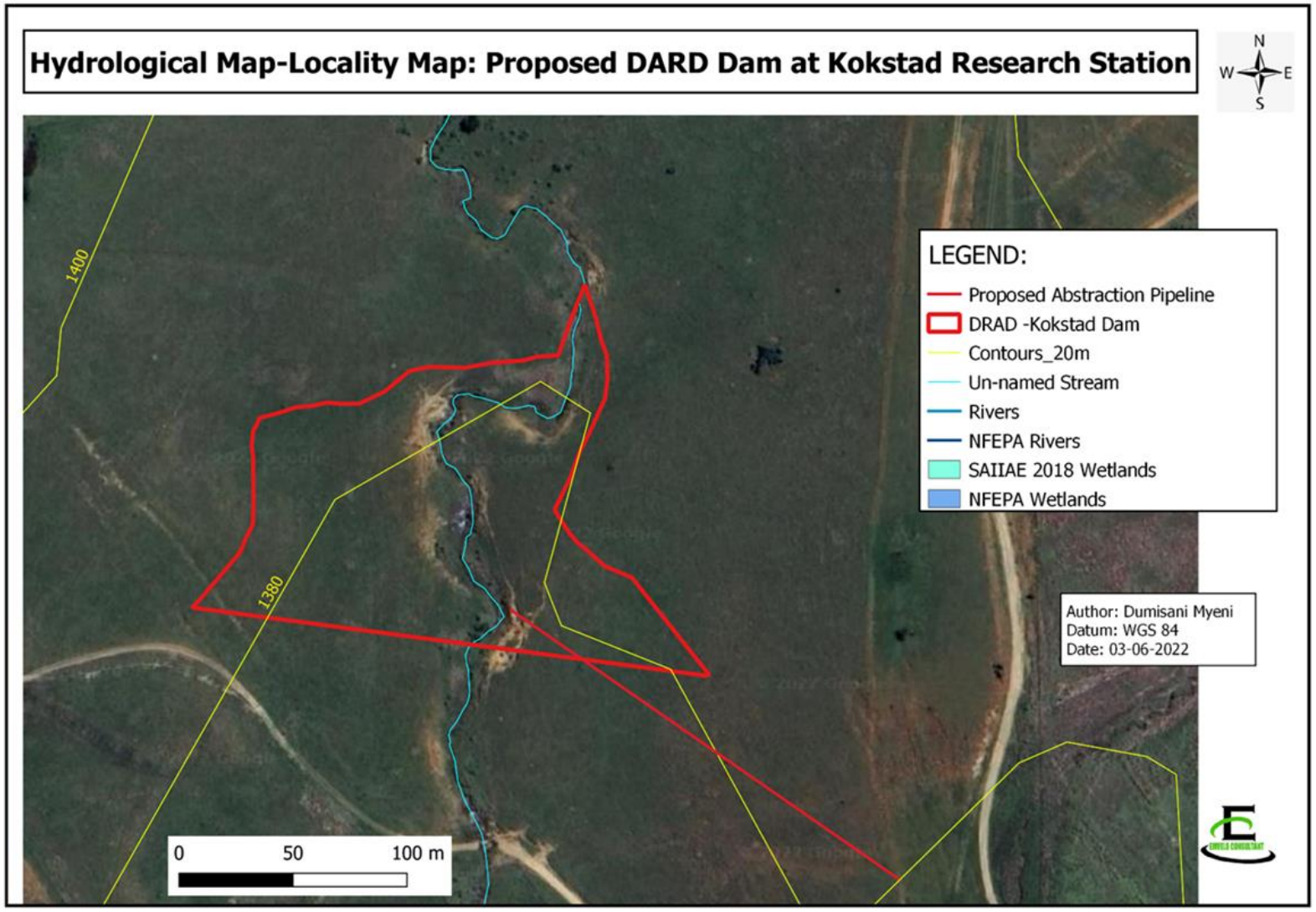

Figure 2: Locality & Sensitivity Map for Kokstad KZN DARD Earth-filled Dam

4 SITES ACCESS

The KZN DARD Kokstad Research Station can be accessed via R56 exiting from N2 into Kokstad, enroute via Kokstad straight to R617 and fork left towards the gravel road traveling almost 2km straight to KZN DARD Kokstad Research Station. The site is within the farm at the research station.

5 PROJECT DESCRIPTION

The Proposed Construction of Earth Filled Dam for KZN Department of Agriculture and Rural Development, at ERF No. 1069, Kokstad Research Station, Ward 6 of Kokstad Local Municipality within Harry Gwala District, KZN.

The proposed development of the instream earth-filled dam will entail the following features:

- In-channel dam to un-named stream
- Area occupied by a dam is 1.6ha
- Dam capacity is 20 194m^3
- Levelled spillway with 36 width and Freeboard of 1,4 m.
- Distance overland flow is 80m
- Core trench width of 14.1m
- Core Trench Volume of 808. 69m^3
- Base Water Side of 27.18m
- Base Dry Side of 18.62m
- Earth banks height of 8.56m
- Bank Volume of 13 752.43m^3
- Total pitching of 4 746,04m^2 (Pitching of crest, Upstream Stone Pitching, Downstream Stone Pitching).

The project entails construction of 30m(275mmø) class 12 UPVC abstraction pipeline (dam outlet pipeline), and a 220m (63mm Ø) class 6 HDPE which will join the existing pipeline which

will join the existing pipeline at (30°30'41.82"S, 29°25'15.14"E) coming from raw water reservoir to Kokstad Research Station WTW.

5.1 Project Anticipated Date

The Project is planned to start at the beginning of March 2024/ August 2024. In favour of the anticipated start date is that due to the nature of works which involve working within the watercourses as a result of construction of an instream earth-filled dam, it is therefore highly recommended that the planned activities be undertaken during winter season (dry season), when the streams are dry or at low flow conditions, as well as when there is less chance of run-off from the disturbed soil at sloping areas. Therefore, for planning and tender process the applicant (KZN DARD) wishes to receive an authorisation by the end of October 2023.

5.2 Design Criteria

The design criteria discussed in this report reflect to the main project activities that triggers the EIA as listed below:

- Construction of in-stream earth-filled dam.
- Bulk Earthworks – required to excavate core trench width of 14.1m
- Development footprint of 1.6ha.
- The design return period of 10, 20 or 50 years for catchment smaller than 8km$^{2.}$, and 10, 20 or 50 years for catchment of 8-1000KM^2.

The catchment size within the study area is 7.8km^2. Therefore, for this project the design period of 20 years is determined below.

Table 6: Design Criteria for Instream Earth-filled Dam

Parameter	Unit
Dam Capacity	20 194m^3
Catchment Area	7.8km^2
Design Return Period	20yrs
RUN-OFF INTENSITY	

Parameter	Unit
Rainfall region	600mm/a
Point Rainfall	85mm/a
Point Rainfall Intensity	34,98 h/Tc
Total annual run-off of flood water	259 397m^3/a
Area reduction	97,9%
Run-Off Intensity	28.667 cumec
OVERFLOW LAND (TIME AND CONCENTRATION):	
Overland flow Average Slope	30%
Overflow land Distance	80m
Surface value r	0.4
Artificial canal flow	0.6m/s
Canal length	600m
SPILLWAY:	
Side Spillway Slope	1: 140
Max flow depth	0.7m
Permissible flow speed	1.2m/s
Discharge	0.8cumec/m
Levelled spillway width	35.8m
Natural spillway width	89.6m
Total Freeboard	1.4m
EARTHBANKS:	
Volume	13 752,43m^3
Upstream Stone Pitching	2 470.09m^2
Downstream Stone Pitching	1 750.95m^2
Pitching of crest	525,00m^2
Total pitching	**4 746,04m^2**
CORE TRENCH	
Core Trench	808. 69m^3
Base Water Side	27.18m
Base Dry Side	18.62m
Depth of Nappe	0.7m
Bank Height	8.56m
Bank Crest	3m
Bank Volume	13 752.43m^3

Parameter	Unit

6 LISTED AND SPECIFIED ACTIVITIES TRIGGERED

The KZN DARD will require an Environmental Authorisation (EA) prior to undertaking the proposed project. The NEMA, and the Environmental Impact Assessment (EIA) Regulations (2014) as amended in 2017, govern the process of applying for environmental authorization for certain developments. A provision in the EIA Regulations is made for two forms of assessment: Basic Assessment and Scoping & EIA, depending on the scope of the activity. The EIA regulations specify that: Activities identified in Listing Notice 1 and 3 (GNR 327 and 324 of 2017) requires a Basic Assessment while activities identified in Listing Notice 2 (GNR 325 of 2017) are subject to a Scoping and EIA. The listed activity associated with the proposed development are: *Listing Notice 1, Listed Activity 19 & 27; Listing Notice 3, Listed Activity 12 & 14*. Therefore, this application will follow a Basic Assessment Process, as the Listing Notice 1 & Listing Notice 3 has been triggered.

The (***Table 7***) below indicates the Listed activities in terms of the EIA 2014 Regulations (as amended on 07 April 2017) that are applicable to the proposed project.

Table 7: Listed and specified activities triggered

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
GNR No. 327 (7 April 2017) Listing Notice 1.	**Listed Activity 19**	The infilling of depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from ─ (i) 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 harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	Kokstad ERF 1069, Portion 0, Kokstad Research Station, KwaZulu Natal. ***Applicability**:* *The construction of an instream earth-filled dam will involve excavation and removal of soil for Core Trench Volume of 808. 69m3; excavation and removal of soil for Bank Volume of 13 752.43m^3; and other excavation required for construction of 1.6ha earth filled dam. As well as excavation for construction of 200m(600mmø) abstraction pipeline (dam outlet pipeline). Therefore, the activities will involve in excavation of soil material of more than 10m^3 and infilling of spoils soils, materials (stone pitching) within the un-named stream, and 32m watercourse regulated area for the construction of an instream earth-filled dam.*

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
GNR No. 327 (7 April 2017) Listing Notice 1.	**Listed Activity 27**	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Kokstad ERF 1069, Portion 0, Kokstad Research Station, KwaZulu Natal. ***Applicability**:* *The proposed dam will cover the surface of 16 032m2 in size. Therefore, construction of an instream earth-filled dam will result in clearance of 16 032m^2 (1.6ha) area overlain by indigenous vegetation characterised of East Griqualand Grassland.*
GNR No. 325 (7 April 2017) Listing Notice 2	**N/A**	N/A	N/A
GNR No. 324 (7 April 2017) Listing Notice 3	**Listed Activity 12**	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **<u>d. KwaZulu-Natal</u>**	Kokstad ERF 1069, Portion 0, Kokstad Research Station, KwaZulu Natal. ***Applicability**:* *The proposed instream earth-filled dam will cover the surface of 16 032m^2 in size. Therefore, construction of earth dam will result in clearance of 16 032m^2 (1.6ha) area overlain by overlain by vegetation related to East Griqualand Grassland within CBA1 & CBA2.*

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
		v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	
GNR No. 324 (7 April 2017) Listing Notice 3	**Listed Activity 14**	The development of— **[(iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size; or** **(xii) infrastructure or structures with a physical footprint of 10 square metres or more;]** (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (b) in front of a development setback; or	Kokstad ERF 1069, Portion 0, Kokstad Research Station, KwaZulu Natal. ***Applicability**:* *The proposed instream earth-filled dam will cover the surface of 16 032m^2 in size. The dam will be in stream (in-channel) storage dam, built within un-named stream. Furthermore, the development of earth dam will take place within CBA1 & CBA2, within the farm (Kokstad Research Station).*

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
		(c) if no development setback has been adopted, 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. KwaZulu-Natal** vii. Critical biodiversity areas or ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	

7 ACTIVITY MOTIVATION

The need for and the desirability of a proposed development forms a key component of any EIA application, as the concept of “need and desirability” relates to, amongst others, the nature, scale and location of development being proposed, as well as the wise use of land. The “need and desirability” are interrelated and the two components collectively can be considered in an integrated and holistic manner (DEA, 2017).

KZN DARD owns and manages the Kokstad Research Station. The Kokstad Research Station operates three research components, namely crop production, animal science and grassland science, with farm services as the support component. The farming activities in this area are concentrated mainly on dairy production and extensive to semi-intensive cattle and sheep production, and crops production. Therefore, in response to the growing urgency to secure adequate and sustainable water supply for the Kokstad Research Station, the KZN DARD proposes to develop an instream earth-filled dam with Kokstad ERF 1069 at the farm for Kokstad Research Station.

7.1 The need

Considering the broader community’s needs and interests as reflected in a credible IDP, SDF and EMF for the area. The financial viability of adopted proposed development or activity location should be considered within the context of justifiable economic development, measured against the broader societal short-term and long-term needs. Therefore, what is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs (DEA, 2017).

Currently, the Kokstad Research Station abstract water from the nearby spring and water is then stored in the reservoir within the farm. The water from spring is currently not sufficient for agricultural use and consumption, as sometimes the spring dries out during the dry periods, as a result the farm experience the water yield only during wet seasons (summer months).

The proposed earth filled dam will increase the capacity of water supply to Kokstad Research Station throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes.

7.2 Desirability

The assessment of desirability of the environmental proposal is fundamental for streamlining the proposal to the baseline environment. This is done in order to meet the objective of the National Development Plan (NDP) 2030 by ensuring that the threat to the "environment and the challenge decent living and livelihood as well as poverty alleviation are closely intertwined through a balance between resource use for economic benefit, improving livelihoods and that of ecosystems protection (DEA, 2017).

As previously explained on (***section 7.1***), in response to KZN DARD need for development of an instream storage dam has been adopted with focus on a cost effective and environmentally compatible process, to increase the capacity of water supply to Kokstad Research Station throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes.

The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

Apart from sufficient water supply to the farm as a result of the instream dam, another the deliverable for infrastructure projects is jobs creation and stimulation of the local economy. Therefore, the inclusion of local labour during the construction period will create the much-needed temporary employment opportunities and transfer of skills to local community, as well as support local supply chains and businesses.

8 PROPOSAL ALTERNATIVES

The DFFE provides guidelines on the assessment of alternatives, to which the impact assessment must be considered. Regulations indicate that any alternatives considered in an assessment process must be reasonable and feasible. Additionally, I&APs must be afforded an opportunity to provide inputs into the process of formulating alternatives. Once a full range of potential alternatives have been identified, the reasonable and feasible alternatives should be formulated as activity alternatives for further consideration during the basic assessment or scoping and EIA process (DEAT,2004a; DEAT, 2006). These alternatives are: location (site), activity (project), site layout, design, scale, routing, scheduling, process, demand, input, technology, and no-go options.

It is, however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the applicant and the appointed EAP, which in some instances culminates in a single preferred project proposal (DEAT, 2006).

After weighing all project alternatives for this project (Discrete Alternative Approach), the preferred '*Alternative A: Site Layout Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Location Alternative*' were adopted as alternatives that will meet the stated need for and purpose of the project, by providing proper mitigation measures, as discussed below.

8.1 Alternative A (Site Layout Alternative)

The site layout alternatives permit consideration of different spatial configurations of an activity on a particular site. This may include particular components of a proposed development or may include the entire activity (DEAT, 2004a). The 'Site Layout Alternatives' provides for an existing site layout to be considered as it is linked to the design.

The area occupied by a dam is 1.6ha suitable to cater for the earth bank with total surface area of 4 746,04m^2 stone pitching for the dam capacity of 20 195m^3. The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream

traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

8.2 Alternative B (Design Alternative)

The design alternative forms an integral part of the project proposal and becomes a part of the project description and need not be evaluated as separate alternatives (DEAT, 2004a). This 'Design Alternative' is in line with project design criteria described in ***Section 5***. Therefore, this section provides for a project design for development of an instream earth-filled dam bulk as previously described.

The design provides for the 20 years design return period of 7.8km^2 catchment area, and a total annual run-off of flood water 259 397m^3/a. This design looks at dam characteristics for dam capacity of 20 194m^3, with reference to run-off intensity, overflow land, earth bank, core trench, spillway (***Section 5.2***).

8.3 Alternative C (Technology Alternative).

The technology to be used in the activity, refers to a consideration of method of operation, such that an alternative includes the option of achieving the same goal by using a different method or process (DEA&DP, 2007). Therefore, the construction of an instream earth-filled dam will involve bulk earthworks. The technology to be adopted for excavation will be based on *in-sutu* material as classified in (***Table 8***) below.

Table 8: SANS1200D Excavatibility Classes (Geology and excavation technologies)

***In-sutu* Geological Conditions at different depth**	**Description of material properties/ Excavatibility and Rippability**
Soft	Material that can be efficiently removed or loaded without prior ripping, by means of bulldozer, tractor-scraper, track type front end loader, back acting excavator, without the use of pneumatic tools such as paving breaker.

Intermediate	Material that can efficiently be ripped by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width and adequately ripped by a bulldozer of mass approximately 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. Or use of pneumatic tools before removal by equipment to one specified above.
Hard rock	Excavation in material that cannot before removal, be efficiently ripped by a bulldozer. This type of bedrock that cannot be removed without blasting or without wedging and splitting
Boulder (Class A)	Excavation in material containing more than 40% volume boulders of size in the range of 0.03-20m^3, in matrix of soft material or smaller boulder.
Boulder (Class B)	Excavation in material containing more than 40% volume boulders of size in the range of 0.03-20m^3, in matrix of soft material or smaller boulder, and which require individual drilling and blasting in order to loaded by a tractor type front-end loader or by a by a tractor loader backhoe (TLB)/back acting excavator

The study area at Kokstad is predominantly underlain by Mudstone of the *Dwyka* Group and Karroo Supergroup with dolerite intrusion, as the project area is within a stratified geological formation forming a belt between of Mudstone Geological Groups Formation. The soils within the proposed dam footprint comprise a mix of moderate to well drained soils with some shallow soils where parent rock is found close to the surface (outcrops). The soil depth is mainly varying from 500mm to 2 300mm with an apedal structure which is easily excavatable. The surrounding matrix/decomposed material is likely to require '*Soft*' to '*Intermediate*' excavation.

Therefore, for the purpose excavation for instream earth filled dam, the earthworks would be likely achieved, as the proposed dam site comprise of material that can be effectively removed or loaded without prior ripping and will be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width, or by means of bulldozer, tractor scrapper, track type front-end loader back acting excavator. However, for efficiency as the project involve bulk excavation for earth-filled dam, the heavy-duty excavator will be most suitable.

In addition, consideration can also be given to use of a tracked excavator of flywheel power exceeding 0.10kW per millimetre of tined bucket width. Where the hard rock shows some resistance to single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW, the rock blasting will be an option. However, blasting must be considered a last resort where all means of heavy ripping have failed.

The 'Impact Analysis' (***Refer to Section 15***) and the recommendations by the EMPr are based on this construction methods.

8.4 Alternative D (Location Alternative)

The 'Location Alternative' could be considered part of site layout alternatives. However, the 'Location Alternative' is considered for the entire proposal or for a component of a proposal, locations that are geographically quite separate, and alternative locations that are in close proximity (DEAT, 2004a). The choice of instream dam location was determined through topography of the project site with overland flow average slope of 30% as incorporated into engineering design supporting efficiency of run-off yield from the headwater.

8.5 Alternative E (No-Go Alternative)

In the absence of the proposed development, the KZN DARD would be unable to construct an instream earth-filled dam within the Kokstad Research Station. Therefore, the Kokstad Research Station will continue to experience the insufficient water supply at the farm, as the water from spring is currently not sufficient for agricultural use and consumption, as sometimes the spring dries out during the dry periods, as a result the farm experience the water yield only during wet seasons (summer months), as discussed in (***Section 7 Above***). Agriculture research is one of the most critical functions of livelihood sustainability, as it addresses the challenges to food insecurity. The food security and sustainable livelihood is a national priority and one of the key elements of a decent standard of living for all South Africans (NPC, 2012).

Therefore, projects that are proposed on public land and/or for the public good should consider the major development alternatives that would meet the stated need for and purpose of the project (DEAT, 2004a).

The EAP is therefore of the view that the NO-GO option is undesirable in the face of social and economic needs of the KZN farming communities and South Africa's National Development Plan 2030 objectives.

8.6 Preferred Alternative

The role of alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts (DEAT, 2004a).

Looking at environmental impact likelihood and providing engineering to mitigate those impacts. The preferred alternatives are '*Alternative A: Site Layout Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Location Alternative*'. These preferred alternatives cannot be undertaken in isolation, as they assessment is integrated.

The '*Alternative A: Site Layout Alternatives*', and '*Alternative D: Site Location*' favour the best dam design practices as the proposed dam location is situated within the low-lying area determined through topography of the project site with overland flow average slope of 30% as incorporated into engineering design supporting efficiency of run-off yield from the headwater, and efficient of area occupying 1.6ha suitable to cater for the earth bank with total surface area of 4 746,04m^2 stone pitching for the dam capacity of 20 195m^3. The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

The '*Alternative B: Design Alternative*' has distinctly caters for dam type and design characteristic for 20 years design return period over a 7.8km^2 catchment area, and a total annual run-off of flood water 259 397m^3/a. This design looks at dam characteristics for dam capacity of 20 194m^3, with reference to run-off intensity, overflow land, earth bank, core trench,

spillway (***Section 5.2***). The design is linked to the '*Alternative C: Technology Alternative*', as the excavatibility and rippability determine the use of machinery, due to intensive earthwork factor of the earth-filled dam. Therefore, '*Alternative C: Technology Alternative*' provides that for the purpose excavation for instream earth filled dam, the earthworks would be likely achieved, as the proposed dam site comprise of material that can be effectively removed or loaded without prior ripping and will be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width, or by means of bulldozer, tractor scrapper, track type front-end loader back acting excavator.

Although, there are impact associated with these preferred alternatives, but preferred/mitigated development proposal presented in this report is responsive to the integrated results of the assessment of potential impacts made by the various specialists on the project team. The adherence to mitigation measures will render the impacts be of temporal nature, only during construction. This will be addressed by mitigation measures discussed under (***Section 15***) and EMPr.

9 ENVIRONMENTAL STATUTORY FRAMEWORK

In terms of the Environmental Regulations promulgated under the NEMA, an EIA must be conducted for any development or activity that requires an Environmental Authorisation. The listed activities in the NEMA, relevant to this project, that triggers the need for an Environmental Authorisation are listed below:

Apart from this EIA triggers, this project also triggers Section 21(c); Section 21 (i); and Section 21 (g) of National Water Act National Water Act (Act No. 36 of 1998). Consequently, the Water Use License Application is underway, due to proposed and anticipated alterations to the wetland characteristics and impeding or diverting flows; and due to the construction of a dam.

Table 9: Environmental Statutory Framework

Legislation	Relevance
Constitution of the	➢ Chapter 2 – Bill of Rights. ➢ Section 24 – Environmental Rights/ Health Or Well-Being / Depletion Of Natural Resources

Legislation	Relevance
Republic of South Africa, (No. 108 of 1996)	➢ Section 32: Access to Information ➢ Section 33: Administrative Decisions ➢ Section 38: Locus Standi ➢ Section 68: Authority for Provincial Legislation
National Environmental Management Act (NEMA) (No. 107 of 1998)	➢ Section 2: Principles in Environmental Management ➢ Section 24: Environmental Authorisations and/or Norms and Standards (EA) (➢ Section 24G: Rectification Application ➢ Section 24J: Implementation Guidelines ➢ Section 24L: Alignment of Environmental Authorisations, including Integrated Environmental Authorisations) ➢ Section 24N: Environmental Management Programmes, Rehabilitation of Disturbed Areas and Closure Plan ➢ Section 24P: Financial Provision for Remediation of environmental damage ➢ Section 24Q: Monitoring and Performance Assessment (Environmental Audit) on EMPr's ➢ Section 24S: Management of Residue Stockpiles and Residue Deposits ➢ Section 24M: Exemption from Application of Certain Provisions of The Act ➢ Section 28: Duty of Care and Remediation of Environmental Damage ➢ Section 28: Soil Pollution ➢ Section 29: Protection of Workers on Refusal to Undertake Work ➢ Section 30: Emergency Incident Causing Danger to Public or Environment ➢ Section 30A: Emergency Situation - Request for Directive to undertake listed activity without EA ➢ Section 31: Access to Environmental Information and Protection of Workers ➢ Section 32: Enforcement of Environmental Laws ➢ Section 34: Liabilities in Criminal Offences Under Environmental Laws ➢ Section 39: Control over products which could harm the environment ➢ Section 43: Appeals (Ch 9, Sec 43) ➢ Section 44 and 47: Regulations ➢ Section 47A: Regulations, Legal Documents and Steps Not In Compliance With Procedural Requirements ➢ Section 47B: Consultation with other Departments ➢ Section 47C: Extension of Time Periods ➢ Section 47D: Delivery of Documents ➢ Section 49A and 49B: Offences and Penalties
GN No. 326 (7 April 2017)	➢ Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing, and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to and EIA, in order to avoid or mitigate

Legislation	Relevance
	detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.
➢ Purpose – to identify activities that would require environmental authorizations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24C of NEMA. ➢ The investigation, assessment, and communication of the potential impact of activities must follow the procedure as prescribed in regulations 19 and 20 of the EIA Regulations published in terms of section 24(5) of the Act. However, according to Regulation 15(3) of GN No. 327, Scoping and an Environmental Impact Report (S&EIR) must be applied to an application, if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities. ➢ Activities that are relevant to this application are: **Listing Notice 1, Listed Activity 19 & 27; Listing Notice 3, Listed Activity 12 & 14.**	
National Water Act (Act No. 36 of 1998)	➢ Chapter 3 – Protection of water resources. ➢ Section 19 – Prevention and remedying effects of pollution. ➢ Section 20 – Control of emergency incidents. ➢ Chapter 4 – Water use (***Section 21C, Section 21i; and Section 21g***) ➢ Authority – Department of Water and Sanitation (DWS).
NEMA 1998 - GN R982 of 4 December 2014 - Environmental Impact Assessment Regulations, 2014	➢ Regulation 1 and 2: Interpretation, Purpose and Commencement of Regulations) ➢ Regulation 3: Timeframes) ➢ Regulation 4: Decision on Applicant and Notification to I&AP's ➢ Regulation 5 and 6: General Requirements for Applications ➢ Regulation 7, 8 and 9: Consultations between Competent Authority and other relevant State Departments ➢ Regulation 10 and 11: Competent Authority - Right of access to information ➢ Regulation 12, 13 and 14: EAP's and Specialists' Appointments and Conditions ➢ Regulation 15: Assessment Process to be followed ➢ Regulation 16, 17 and 18: Requirements applicable to the EA Application ➢ Regulation 19 and 20: Basic Assessment Report submitted to Competent Authority ➢ Regulation 21, 22, 23 and 24: S&EIR submission to Competent Authority ➢ Regulation 25 and 26: Issue and Content of an Environmental Authorisation ➢ Regulation 31, 32 and 33: Amendment of Environmental Authorisation ➢ Regulation 34: Audits on EA's, EMPr's and Closure Plans ➢ Regulation 36 and 37: Amendments to an EMPr and Closure Plan ➢ Regulation 38: Suspension and Withdrawal of Environmental Authorisation ➢ Regulation 39, 40, 41, 42, 43 and 44: Public Participation ➢ Regulation 45, 46 and 47: General Matters ➢ Regulation 48: Offences

Legislation	Relevance
National Environmental Management Air Quality Act (Act No. 39 of 2004)	➢ NEM: AQA (Act No.39 of 2004). ➢ Air quality management ➢ Section 32 – Dust control. ➢ Section 34 – Noise control. ➢ Authority – Harry Gwala District Municipality
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	➢ Section 43-48: Biodiversity Management Plans (Ecosystems, Indigenous Species or Migratory Species) ➢ Section 51-55: Threatened or Protected Ecosystems and Threatening Processes ➢ Section 56-58: Threatened or Protected Species ➢ Section 64-67 and 69: Alien Species Posing a potential threat to Biodiversity ➢ Section 70 and 77: Invasive Species posing a potential threat to Biodiversity (➢ Section 101 and 102: Offences and Penalties Authority – DFFE.
Occupational Health & Safety Act (Act No. 85 of 1993)	➢ Provisions for Occupational Health & Safety Regulation 9A and 14: Hazardous Chemicals Substances ➢ Regulation 10 and 15: Disposal of HCS Waste ➢ Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	➢ Section 34 – protection of structures older than 60 years. ➢ Section 35 – protection of heritage resources. ➢ Section 36 – protection of graves and burial grounds. Section 51: Offences and Penalties ➢ Authority – Provincial Heritage Agency: Amafa Institute Heritage Agency
National Road Traffic Act 1996 (Act No. 96 of 1996)	➢ Section 51: Waste on Or Near National Road ➢ Authority – KZN Department of Transport and community safety
Environment Conservation Act (Act 73 Of 1989)	Section 29: Offences and Penalties Section 31A: Damage to Environment
Promotion of Access to Information Act, 2000 (Act No 2 of 2000)	➢ Section 11 and 12: Access to Records of Public Bodies ➢ Section 50: Access to Record of Private Bodies ➢ Section 51: Publication and Availability of Certain Records ➢ Section 70: Mandatory Disclosure by Public/Private Bodies

Legislation	Relevance
Water Services Act, 1997 (Act No. 108 of 1997)	➢ Section 3:Right of Access to Basic Water Supply and Sanitation ➢ Section 9: National Standards on Provision or Water Services ➢ Section 11: Duty to Provide Access to Water Services ➢ Section 12-18: Water Services Development Plans ➢ Section 27: Monitoring of Water Services Provided ➢ Section 77: Transferability of Servitudes
Hazardous Substances Act, 1973 (Act No. 15 of 1973)	➢ Section 2-3: Grouped Hazardous Substances ➢ Group I – Hazardous Substances (GN R 452 Of 25 March 1977 and GN 801 Of 31 July 2009) ➢ Group II Hazardous Substances (GN R1382 Of 12 August 1994) ➢ Group III Hazardous Substances (GN R1302 Of 14 June 1991) ➢ Group IV Hazardous Substances (GN R247 of 26 February 1993) ➢ Section 18 and 19: Offences and Penalties
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947)	➢ Section 3 and 7: Pest Control Operators, and use of fertilizers, farm feeds, agricultural, stock remedies and sterilising plants ➢ Section 7: Sale of fertilizers, farm feeds, agricultural remedies, and stock remedies ➢ Section 7BIS: Prohibition on acquisition, disposal, sale or use of certain fertilizers, farm feeds, agricultural remedies, and stock remedies ➢ GN R181 of 7 February 2003 - Regulation Relating to the Prohibition of the Sale, Acquisition, Disposal or Use of Agricultural Remedies ➢ Containers And Labels of Agricultural and Stock Remedies
	➢ GN 98 of 11 February 2011 - Pest Control Operator Regulations
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	➢ Section 7-9: National Norms and Standards, Provincial Norms and Standards and Waste Service Standards ➢ Section 14 and 15: Priority Waste ➢ Section 16: Duty on Waste Holder to Implement Reasonable Measures ➢ Section 17: Reduction, Re-Use, Recycling and Recovery of Waste ➢ Section 43-59: Waste Management Licences for Listed Waste Activities or Compliance to Norms and Standards ➢ Section 21 and 22: Storage of Waste ➢ Section 23 and 24: Waste Collection needs to be Authorised by the Municipality ➢ Section 25: Waste Transportation ➢ Section 26: Unauthorised Disposal of Waste and Protection of Environment ➢ Section 25: Protection of Environment at Private Land ➢ Section 35-41: Contaminated Land ➢ Section 67 and 68: Offences and Penalties ➢ Regulation 4: Waste Classification ➢ Regulation 5: Safety Data Sheets for Hazardous Waste

Legislation	Relevance
	➢ Regulation 6: General Obligations on Waste Generators, Transporters And Managers ➢ Regulation 7: Waste Treatment ➢ Regulations 8: Waste Assessment - Waste Disposal to Landfill - Obligations on Generators and Managers ➢ Regulation 9:Waste Management Activities that do not require a Waste Management Licence ➢ Regulation 10: Records on Waste Generation and Management
Advertising on Roads and Ribbon Development Act, 1940 (Act No. 21 of 1940)	➢ Section 8: Articles Or Materials On Or Near Public Roads
Health Act, 1977 (Act No. 63 of 1977)	➢ Section 20: Waste Being a Threat to Human Health
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	➢ Section 5: Prohibition on the Spreading of Weeds ➢ Section 8 and 9: Soil Conservation Schemes ➢ Regulation 8: Managing the Flow Pattern of Run-off Water ➢ Regulation 12: Burning of Veld, Prevention and Control of Veld Fires ➢ Regulation 15: Weeds and Invader Plants
National Forests Act, 1998 (Act No. 84 of 1998)	➢ Section 7: Indigenous trees ➢ Section 12-15: Protected Trees (All Areas) ➢ Section 16: Registration in Title Deeds ➢ Section 61-64: Offences and Penalties
National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)	➢ Section 9 and 10: Fire Danger Rating ➢ Section 17-19 and 34: Firebreaks ➢ Section 24 and 25: Offences and Penalties
National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003)	➢ Section 18 and 19: Special Nature Reserves ➢ Section 23-26: Nature Reserves ➢ Section 28 and 29: Protected Environments ➢ Section 37: Management of Protected Areas ➢ Section 38-42: Management Plans in Protected Areas ➢ Section 43: Monitoring performance of Protected Areas ➢ Section 45-47: Access to Protected Areas

Legislation	Relevance
	➢ Section 48: Restricted activities in Protected Areas ➢ Regulation 49: Regulation or Restriction of Activities in Protected Areas ➢ Section 89: Offences and Penalties

10 THE PUBLIC PARTICIPATION PROCESS

Section 24 (4) (a) (v) of NEMA, provides that the procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment, must ensure, with respect to every application for an Environmental Authorisation, the public information and participation procedures which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures.

10.1 Background

Public Participation Process (PPP) is part of the EIA process which is governed under the principles of NEMA as well as the EIA regulations. It is defined as the process by which an organization consults with all interested or affected parties (I&APs) which include organizations, government entities, affected communities, non-governmental organisations (NGOs), etc. It is a two-way communication process and collaborative problem solving with the goal of achieving better and more acceptable decisions.

The PPP also provides all the stakeholders including the community with a platform to raise their environmental concerns before the Competent Authority can make a final decision regarding the issuing of the Environmental Authorization. This prevents and minimizes disputes before they become unsolvable. Chapter 6 of the EIA regulations emphasize that the information related to the proposed project must be made available to I&APs, prior to a final decision. Therefore, this process will allow I&APs to have access to the information relating to this project. The application was conducted according to Chapter 6 of the EIA Regulations 2017.

10.2 Objectives of public participation

The objectives are as follows:

- To inform and involve the community and the stakeholders about the proposed development;
- To identify and address the community and stakeholder's environmental concerns regarding this activity;
- To provide opportunities for the community, relevant government departments, surrounding businesses, the residents, and other stakeholders to raise their environmental concerns, suggest solutions and identify priorities or issues;
- To protect the environmental rights of the local community; and
- To optimise on local and indigenous knowledge of the area.

10.3 Landowner

According to Regulation 39(1) of GN No. 326 (7 April 2017), if the applicant is not the owner or person in control of the land on which the activity is to be undertaken, the applicant must, before applying for an Environmental Authorization in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land.

The KZN DARD is the landowner of Kokstad ERF 1069, Kokstad Research Station.

10.4 Legal Compliance

The PPP must comply with several important sets of legislation that require public participation as part of an application for authorisation or approval, namely but not limited to:

- The National Environmental Management Act (Act No. 107 of 1998 – NEMA);
- The National Water Act (Act No. 36 of 1998-NWA)

10.5 Consultation with the Competent Authority

The relevant authorities required to review the proposed project and to provide an Environmental Authorisation were consulted from the outset of this study and have been engaged throughout the project process. In terms of NEMA Section 24 (C), the lead decision-making authority for this application for Environmental Authorisation is the National Department of Forestry, Fisheries and Environment (DFFE).

However, other authorities with jurisdiction over elements of the receiving environment or project activities were consulted and listed as I&APs.

Authority consultation included the following activities:

- Submission of EA Enquiry to DFFE;
- The EA Pre-Application Meeting was convened with DFFE on 27th of July 2022 (***Refer to Appendix E*** for a copy of the minutes).
- An application for authorisation in terms of NEMA (Act 107 of 1998), is submitted to DFFE as a competent authority.

10.6 Consultation with other Relevant Authorities

Background information (BID) regarding the proposed project was provided to relevant authorities and agencies, requesting their input into the EIA process. The authorities include *inter alia* as:

- Department of Water and Sanitation (DWS);
- KZN Department of Economic Development Tourism and Environmental Affairs (EDTEA);
- Biodiversity Component for: Department of Forestry, Fisheries and Environment
- Ezemvelo KZN Wildlife;
- Mount Currie Nature Reserve;
- Department of Agriculture and Rural Development;
- South African Heritage Resource Agency;

- Amafa Heritage Resources Institute;
- Harry Gwala District Municipality;
- The Greater Kokstad Local Municipality;

10.7 Notification of the Interested and Affected Parties (I&APs)

Section 41 of Chapter 6 of the EIA regulations have listed the different options, to be used when notifying the I&APs. The PP process for this project was conducted, as detailed in (***Table 10***) and indicated by the green blocks, as well as the process outlined in (***Table 11***).

Table 10: Notification of I&APs

All the Interested and Affected parties were notified of the application by-		
Fixing a notice board at the place conspicuous to and accessible by the public at the boundary, on the fence, or along the corridor of any alternative sites. *Appendix E: Onsite notices at strategic positions.*	**YES**	~~**NO/NA**~~
Any alternative site also mentioned in the application	~~**YES**~~	**NO/NA**
Has a written notice been given to-		
Landowner or person in control if the applicant is not in control of the land. *The (Applicant) The KZN DARD is the landowner of Kokstad ERF 1069, Kokstad Research Station.*	**YES**	~~**NO/NA**~~
The municipal councillor of the Ward in which the site and alternative site of the proposed activity. *The BID was sent to the Cllr: Ward 6 of the Greater Kokstad Local Municipality*	**YES**	~~**NO/NA**~~
The municipality which has jurisdiction in the area and other organs of state: *The BID was sent to the Greater Kokstad Local Municipality.*	**YES**	~~**NO/NA**~~
Placing an advertisement in-		
*Regional newspaper (**The Kokstad Advertiser:** 15/09/2022 Edition).*	**YES**	~~**NO/NA**~~
Onsite Notices: *Onsite notices have been placed at boundaries and intersections as well as strategic points*.	**YES**	~~**NO/NA**~~
Any official Gazette that is published specifically for providing public notice of applications	~~**YES**~~	**NO/NA**
One provincial newspaper, any official Gazette that is published with the purpose of providing public notice of applications.	~~**YES**~~	**NO/NA**

Table 11: Public Participation Process

Basic Assessment Public Participation
Identification of I&APS: Interested and Affected Parties (I&APs) have been identified throughout the process. Initial identification of I&APs includes state departments/organs, state agencies, adjacent properties servitudes owners/operators, municipality, and ward councillors.
Notification BIDs have been circulated to all identified I&APs informing them of the proposed development and the opportunity to comment (Proof of Circulation attached in ***Appendix E***).
Notification by Onsite Notices: The Onsite notices have been placed at boundaries and intersections as well as strategic points (***Refer to Appendix E: Onsite Notices***)
Notification by Newspaper Notices/Advert: An advertisement was placed on (***The Kokstad Advertiser:*** *15/09/2022 Edition*), attached on (***Appendix E***).
Registration of I&APS: Registration of I&APs was conducted from the period of 14 days, register attached on (***Appendix E***).
Public Participation Meeting: Public meeting was not held since the is within the KZN DARD Research station. The BID was given to the adjacent occupants adjacent occupants and properties and servitudes owners/operators, municipality, and ward councillors.
Circulation of a Draft Basic Assessment Report: The DFFE has received the draft Basic Assessment Report (DBAR), via online submission. The DBAR is circulated via email to all identified and registered I&APs. The Hard copy is placed at Kokstad Library for 30 days public review and comments. The DBAR is delivered and sent via email to relevant State Departments and Organs of State and their inputs and comments were requested. (Proof of circulation will be attached on the Final Basic Assessment Report in ***Appendix E***). The Proof of circulation will be attached on the Final Basic Assessment Report in (***Appendix E***).
Final Basic Assessment Report: All comments received from DBAR during the commenting period will be included in the Final Basic Assessment Report (FBAR) and attached in (Appendix E) comments and response report (CRR). The FBAR will be submitted to DFFE for Environmental Authorisation decision.

10.1 Comments from the registered Interested and Affected Parties (I&APs).

Section 43 of Chapter 6 of NEMA (EIA Regulations 2017) indicates that all I&APs are entitled to comment in writing on all reports produced by the applicant during the EIA process. This will bring the concerns raised to the attention of the applicant.

The I&APs were provided with the opportunity to raise their concerns and comments regarding the proposed development project. Firstly, a Background Information Document (BID) was sent to all relevant I&APs on the 7th of September 2022 as attached in (***Appendix E***). The onsite notices were posted onsite on 8th of September 2022. Notices were displayed in strategic positions in the project area in order to enhance accessibility from the public, as attached in (***Appendix E***). Following, the posting of onsite notices, the newspaper advert was published by (*The Kokstad Advertiser: 15/09/2022 Edition* as attached in (***Appendix E***). The DBAR is circulated for 30 days period. The I&APs were given a fair opportunity to comment public participation, and their comments are attached. All public participation activities are attached under (***Appendix E***).

Public participation activities and reports are attached in Appendix E (Public Participation).

11 DESCRIPTION OF BASELINE ENVIRONMENT

This section provides a general description of the status quo of the receiving environment in the project area. This serves to provide the context within which the Basic Assessment exercise was conducted. It also allows for an appreciation and identification of sensitive environmental features and possible receptors of the effects of the proposed project.

11.1 Climate

The Southern African region is divided into three climatic regions: Wet, dry, and moderate regions. In this regard the KwaZulu Natal encompasses the categories such as humid subtropical (*Cfa*), oceanic climate (*Cfb*), hot semi-arid climates (*BSh*) tropical savanna climate (*Aw*), subtropical highland oceanic climate (*Cwb*), but the most prevalent ones are *Cfa*, *Cfb*, *BSh* and Aw (Climate-Data.org). (Climate-Data.org).

The climate region of this study is referenced to Kokstad. The study district of Harry Gwala District has a varying driven by the varying altitudes which range from 3500m along the Drakensberg to 600m in the south-east of the district. The Greater Kokstad Municipality in the south-west comprise of annual mean temperature of 14°C, with severe frosts being common in winter and occasional snowfalls occurring in the areas of higher altitude. The warmest month of the year is January, with an average temperature of 17.8°C, while the lowest average temperatures in the year occur in July, when it is around 7.7°C, with a In Kokstad, there precipitation occurrence is widely distributed throughout the year, even in the driest month as its climate falls under *Cfb* and is classified as warm and temperate, with the mean annual precipitation of 995mm, experienced during summer season mostly December- January, but some precipitation also experienced even in dry season. The driest month is June, with 24mm, and the most wet period is December with a precipitation of a with an average of 151mm. The difference in precipitation between the driest month and the wettest month is 127mm. The study area has a Mean Annual Precipitation (MAP) of 225mm (Ezemvelo KZN Wildlife, 2014; Climate-Data.Org).

Figure 3: Kokstad climate graph over a 12-month period [Source: Climate-Data.Org]

11.1.1 Potential impact

The project deeply relies on climate and seasonal trends such as stream discharge since pipeline construction corridor is within the un-named stream. Due to various return periods and extreme events on stream associated with wet period, the excavation during the peak flow conditions will results to surface run-off, siltation and erosion within the project area during construction of an instream earth-filled dam.

Given the above-mentioned climatic trajectory (***Figure 3***), it is inferred that construction within instream and the riparian zone, will have minimal impact such as degradation of riparian and instream habitat when conducted between April and September. It is therefore imperative that measures to regulate the impact during construction, be detailed in an EMPr, and Aquatic Ecological Impact Assessment. It must also be noted that extreme weather events, caused by climate change, would impact the construction activities, work progress and the resilience of the engineering designs.

11.2 Surface Hydrology

The Harry Gwala District has three main catchments, namely the Mkomazi in the north, the central Mzimkhulu and the Mzimvubu catchment in the south, as well as the headwaters of the Mpambanyoni, Mtwalume and Mzumbe catchments located in the north-east. (Ezemvelo KZN Wildlife, 2014).

The study area is located in the Quaternary Catchments T32C, within the Pongola to Mtamvuna Water Management Area (WMA) 4.

The freshwater ecosystem within the Harry Gwala District comprises diverse rivers, dams wetlands, lakes as discussed below.

11.2.1 Rivers, dams and lakes

The river systems within the Harry Gwala District have its headwater from the Drakensberg Mountains. The headwater for Mkomazi River is at the Drakensberg Mountains and flows in a south-easterly direction entering the Indian Ocean near the town of Mkomazi, forming the northern boundary of the Ubuhlebezwe Municipality. The Mzimkhulu River also has its

headwater from the Drakensberg Mountains and as with the Mkomazi River flows in a south easterly direction entering the Indian Ocean near the town of Port Shepstone. The Mzimvubu River has its headwater from the mountainous area of the western portion of the Greater Kokstad Municipality, this river traverse both Kokstad and Eastern Cape Province, as it winds along the region to further to the east. These rivers are categorised as the free-flowing rivers (perennial rivers). The Greater Kokstad region is also drained by several tributaries including the Gungununu, Mzintlava, Ndawana, Mfelamadoda, Krom, and Riet Rivers (Ezemvelo KZN Wildlife, 2014).

The study area drains into perennial unnamed tributary identified as a likely receiver of impacts from the proposed instream earth-filled dam to be constructed and include the construction of a 200m pipeline. The unnamed tributary flows downstream and eventually join the NFEPA Mzintlava River. Various additional drainage non-perennial streams drain to this unnamed stream and occur within the 500m regulated buffer zone of the development. These tributaries flow in a south to south-easterly direction before joining the NFEPA Mzintlava River downstream. The proposed dam construction is also located within a River FEPA area. (***Figure 4***).

The analysis of the overall Eco Status of the assessed unit within the instream and riparian habitat is in a moderately modified (*Class C*) condition. A noticeable difference was observed at this site compared to the upstream site with disturbance impacts being more prominent in the former. The primary impacts affecting the instream and riparian habitat are associated with water abstraction, water quality and channel modification. A water pump was situated at this site and used to supply water to the farm offices. A dirt road crossing traverses a portion of this site with definite impacts to the channel and evidence of sedimentation. Bank erosion was also observed along with invasive plant alien species within the riparian zone. This included *verbena rigida*, and *Cirsium vulgare* which are known to invade grasslands, riverbanks and wetlands.

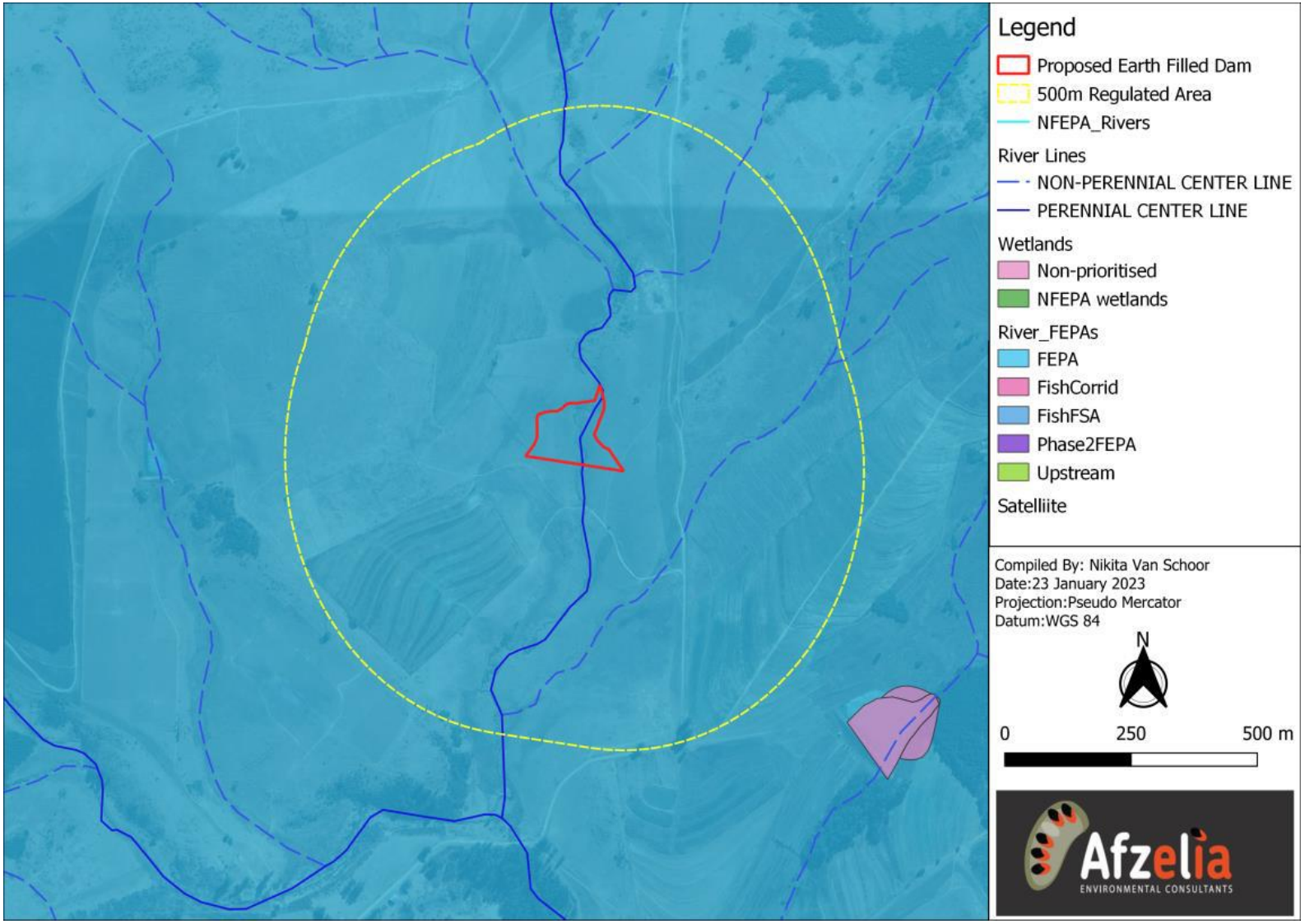

Figure 4: General drainage and River FEPA coverage within proximity to the study area

11.2.2 Wetlands

As discussed above in (***Section 10.2***), the major wetlands systems at Harry Gwala District are mainly formed at the large areas of low-lying plains draining from the west of the district. The Harry Gwala District has several large wetland systems including: the Pholela, Ngwangwane and Ndawana systems in the north western section of the District in the foothills of the Drakensberg; The Kromrivier and Mzintlanga systems in the southern area of the District, which includes the Franklin Vlei; to the north the Ntsikeni Nature Reserve and its extensive wetland system ; and to the north east the Upper and little Bisi system in the Umzimkhulu Municipality; as well as several wetlands in the Ingwe and Ubuhlebezwe Municipalities. (Ezemvelo KZN Wildlife, 2014).

Within the section of the study area, the NFEPA dataset, Ezemvelo KZN Wildlife and SAIIAE showed that there were no wetland systems within 500m coverage of the project area (***Figure 5***).

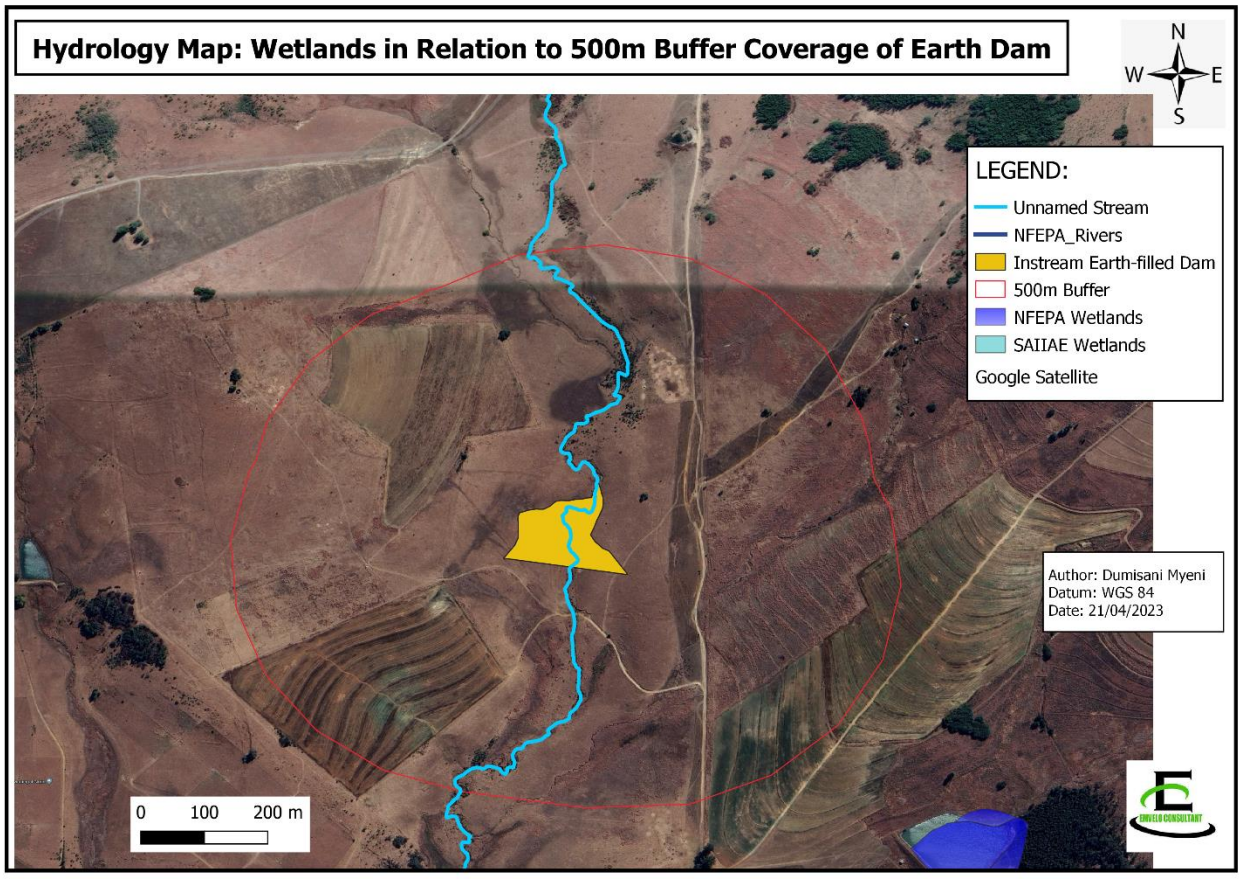

Figure 5: Map showing Wetlands in relation to 500m buffer of Earth Dam

The infield riverine habitat delineation provided that no wetlands, fish corridors, or upstream management areas are located within the development buffer zone. The riparian zone has been delineated (***Figure 6***) and is largely surrounded by *Leucosidea sericea*. This small tree species can grow up to 7m and is often grazed on by cattle and sheep. The trees within the upstream site were relatively small suggesting that they may have been previously grazed upon and therefore are in early stages of growth. Additional vegetation types encountered included grassland species, wetland species and *crocosmia* species.

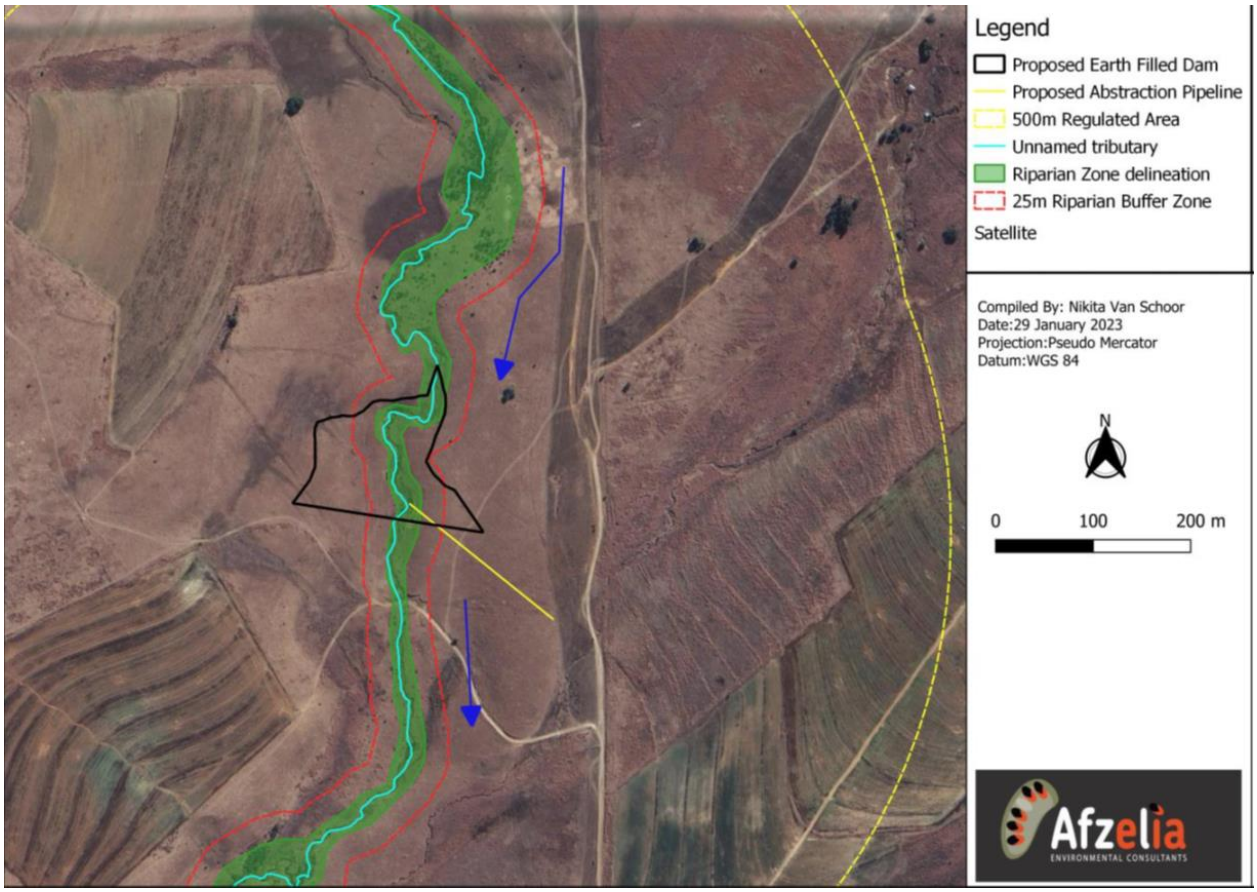

Figure 6: Map showing delineated riparian zone for unnamed stream

11.2.3 Potential impacts of the project hydrological features

The construction of the instream earth-filled dam will involve the excavation within instream and riparian habitat. any construction within the watercourse is considered environmental sensitive, as this could result in riparian incision, banks inundation, stream flow reduction, and downstream pollution, if proper mitigation measures and good construction practice are not

adhered to. Therefore, measures to regulate the impact that result during construction is described in the EMPr, and Aquatic Ecological Impact Assessment.

11.3 Ground Water

The proposed construction will take place within the instream habitat, and riparian habitat, it is therefore given that the riparian habitat has a perch water static ground water level is at approximately 1m below EGL.

11.3.1 Potential Impacts

The potential to groundwater contamination as a result of spillage of hydrocarbon from the excavators etc, is likely during the construction. The groundwater seepage onsite at riparian habitat could be encountered at approximately less than 1m below EGL. Potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground. Therefore, measures to regulate the impact that result during construction is described in the EMPr, and Aquatic Ecological Impact Assessment.

11.4 Biomes

The Harry Gwala District traverses five biomes, namely: Forest, Fynbos, Grassland, Savanna and Wetland and contains 28 vegetation types. (Ezemvelo KZN Wildlife, 2014). The study area within the proposed KZN DARD Earth-filed Dam is made up of open Grassland Biome (***Figure 7***), overlain by East Griqualand Grassland.

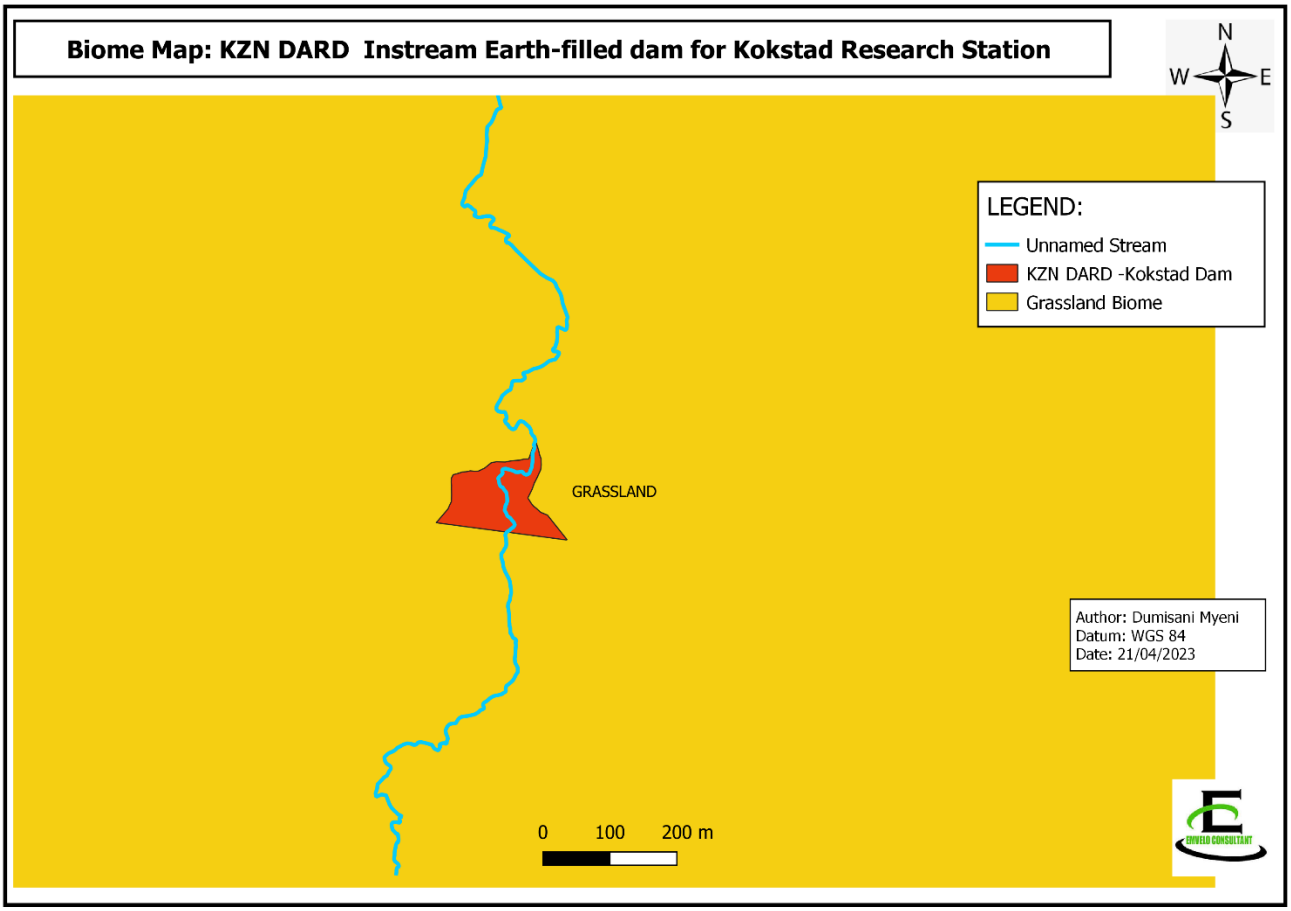

Figure 7: Map Showing Dominant Savanna Biome within project area

11.5 Flora

As discussed in (***Section 9.3***), the vegetation communities within Harry Gwala District are stratified according to respective biomes. The vegetation types with high conservation status within the district are: KwaZulu-Natal Sandstone Sourveld, Midland Alluvial Woodland and Thicket all with a conservation status classified as '*Critically Endangered*'. The Eastern Mistbelt Forests, Mabela Sandy Grassland, Midlands Mistbelt Grassland, Moist Coast Hinterland Grassland all with the conservation status classified as '*Endangered*'. The Dry Coast Hinterland Grassland, East Griqualand Grassland, Mooi River Highland Grassland, Southern KwaZulu-Natal Moist Grassland all with the conservation status classified as '*Vulnerable*'. The Harry Gwala District also support a number of Red Data species, including one (1) Critically Endangered species, *Helichrysum citricephalum*, which is found in the Ixopo area in one know location, and two (2) Endangered species, *Ocotea bullata* (Black Stinkwood) which occurs in high Afromontane forests and *Disa scallyi* (orchid family) which occurs in high

altitude grasslands wetlands or stream edges. Moreover, biophysical habitat and micro climatic conditions is strongly linked to highly variable topography characteristic of the district. The warmer and drier north facing slopes supports the grassland habitat, whereas the cooler and wet south facing slopes such as escarpments and sheltered kloofs support the supporting indigenous forest habitat. This mosaic of habitat provides opportunity for a diversity of biota with different habitat requirements to exist within relatively smaller areas, in comparison to regions with flat topography (Ezemvelo KZN Wildlife, 2014).

The vegetation type with the study area main as depicted by (***Figure 8***) is overlain by East Griqualand Grassland (*Gs12*) '*Vulnerable*' with (23%) conservation target. (Mucina & Rutherford, 2006).

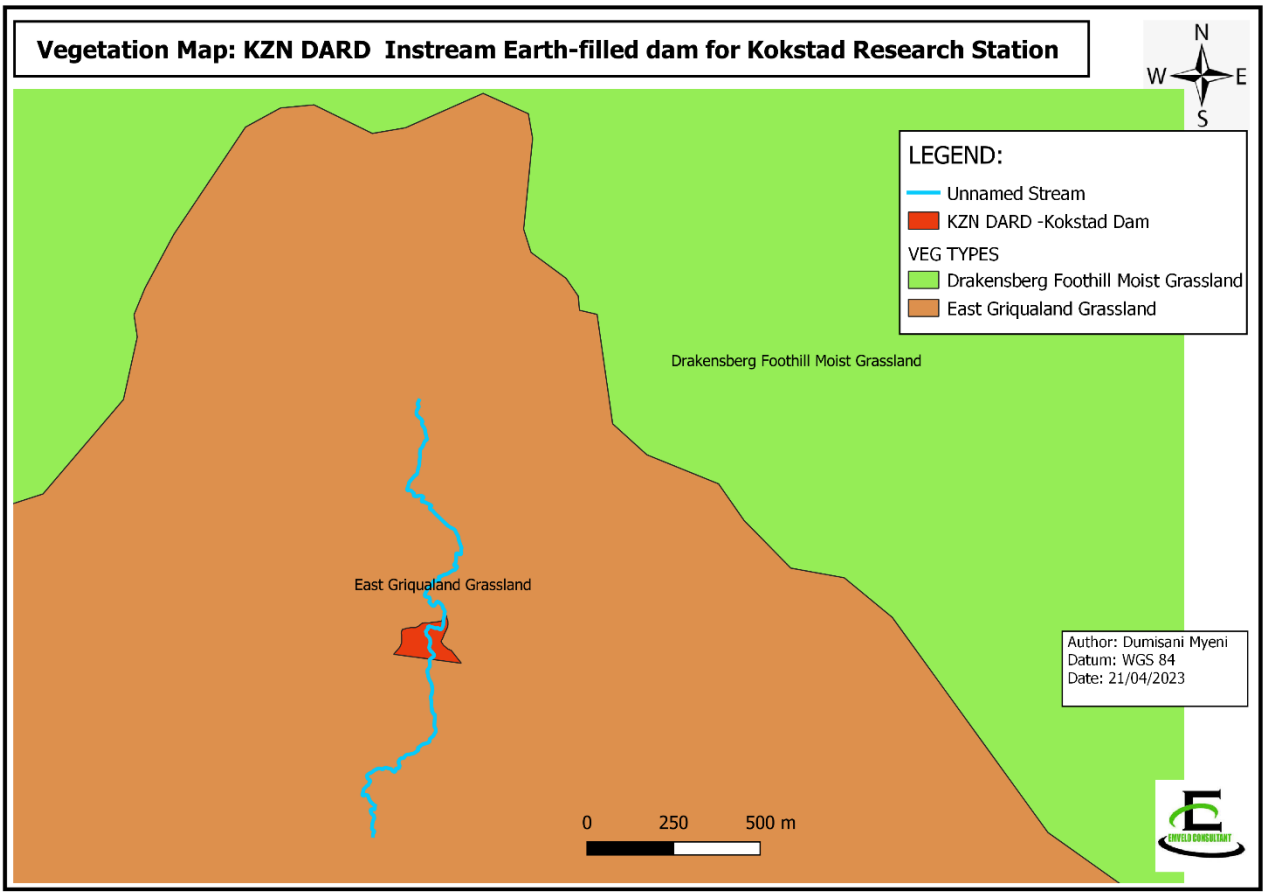

Figure 8: Map showing dominant the vegetation type within the study area

Three (3) discrete habitat types were delineated within the assessment area, namely, riparian and instream habitat, and grassland habitat. The grassland provides the grazing filed, hence can be considered agricultural. The riparian habitat is dominated by shrubs such as *Leucosidea sericea* and sedges such as *Cyperus obtusiflorus var. flavissimus*.

The infield investigation within the construction corridor did not observe plant Species of Conservation Concern (SCC) within construction corridor and within the Project Area of Influence (PAOI) outside the constriction corridor. However, the plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes Kniphofia *linearifolia*. Since this project involves a construction of a dam and all plant species on site would be destroyed, an Ordinary Permit will be required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the proposed site. A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these plants can be relocated to.

Alien invasive plant species on the study area were observed to occur in clumps, scattered distributions or as single individuals. Invader and weed species on site must be controlled to prevent further infestation and it is recommended that all individuals of invader and weeds species (especially Category 1b) must be removed and eradicated.

The field assessment within the PAOI observed that vegetation communities with this area of Kokstad Research Station Farm consist of the following plant species, as listed in ***Table 12*** below.

Table 12: Plant Species Recorded within Kokstad Research Station Farm PAOI

Scientific name	Common name	Ecological status	Growth Form
Abildgaardia ovata	Flatspike sedge	Least concern	Grass
Acacia mearnsii	Black wattle	Category 2 AIS	Tree
Acalypha glandulifolia	Ungibonisele	Least concern	Herb
Acalypha peduncularis	Ikhothe	Least concern	Herb
Arctotis arctotoides	Marigold	Least concern	Herb
Berkheya purpurea	Purple berkheya	Least concern	Herb
Berkheya multijuga	Thorny mountain thistle	Least concern	Herb
Berkheya speciosa	Skraaldissel	Least concern	Herb
Berula repanda (=Sium repandum)	Water Parsnip	Least concern	Shrub
Calpurnia sp			Shrub

Scientific name	Common name	Ecological status	Growth Form
Chaetacanthus burchellii	Fairy Stars	Least concern	Herb
Cirsium vulgare	Scotch thistle	Category 1b AIS	Herb
Clutia sp			Herb
Conium chaerophylloides	Poison Hemlock	Least concern	Herb
Crabbea angustifolia	Prickle head	Least concern	Herb
Cynodon dactylon	Couch Grass	Indigenous/ Least concern	Grass
Cyperus obtusiflorus var. flavissimus	Yellow Sedge	Least concern	Herb
Diclis reptans	Dwarf Snapdragon	Least concern	Herb
Diospyros lycioides	Bluebush Star-apple	Least concern	Shrub
Eragrostis curvula	Weeping lovegrass	Least concern	Grass
Felicia filifolia	Fine-leaved Felicia	Least concern	Herb
Gazania krebsiana	Common Gazania	Least concern	Herb
Gerbera ambigua	Griqua gerbera	Least concern	Herb
Gladiolus sp			Herb
Haplocarpha scaposa	False gerbera	Least concern	Herb
Helichrysum aureonitens	Golden Everlasting	Least concern	Herb
Helichrysum callicomum	Motoantoanyane	Least concern	Herb
Helichrysum rugulosum	Wrinkly Everlasting	Least concern	Herb
Hermannia depressa	Rooiopslag	Least concern	Herb
Hilliardiella aristata (=Vernonia natalensis)	Silver vernonia	Least concern	Herb
Hyparhenia hirta	Thatch Grass	Least concern	Grass
Hypochaeris radicata	Hairy wild lettuce	Weed	Herb
Kniphofia cf linearifolia	Common Marsh Poker	Least concern	Herb
Kohautia amatymbica	Tremble Tops	Least concern	Herb
Lactuca inermis	Small Marsh Daisy	Least concern	Herb
Leucosidea sericea	Old wood	Least concern	Shrub
Ipomoea ommaneyi	Cattle sweet potato	Least concern/Medicinal	Herb
Ipomoea oblongata	Ubhoqo	Least concern/Medicinal	Herb
Lasiosiphon kraussianus (= Gnidia kraussiana)	Yellow heads	Least concern	Shrub
Ledebouria ovatifolia	Flat-leaved African hyacinth	Least concern/Medicinal	Herb
Pellaea calomelanos	Hard fern	Indigenous/Least concern	Fern
Pentanisia prunelloides	Broad-leaved Pentanisia	Least concern	Herb
Pentanisia angustifolia	Narrow-Leaved Pentanisia	Least concern	Herb
Pimpinella caffra	Ibheka	Least concern	Herb
Polygala sp			Herb
Pyracantha angustifolia	Narrowleaf firethorn	Category 1b AIS	Shrub
Richardia brasiliensis	Tropical richardia	Weed	Herb
Rubus rigidus	Wild Bramble	Least concern	Herb
Searsia discolor	Grassveld currant	Indigenous/Least concern	Shrub
Searsia pyroides	Common wild currant	Least concern	Shrub
Senecio cf. latifolius	Molteno-Disease Plant	Least concern	Herb
Senecio retrorsus	Grass Stagger's Weed	Least concern	Herb
Senecio scitus	Elegant Ragwort	Least concern	Shrub
Scabiosa columbaria	Small scabious	Least concern	Herb
Schizoglossum hamatum	Buttercup	Least concern	Herb
Solanum incanum	Bitter Apple	Weed/Exotic	Herb
Stachys aethiopica	African Stachys	Least concern	Herb
Taraxacum officinale	Common dandelion	Weed	Herb

Scientific name	Common name	Ecological status	Growth Form
Themeda triandra	Red grass	Least concern	Grass
Typha capensis	Bulrush	Least concern	Aquatic Herb
Verbena bonariensis,	Purpletop vervain	Weed/exotic	Herb
Verbena rigida	Slender vervain	Least concern	Herb

11.5.1 Potential Impacts

Potential impacts to vegetation could result from the vegetation clearance of 1.6ha for construction of KZN DARD Earth-filled Dam which will involve the clearance of vegetation at the riparian habitat and the CBAs. However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr, Terrestrial Biodiversity Impact Assessment, and the Wetland Habitat Impact Assessment.

11.6 Protected Areas and Biodiversity Sector Plan

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM: PAA) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable. Protected areas in South Africa are defined as parts of the landscape that are formally protected by law in terms of the NEM: PAA and managed primarily for the purpose of biodiversity conservation.

The Harry Gwala District falls within a bioregion which hosts a several of formally protected and other conservation areas, namely: uKhahlamba Drakensberg Park World Heritage Site; Coleford Nature Reserve; Highover Nature Reserve; Igxalingenwa Nature Reserve; Impendle Nature Reserve; Ingelabantwana Nature Reserve; Kwa-Yili Nature Reserve; Marutswa Nature Reserve; Marwaqa Nature Reserve; Mount Currie Nature Reserve; Ntsikeni Nature Reserve; Soada Forest Nature Reserve; The swamp Nature Reserve; Xotsheyake Nature Reserve; and several of private game reserves (Ezemvelo KZN Wildlife, 2014).

The study area does not fall within any of the formal Protected Areas (PA) and the nearest PAs are situated approximately 660m west of the project area, namely: Mount Currie Nature Reserve (**Figure 9**).

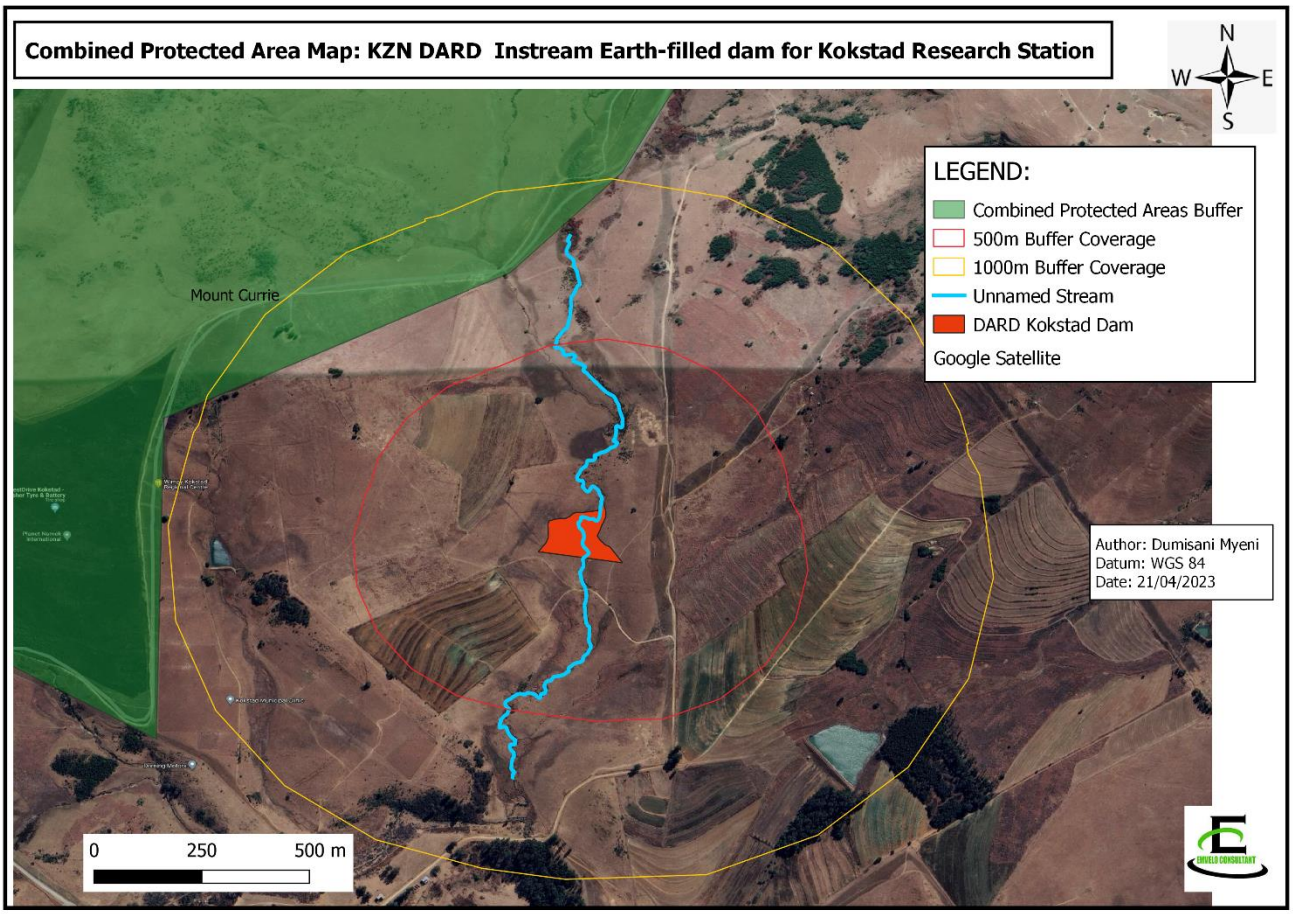

Figure 9: Map showing a buffer of a protected area near the project area

There are two main categories of areas that are required to meet conservation targets. These two main categories include Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The CBAs are crucial for supporting biodiversity features and ecosystem functioning and are required to meet biodiversity and/or process targets including corridors. The ESAs represent the functionality and not necessarily the entire natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within a Critical Biodiversity Areas (***Refer to table 13***).

It is estimated that threatened ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), Environmental Impact Assessments (EIAs) and other environmental applications (Mucina et al. 2006).

Table 13: Subcategories of CBA and ESAs [Source: Ezemvelo KZN Wildlife,2014]

Critical Biodiversity Areas (CBAs) **– Crucial for supporting biodiversity features and ecosystem functioning and are required to meet biodiversity and/or process targets**	
Critical Biodiversity Areas: Irreplaceable (CBA1)	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Areas: Optimal (CBA2)	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high-cost areas as much as possible (Category driven primarily by process but is informed by expert input).
Ecological Support Areas (ESAs) – **Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within Critical Biodiversity Areas.**	
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of Ecosystem Services.
Ecological Support Areas: Species Specific	Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites.
Ecological Support Areas: Buffers	Terrestrial areas identified as requiring land-use management guidance not necessarily due to biodiversity prioritisation, but in order to address other legislation/ agreements which the biodiversity sector is mandated to address, e.g., WHS Convention, Triggers Listing Notice criteria, etc.

According to the Ezemvelo KZN Wildlife (2016), the proposed development site falls within ESA and CBA1. Also, the PIO falls within the CBA2 (***Figure 10***).

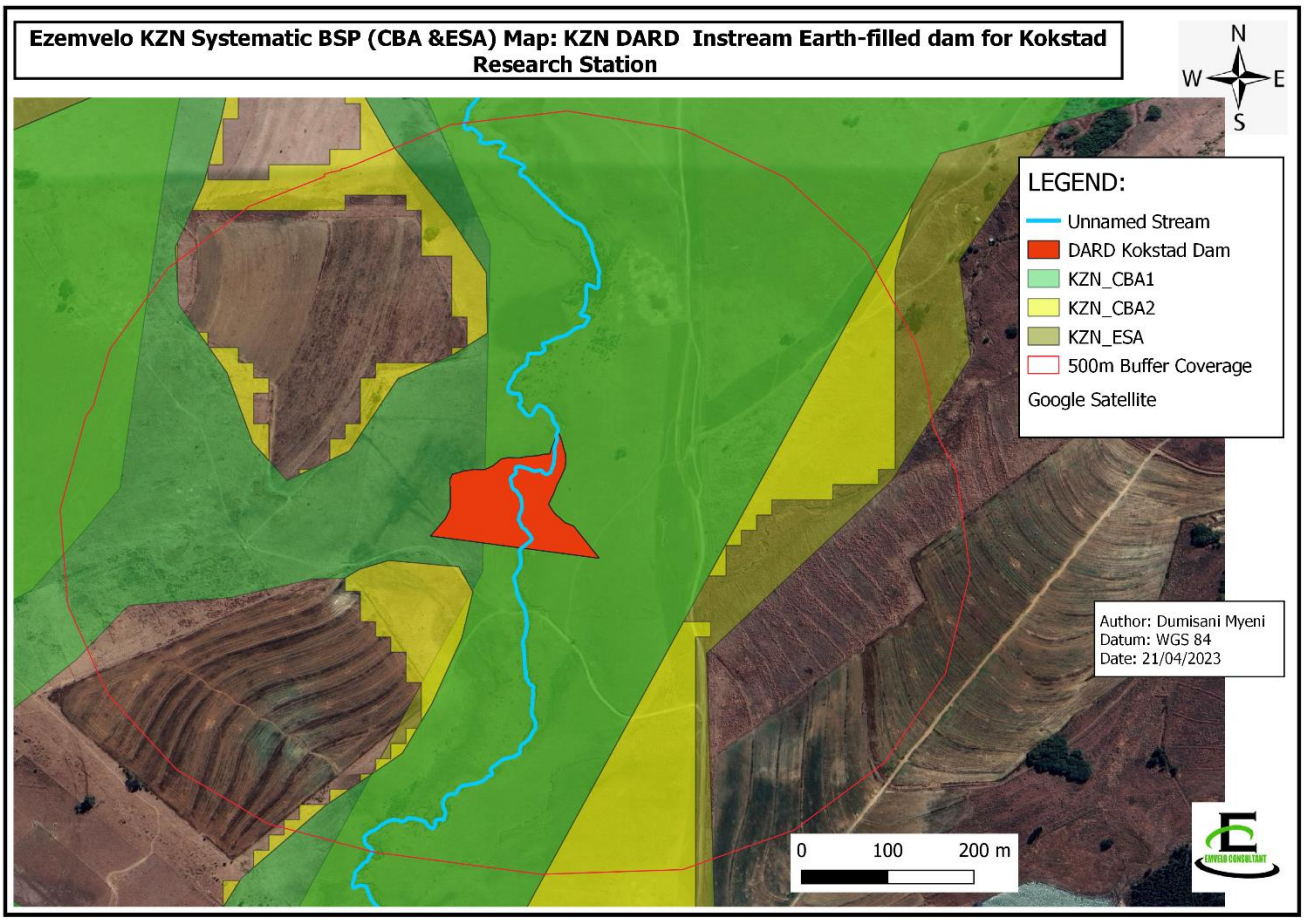

Figure 10: Sensitivity map showing CBAs and ESA within the project reach

11.6.1 Potential Impacts

The CBAs supports species habitat; therefore, it is important to note that intensive vegetation clearance at project site can lead to fragmentation, reduction, and loss of habitat as well as loss of plant species SCC and migration of animals away from the area. However, proper mitigation can be achieved through carefully implementation of recommendations given by the EMPr, and by Terrestrial Ecological Impact Assessment.

11.7 Fauna

The recorded faunal data for the Harry Gwala District indicates a number of Red List species, including five (5) Critically Endangered species, namely the Mistbelt moss frog, the Eurasian

Bittern, the Wattled Crane, the White-winged Flufftail and the Herbert's Velvet Worm, and Six (6) Endangered species, namely the Long-toed Tree Frog, the Cape Parrot, the Bearded Vulture and the Short-winged Katydid (Ezemvelo KZN Wildlife, 2014).

In addition, the desktop survey interrogated the potential faunal species that could be found on the study area are those which have been recorded in the Quarter Degree Square 3029CB (***Figure 11***) obtained from FitzPatrick Institute of African Ornithology (2023).

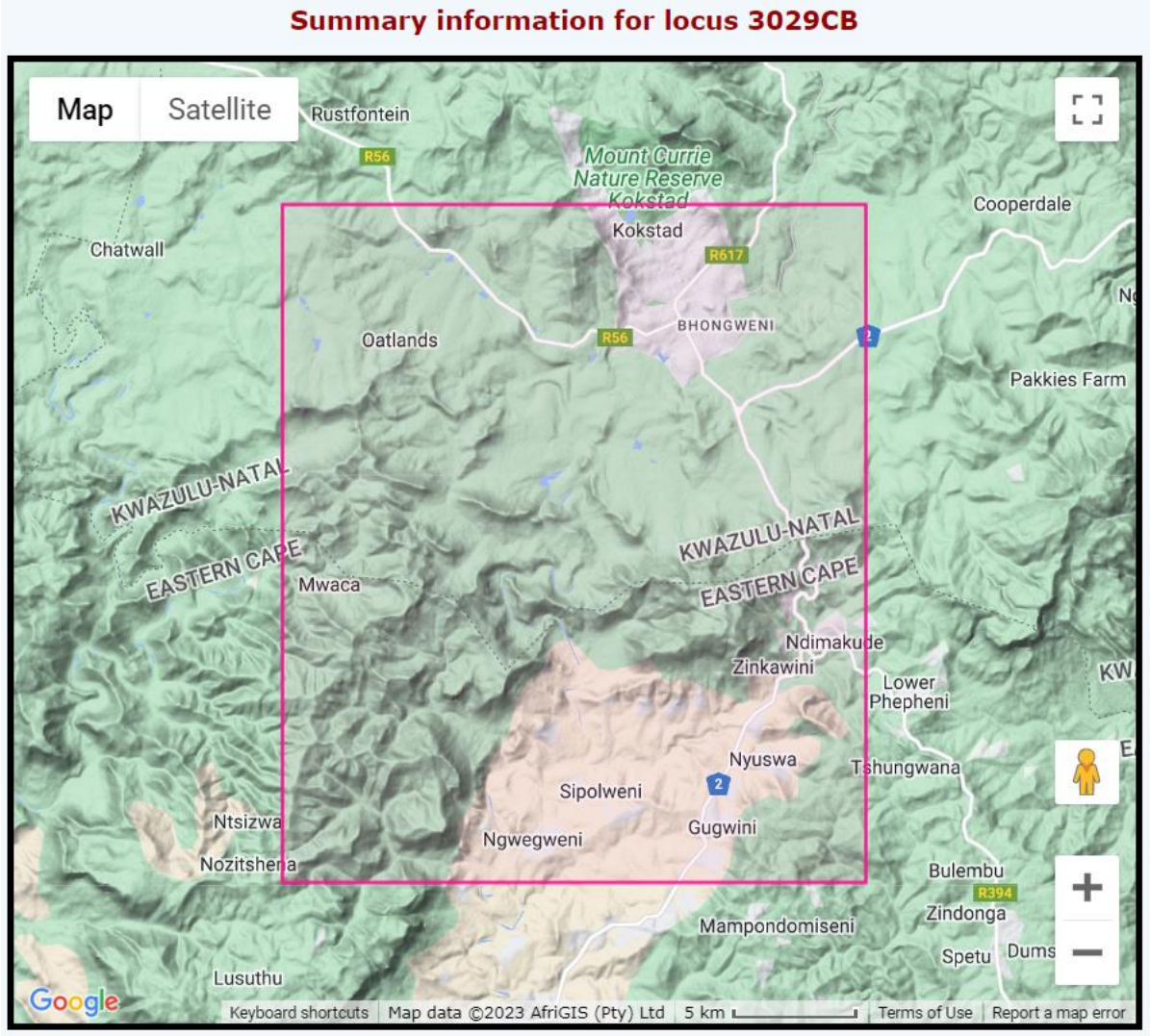

Figure 11: Quarter Degree Square 3029CB [Source: ADU, 2022]

The desktop observed the probability of occurrence of 9 bird species, to which one (1) with conservation as '*Endangered*', one (1) '*Least concern*' and the remaining not in red data list

category. There results showed the existence of 11 frog species all listed as '*Least concern'*. The existence of 113 *Lepi* (butterfly) species to which one (1) classified as '*Vulnerable*' and the rest classified as 'Least Concern'. The existence of 22 of Odonata (dragonfly) species with conservation status classified as '*Least Concern'*. The existence of 19 reptile species to which one (1) classified as '*Near Threatened'* and the remaining are '*Least concern'*. There are 16 mammal species recorded to which one (1) classified as '*Endangered*' and other one (1) classified as '*Near threatened'* while the remaining are classified as '*Least concern'*.

The field investigation by Terrestrial Ecological Assessment observed the existence of mammal species such as Otter due to scats of an Otter which were observed on site. Observed 29 bird species including one red data specie which were common and widespread and typical of grassland biome. Only one reptile species was recorded during the survey, namely Rhombic Night Adder (*Causus rhombeatus*). Three frog species were recorded along the stream, namely Raucous toad (*Bufo rangeri*), Bronze Caco (*Cacosternum nanum*) and Bubbling kassina (*Kassina senegalensis*). No frog Species of Conservation Concern were recorded on site. The following invertebrates species were recorded on the proposed development site, namely Tiger Fruit Chafer (*Atrichelaphinis tigrine*), Pirate (*Catacroptera cloanthe cloanthe*), African ringlet or common three-ring (*Ypthima asterope hereroica*), Pyrgomorphid Grasshopper (*Ochrophlebia caffra*) and Table Mountain Beauty (*Aeropetes tulbaghia*). No invertebrates species of conservation concern were recorded during the survey.

A standard sampling method was implemented which yielded no fish within the assessed area. The sampled tributary was also relatively small and was not a major order river in which fish species are more likely to be expected.

11.7.1 Potential Impacts

Vegetation clearance within the riparian and instream, and grassland habitat for the purpose of construction of earth-filled dam could modify natural integrity of the species habitat, locality fauna disturbance might occur and could led to fragmentation, reduction, and loss of habitat as well as the ecological corridors and connectivity. However, proper mitigation can be achieved through carefully implementation of recommendations given by the EMPr, Terrestrial Ecological Assessment.

11.8 Topography

The Harry Gwala District has a varied topography characterised by a diverse terrain consisting of Drakensburg plateau, mountain terrain and low-lying foothills, high hills and incised river valleys, that extends from the largely flat topography in the east moving to more rugged terrain in the west. Elevation across the District ranges from 600 mAMSL in the south-east, extending to approximately 3 500 mAMSL at the Drakensberg plateau along the western border. The south of the district (Greater Kokstad Municipality) has gentle to moderately rolling topography moving to mountainous terrain in the south-west. The highly variable topography characteristic of the district supports the biophysical habitat and micro climatic conditions, as the warmer and drier north facing slopes supports the grassland habitat, whereas the cooler and wet south facing slopes such as escarpments and sheltered kloofs support the supporting indigenous forest habitat. This mosaic of habitat provides opportunity for a diversity of biota with different habitat requirements to exist within relatively smaller areas, in comparison to regions with flat topography (Ezemvelo KZN Wildlife, 2014).

The study area is at Kokstad located within the south-western region of the Harry Gwala District and is characterised by high altitudes and the undulating gentle to moderately rolling topography moving to mountainous terrain with the altitude ranging between 1360 and 1400mAMSL. The Dam is located within 1380mAMSL (***Figure 12***), and the site is characterised of incised stream running across the location of the proposed instream dam.

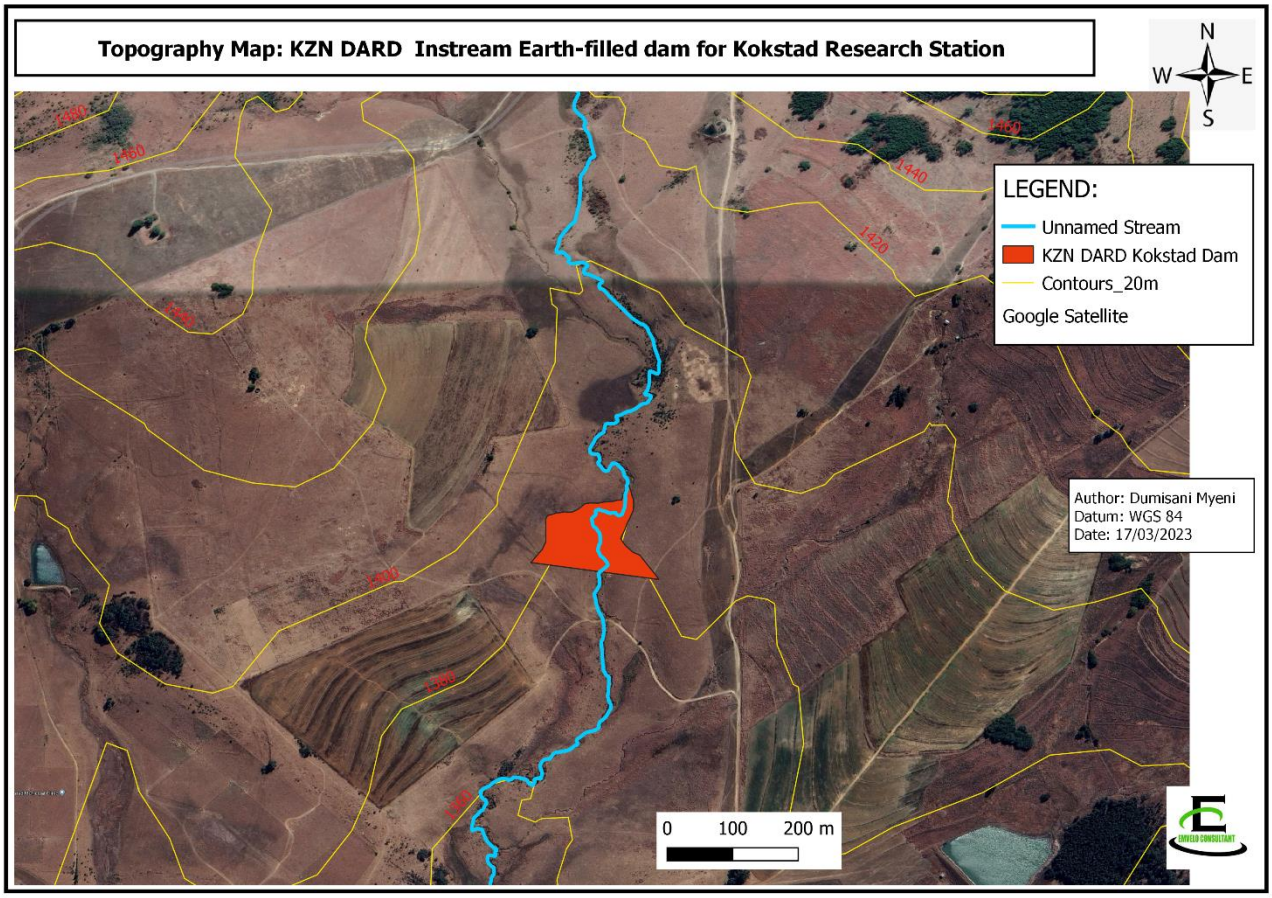

Figure 12: Contour Map showing elevations project area

11.8.1 Potential impacts

The vegetation clearance at slopes and incised valley can have surface run-off propensity. Notwithstanding, the soil survey and land use assessment investigation was undertaken to determine the necessary mitigation and construction methods where the cut slopes will be required. This will be addressed in accordance with in-sutu material erodibility, excavatibility, rippability, and run-off propensity. However, proper mitigation can be achieved through carefully implementation of recommendations given by the Soil Resource Assessment and EMPr.

11.9 Geology

The Harry Gwala District's geological features are stratified and with intrusion across the regions, which vary widely according to their topographical location. Sedimentary derived soils are found on the east of Underberg and Himeville and tend to be shallow and dry or poorly drained. Around the Kokstad the soils are highly variable ranging from deep, highly leached, strongly acid soils to shallow badly drained soils. Where soils are shallow fertility is low, but such soils have good physical properties. Around the edges of Ubuhlebezwe Local Municipality soils are of the Table Mountain Sandstone plateau, with rugged low potential soils in the north of the Local Municipality. On the eastern boundary of the Municipality the soils are acid and leached. They consist of shallow sandy soils derived from the Table Mountain series with heavier soils are derived from dolerite and *Dwyka* Tillite. Small pockets of high potential soils do occur within the Municipality however erosion on the steep slopes is problematic in these areas (Ezemvelo KZN Wildlife, 2014).

The study area is situated at Kokstad which is located at the south-western region of Harry Gwala District. The dominance geological formation comprises the Mudstone *of* the Dwyka Group and Karroo Supergroup with dolerite intrusion, as the project area is within a stratified geological formation forming a belt between of Mudstone Geological Groups Formation (***Figure 13***). The proposed site lies on the mudstones and shales of the *Adelaide* Subgroup, Beaufort Group.

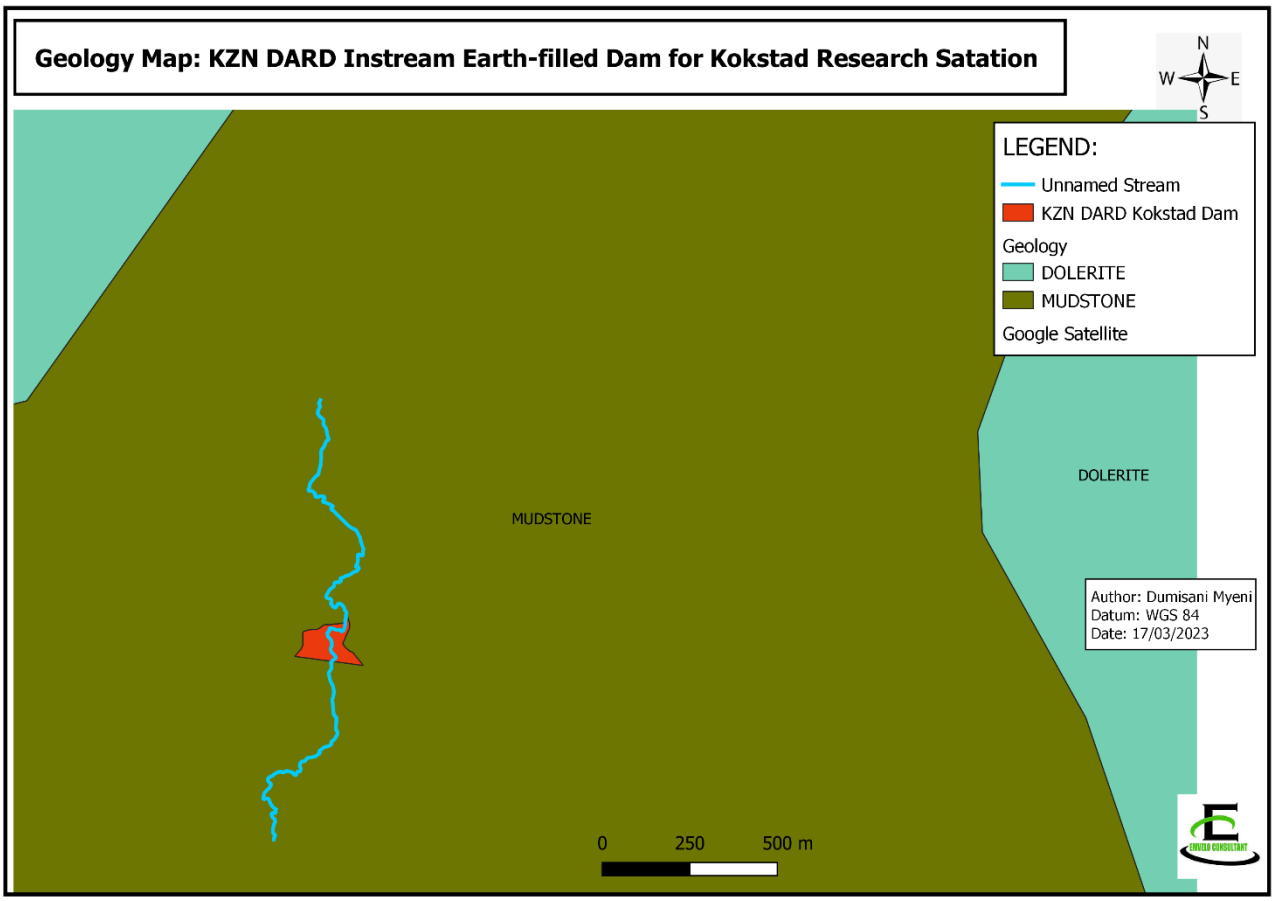

Figure 13: Map showing a dominance geological formation within study area

The infield investigation indicated that study area is bisected by an incised water channel and characterised of gentle slopes with some signs of gully erosion. The soils within the proposed dam footprint comprise a mix of moderate to well drained soils with some shallow soils where parent rock is found close to the surface (outcrops). The soil depth is mainly varying from 500mm to 2 300mm with an apedal structure which is easily excavatable. The prominent geological material is characterised of dolerite and dyke group formation. The sign of wetness within the study area indicates the fluctuation of water table.

11.9.1 Potential impacts

The construction activities for instream earth-filled dam include bulk earthwork excavation to determine the dam core trench volume of 808. 69m^3; earth banks height of 8.56m; and bank volume of 13 752.43m^3. This activity may have impact on geological stability within the vicinity

of earth-filled dam, thus result in run-off erosion. Therefore, the mitigation measures given by the Soil Resource Assessment and EMPr must be adhered to in order to minimise any potential significant impacts that may arise.

11.10 Visual environment and land use character

Subject to the direct visual influence of the proposed project, the zone of visual influence can be experienced at different scales by receptors located at various distances from the site. The viewshed area and zone of visual influence for new developments is classified as follows:

- High visibility - Visible from a large area (several square kilometres, >5km radius)
- Moderate visibility - Visible from an intermediate area (several hectares, 2.5 – 5 km radius).
- Low visibility - Visible from a small area around the project site (<1km radius).

Three (3) discrete habitat types were delineated within the assessment area, namely, riparian and instream habitat, and grassland habitat (***Figure 14***). The proposed development (construction of the earth-filled dam) will take place within the farm to support the farming activities. Therefore, the proposed development will have 'Low visibility" and no visual impact as the development will be streamlined with the current land use.

During construction activities it is likely that the project could be considered '*low visibility'* as it can be visible from a small area around the project site (<1km radius). However, the visual impact will be temporary as will only be experience during construction, due to the site camp establishment is considered to have no negative visual impacts, as the proposed infrastructure will be concentrated within existing developed area or make use of Kokstad Research Station Facilities.

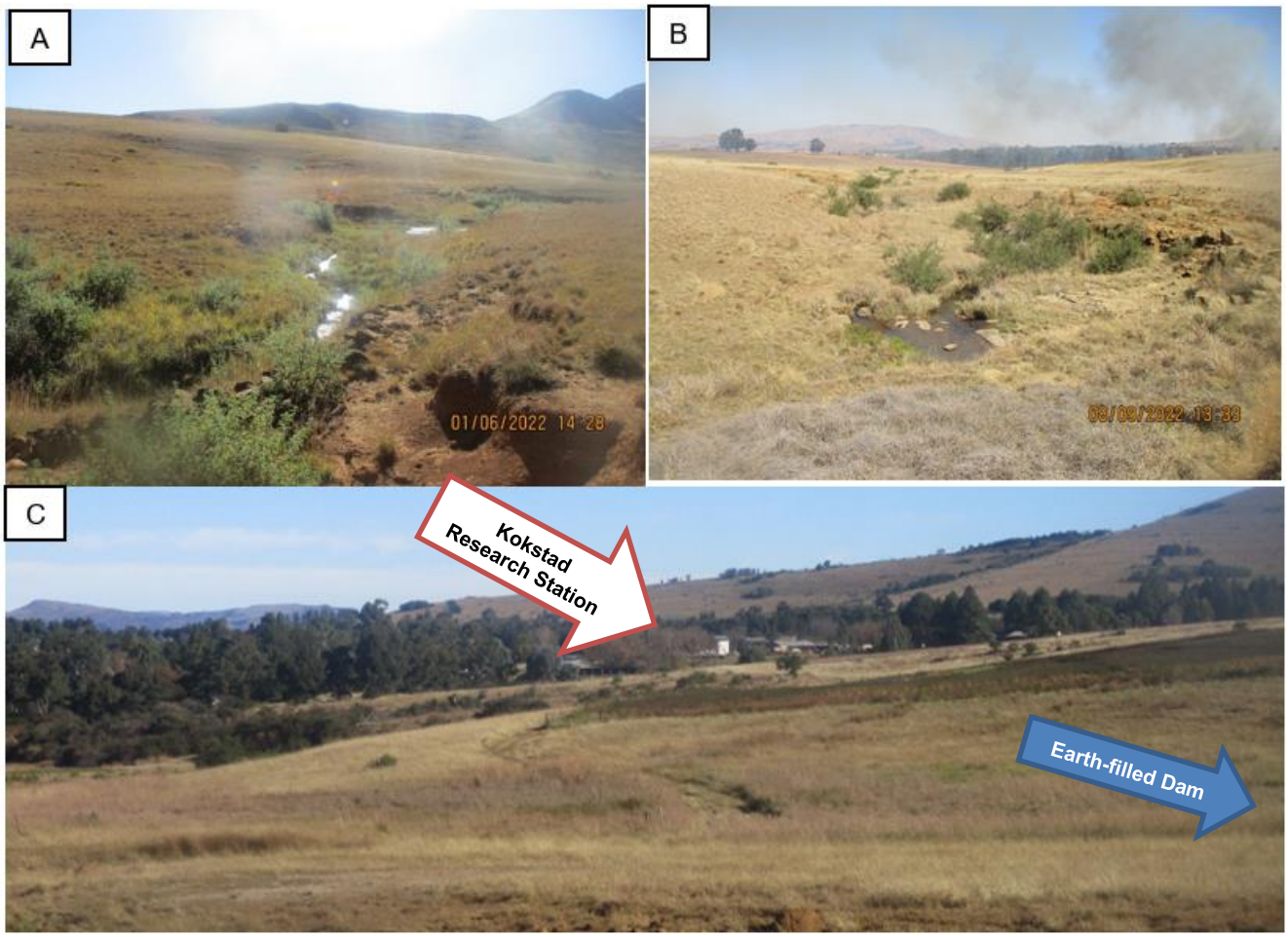

Figure 14: Visual Characteristics of the Project Area

Notes: *Frame A & B, depict the proposed instream earth-filled dam site, showing the stream. Frame C depict overview of the project area also showing the Kokstad Research Station offices within the farm.*

11.10.1 Potential Impacts

The proposed development (construction of the earth-filled dam) will take place within the farm to support the farming activities. Therefore, the proposed development will have 'Low visibility" and no visual impact as the development will be streamlined with the current land use. The visual impacts could only be experienced during construction through movement of construction machinery, storage of materials/equipment and bulk earthworks excavated spoil materials, which can only be viewed at the local scale. Also, the dust and other visibility aspects will be managed through proper implementation of recommendations contained in EMPr.

11.11 Heritage and cultural aspects

The heritage and cultural attributes of the Harry Gwala District stems from the intrinsic heritage largely emanates from the Drakensburg Mountain, situated in the western part of the district, to which the uKhahlamba Drakensburg Park is established. The Archaeological Period of the Drakensburg evolves around Early Stone Age (*more than 2 million years ago to >200 000 years ago*), Middle Stone Age(*<300 000 years ago to >20 000 years ago*), Late Stone Age*(<40 000 years ago up to historical times in certain areas*), Iron Age (*c. AD 200 - c. AD 1840*) and Rocks Paintings (*around 1830 AD*). It is observed that the sites belonging to this period in the Drakensberg are mostly characterised by a few surface scatters and individual stone tools, usually in the close vicinity of water, as well as the San rock art which is regarded by many to be the finest prehistoric rock art in the world, having a high degree of complexity of meaning, and including some of the last rock art ever painted (uKhahlamba Drakensberg Park, 2019).

The Archaeology of the Harry Gwala District can be attributed to Nguni settlement and Griqualand establishments. The Iron Age communities in South Africa, also known as the farming communities, only arrived in modern day South Africa approximately 2000 years ago (Huffman, 2007). In the KZN province, farming communities only arrived around AD1300. They contribute to the multiple historical layering scattering within the borders of the KwaZulu Natal province. The subsistence of these communities was partly anchored on iron tool production and the resulting tools were either used domestically or used as trade goods (Huffman 2007). The term “Iron Age” has become obsolete in the current archaeological fraternity because of its derogative nature. The designation “Farming Communities” has become viable mostly because these communities also depended on cattle and crop farming.

Archaeological and Cultural Heritage assessment has been considered viable as the site has a ‘*Very High*’ sensitivity theme, as depicted by Environmental Screening Tool (***Figure 15***).

Figure 15: Archaeological and Cultural Heritage Sensitivity Theme

The SAHRIS palaeosensitivity provides that, the ***Red,*** 'Very High' - field assessment and protocol for finds is required; ***Orange/yellow***, '*High*'- desktop study is required and based on the outcome of the desktop study, a field assessment is likely; ***Green***, '*Moderate*' - desktop study is required; ***Blue***, '*Low*' - no palaeontological studies are required however a protocol for finds is required; ***Grey***, '*Insignificant/Zero*' - no palaeontological studies are required; ***White/Clear***, '*Unknown*' - these areas will require a minimum of a desktop study. As more information comes to light.

A preliminary desktop study for palaeontological fossils sensitivity of the proposed site, reveals that the site falls within a proximity of the stratified belt of '*Very High'* Sensitivity (***Figure 16***) as result an assessment of the potential impacts to possible palaeontological resources was considered.

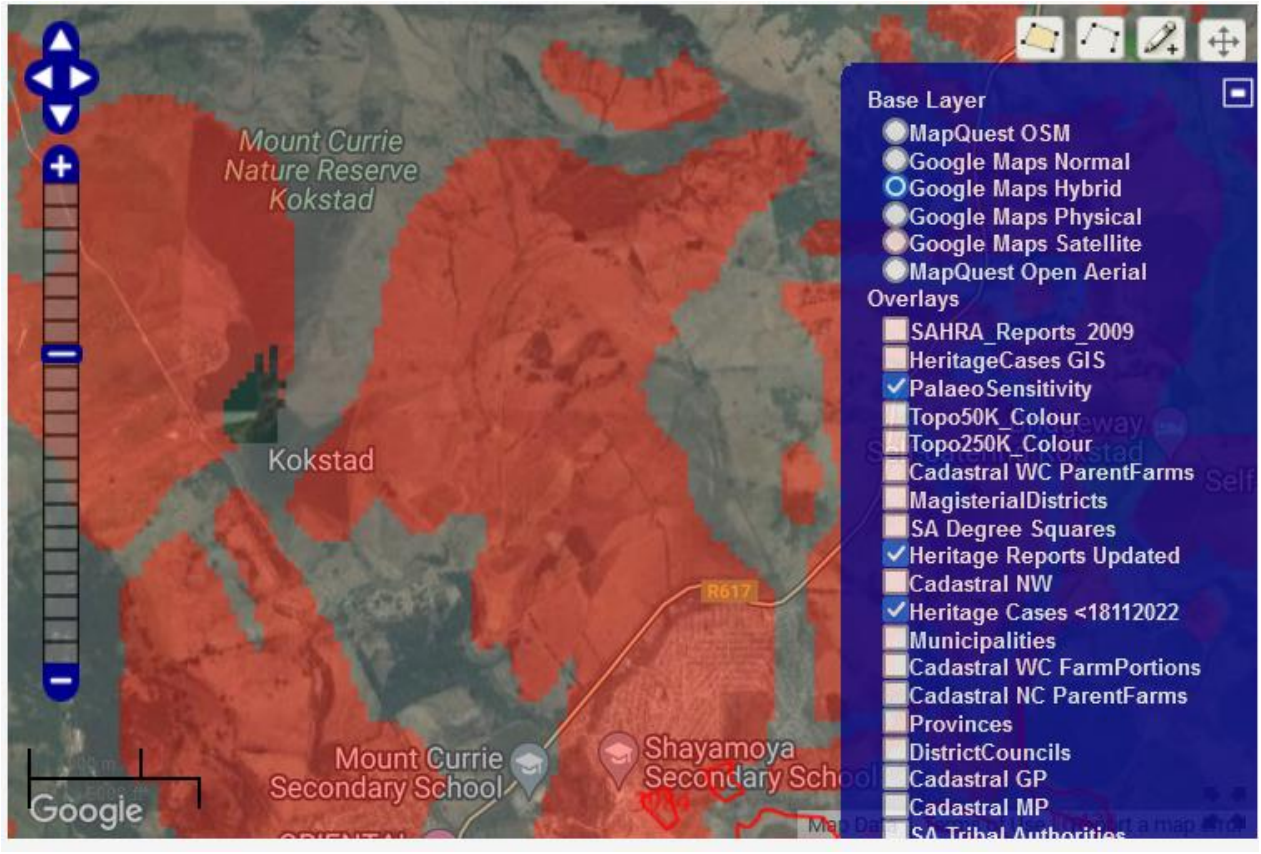

Figure 16: Palaeontological Sensitivity of the study area

[Source: https://sahris.sahra.org.za/node/add/heritage-cases]

Moreover, the environmental screening tool also describe that the section of the study area as having '*Very High*' paleontological sensitivity theme (***Figure 17***). Therefore, the Archaeological and Cultural Heritage Assessment, and Paleontological Assessment were conducted.

Figure 17: Environmental Screening Tool Palaeontological Sensitivity

Archaeological resources may still be discovered during excavations or any ground-breaking activities during the construction phase.

The inquiry has been lodged with South African Heritage Resource Agency care of Amafa Heritage Resource Institute to ascertain whether there are any cultural and heritage sites within the study area. Findings will be incorporated into the final Basic Assessment Report.

The field investigation by the Archaeological and Cultural Heritage Specialist and Paleontological Specialist provided that there were no archaeological sites/stone tools, heritage monuments, historical buildings, or graves (Cultural Heritage Resources). The proposed earth filled dam, is mainly covers an area of 1.6ha within the farm. The site is trembled on by the livestock and the location of the instream earth dam is characterised of

incised stream banks. However, the region through to historical background and literature, has a rich potential of archaeological sites , as Middle Stone Age artefacts have a wider distribution that extends into and across the Drakensberg including rock shelters with deep Middle Stone Age deposits, found both east and west of the of the study area; The available evidence, as captured in the Amafa Heritage Research and Institute suggests that although there has been no systematic archaeological survey of the area several archaeological sites have been recorded in the general area of Kokstad; Four (4) Middle Stone Age sites occur within the greater Kokstad area and eleven Later Stone Age sites occur within the Kokstad area. None are known to be located close to the study area.

The site is characterised of incised stream with some area considered to have outcrops and boulders. No fossils have been recorded from the site to date. Fossils can be trapped in the Tertiary and Quaternary sands and alluvium but are seldom preserved there. However, the geological structures suggest that the rocks are the wrong type to preserve fossils (soils and dolerite) but the shales and mudstones might preserve fossils. Furthermore, the material to be used for the wall construction is soil, and this does not preserve fossils. Since there is a small chance that fossils from the Normandien Formation may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage is moderate to low.

11.11.1 Potential Impacts

During the clearing of vegetation, excavation and construction activities, heritage resources/artefacts/places that might be buried underground may be affected. Moreover, excavations (pre-construction and construction phase) could uncover the following: stone foundations, ash middens associated with the farmsteads and homesteads that can contain bone, glass and clay ceramics, ash, metal objects such as spoons, knives, and possible adult and infant burials (especially unmarked). However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr.

11.12 Social and economic aspects

The Greater Kokstad Local Municipality is a rural municipality with only one urban area being Kokstad Town, which is considered as development node as it links KwaZulu Natal with

Eastern Cape, thus providing for the movement of goods and people between different areas, and as a result Kokstad has been part of economical hub for the region. The Kokstad Town provides a highly commercialised urban area which service the communities from Kokstad, Matatiele as well as neighbouring communities of the Eastern Cape (Mount Elyf and Mount Frere). The agriculture, tourism, retail, workshops and commercial sectors, game reserves and government institutions bare the major sources of employment creation (District Economic Profile, 2021; GKM IDP, 2020/21; Stats SA, 2011).

The agriculture is an important sector for the Greater Kokstad Municipality economy. The municipality needs to consider the impact on agriculture on all other economic activity and identify ways to preserve and strengthen this sector as a viable economic mainstream (District Economic Profile, 2021; GKM IDP, 2020/21; Stats SA, 2011).

Provision of the agriculture research addresses the social and economic impact livelihood and food security. Therefore, the Kokstad Research Station is one of the six research stations that builds expertise and transfers technology to the surrounding communities, as well as KZN at large. Furthermore, the station provides solutions to problems, offset constraints and offers new and innovative technologies which ensure sustainable agricultural production in KwaZulu-Natal in the future. There are three research components at the Research Station, namely crop production, animal science and grassland science, with farm services as the support component.

The DARD Kokstad station has contributed significantly to the livelihoods of the KZN rural communities, for example the cultivation of soybean, maize production, quinoa as an alternative crop for food security and poverty alleviation and this have contributed immensely to the socio-economy of Kokstad and KwaZulu Natal at large. Some of the knowledge shared with the public by the research station include Veld Management Principles – these are principles that guide both small- and large-scale farmers about what management styles and principles are needed to balance what is good for the animal with what is good for the grass. Some of these principles include matching the stocking rate to the carrying capacity, using fire appropriately and using rotational rest. The station further offers small- and large-scale farmers insight on buying and selling livestock at auctions, ultimately offering informative knowledge and a safety net to protect households improve their income and prosper business-wise.

Therefore, having mention all of about socio-economic benefits the implementation of the instream earth-filled dam will increase the capacity of water supply to KRS farm throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes.

11.12.1 Potential Impacts

No negative impact associated by the proposed development, as there is no relocation of households is anticipated. In fact, the project will have positive impacts in terms of improving livelihoods, through provision of efficient search knowledge to rural and farming communities, thereby ensure food security. It is also expected that the local community will benefit through jobs during the construction, operation, and maintenance phase, which will enable the transfer of skills and boost the local economy. Additionally, local businesses will benefit from the supply chain processes. This will contribute to alleviating poverty and decrease the dependency ratio of the area.

11.13 Traffic

The access road to the project sites is linked to the existing road to the Kokstad research station. Not much movement of heavy construction vehicles as the activity will be central to the Kokstad Research Station, which will involve bulk earth movement for forming dam embarkment. The route which will be used for hauling of machinery to and from site will be R56 exiting from N2 into Kokstad, enroute via Kokstad straight to R617 and fork left towards the gravel road traveling almost 2km straight to KZN DARD Kokstad Research Station, thereafter the farm access road within the farm. However, this would be a once off activity as no material will be imported therefore no bulk material will be transported. The only traffic will occur during the hauling of construction equipment/machinery.

11.13.1 Potential Impacts

The hauling of material and equipment/Machinery to site will utilise existing local roads. The access to the site will have impact main road traffic, as construction vehicles turn main road. Local communities and road users including school children will be impacted during construction activities in the area. Safety risks, and domestic and wildlife collisions, related to

the movement of heavy equipment, materials and vehicles will likely increase during the course of the project. However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr. A basic traffic management plan will be included during construction phase. Mitigation of potential traffic related impacts will be addressed by proper implementation of safety management systems during the construction.

12 WASTE AND POLLUTION DURING CONSTRUCTION AND OPERATION

Construction activities, like other operations, also lead to water pollution and waste generation, and such pollution and waste have detrimental effect on the receiving environment.

12.1 Waste management

Some of the possible solid and liquid waste during the construction and assembling of the pipelines and associated infrastructure include general waste (plastic, paper, food scraps, etc.), hazardous waste (chemicals, oil, diesel, resins, drilling fluids, sewage, etc.), medical waste from onsite injuries (bandages, swabs, medication, needles, etc.) and building rubble (cement, steel, wood, etc.) The general waste will be disposed of at the Kokstad landfill site, while the disposal of hazardous and medicinal waste will be handled by a certified service provider. Proper measures will be put in place to contain generated during construction, as prescribed by EMPr.

12.2 Hazardous waste

The incorrect handling and disposal of hazardous waste (lubricants, fuel, chemicals, agricultural remedies, *inter alia*) could have detrimental impacts on nearby watercourses. Potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground or disposed of incorrectly. Proper measures will be put in place to contain any spillages (oil spills) occurring during construction, as prescribed by EMPr.

12.2.1 Potential Impacts

The incorrect handling and disposal of hazardous waste (lubricants, fuel, chemicals, agricultural remedies, inter alia) could have contaminate nearby watercourses.

The potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground or disposed of incorrectly or enter the water bodies. Hazardous waste (eg. chemical) contamination of water bodies by runoff water that contain contaminants from onsite waste storage areas and/or chemical storage areas can have significant impacts. Management plans will be implemented to contain any spillages (hazardous substances), handling of waste emanating from the site, and clean-up of spillages, as prescribed in the EMPr.

12.3 Wastewater (effluent)

Wastewater will also be discharge during construction activities especially with the large number of workers on site. Some of the sources of wastewater include:

- surface runoff from construction activities
- washing of vehicles, equipment, implements, etc.
- site toilets, food preparation, personal hygiene

As prescribed in the EMPr including chemical toilets located conveniently along the working areas, managed by a competent portable toilet service provider and all effluent waste will be disposed off at licensed WWTW.

12.3.1 Potential Impacts

The incorrect handling and disposal of wastewater (chemicals toilet and grey water) from site during construction could have detrimental impacts on nearby watercourses. Proper measures will be put in place to contain any spillages (wastewater), sludge and handling of waste emanating from the site. Management plans will be implemented to contain any spillages effluent waste, handling of effluent waste emanating from the site, and clean-up of spillages, as prescribed in the EMPr.

12.4 Air Pollution

The proposed development itself will not have direct impact on air pollution and atmospheric emission. However, certain activities during construction could have a minor impact on the ambient air as a result of emissions from the onsite equipment, machinery, and vehicles. These include dust emanating from construction activities and fumes (carbon monoxide) released by construction vehicles and machinery.

12.4.1 Potential Impacts

The proposed development itself will not have direct impact on air pollution and atmospheric emission. However, proper measures will be put in place to contain any dust and emissions occurring during construction, as prescribed by EMPr.

12.5 Noise Pollution

The project sites will emit different levels of noise due the various construction activities, movement of heavy construction vehicles, use of machinery as well as from large number of workers on site. However, noise impacts are expected to be of short duration and only during certain times of the construction phase, which is likely to only have impacts to the immediate environment.

12.5.1 Potential Impacts

The level of noise from the construction vehicle could be heard within the locality of the project sites and adjacent properties. However, proper measures will be put in place to contain any potential noise pollution impact occurring during construction, as prescribed by EMPr.

13 UTILITY SERVICES

The services imply to utilities supporting the construction and operation of the facility/activity. The service for consideration refers to; Water supply, sewer provision, and energy (electricity).

13.1 Water Supply

The water to be used during construction will be supplied by the Kokstad Research Station, with the provision of existing water within the project locality. The water use will include water construction, consumption, drinking, equipment cleaning and hygiene as well as dust suppression where required.

13.2 Sanitation Facilities

All construction sites will have chemical toilets located conveniently for construction working area, and all effluent waste will be disposed of at the licensed WWTW.

13.3 Energy (Electricity)

The construction will merely involve the earthworks and landscaping such as stone pithing the earth dam embarkments. No use of electricity will be required, during construction.

For operation if the abstraction through pumps will be required, these will be connected to existing electricity supplied to Kokstad Research Station, or use of diesel fuelled pump.

14 OTHER EXISTING SERVICES

The existing services include the sub-surface infrastructure, such the existing pipeline running parallel at 200m away from the dam at (30°30'41.82"S, 29°25'15.14"E) coming from raw water reservoir to Kokstad Research Station WTW. No other existing services were envisaged.

14.1 Potential Impacts

There will be no impact on existing infrastructure as the existing pipeline is well known, and part of the project activities is construction of 200m(600mmø) abstraction pipeline (dam outlet pipeline) which will join the existing pipeline at (30°30'41.82"S, 29°25'15.14"E) coming from raw water reservoir to Kokstad Research Station WTW.

15 IMPACT ASSESSMENT AND MITIGATION MEASURES

The Environmental Impact Assessment (EIA) conducted for the construction phase and the operational phase for the site, are discussed in (***section 15.1***) below.

Each impact identified is assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To effectively implement the adopted scientific approach in determining the significance of the environmental impact, a numerical value was linked to each rating scale.

The following criteria will be applied to the impact assessment for the proposed development:

Occurrence

- Probability - the probability of the impact describes the likelihood of the impact actually occurring.
- Impact duration - the duration of the impact describes the period of time during which an environmental system or component is changed by the impact.

Severity

- Magnitude – refers to the 'degree of disturbance' to biophysical systems and components which expresses the change in the health, functioning and/or role of the system or component as a result of an activity.
- Scale/extent - the extent of the impact generally expresses the spatial influence of the effects produced by a disturbance to an environmental system or component.

The following ranking scales were used:

Probability = P 5 – Definite (More than 80 % chance of occurrence) 4 – Probable (Between 60-80% chance of occurrence) 3 – Possible (Between 40-60% chance of occurrence) 2 – Fairly Unlikely (Between 20-40% chance of occurrence 1 – Unlikely (Less than 20% chance of occurrence)	*Duration = D* 5 – Permanent - The only class of impact that will be non-transitory (indefinite) 4 - Long-term - The impact and its effects will continue or last for the entire operational life of the development (15 - 50years) 3 - Medium-term - The impact and its effects will continue or last for some time after the construction phase (5 - 15 years) 2 – Medium-short - The impact and its effects will continue or last for the period of a relatively long construction period and/or limited recovery time after this construction period (2 - 5 years) 1 – Short Term - Likely to disappear with mitigation measures or through natural processes which span shorter than the construction phase (0-2 years)
Scale = S 5 – International (beyond 200km) 4 – Regional (50-200km radius) 3 – Local (2-50km radius) 2 – Surrounding area (within 2km) 1 – Site (within100m)	*Magnitude = M* 5 - High 4– Medium High 3 – Medium 2 – Medium Low 1 – Low
Status of Impact *+ Positive / -Negative or 0-Neutral*	

The overall impact significance score/points (SP) for each identified impact are calculated by multiplying magnitude, duration, and scale by the probability of all this happening.

The range of possible significance scores is classified into seven rating classes (***Refer to section 15.1***).

SP = (Magnitude +Duration +Scale) x Probability

The impacts status can either be positive, negative or neutral as depicted in table below.

Significance	Environmental Significance Points	Colour Code
Negligible	0-10	N
Very low	11-20	VL
Low	21-30	L
Medium	31-40	M
Medium-High	41-50	MH
High	51-60	H
Very high	61-75	VH

15.1 Impact Analysis (Preferred Site Layout, Design/ Technology, and Location Alternative)

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project panning will result in unnecessary damage and disturbance to natural vegetation: Extensive vegetation clearance due to poor site layout design, and planning which will result in extensive vegetation clearance, large scale topsoil removal and excavation for site site-up clearing and degradation of indigenous vegetation and sensitive plant communities such as *East Griqualand Grassland (Gs12)*, and riparian habitats.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP =50**	➢ The site layout plan must clearly delineate the servitude for the instream earth-filled dam construction corridor. ➢ The design must incorporate a 15m buffer determination along the project site (earth-filled dam) and must be limited to demarcated footprint. ➢ The site layout plan must indicate areas that are no-go zones, to limit large scale and unnecessary vegetation clearance. ➢ Development planning must ensure that further loss of vegetation and disturbance are restricted within the recommended site layout footprint. ➢ ECO must be appointed to oversee construction activities. ➢ A plan to actively rehabilitate the construction area post-construction needs to be developed. ➢ Pre-construction environmental induction must be conducted for all construction staff	**Negligible (10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP =10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		on site to ensure that basic environmental principles are adhered to. This includes awareness as to conservation and importance of protected plants/trees and medicinal plants, as well as to conditions of the EA and the various permits/licenses.	
Poor project planning will result in loss of plants SCC: Poor design and construction planning may result in the permanent loss of various plant SCC as the construction works will take place within a sensitive plant community such as *East Griqualand Grassland (Gs12),* and riparian habitats. The site is within CBA1 & ESA and within 500m buffer coverage of CBA2. No threatened plant species or plant SCC were recorded within the construction corridor during the survey. However, the plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes *Kniphofia linearifolia*.	**Medium** **(40)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 4** **SP =40**	➢ The site layout for the earth-filled dam construction must clearly illustrate the proposed construction footprint and clearly delineate the servitude for the construction corridor. ➢ The site layout plan must indicate no-go areas to limit large scale and unnecessary vegetation clearance. ➢ Since this project involves a construction of a dam and all plant species on site would be destroyed plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes *Kniphofia linearifolia*. An Ordinary Permit will be	**Negligible** **(5)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 1** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the proposed site. A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these plants can be relocated to. ➢ Site camp must be established at already disturbed site, if possible preferable within Kokstad Research Station complex. ➢ An ECO must be appointed to oversee construction activities, and establishment of construction site camp, as well as to ensure compliance to all environmental legal requirements. ➢ A plan to actively rehabilitate the site during construction and post-construction needs to be developed and implemented.	
Poor project planning will result in loss of fauna SCC): Poor design and construction planning may result in the permanent loss of various animal SCC as the construction works will take place within *East Griqualand Grassland (Gs12),* and riparian habitats.	**Medium (36)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 3** **SP =48**	➢ The site layout for the construction of the earth-filled dam must clearly illustrate the proposed construction footprint and clearly delineate the servitude for the construction corridor.	**Negligible (5)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 1** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
The site is within CBA1 & ESA and within 500m buffer coverage of CBA2. No animal SCC were recorded within the construction corridor during the survey. Local fauna disturbance might occur and could led to fragmentation, reduction, and loss of habitat as well as destruction of ecological corridors and connectivity.		➢ The site layout plan must make indicate no-go areas/zone, to limit large scale vegetation clearance. ➢ Site camp must be established at already disturbed site, if possible preferable at the Kokstad Research Station complex.	
Poor project planning will result in degradation of riparian and instream habitats: Poor design and / or implementation of the construction of the instream earth-filled dam is likely to result in degradation of watercourse habitat include (i) undertaking bulk earthworks along the banks and riverbed (ii) placing infrastructure within watercourses, and (iii) dewatering of the construction area. These activities will lead to removal of instream and riparian vegetation, flow regime alteration as well as the alteration of the natural topography of the watercourse.	**High (55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ Develop the engineering designs to prevent or minimize alteration of flow regime within the vicinity of the instream dam. ➢ The project plan must schedule the construction activities within the instream and riparian habitat to take place during the low flow condition and dry period. Preferable during the dry (winter season). ➢ Designing the dam with adequate spillway capacity, outlet works, and sediment bypass or flushing facilities to control the sediment deposition and release. ➢ A site layout plan must be compiled indicating the limits of disturbance associated with the construction of the instream earth-filled dam	**Very Low (12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) ×2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		new. No-go areas and any stormwater infrastructure must be indicated on this plan; ➢ Clearly delineate the servitude for the construction corridor. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO. ➢ Conceptual riparian zone rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, be compiled prior construction and implemented. ➢ An ECO must be appointed to oversee construction activities, and establishment of construction site camp, as well as to ensure compliance to all environmental legal requirements.	
Poor project planning will result in deterioration of surface water quality and streamflow reduction: Poor design and / or implementation of the planned construction activities for an instream earth-filled	**High (55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5**	➢ Engineering design to mitigate extreme events from inundation upstream of the earth-filled dam. ➢ The project plan must schedule the construction activities within the instream and	**Very Low (12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) ×2**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
dam infrastructure is likely to result in deterioration of surface water quality and streamflow reduction, include (i) undertaking bulk earthworks along the banks and riverbed (ii) placing infrastructure within watercourses, and (iii) de-watering of the construction area. These activities will lead to removal of instream and riparian vegetation, flow regime alteration as well as the alteration of the natural topography of the watercourse, and concrete encase at river crossing.	**SP = 55**	riparian habitat to take place during the low flow condition and dry period. ➢ The design must provide that all pipeline crossings be aligned and designed to minimize the extent of river habitat directly impacted by construction activities. In this regard the pipeline crossings should be aligned at right angles to flow and along existing or planned areas / corridors of disturbance. ➢ Ensure that the timing of the topsoil stripping is optimised to limit the time between stripping and construction/deposition. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic/wetland ecologist or ECO.	**SP = 12**
Poor project planning will result in site geological instability (soil erosion and banks incision):	**High (60)** **SP= (M + D + S) × P**	➢ Design geosynthetics (banks stone pitching) for instream earth-filled dam to prevent bank incision and erosion.	**Negligible (6)** **SP= (M + D + S) × P**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project designs and planning would result in erosion and degradation of habitats is likely to occur during clearing of vegetation, topsoil removal and excavation works at riverbanks and instream habitat. Furthermore, the disturbed soils are prone to surface run-off.	**SP= (5 + 5 + 2) × 5** **SP = 60**	➢ Design an adequate stormwater management system to include surface drainage for continual drainage within vicinity of the earth-filled dam to prevent bank incision, seepage and geological instability as a result of ponding. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO. ➢ All excavation works which require ripping must be determined by Seismic Evaluation. ➢ Blasting of rock outcrops must be considered as a last resort. A detail report must be submitted by the contractor prior to construction detailing the conditions which will resort in blasting. This report must be accompanied by blasting method statement. ➢ Conceptual riparian zone rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, be compiled prior to construction.	**SP= (3 + 2 + 1) ×1** **SP = 6**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Loss of indigenous vegetation during construction: The development is for the construction of the instream earth-filled dam in an area extent if 1.6ha. Therefore, this will result in vegetation clearance and obliteration of vegetation on site for the purpose of construction earth-filled dam and outlet pipeline infrastructure. Also uncontrolled construction activities beyond the required footprint of the project area. This could lead to loss of flora habitat, as the construction will take place within the *East Griqualand Grassland (Gs12)*, and riparian habitats.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP =50**	➢ The project boundary must be demarcated and vegetation clearing as well as topsoil removal must be limited to the site only. ➢ Clearly demarcate the construction footprint prior to clearing of vegetation. ➢ Vegetation clearance for construction of the instream earth-filled dam must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development and stockpiling should take place outside 15 buffer of the site. ➢ The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ The demarcations are to remain until construction and rehabilitation is complete.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (2+ 2 + 1) × 2** **SP =10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. ➢ Surrounding areas with indigenous vegetation should under no circumstances be fragmented or disturbed further or used as an area for ruble and stockpiles ➢ Only the approved existing access road must be used, and vehicles must not traverse virgin land. ➢ All laydown, storage areas, site camps etc. must be restricted to within the project area and should preferably be situated within areas of low sensitivity (already disturbed areas, such as within Kokstad Research Station complex). ➢ Vegetation clearance in the construction phase is to be removed in a phased approach, as and when it becomes necessary as vegetation harbours fauna. ➢ Undertake progressive rehabilitation: Areas cleared of vegetation must be revegetated/ land scaped, immediately after the	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		infrastructure in that portion has been installed. Do not wait for the project to be completed or contractor leaving the site. ➢ ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance. ➢ All workers to undergo environmental awareness and training, including induction on conditions of the EA and permits to ensure effective implementation of the conditions of the EA and permits for environmental legal compliance.	
Disturbance of terrestrial species habitat as a result of construction activities: The removal of high velocity habitats has the potential to alter the invertebrate community structure which depend on these velocities over a long-term basis. The uncontrolled construction activities may result in the loss of habitat and permanent loss of	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4+ 2) × 5** **SP =50**	➢ The construction corridors must be surveyed for potential habitats such as burrowing and roasting sites, prior to site clearance in order to delineate and buffer the areas, where not possible to relocate them. ➢ The project boundary must be demarcated and vegetation clearing as well as topsoil removal must be limited to the site only.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2+ 2 + 1) × 2** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
unidentified animal SCC. Also, this might encourage migration of species. Furthermore, the animals with limited mobility are often the first to be affected by habitat fragmentation due to the effects on population viability. Unnecessary destruction of riparian vegetation habitat onsite which provides foraging and cover for all animal species; Unnecessary destruction grasslands vegetation habitat on site which provides a foraging and significant feeding area for animal species.		➢ Clearly demarcate the construction footprint prior to clearing of vegetation. ➢ Vegetation clearance for construction of the instream earth-filled dam must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development and stockpiling must take place outside 15 buffer of the site. ➢ No-go zones should be strictly adhered to. This is particularly important for the upstream river area as biota may migrate upstream in search of suitable habitat. ➢ Install buffers to restrict development from encroaching into sensitive environments. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ All construction activities must take place within an area demarcated for the development. ➢ Natural features such as trees or grasslands should not be removed from the dam margins	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		in order to provide submerged habitats in the form of roots and overhanging vegetation for the aquatic biota. ➢ No ad-hoc roads are permitted, access roads must be defined and utilised and avoided within sensitive habitat. ➢ All laydown, storage areas, site camps etc. must be restricted to within the project area and preferably be situated within areas of low sensitivity (already disturbed areas, such as within the Kokstad Research Station complex). ➢ A terrestrial specialist must be employed to ensure that no red listed plant species will be destroyed. It may be necessary to relocate these species. ➢ ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Loss of plant SCC during construction: Uncontrolled construction activities may result in vegetation clearance and result in the permanent loss of various plant SCC, as the construction works will take place within *East Griqualand Grassland (Gs12), instream habitat* and riparian habitats. The site is within CBA1 & ESA and within 500m buffer coverage of CBA2. No threatened plant species or plant SCC were recorded within the construction corridor during the survey. However, the plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes *Kniphofia linearifolia*.	**Medium** **(40)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 4** **SP = 40**	➢ A terrestrial specialist must be employed to ensure that no red listed plant species will be destroyed. It may be necessary to relocate these species. ➢ An ecologist must conduct a walk through prior to vegetation clearing and a permit must be obtained to remove any TOPS. ➢ The demarcated construction corridor must be surveyed prior to construction for identification of plant SCC. ➢ Establish buffer by means of visible construction barricades to section off plant SCC falling outside construction corridor and declare it a no-go area. ➢ The plant SCC outside construction corridor must not be removed or disturbed. ➢ Relocate plant SCC within the construction corridor to undisturbed areas within project locality. a plant 'rescue' operation must be undertaken under the directive of an ecologist/botanist. A suitable habitat just outside of the development site exists in the	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2+ 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		Mount Currie Nature Reserve of which these plants can be relocated to. ➢ Buffer and indicate no-go areas to prevent disturbance or removal of "Specially Protected Indigenous Plants". Since this project involves a construction of a dam and all plant species on site would be destroyed plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes *Kniphofia linearifolia*. An Ordinary Permit will be required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the proposed site. A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these plants can be relocated to. ➢ If needed, approval must be obtained from the ECO, before any disturbance or removal of plant species of conservational concern; plants to be relocated, by a Botanist.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance. ➢ All workers to undergo environmental awareness and training, including induction on conditions of the EA and permits to minimise or prevent impacts to plant SCC, and protected plant species.	
Encroachment of Invasive Alien Plant Species: Uncontrolled construction activities, such as vegetation clearance and excavation are likely to spread and/or exacerbate colonization and establishment of invasive alien species. Encroachment, proliferation and spread of weeds and invasive alien plant (IAP) species are mainly associated with clearance of vegetation. Disturbance to habitat and removal of vegetation will increase the likelihood of IAP invasion and noxious weeds. The colonisation by weeds and IAPs poses a risk to indigenous plant communities and habitat	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ Prevent large scale clearance, and only clear the areas as demarcated by the approved project plans. All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed. ➢ The control and eradication of a listed invasive species must be carried out during and post construction within the project site. ➢ All sites disturbed by construction activities must be monitored for colonization by exotics or invasive plants and be regular removed. ➢ Alien invasive plants (listed in this study) can be removed manually or with the help of	**Negligible** **(8)** **SP= (M + D + S) × P** **SP= (2 + 1+ 1) × 2** **SP = 8**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
characteristics as IAPs outcompete indigenous vegetation and may reduce species richness or cause a loss in biodiversity. Overtime, IAP may disperse and proliferate into riparian and wetland habitat and alter the hydrology of the watercourses**.**		simple tools. This entails damaging or removing the plant by physical action. ➢ An alien invasive removal and management plan must be compiled and implemented onsite. ➢ Stockpiles must be vegetated if they are to be stored for prolonged periods of time such as 3 to 6 months. ➢ All stockpiles must be kept free of weeds and IAPs. ➢ The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.	
Disturbance to surrounding wildlife and fauna: Uncontrolled construction activities: vehicle movements, noise and habitat destruction will disturb animals in the area. As a result, the proposed construction activities are likely to result	**Medium-High (48)** **SP= (M + D + S) × P** **SP= (5 + 4 + 3) × 4**	➢ An ecologist must conduct a walk through prior to vegetation clearing to relocate Fauna SCC. A suitable habitat just outside of the development site exists in the Mount Currie	**Negligible (4)** **SP= (M + D + S) × P** **SP= (2 + 1+ 1) × 1**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
in the migration of species which are endemic to the project area or a loss of animal species currently found on site, as reptiles, bird species, mammals, and invertebrates may be separated into distinct populations. Unnecessary destruction of riparian vegetation habitat onsite which provides foraging and cover for all animal species; Unnecessary destruction grasslands vegetation habitat on site which provides a foraging and significant feeding area for animal species. Inadvertent killing and injury of fauna species during vegetation clearance and construction activities. Loss/displacement of fauna species potentially present on site.	**SP = 48**	Nature Reserve of which these animal species can be relocated to. ➢ During site preparation, special care must be taken during the clearing of the works area in order to minimize damage or disturbance of roosting and nesting sites. ➢ If possible, the clearance of vegetation should commence during non-breeding season of fauna species (i.e., winter). ➢ Walkways must be constructed allowing for animals to escape from the trenches, and construction corridors with an aid of a Herpetologist/Ecologist. ➢ If any herpetological species are encountered or exposed during the construction phase, these must be removed and relocated to natural areas in the vicinity. A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these animal species can be relocated to. This remedial action requires the employment of a herpetologist and or ecologist to oversee the	**SP = 4**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		removal of any herpetofauna during the initial ground clearing phase of construction (i.e., initial ground-breaking by earthmoving equipment). ➢ It is advisable that the earthworks be confined to the dry season, when there is likely to be less faunal movement. ➢ Construction activities must be limited to the designated development footprint. ➢ No faunal species are to be disturbed, trapped, hunted, or killed. ➢ Wetland fauna (e.g., birds, snakes, frogs, small mammals) that are encountered during the construction phase must be relocated to other parts of the wetland under the guidance of the EO or ECO. ➢ During the construction phase, no construction is to occur at night to minimise all possible disturbances to amphibian species possibly inhabiting the wetland. ➢ All construction and maintenance vehicles must stick to properly demarcated and prepared roads.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Driving on virgin land must be strictly prohibited. ➢ No fires must be allowed at the site. ➢ No dogs or other pets should be allowed at the site	
Potential loss of wetland and riparian habitat: Construction will result in alteration of hydrological and geomorphological processes. The infield water aquatic assessment confirmed the presence of riparian, also provided that no wetlands, fish corridors, or upstream management areas are located within the development buffer zone. The riparian zone delineated (***Figure 6***) is largely surrounded by *Leucosidea sericea*. Expanded / more intense edge impacts could occur as a result of deterioration in vegetation quality and cover and the potential for increased alien invasive plant invasion due to disturbance causing activities taking place within or near the riparian zones.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ An ecologist must conduct a walk through prior to vegetation clearing and a permit must be obtained to remove any TOPS. ➢ The project site servitude must be clearly demarcated to avoid unnecessary large-scale disturbances to adjacent areas. ➢ All work to be done within the riparian and habitats must be carried out during low flow conditions, and dry periods. ➢ Clearing activities must be undertaken in a phased approach. ➢ The vegetation clearance and earthworks must be limited to project area as demarcated by the layouts. ➢ Construction corridor must be clearly delineated and marked with pegs. The servitude must include the trench, one-way running track, topsoil stockpile corridor and	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (3 + 1+ 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ The demarcations are to remain until construction and rehabilitation is complete. ➢ Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. ➢ Vegetation at riparian zones adjacent the vicinity of the instream earth-filled dam must remain intact where possible, to limit high surface flows and mobilisation of sediments. ➢ Vegetation must be cleared in a phased approach and trench should not be left bare and exposed to erosion. ➢ Soils must be stabilised, and sediment traps must prevent sediment from entering stormwater.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Create berms downslope of working area to divert impacts away from wetlands. ➢ The monitoring plan must be developed in order to quantify the impact on the watercourses. ➢ Disturbed watercourse habitats must be rehabilitated as soon as construction is complete or near complete and not left until the end of the project to be rehabilitated. ➢ Soil berms and sediment traps must be established to prevent sediment entering watercourses. ➢ Topsoil must be stockpiled in stockpiles not exceeding 2 m in height. ➢ All stockpiles must be established outside the buffer of all watercourses and on relatively flat ground at least 30m away from the watercourse. ➢ If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ No *ad-hoc* roads are permitted, access roads must be defined and utilised and avoided within wetlands. ➢ Site camp must be located outside the riparian and at least 100m away from the watercourse at relatively flat area. Most preferable the site camp must be established with Kokstad Research Station complex. ➢ ECO ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance.	
Degradation of freshwater (aquatic) habitat as a result of construction activities. Construction activities within a watercourse are likely to result in degradation of watercourse habitat include (i) undertaking bulk earthworks associated with construction of an instream earth-filled dam and the dam outlet pipeline within riparian, (ii) placing infrastructure within watercourses, (iii) dewatering of the construction area, when necessary, and (iv) Excavation within riparian.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 60**	➢ All work to be done within the riparian, instream habitats, and wetlands must be carried out during low flow conditions, and dry periods. ➢ All clearance and excavations within the riparian and instream habitat for the purpose of construction of the instream earth-filled dam must be limited to areas as demarcated and approved by the project plans. ➢ It is recommended that construction of the dam and pipeline commence during the dry	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Also, during construction activities it is highly likely that upstream flows will have to be diverted around the working area through the utilisation of coffer dams. In Modification/destruction of riparian habitat, loss of riverine habitat and loss of aquatic biota		season so as to limit the amount of sediment which may run off into the tributary. ➢ Install buffers to restrict development from encroaching onto sensitive environments. ➢ Vegetation clearance for construction of the instream earth-filled dam must be limited to demarcated footprint. A 15m buffer along the dam footprint must be considered, and no development and stockpiling must take place outside 15 buffer of the dam footprint. ➢ Topsoil stockpile must be stockpiled in stockpiles not exceeding 2 m in height, on a relatively flat surface. ➢ All stockpiles must be established outside the buffer of all watercourses and on relatively flat ground at least 32m away from the watercourse within a relatively flat areas. ➢ If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile. ➢ In the case that coffer dams are used to divert flow for construction purposes, these structures must be temporary in nature and	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		be removed from the river/channel immediately after the required construction has been completed. ➢ No construction of an artificial channel outside of the watercourse habitats for water diversion purposes will be permitted. Therefore, the coffer dam wall (sandbags must be placed along both banks of an incised channel where exaction for dam will take place. The excavation starts at the far side of the banks when natural flow is not disturbed, coffer dam wall (sandbags) acting as silt barrier. ➢ De-watering process from the coffer dams must involve piping the water directly to the active channel downstream of the site as, or if, required. ➢ Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion and siltation. ➢ A dewatering site must be identified in conjunction with the ECO and must be on flat	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		ground away from the edge of the stream channel and preferably in a well vegetated area. ➢ Pumped water must be discharged into a silt trap/hay-bale trap adequately sized to deal with the expected volumes. Outflow from this trap must be via sheet flow and energy dissipation measures may be required. ➢ Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation. ➢ Disturbed watercourse habitat must be rehabilitated as soon as construction is complete or near complete, and not left until the end of the project to be rehabilitated. ➢ Rehabilitate all watercourses in accordance with DWS approved Rehabilitation and Maintenance Plan ➢ ECO must be appointed to oversee construction activities and ensure legal environmental compliance.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Alteration of flow regimes and fluvial systems, as well as streamflow reduction as a result of construction activities: The construction will result in alteration of hydrological and geomorphological processes. The temporarily reduced channel/stream ecological connectivity during the construction at the vicinity of instream earth-filled dam. Excavation will alter percolation through the area and may affect water feeds into the receiving environment. Construction related activities will therefore alter sediment and water inputs into the receiving environment and may affect groundwater recharge. In addition, the poor construction processes could lead to stream siltation, further sedimentation of downstream, collapse of banks due to uncontrolled excavation, increased volumes of water altering hydrological regime stormwater runoff.	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 4+ 2) × 5** **SP =60**	➢ Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible. ➢ Construct and maintain earth berm to prevent flooding and sedimentation during construction. ➢ No construction of an artificial channel outside of the watercourse habitats for water diversion purposes will be permitted. Therefore, the coffer dam wall (sandbags must be placed along both banks of an incised channel where exaction for dam will take place. The excavation starts at the far side of the banks when natural flow is not disturbed, coffer dam wall (sandbags) acting as silt barrier. ➢ If it is necessary that the flows require diversion in order for the work to be carried out, the flows must be returned to their original pathways and velocities post establishment.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP =10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation. ➢ Minimise impervious surfaces and maximise infiltration by maintaining vegetation as far as possible to convey and hold surface runoff and provide for a slow release into the receiving environment. ➢ Stone pitching or gabions will be required to prevent further incision in areas where the banks of channels are incised, and these banks must be stabilised to prevent further gully erosion. ➢ Stormwater management measures must be implemented in order to minimise diverted flows as the result of rains and prevent the siltation and sedimentation of nearby watercourse also minimise the impacts of the disturbed areas.	
Deterioration of surface water quality as a result of construction activities:	**Medium-High (45)** **SP= (M + D + S) × P**	➢ Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow conditions. The activities within watercourse must only be undertaken during	**Negligible (10)** **SP= (M + D + S) × P**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Uncontrolled construction processes could lead to stream siltation, further sedimentation of downstream, collapse of banks due to uncontrolled, Increased volumes of water altering hydrological regime stormwater runoff. In addition will result in excessive run-off from excavations and/or hard surfaces; inappropriate stormwater management. During construction especially excavation along riparian and instream habitat has potential to Oil, grease and chemical spills from construction machinery, also discharge of untreated effluent spill from unmanaged portable toilets onsite. Potential contaminants from this machinery include hydrocarbons, oils and grease. These may enter the nearby watercourse as surface runoff	**SP= (5 + 2 + 2) × 5** **SP = 50**	agreed working times and permitted weather conditions. If heavy rains are expected, the clearing and excavation activities must be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months. ➢ It is prudent however to be prepared for increased flows by scheduling work according to the weather forecast and to be adequately prepared for unexpectedly large runoff from a sudden storm. ➢ Prevent pollutants from entering drainage lines in amounts that exceed the systems' natural ability to assimilate the pollutants and provide the desired functions. ➢ Construct and maintain earth berm to prevent flooding and sedimentation during construction. Sediment barriers must be installed in areas sensitive to erosion such as near water supply points, slopes, and actively eroding riverbanks. These measures include	**SP= (2 + 1 + 2) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		but are not limited to - the use of sandbags, hessian sheets, silt fences, geotextiles, rock gabions, etc to prevent erosion and stream siltation. ➢ Minimise impervious surfaces and maximise infiltration by maintaining vegetation as far as possible to convey and hold surface runoff and provide for a slow release into the receiving environment. ➢ Sediment barriers (e.g.: silt fences/sandbags/hay bales) must be installed immediately downstream of active work areas (including soil stockpiles) as necessary to trap any excessive sediments generated during construction. ➢ No construction machinery must be operated directly into the water, except where coffer dam is in place. ➢ The use of heavy machinery (excavator) within the watercourse must be closely supervised. If possible, the excavator must only be positioned as far as possible away	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		from the water edge, as it stretches the bucket to excavate the instream habitat. ➢ Any soil contaminated by hydrocarbons (fuel and oils), grease, bitumen's, cement or any other binding agent used in the dam construction must be removed and the affected area rehabilitated immediately. ➢ Implementing of a stormwater control/management plan with effective stormwater controls within riparian throughout active working areas. ➢ Potential stormwater run-off from hard surfaces requires careful attention to ensure that the nearby watercourse is not negatively impacted by sedimentation and run-off carrying oil, grease, hydrocarbons and/or harmful chemicals. ➢ Place topsoil of disturbed areas along the and revegetated immediately, to prevent run-off and siltation. Stockpiles must not be more than 2m in height and stored at least 30m away from the watercourse on the area with a relatively flat surface.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Machinery must be parked at least 32m away from the watercourse and only parked on the designated bunded areas and dip trays must be placed under the machinery, when not used to capture any possible hazardous substance leaks. ➢ Stormwater management measures must be implemented in order to minimise diverted flows as the result of rains and prevent the siltation and sedimentation of nearby watercourse also minimise the impacts of the disturbed areas. ➢ The site must have portable toilets at the ratio of 1:10. These portable toilets must be positioned at relatively flat surface, with shoring and at least 30 meters away from any habitat near a watercourse. ➢ Portable toilets must be maintained on a regular basis by a licensed service provider with the provision of service level agreement letter with WWTW facility, and waybills must be saved as documentation.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Petroleum fuel must be kept in a covered, bunded structure. The bund must be able to hold at least 110 percent of the content amounts. ➢ All chemicals and hazardous substances including cement must be mixed and/or decanted on a tray, shutter boards, or an impermeable surface. ➢ ECO must be appointed to oversee construction activities. ➢ ECO to Conduct water quality monitoring (baseline and during construction) at suitable up and downstream sites	
Ground water contamination as a result of construction activities: The uncontrolled construction activities may have potential for leaks of hazardous substances from equipment on site. Such hazardous substances have the potential to enter the soil and watercourses. Hydrocarbons, oils and grease, cement, sewage from portable chemical toilets, and events involving the discharge of untreated effluent	**High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP = 50**	➢ Suitable storage facilities for handling and storage of oils, paints, grease, fuels, chemicals, and any hazardous materials to be used; must be provided to prevent the migration of spillage into the ground and possible ingress into the groundwater regime. ➢ Implement protocols and emergency responses for accidental leakages or release of contaminants into environment.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (2 + 1 + 2) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
are examples of potential contaminants during the construction period. Machinery will use petroleum and oil products and if not properly managed can lead to contamination of the perched groundwater system. The oil spills from construction machinery may also leach the soil and contaminate the groundwater through groundwater seepage		➢ Machinery must be parked on the designated bunded areas and dip trays must be placed under the machinery, when not used to capture any possible oil leaks. ➢ Vehicle maintenance must not take place on site unless a specific bunded area is constructed for such a purpose. ➢ Hazardous storage and refuelling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. The bund wall should be high enough to contain at least 110% of any stored volume. The surface of the bunded surface should be graded to the centre so that spillage may be collected and satisfactorily disposed of. ➢ All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. Portable clean-up kits must be available on	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		site to undertake immediate clean-up, should a spill occur. ➢ Contaminated water containing fuel, oil or other hazardous substances must never be released into the environment. It must be disposed of at a registered hazardous landfill site.	
Soil degradation and geological degradation: Uncontrolled construction processes would result in erosion and degradation of habitats is likely to occur during clearing of vegetation, topsoil removal and excavation works at riverbanks and riparian habitat Therefore, excavation at riverbanks, riparian and instream is considered highly sensitive as it may result in stream sedimentation. Furthermore, the disturbed soils are prone to surface run-off.	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2 × 5** **SP =60**	➢ During the site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately, away from spoil, for use post-construction. ➢ Vegetation clearing must be undertaken in a phased approach to avoid loose soils and erosion and ideally should take place in the dry period. Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Vegetation clearance must be kept as minimal as possible to areas as demarcated by the project plans and to make use of natural erosion suppressors such as good grassland cover. Rehabilitation to begin immediately and not only when construction ends. ➢ All bare slopes and surfaces within the vicinity of the instream earth-filled dam, the high sloping areas to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of sandbags and/or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2m) to break the energy of surface flows. ➢ Several slope stabilizing measures can be implemented for construction (the nature and design of which to be assessed and determined by responsible engineer); ➢ Trim the soils to 1:1.5 (33o) for the duration of construction. Trimming carried out as “soft excavation” using conventional plant;	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Modifying the slope geometry by reducing the slope angle, removing weight from the slope head, increasing weight at the slope toe and/or constructing of benches or berms. ➢ It is recommended that excavations be carried out along the guidelines given in SANS 10400-G (current version). ➢ No work within riparian, incised banks and wetland habitat area must be carried out during the wet period or peak flow conditions. ➢ No vegetation clearance and excavation must be carried within the highly sloping susceptible to surface erosion during wet period as this could increase erosion propensity. ➢ Make use of gabions along the excavated areas within the riverbanks, to prevent erosion as a result of loose banks caused by excavations. ➢ Regular maintenance of any sediment control dams must be undertaken during the construction / establishment period to ensure	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		that these structures continue to function appropriately. ➢ If re-vegetation of exposed surfaces cannot be established immediately due to phasing issues, temporary erosion and sediment control measures must be maintained until such a time that re-vegetation can commence. ➢ All temporary erosion and sediment control measures must be monitored for the duration of the construction phase and repaired immediately when damaged. All temporary erosion and sediment control structures must only be removed once vegetation cover has successfully recolonised the affected areas. ➢ After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gulley for additional protection until	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		vegetation has re-colonised the rehabilitated area. ➢ ECO must be appointed to oversee construction activities and to ensure environmental legal compliance.	
Disturbance of Heritage Resources: There is no evidence of heritage resources and heritage sites observed during filed investigation. Uncontrolled excavation works, particularly in within the riparian and rural settlement are most likely to cause disturbance or destruction of non-renewable heritage resources. However, there are no evidence of heritage resources within the locality of the project site. The heritage and arachnological survey also paid special attention to disturbed and exposed layers of soils such as eroded surfaces along the general development site and the river stream. These areas is likely to exposed or yield archaeological and other heritage resources that may be buried underneath the soil and be brought to the surface by animal and	**Low** **(24)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 2** **SP = 24**	➢ Excavation for instream earth-filled dam the at riparian zone must only be limited to development area as approved by project plans ➢ Monitoring must take place during site clearance and implement the Chance Finds Procedure (CFP) if any human remains is uncovered. ➢ If any human remains, graves, archaeological and historical residues are discovered, the Amafa Heritage Resource Institute and the National Heritage Resources Act, No 25 of 1999, requires that operations should cease immediately pending an evaluation by the relevant heritage authorities.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
human activities including animal barrow pits and human excavated grounds.			
Loss of archaeological and paleontological resources: Uncontrolled construction activities could result in disturbance of surfaces and/or sub-surfaces which would be destroyed, damaged, altered, or removed from its original position of archaeological and paleontological material or objects. A preliminary desktop study for palaeontological fossils sensitivity of the proposed site, reveals that the site falls within a 'Very High' paleontological sensitivity, there is a very small chance that fossils may occur in the mudstones and shales of the late Permian Adelaide Subgroup. No fossils were recorded as being preserved in the overlying soils of the Quaternary. Fossils can be trapped in the Tertiary and Quaternary sands and alluvium but are seldom preserved there. Such fossils could be associated with palaeo-channels from rivers that have changed	**Low** **(24)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 2** **SP = 24**	➢ Excavation for instream earth-filled dam the at riparian zone must only be limited to development area as approved by project plans ➢ Measures must be taken to avoid any geological structure from being eroded and collapsing, and in the process causing loss of archaeological and paleontological resources. ➢ Regular Archaeological Watching Briefs should be carried out during construction in case any chance findings are made. ➢ Should any fossils are found by the contractor, environmental officer, or other responsible person, once excavations for the dam wall and other infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample (with an AMAFA permit).	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
their course such as the palaeo-Koa and palaeo-Orange Rivers.			
Air pollution, dust, and emissions: Dust could be generated during construction as a result of earthworks and stockpiles. The major dust sources could emanate from the movement of vehicles on access road transporting material and equipment to the working areas. Furthermore, transportation and storage of fine sand, spoils and cement could result in dust. Emissions from construction vehicles and heavy machinery, especially those poorly maintained will result in air pollution.	**Medium** **(32)** **SP= (M + D + S) × P** **SP= (5 + 1 + 2) × 4** **SP = 36**	➢ Apply dust suppression to exposed soil and stockpiles. All transported and stored fine product must be covered to prevent spills and been blown by wind. ➢ Excavated material is to be stockpiled along the trench within the working servitude for later backfilling, of not more than 2m in height. ➢ Limit on-site vehicle speed to 40 km/h or lower due to driving conditions. ➢ All fine products must be covered during transportation. ➢ Minimise gas emission through regular servicing of construction vehicles to meet minimum emission requirements.	**Negligible** **(4)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) × 1** **SP =4**
Aesthetic / visual Impact: The viewshed area and zone of visual influence for the proposed instream earth-filled dam is considered ***"low visibility"*** as it can be visible from a small area around the project site (<1km radius). As the proposed development (construction of the earth-filled dam) will take place within the farm to	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP = 12**	➢ Landscaping all disturbed areas to Natural Ground Level (NGL). ➢ Removal of all construction material and debris from site. ➢ Concentrate the construction activity and temporary infrastructure in a designated place. In this regard the site camp, must be	**Negligible** **(4)** **SP= (M + D + S) × P** **SP= (1+ 1 + 2) × 1** **SP = 4**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
support the farming activities. Therefore, the proposed development will have 'Low visibility" and no visual impact as the development will be streamlined with the current land use. However, during the construction phase, residents who live in close proximity to or overlook the proposed project site will experience a change in their existing views as residents will have a view of the construction site characterized by exposed earth and machinery.		constructed within research station to avoid high visibility of construction activities. ➢ The contractor must maintain good housekeeping on-site to minimise waste generation and avoid litter. ➢ Dust suppression is important to reduce the visibility of the development. ➢ Excavated material is to be stockpiled along the trench within the working servitude for later backfilling, of not more than 2m in height. ➢ Avoid the use of floodlight at site camp. Also, the light must not face the neighboring homesteads and oncoming traffic on the rural access roads. ➢ The clearance must be minimal, only to a corridor as approved by project plans and layouts.	
Noise pollution: The main sources of noise associated with the proposed construction activities include the following: construction activities and equipment delivery. Construction activities are likely to be confined to daytime and the noise levels will only	**Medium (40)** **SP= (M + D + S) × P** **SP= (5 + 1 + 2) × 5** **SP = 40**	➢ In recognition of the inherently noisy and temporary nature of construction activities, specify standard construction hours during which the usual fixed noise limits do not apply.	**Negligible (8)** **SP= (M + D + S) × P** **SP= (2+ 1 + 1) × 2** **SP = 8**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
affect the adjacent areas for a relatively short period of time.		➢ Ensure that operating hours as determined by the EA are adhered to. Where not defined, development must be limited to daylight hours. ➢ All vehicles must be maintained in accordance with manufacturer's specifications to avoid excessive noise.	
Traffic impact: The construction will manly involve earthworks with limited material brought to site. Nevertheless, the construction project result in the increase in construction vehicles in and around the proposed site, and trucks transporting materials turning from the main road to access road to site, vice versa. However, it will be occasional and of temporary duration as it will only last for the construction duration of the project. The traffic within the main road turning point will be affected by number of construction trucks turning to and from the site.	**Low** **(24)** **SP= (M + D + S) × P** **SP= (5 + 1 + 2) × 3** **SP = 24**	➢ Identify and delineate the existing access road. The access routes must form an integral part of site layouts which must be communicated to the project team including delivery crew. ➢ Appropriate temporary signage, traffic control signals, delineators, message boards, must be used for traffic accommodation in the work zone, truck turning points and shall be visible by motorists and pedestrians. ➢ Establish speed limits at an approach to construction vehicle turning point where the road conditions dictate, vehicles must be driven slower and with an awareness of potential risks. Limit on-site vehicle speed to 40 km/h or lower due to driving conditions.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 1 + 2) × 2** **SP =10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Social distress and damage to existing services: The development will take place within Kokstad Research Station. The existing services include the sub-surface infrastructure, such the existing pipeline running parallel at 200m away from the dam at (30°30'41.82"S, 29°25'15.14"E) coming from raw water reservoir to Kokstad Research Station WTW. No other existing services were envisaged.	**Negligible (6)** **SP= (M + D + S) × P** **SP= (2 + 1 + 3) × 1** **SP = 6**	➢ Identify all existing underneath and surface infrastructure, such as water pipeline, telecommunication lines, and powerlines which will be in the corridor, and construct in accordance with authority requirements, as per prescribed by approved design and wayleaves.	**Negligible (4)** **SP= (M + D + S) × P** **SP= (1+ 1 + 2) × 1** **SP =4**
Waste emanating from construction activities: Uncontrolled waste generated from construction activities such as: general, health care and hazardous wastes are more likely inherited from construction activities.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 2 + 3) × 5** **SP = 50**	➢ Educate of workers on pollution prevention practices. Training programme must provide information on material handling and spill prevention and response. ➢ Have sufficient and separate bins for general, medical and hazardous waste disposal by implementing the Integrated Waste Management approach: segregation of waste into separate bins and clearly marked for each waste type. ➢ Refuse must be removed regularly to licensed landfill sites.	**Negligible (8)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) × 2** **SP = 8**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Hazardous waste must be stored in a secured waste receptacle and disposed of at a registered waste disposal site. ➢ Adequate sanitary facilities and ablutions on the project site must be provided for all personnel throughout the project area. ➢ All waste manifest and disposal certificates must be kept on record	

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Soil erosion and geological degradation: Poor placement or design of the on-site earth dam stormwater infrastructure during the operation phase could lead to weathering of riverbanks in cut-face at sloping areas, in the process resulting in run-off and erosion in event of high precipitation and peak flow period, increased erosion, and sedimentation into the watercourse. Due to overflow of water from the dam basin over the dam crest or spillway, which can cause flooding, scouring, and sedimentation downstream. The dam may also act as a sediment trap preventing the movement of sediments downstream which could change the morphology of the watercourse. Furthermore, the reduction in sediment available could increase the erosive power of the water leading to reduced stream bank stability and erosion downstream. The significance of these impacts is rated as moderate.	**Medium-High (44)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 4** **SP = 50**	➢ Proper design and construction of stone pitching. ➢ Implement the Stormwater Management Plan ➢ Construct storm water system and make provision for erosion protection. ➢ Conducting regular inspections and monitoring of the dam to detect any signs of seepage, such as wet spots, sinkholes, cracks within stone pitching, or changes in water level or quality. ➢ Managing the reservoir level and operation to avoid rapid fluctuations or overtopping that can increase seepage pressure and flow. ➢ The disturbed watercourse habitat and rehabilitated areas must be monitored for potential erosion and scouring. This should initially take place immediately after construction, thereafter quarterly for two years and thereafter annually. ➢ Follow the best practices and guidelines for spillway maintenance to ensure a reliable and safe operation of an impounding reservoir. ➢ Installation of gabion baskets and mattresses, energy dissipaters and stone picthing	**Negligible (8)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP =8**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Seepage through the dam foundation or abutments, which can cause erosion, instability, and leakage of water and pollutants.		➢ Stormwater management through regular inspection for evidence of sediment and debris build-up during wet season. ➢ Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified. ➢ Maintenance vehicles must use the existing access route.	
Changes in Natural Flow (Flow regime alteration): It has been widely recognised that dams have a significant impact on the natural flow of rivers. Alteration to hydrological regimes from impeding and diverting flows. This could result in stream flow reduction, and inundation. During potential flooding events, water is likely to inundate upstream sites if the dam is at full capacity. This could result in short term changes in water quality of the inundated area, habitat destruction and loss of biota.	**High (55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ Spillway design for the correct timing of water released from the dam in order to simulate natural seasonal variability. This will ensure that ecosystem services are maintained downstream. ➢ Flow rates must be monitored to determine any excessive deviation from the natural state. If flow rates are drastically reduced, additional hydrological studies will be required such as an analysis of ecological/environmental water requirements, water balance as well as a hydrological yield analysis to determine the impact of the dam on the local scale.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP = 10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Alien Invasive Plant Species Alien invasive plant species within the pipeline servitude. Encroachment of IAPs. Permanent alteration to wetland functionality.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ In terms of management, alien invasive plant control must be practiced on an on-going basis in line with the requirements of Section 2(2) and Section 3 (2) the National Environmental Management: Biodiversity Act (NEM:BA), which obligates the landowner/developer to control IAPs on their property. ➢ Progressively, remove alien plant species within the dam and servitude. ➢ Establish and maintain an IAPs management programme. ➢ A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be compiled for the site. ➢ Where chemical treatment methods are used, the contractor must ensure the utilisation of watercourse friendly herbicides. ➢ The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
		offspring, forming seed, regenerating or re-establishing itself in any manner.	
Transformation of watercourse habitat The removal of high velocity habitats has the potential to alter the invertebrate community structure which depend on these velocities over a long-term basis. Many invertebrate species sampled at the current location were found in the cobble and gravel biotopes which are likely to be lost as flow rates reduce within the dam footprint.	**Medium-High (44)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 4** **SP = 44**	➢ Natural features such as trees or grasslands should not be removed from the dam margins in order to provide submerged habitats in the form of roots and overhanging vegetation for the aquatic biota. ➢ The introduction of invasive alien fish species such as *Micropterus salmoides* (Largemouth Bass) and *Cyprinus carpio* (Common Carp) for recreational fishing purposes must not take place within the dam. Flood events can potentially result in these invasive species being transported to larger, more important, river systems. ➢ Monitoring the sediment load and distribution in the dam basin and downstream channel using sediment sampling, bathymetric surveys, and remote sensing techniques.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 10**
Pollution of Water Resources and Soil Improper catchment land use management could lead to the buildup of nutrients within the dam, whereby nutrients will accumulate within the dam,	**Medium-High (44)** **SP= (M + D + S) × P**	➢ Monthly water quality monitoring must be conducted for the first 6 months of the dam operation.	**Negligible (10)** **SP= (M + D + S) × P**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
leading to potential algal blooms and eutrophication.	**SP= (5 + 4 + 2) × 4** **SP = 44**	➢ A management action plan must be set in place to deal with any significant deterioration in water quality. ➢ Efforts must be made to prevent fertilizer runoff into the watercourse through effective irrigation management. ➢ Livestock are prohibited from grazing within the riparian zone of the watercourse to prevent animal waste runoff into the watercourse. ➢ The dam water quality must be in accordance with approved TWQR allocation indicated in the water use license.	**SP= (3 + 2 + 1) × 2** **SP = 10**
Overall Mean significance: Nature of a project without mitigation	**Medium-High** **(44)** **$1323 \div 30=44$**	Nature of a project post mitigation	**Negligible** **(9)** **$260 \div 30=9$**

16 CUMULATIVE IMPACT ASSESSMENT AND MITIGATION MEASURES

In terms of the EIA Regulations, the cumulative impact is considered from the holistic point of view. It means that the impacts of an activity are considered from the past, present and foreseeable future, together with the impact of activities associated with that activity. The activity itself may not be significant, but when combined with the existing and reasonably foreseeable impacts eventuating from similar or diverse activities may result in a significant change. “Cumulative impacts can be: additive, synergistic, time crowding, neutralizing and space crowding” (DEAT, 2004b;14).

It is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

Table 14: Criteria for Cumulative Impacts.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

Table 15: Prioritisation Factor (Cumulative Impacts)

Impact Description	Alternative	Phase	Cumulative Impact	Irreplaceable Loss
Habitat fragmentation: Loss of species habitat	A, B, C & D	Construction + Operation	2	1
Biodiversity (flora): Loss of plant species of conservation concern (SCC)	A, B, C & D	Construction +Operation	2	1
Biodiversity (fauna) Loss of animal species of conservation concern (SCC)	A, B, C & D	Construction + Operation	1	1
Invasive Alien Plant Species	A, B, C & D	Construction + Operation	3	1
Impact on terrestrial surface water resource (rivers, wetlands)	A, B, C & D	Construction + Operation	2	1
Pollution of Surface Water Resources	A, B, C & D	Construction + Operation	2	1
Changes in Natural Flow (Flow regime alteration)	A, B, C & D	Construction + Operation	2	1
Impact on ground water resource (Oil spillages & Ground water contamination)	A, B, C & D	Construction + maintenance	1	1
Erosion, slits and compaction.	A, B, C & D	Construction + maintenance	3	1
Impact on Air Pollution: Dust from construction areas and emissions from vehicles and equipment.	A, B, C & D	Construction + maintenance	1	1
Waste (General, Hazardous Waste and HCW)	A, B, C & D	Construction + maintenance	1	1
Loss of Heritage Resources, fossils and Paleontological resources	A, B, C & D	Construction + maintenance	1	1
Visual Impact	A, B, C & D	Construction + maintenance	1	1
Socio-economic Impact	A, B, C & D	Construction + maintenance	3+	1
Impact on Traffic	A, B, C & D	Construction + maintenance	1	1
Noise Pollution	A, B, C & D	Construction + maintenance	1	1
Impacts on existing services (properties or utility infrastructure)	A, B, C & D	Construction + maintenance	1	1

Table 16: Description of Cumulative Impacts

Impact	Impact Level	Description	Mitigation
Loss of Habitat and Biota Loss of flora and fauna species The removal of high velocity habitats has the potential to alter the invertebrate community structure which depend on these velocities over a long-	Medium (2)	The proposed earth filled dam will occupy an area of 1.6ha and will therefore require the removal and clearance of instream, riparian and terrestrial vegetation. In particular, this relates to the East Griqualand Grasslands which	All construction activities must take place within an area demarcated for the development, as per project plan. All work to be done within sensitive riparian and instream habitats, if any, should be carried out at a time of low flow conditions (winter to early spring).

Impact	Impact Level	Description	Mitigation
term basis. Many invertebrate species sampled at the current location were found in the cobble and gravel biotopes which are likely to be lost as flow rates reduce within the dam footprint.		are considered endangered. This vegetation will therefore be permanently removed along with the associated riparian vegetation identified in the above sections. A prominent riffle and pool habitat is located within the proposed dam construction area which will be completely lost. This habitat loss is inevitable with or without mitigation measures. During potential flooding events, water is likely to inundate upstream sites if the dam is at full capacity. This could result in short term changes in water quality of the inundated area, habitat destruction and loss of biota. The removal of high velocity habitats has the potential to alter the invertebrate community structure which depend on these velocities over a long-term basis.	It is prudent however to be prepared for increased flows by scheduling work according to the weather forecast and to be adequately prepared for unexpectedly large runoff from a sudden storm. No-go zones should be strictly adhered to. This is particularly important for the upstream river area as biota may migrate upstream in search of suitable habitat. This will ensure the sustainability of the aquatic biodiversity. Natural features such as trees or grasslands should not be removed from the dam margins in order to provide submerged habitats in the form of roots and overhanging vegetation for the aquatic biota.
Changes in Natural Flow (Flow regime alteration):	Medium (2)	Potential disturbance of flow regime as result of upstream inundation.	Comprehensive mitigation will include prevention of stream sediment loads, prevention of stream inundation and flood attenuation.

Impact	Impact Level	Description	Mitigation
It has been widely recognised that dams have a significant impact on the natural flow of rivers. The earth filled dam construction will therefore result in reduced flows to the immediate downstream receiving environment. Although water within the dam can be released to simulate normal flow conditions, these releases will seldom follow the natural regime and variability of the watercourse. This impact will largely be evident during the operational phase		During potential flooding events, water is likely to inundate upstream sites if the dam is at full capacity. This could result in short term changes in water quality of the inundated area, habitat destruction and loss of biota.	A management plan should be implemented for the correct timing of water released from the dam in order to simulate natural seasonal variability. This will ensure that ecosystem services are maintained downstream. Obtain accurate floodline data in order to adequately plan for surrounding land use. Flow rates must be monitored to determine any excessive deviation from the natural state. If flow rates are drastically reduced, additional hydrological studies will be required such as an analysis of ecological/environmental water requirements, water balance as well as a hydrological yield analysis to determine the impact of the dam on the local scale.
Deterioration of downstream surface water quality Toxic spills potentially result in fatalities of aquatic fauna sensitive to water quality changes, leading to a further shift in species composition, favouring tolerant species.	Medium (2)	Heavy machinery will be required to excavate within the riparian and instream habitat. Therefore, this will have potential contaminants from this machinery include hydrocarbons, oils and grease. The water quality results from this study revealed that inputs from fertilizer and	Monthly water quality monitoring should be conducted for the first 6 months of the dam operation. A management action plan should be set in place to deal with any significant deterioration in water quality.

Impact	Impact Level	Description	Mitigation
Sedimentation caused by this loose soil can impact riverine systems through diminishing water quality by increasing turbidity which may affect local floral and faunal assemblages. During the operation of the dam the nutrients will accumulate within the dam, leading to potential algal blooms and eutrophication.		animal waste runoff has already affected the rivers water quality. Therefore, improper catchment land use management could lead to the build-up of nutrients within the dam.	Efforts should be made to prevent fertilizer runoff into the watercourse through effective irrigation management. Livestock are prohibited from grazing within the riparian zone of the watercourse to prevent animal waste runoff into the watercourse. Any soil contaminated by hydrocarbons (fuel and oils), grease, bitumen's, cement or any other binding agent used in the dam construction must be removed and the affected area rehabilitated immediately. Fuels, chemical and binding agents must be stored in a bunded structure with a roof. The bund must be able to contain at least 110% of the volumes of fuel. Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface. Drip trays should be utilised at all dispensing areas. A chemical spill kit must be always present onsite and once used it must be disposed of at a registered hazardous landfill site.

Impact	Impact Level	Description	Mitigation
Impacts on watercourse habitat functions and services. Uncontrolled construction works within a riparian and instream habitat is considered highly sensitive. Sedimentation caused by this loose soil can impact riverine systems through diminishing water quality by increasing turbidity which may affect local floral and faunal assemblages.	Medium (2)	Potential for increased sediments to enter the system through surface water dispersion causing siltation and other water pollution, as a result of excavation at riparian habitat.	All clearance and excavation within riparian and wetland habitat along the construction corridor must be limited to areas as demarcated and approved by project plans. Excavation at riparian must not be undertaken during wet (rainy) periods or peak flow condition. Vegetation at riparian should remain intact where possible, to limit high surface flows and mobilisation of sediments. ECO must oversee the implementation of the EMPr during the construction phase of the project, with riparian, and streams areas as a priority. Also, the monitoring plan should be developed in order to quantify the impact on the watercourses.
Soil erosion and geological degradation During the operational phase of the dam, water releases may result in increased erosion of the riverbanks if release volumes are not carefully calculated. The dam may also act as a sediment trap preventing the movement of sediments downstream which could	High (3)	The Construction activities (i.e. excavations, vegetation clearing and depositing fill material) expose soil to environmental factors including rainfall and wind which can lead to the removal of topsoil resulting in soil erosion. The reduction in sediment available could increase the erosive power of the water	No work within sensitive riparian should be carried out during wet period or peak flow season. Construction of the dam and pipeline commence during the dry season so as to limit the amount of sediment which may run off into the tributary. After every rainfall event, the contractor must check the site for erosion damage and immediately repair any damage recorded.

Impact	Impact Level	Description	Mitigation
change the morphology of the watercourse. The nature of the project, which involves the use of riverine material to construct the dam, incurs definite impacts even with mitigation measures		leading to reduced stream bank stability and erosion downstream. Compaction of soil will occur in the working areas due to heavy vehicle traffic during construction which will promote surface run-off and reduce infiltration which, in turn, will increase the volume and velocity of surface water entering the river system, thereby creating an erosion risk.	Construct storm water system and make provision for erosion protection. Vegetation clearance must be kept as minimal as possible to areas as demarcated by the project plans and to make use of natural erosion suppressors such as good grassland cover. It is recommended that excavation be carried out along the guidelines given in SANS 1200 (current version).
Invasive Alien Plant Species Uncontrolled construction activities, such as vegetation clearance and excavation are likely to spread and/or exacerbate colonization and establishment of invasive alien species	High (3)	Local alien invasive species may rapidly encroach into areas that have been disturbed by construction activities.	Comprehensive mitigation will include rehabilitation plan and prevention of spreading of Alien Invasive Plant Species. The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

17 SPECIALISTS STUDIES

There were five specialist studies undertaken for this Environmental Assessment, namely:

- Aquatic Biodiversity Impact Assessment (*Appendix G1*);
- Terrestrial Biodiversity Impact Assessment (*Appendix G2*);
- Basic Hydrological Assessment Compliance Statement (Appendix G3);
- Archaeological and Cultural Heritage Impact Assessment (Appendix G4);
- Paleontological Impact Assessment *(Appendix G5); and*
- Soil Resources Assessment (*Appendix G6*).

Environmental Screening Tool on the site and surrounding is recognized on the following themes:

Table 17: Environmental Screening Tool Sensitivity Theme

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low sensitivity
Agriculture			X	
Animal Species		X		
Aquatic Biodiversity	X			
Archaeological and Cultural Heritage	X			
Palaeontology	X			
Civil Aviation			X	
Defence Theme				X
Plant Species			X	
Terrestrial Biodiversity	X			

17.1 Motivation for excluding compliance statements:

The compliance statement for animal species was deemed to be unnecessary due the following reasons:

17.1.1 Animal Species Theme

The animal species is covered by a terrestrial biodiversity impact assessment, attached as (*Appendix B*).

17.2 Motivation for Exclusion of other Specialist Studies

Motivation for exclusion of other specialist studies prescribed by the Environmental Screening Tool is outlined in (***Table 18***) below.

Table 18: Specialist Studies Identified by Environmental Screening Tool

Specialist Study	Motivation for Exclusion of Specialist Study
Agricultural Impact Assessment	This study is not considered viable as the site has a medium sensitivity theme. Moreover, the instream- earth filled dam, will be a component of agriculture for Kokstad Research Station. Therefore, no change in land use.
Landscape/Visual Impact Assessment	This study is not considered viable as the instream- earth filled dam, will be a component of agriculture for Kokstad Research Station. Therefore, no change in land use. The proposed development (construction of the earth-filled dam) will take place within the farm to support the farming activities. Therefore, the proposed development will have 'Low visibility" and no visual impact as the development will be streamlined with the current land use.
Archaeological and Cultural Heritage Impact Assessment	The Archaeological and Cultural Heritage Impact Assessment was conducted for this EIA, attached as (*Appendix G4*).
Palaeontology Impact Assessment	The Palaeontology Impact Assessment was conducted for this EIA, attached as (*Appendix G5*).
Terrestrial Biodiversity Impact Assessment	The Terrestrial Biodiversity Impact Assessment was conducted for this EIA, attached as (*Appendix G2*).
Aquatic Biodiversity Impact Assessment	The Aquatic Biodiversity Impact Assessment was conducted for this EIA, attached as (*Appendix G1*).
Hydrology Assessment	The Basic Hydrological Assessment Compliance Statement was undertaken to assess the impact of the surface hydrology, attached as (*Appendix G3*).
Geotechnical Assessment	The Soil Resources Assessment was conducted for this EIA in place of Geotechnical Assessment, attached as (*Appendix G6*).
Socio-Economic Assessment	This study was not considered viable as, the earth dam is within the Kokstad Research Station and supports the farm operation within Kokstad Research Station.

Specialist Study	Motivation for Exclusion of Specialist Study
Seismicity Assessment	The Soil Resources Assessments scope has a provision of Seismicity Assessment, as a result provision for will form part of assessment. Furthermore, this is a small stock watering dam (approximately20 194m^3). Therefore, there will be no Dam Safety (Seismic Assessment) for this dam.
Plant Species Assessment	This assessment is covered by Terrestrial Biodiversity Impact Assessment, which was conducted for the proposed development (*Appendix G2*)
Animal Species Assessment	This assessment is covered by Terrestrial Biodiversity Impact Assessment, which was conducted for the proposed development (*Appendix G2*)

18 SUMMARY OF FINDINGS BY SPECIALISTS

The summary of findings detailed below, are derived from the: Aquatic Biodiversity Impact Assessment (*Appendix G1*); Terrestrial Biodiversity Impact Assessment (*Appendix G2*); Basic Hydrological Assessment Compliance Statement (Appendix G3); Archaeological and Cultural Heritage Impact Assessment (Appendix G4); Paleontological Impact Assessment *(Appendix G5); and* Soil Resources Assessment (*Appendix G6*), and are summaries as follows:

18.1 Aquatic Biodiversity Impact Assessment Findings

One perennial unnamed tributary was identified as a likely receiver of impacts from the proposed earth filled dam. The earth filled dam will be constructed instream and include the construction of a 200m pipeline. The unnamed tributary flows downstream and eventually joins the NFEPA uMzintlava River. No wetlands, fish corridors, or upstream management areas are located within the development buffer zone.

The Intermediate Habitat Integrity Assessment (IHIA) of the unit found that the instream and riparian habitats of the upstream site was in a largely natural state (***Class B***), whilst the instream and riparian habitats of the downstream site was in a moderately modified (***Class C***) state. The aquatic macroinvertebrate assessment yielded an overall poor diversity of macroinvertebrates, the majority of which were tolerant of poor water quality conditions. The fish assessment yielded zero species although this was expected on this reach of the river.

The water quality results indicated that nutrient loading from fertilizer and animal waste runoff from the farm is an issue. The overall EcoStatus of the assessed unit was determined to be a Class C at the upstream site, and a ***Class C/D*** at the downstream site. The slightly more degraded downstream site was attributed to greater habitat impacts, identification of more invasive plant species and water abstraction from the farm pump used to supply water to the office buildings.

Upon interrogation of the buffers tool for the determination of river ecosystem buffers, it was calculated that the recommended buffer width for the riparian zones within the study area would be 25m during the construction and the operation phase of the project in the case of best practice mitigation measures being applied onsite. In the case of no mitigation being applied onsite the recommended buffer zones would be 29m during the construction phase and 50m during the operation phase.

The potential impacts to the riverine areas arising from the construction and operation phase of the development are linked to; Transformation of watercourse habitat; Loss of biota; Increased flood peaks; Changes in natural flow; Soil erosion and sedimentation; Pollution of water resources and soil; and Alien invasive species introduction. These impacts are associated with the proposed earth filled dam are ranged from low to high without mitigation, however, the majority of these impacts can be reduced to medium or low in the case that the specialist mitigation measures provided in this report are adhered to. Higher impact significance is largely related to the permanent impacts of the dam construction instream, associated habitat loss and changes in natural stream flow. However, it is worth noting that the identified impacts would largely be confined to the dam footprint and local areas upstream and downstream of the dam construction. It is unlikely, considering the vast size of the catchment and various additional tributaries, that flows into the NFEPA river downstream (the Mzintlava) would be significantly impacted.

18.2 Terrestrial Biodiversity Impact Assessment Findings

According to the Screening report for an Environmental Authorization as required by the 2014 EIA regulations – proposed site environmental sensitivity, the Terrestrial Biodiversity Theme sensitivity of the Proposed KZN DARD Earth Filled Dam site is assigned a Very High Sensitivity due to Critical biodiversity area 1 and also the site forms part of the Protected Areas

Expansion Strategy. The site verification was conducted concurrently with the Terrestrial biodiversity impact assessment and during the survey, it was concluded that the proposed development site falls within High in terms of ecological sensitivity.

The project site is delineated as a primary grassland, which is intercepted by a perennial river. The riverine habitat is dominated by shrubs such as Leucosidea sericea and sedges such as *Cyperus obtusiflorus var. flavissimus*.

The findings from the Terrestrial Biodiversity Impact Assessment indicated that there were no threatened plant species or plant Species of Conservation Concern (SCC) were recorded during the survey. However, plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes Kniphofia linearifolia. According to the information obtained from authorities, since this project involves a construction of a dam and all plant species on site would be destroyed, an Ordinary Permit will be required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the proposed site. A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these plants can be relocated to. With the relocation of these species to suitable habitat, the cumulative impact to biodiversity could be adequately managed.

Two micro-habitats, namely grassland, instream/riparian habitat on and around the proposed development site represent a significant breeding, feeding and foraging areas for bird species, namely grasslands & riparian habitat and woodlands. Twenty-Nine (29) bird species were recorded during the field survey. Species recorded were common and widespread and typical of grassland biome. One Red Data bird species associated with the study area was recorded, namely Crowned eagle (*Stephanoaetus coronatus*). This species generally prefers forest habitats, such as gallery forest, dense woodland, forest gorges in savanna or grassland and alien tree plantations (such as *Eucalyptus* and pine). The grasslands and riparian vegetation (watercourse) provide suitable habitats for reptile species to occur on the project site. Only one reptile species was recorded during the survey, namely Rhombic Night Adder (Causus rhombeatus). According to the information obtained from the locals, snake species such as *Rinkhals* (*Hemachatus haemachatus*) and Mole Snake (*Pseudaspis cana*) have been observed on site. No reptile species of conservation concern were recorded during the survey.

The perennial stream within the proposed development site holds water on a permanent basis and are an important breeding habitat for most of the frog species which could occur within the study area. During the field survey, three frog species were recorded along the stream, namely Raucous toad (*Bufo rangeri*), Bronze Caco (*Cacosternum nanum*) and Bubbling kassina (*Kassina senegalensis*). No frog Species of Conservation Concern were recorded on site.

Tiger Fruit Chafer (*Atrichelaphinis tigrine*), Pirate (*Catacroptera cloanthe cloanthe*), African ringlet or common three-ring (*Ypthima asterope hereroica*), Pyrgomorphid Grasshopper (*Ochrophlebia caffra*) and Table Mountain Beauty (Aeropetes tulbaghia). No invertebrates species of conservation concern were recorded during the survey.

The site is situated less than a kilometre from the Mount Currie Nature Reserve and this Reserve is home for mammal species such as Endangered species.

Generally, the development activities proposed within the project area will have a significant impact on biodiversity conservation within the site. In order to conserve the faunal species community structures within the study area, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the required footprint only and effectively designed and managed dams can attract a variety of birds, insects, and animals to the area which can contribute to the conservation of biodiversity and the proposed dam may provide water-dependant avifauna with habitat for breeding and nesting sites. Because of the proximity to intensively cultivated areas, it is not expected that the proposed dam location will have a significant impact on fauna species. The impact on reptiles and amphibians is likely to be localized and may result in species being displaced (snakes and lizards) but no significant and irreversible impact on these species is expected. Mitigation measures to reduce any potential direct and acute impact on reptilian and amphibian species, such as conducting phased earthworks over time to allow various fauna to move away from the site of development, must be implemented.

The impacts of the proposed development on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur.

18.3 Hydrological Assessment Compliance Statement

The wettest period for the project site is from October to March while the period from April to September are the relatively dry months. This is consistent with the area being part of the summer rainfall region of the country. It is also clear that the seasonal pattern of evaporation and temperatures is nearly identical to the seasonal rainfall pattern.

The project site lies within a contributing catchment. This was derived using the SAGA toolbox that comes with the QGIS application. The contributing catchment covers an area of 7.935 km2 (7 935 199 m^2). The peak flow rate for 1:50 and 1:100 are 237.389 m^3/s and 273.130 m^3/s, respectively.

During the construction phase, there are several environmental risks that could pose a threat to surface water resources, these are: Sedimentation, habitat loss, water quality, and disruption of natural processes.

It is evident that one of the impacts that the dam wall would have during operation phase is the impact on the flow regime in the river both upstream and downstream of the proposed dam location, as a result of backwater effect. This is the backwater effect - a phenomenon that occurs when the water level of a river is raised by an artificial obstruction, such as a dam wall, and affects the flow conditions upstream. The backwater effect can alter the water depth, velocity, sediment transport, and morphology of the upstream river, as well as its ecological and social functions. The extent and magnitude of the backwater effect depend on several factors, such as the geometry and operation of the dam, the discharge and slope of the river, and the characteristics of the flood events.

The backwater effect is an important factor to consider when planning or evaluating the impacts of dam construction on rivers. It can have positive or negative consequences, depending on the objectives and perspectives of different stakeholders. For instance, some benefits of the backwater effect could be increased water storage, improved navigation, enhanced flood protection, or reduced erosion. Some drawbacks could be reduced flow velocity, increased sedimentation, altered habitat quality, or increased flood risk. Therefore, a comprehensive assessment of the backwater effect is needed to balance the trade-offs and optimize the management of dammed rivers.

Mitigation measures would be achieved through designing the dam with adequate spillway capacity, outlet works, and sediment bypass or flushing facilities to control the sediment deposition and release.

18.4 Archaeological and Cultural Heritage Impact Assessment Findings

The historical background of the study area provide a window of era dating from middle stone age to iron age.

The survey also paid special attention to disturbed and exposed layers of soils such as eroded surfaces along the general development site and the river stream. These areas are likely to exposed or yield archaeological and other heritage resources that may be buried underneath the soil and be brought to the surface by animal and human activities including animal barrow pits and human excavated grounds.

The Kokstad is within the National heritage significance Status sites and cultural Landscapes with Provincial heritage Significance Status. However, the proposed development site cultural landscape is characterised as a relatively unimportant cultural landscape with few features of value or interest, potentially tolerant of substantial change of the type proposed, as the proposed development site is already disturbed, and no sub surface finds can be made due to the disturbances. The study site is not known to have any archaeological sites, cultural heritage resources or any significant historical significance. The undertaken archaeological and historical background study revealed that there are no archaeological sites within the immediate vicinity of the proposed development site.

The potential impact of the development on cultural heritage resources is LOW, therefore a field survey or further mitigation or conservation measures are necessary if cultural heritage resources are found (according to SAHRA protocol).

18.5 Paleontological Impact Assessment Findings

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the wrong type to preserve fossils (soils and dolerite) but the shales and mudstones might preserve fossils. Furthermore, the material to be used for the wall construction is soil, and this does not preserve fossils.

The proposed site lies on the mudstones and shales of the Adelaide Subgroup, Beaufort Group (possibly on the Normandien Formation) that could preserve later Permian Glossopteris flora plants, or vertebrates of the *Daptocephalus* Assemblage Zone. No fossils have been recorded from the site to date. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, environmental officer or other designated responsible person once excavations for the dam and wall and piping have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

18.6 Soil Resources Assessment Findings

The study area at Kokstad is predominantly underlain by Mudstone of the Dwyka Group and Karroo Supergroup with dolerite intrusion, as the project area is within a stratified geological formation forming a belt between of Mudstone Geological Groups Formation. The soils within the proposed dam footprint comprise a mix of moderate to well drained soils with some shallow soils where parent rock is found close to the surface (outcrops). The soil depth is mainly varying from 500mm to 2 300mm with an apedal structure which is easily excavatable. The surrounding matrix/decomposed material is likely to require '*Soft*' to '*Intermediate*' excavation.

The infield investigation indicated that study area is bisected by an incised water channel and characterised of gentle slopes with some signs of gully erosion. The soils within the proposed dam footprint comprise a mix of moderate to well drained soils with some shallow soils where

parent rock is found close to the surface (outcrops). The soil depth is mainly varying from 500mm to 2 300mm with an apedal structure which is easily excavatable. The prominent geological material is characterised of dolerite and dyke group formation. The sign of wetness within the study area indicates the fluctuation of water table.

Therefore, for the purpose excavation for instream earth filled dam, the earthworks would be likely achieved, as the proposed dam site comprise of material that can be effectively removed or loaded without prior ripping and will be removed by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width, or by means of bulldozer, tractor scrapper, track type front-end loader back acting excavator.

19 RECOMMENDATIONS BY SPECIALISTS

19.1 Recommendations by the Aquatic Ecological Assessment

The following were recommended by Aquatic Ecological Specialist, and should be included in the Environmental Authorisation:

a) All work to be done within sensitive riparian and instream habitats, if any, should be carried out at a time of low flow conditions (winter to early spring). It is prudent however to be prepared for increased flows by scheduling work according to the weather forecast and to be adequately prepared for unexpectedly large runoff from a sudden storm.

b) It is recommended that construction of the dam and pipeline commence during the dry season so as to limit the amount of sediment which may run off into the tributary.

c) No-go zones should be strictly adhered to. This is particularly important for the upstream river area as biota may migrate upstream in search of suitable habitat. This will ensure the sustainability of the aquatic biodiversity.

d) Natural features such as trees or grasslands should not be removed from the dam margins in order to provide submerged habitats in the form of roots and overhanging vegetation for the aquatic biota.

e) The monthly water quality monitoring must be conducted for the first 6 months of the dam operation. This is particularly important considering the already elevated nutrient levels within the watercourse and potential safety risks of using this water for domestic purposes.

f) Efforts must be made to prevent fertilizer runoff into the watercourse through effective irrigation management.

g) Livestock are prohibited from grazing within the riparian zone of the watercourse to prevent animal waste runoff into the watercourse.

h) Flow rates must be monitored to determine any excessive deviation from the natural state.

i) A management plan should be implemented for the correct timing of water released from the dam in order to simulate natural seasonal variability. This will ensure that ecosystem services are maintained downstream.

j) Flow rates must be monitored to determine any excessive deviation from the natural state. If flow rates are drastically reduced, additional hydrological studies will be required such as an analysis of ecological/environmental water requirements, water balance as well as a hydrological yield analysis to determine the impact of the dam on the local scale.

19.2 Recommendations by the Terrestrial Biodiversity Assessment

The following were recommended by Terrestrial Biodiversity Ecologist, and should be included in the Environmental Authorisation:

a) Plant species listed as “Specially Protected Indigenous Plants” in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL IRIDACEAE, which includes *Kniphofia linearifolia*. An Ordinary Permit will be required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the proposed site.

b) A suitable habitat just outside of the development site exists in the Mount Currie Nature Reserve of which these plants can be relocated to. Through the search, rescue and relocation, a concerted effort must be made to prevent the loss of SCC that will be affected by the project.

c) The newly cleared soils will have to be re-vegetated and stabilised as soon as construction activities have been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging alien invasive plant species.

d) The rehabilitation of disturbed areas should receive high priority and the plant species used during rehabilitation should be site specific and according to the surrounding vegetation composition.

e) In order to conserve the faunal species community structures within the study area, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that construction activities are limited to the required footprint only.

f) All development footprint areas must remain as small as possible and should not encroach onto surrounding areas.

g) In order to alleviate the loss of habitat within the study area, it is recommended that a clear, concise and well formulated rehabilitation plan be implemented after the construction activities, focusing on fauna species

h) Any fauna threatened by the construction activities must be moved to safety by a suitable qualified Ecologist.

19.3 Recommendations by the Hydrological Compliance Statement

The following were recommended by Hydrological Specialist, and should be included in the Environmental Authorisation:

a) Design the dam with adequate spillway capacity, outlet works, and sediment bypass or flushing facilities to control the sediment deposition and release.

b) Monitoring the sediment load and distribution in the reservoir and downstream channel using sediment sampling, bathymetric surveys, and remote sensing techniques.

c) Adjusting the reservoir operation and maintenance plans according to the sedimentation patterns and impacts.

d) Conducting regular inspections and monitoring of the dam to detect any signs of seepage, such as wet spots, sinkholes, cracks, or changes in water level or quality.

e) Develop and implement an environmental flow regime that mimics the natural variability of the river and maintains its ecological functions. The environmental flow regime should consider the hydrological, biological, geomorphological, and water quality aspects of the river system, as well as the social and economic needs of the stakeholders.

19.4 Recommendation by Archaeological and Cultural Heritage Impact Assessment

The following were recommended by Archaeological and Cultural Heritage Specialist, and should be included in the Environmental Authorisation:

a) The potential impact of the development on cultural heritage resources is LOW, therefore a field survey or further mitigation or conservation measures are necessary if cultural heritage resources are found (according to SAHRA protocol). Amafa Research and Institute or a qualified archaeologist must be called on site if cultural heritage resources are found during construction, should the indicators of unmarked sub-surface sites are encountered:

- Bone concentrations, either animal or human;
- Ceramic fragments such as pottery shards either historic or pre-contact;

19.5 Recommendations by a Paleontological Impact Assessment

The following were recommended by a Paleontological Specialist, and should be included in the Environmental Authorisation:

a) No fossils were recorded as being preserved in the overlying soils of the Quaternary. A Fossil Chance Find Protocol must be added in EMPr and implemented during construction. If fossils are found by the contractor, environmental officer, or other responsible person, once excavations for the dam wall and other infrastructure have commenced then they should be rescued, and a palaeontologist called to assess and collect a representative sample (with an AMAFA permit).

20 RECOMMENDATIONS FROM THE EAP FOR INCLUSION IN EA

Having considered all issues, included the views of interested and affected parties and the inputs from the specialist reports, the EAP recommends the authorization of this application. After an Authorization has been granted, it is the applicants' responsibility to ensure that all recommendations outlined in this report as well as in the EMPr are properly implemented.

20.1 Pre-Construction phase

The following conditions and mitigation measures are recommended and should be considered in any authorization that may be granted by the CA in respect of the application:

a) The site layout plan must clearly delineate the servitude for the instream earth-filled dam construction corridor.

b) The design must incorporate a 15m buffer determination along the project site (earth-filled dam) and must be limited to demarcated footprint.

c) The site layout plan must indicate areas that are no-go zones, to limit large scale and unnecessary vegetation clearance.

d) Development planning must ensure that further loss of vegetation and disturbance are restricted within the recommended site layout footprint.

e) A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO and relevant workers to be inducted on the method statement.

f) Spillway design for the correct timing of water released from the dam in order to simulate natural seasonal variability. This will ensure that ecosystem services are maintained downstream.

g) A plan to actively rehabilitate the construction area during construction and post-construction needs to be developed before construction commences.

h) Pre-construction environmental induction and training must be conducted for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of the importance of protected plants/trees, medicinal plants, wildlife, heritage resources, waste management and social issues. The training must also include EA, permit and license conditions and the EMPr. Records of all training undertaken must be kept on file for audit purposes.

i) Appoint an ECO to monitor and enforce compliance of all EA, permits and licences conditions during construction.

20.2 During Construction Phase

a) The development area must again be surveyed prior to construction in order to locate and capture any animal and plant SCC and relocate them.

b) Clearly delineate the servitude for the construction corridor along the15m buffer of the development site. All areas of watercourses outside this servitude must be considered

no-go areas. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

c) All excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow periods. The activities within watercourse must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, the clearing and excavation activities must be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months.

d) Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible.

e) Where coffer dams are used to divert flow for construction purposes, these structures must be temporary in nature and be removed from the river immediately after the required construction has been completed. The de-watering process from the coffer dams should involve piping the water directly to the active channel downstream of the site as, or if, required.

f) A one-way running track must be established across the riverbed for the excavators to move along. The running track must be shielded with a wall of coffer dam and be constructed of a rock base overlain by coarse aggregate.

g) The use of heavy machinery (excavator) within the watercourse must be closely supervised. If possible, the excavator must only be positioned as far as possible away from the water edge, as it stretches the bucket to excavate the instream habitat.

h) The construction of an artificial channel outside of the watercourse habitats for water diversion purposes is not permitted, as this could lead to unnecessary erosion and instream siltation.

i) Detailed method statement for working within the watercourse with provision for spillage and construction debris management must be compiled by the contractor prior to the commencement of the project;

j) Stockpiles must not be more than 2m in height, and be stored on ideally flat area 32m away from the watercourse;

k) Rehabilitate all watercourses in accordance with DWS approved Rehabilitation and Maintenance Plan.

l) It is highly recommended that site camp be developed at already disturbed site, on ideal at Kokstad Research Station workshops or relatively flat surface area which is at least 32m away from the watercourse. Also, the construction machinery must be parked only at site camp on the designated bunded areas and dip trays must be placed under the machinery, when not in use to capture any possible hazardous substance leaks;

m) More regular water quality monitoring is required when major construction activity takes place directly within a watercourse, such as exaction of riverbanks, instream habitat disturbance, de-watering of coffer dams, and pouring of encased concrete at stream crossings;

a) All stockpiles must be kept free of weeds and invasive alien plants;

b) If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile;

c) Monitoring must take place during site clearance for possible archaeological and heritage artefacts and implement the Chance Finds Procedure (CFP) if any such finds are uncovered.

d) Regular Archaeological Watching Briefs must be carried out during construction in case any chance findings are made.

e) The Contractor must ensure that all temporary structures, materials, waste and facilities used for construction activities are removed upon completion of the project.

f) Fully rehabilitate all disturbed areas and protect them from erosion

g) The control and eradication of a listed invasive species from the construction footprint, including the site camp must be carried out using methods that are appropriate for the species concerned and the environment within which it occurs.

h) The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

i) The local community must take priority when it comes to employment and all skills that can be sourced from the local communities. Additionally, locals must be given the opportunity to participate in the development and only specialized skills must be sourced from outside of the surrounding communities;

j) All reasonable precautions must be taken to minimize noise generated on-site.

k) Storage areas must be managed properly by applying the suggested mitigation measures recommended in this document and EMPr;

l) All employees and contractor staff must undergo environmental training covering the following areas: The Environmental Authorisation, the EMPr, Spill Management, Waste Management, Emergency Procedures and Evacuation Procedures;

m) No workers are permitted to be accommodated overnight in the site except for essential security personnel.;

n) Ensure compliance to EA, permit and license conditions.

o) Construction method statements are to be adhered to. These method statements must consider the environmental facets associated with the rivers such as hydrological flow regimes, flora and fauna. These should be approved by the relevant departments (i.e. EDTEA and DWS);

p) It is recommended that education of workers is key to establishing good pollution prevention practices. Training programs must provide information on material handling and spill prevention and response, to better prepare employees in case of an emergency;

q) Petrochemical storage tanks must be enclosed in a bunded area that makes provision for 110% of the total volume of tanks that they contain. All these bunded areas must be supplied with a closable valve through which any spillage can be safely removed;

r) If there is any need to review or amend the environmental conditions/requirements, this must be done in consultation with and approval of the ECO.

20.3 During Operation/ Maintenance

a) Establish and maintain an IAPs management programme.

b) Construct storm water system and make provision for erosion protection.

c) Conducting regular inspections and monitoring of the dam to detect any signs of seepage, such as wet spots, sinkholes, cracks within stone pitching, or changes in water level or quality.

d) The disturbed watercourse habitat and rehabilitated areas must be monitored for potential erosion and scouring. This must initially take place immediately after construction, thereafter quarterly for two years and thereafter annually.

e) Flow rates must be monitored to determine any excessive deviation from the natural state. If flow rates are drastically reduced, additional hydrological studies will be required such as an analysis of ecological/environmental water requirements, water balance as well as a hydrological yield analysis to determine the impact of the dam on the local scale.

21 ENVIRONMENTAL IMPACT STATEMENT

The findings of this EIA Report as well as the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Six (6) specialist studies were considered for this EIA: Aquatic Biodiversity Impact Assessment (*Appendix G1*); Terrestrial Biodiversity Impact Assessment (*Appendix G2*); Basic Hydrological Assessment Compliance Statement (Appendix G3); Archaeological and Cultural Heritage Impact Assessment (Appendix G4); Paleontological Impact Assessment *(Appendix G5); and* Soil Resources Assessment (*Appendix G6*), Overall, anticipated adverse impacts linked with the planned activities during construction and operation are expected to be of medium-high impact significance, and with mitigation are rated as negligible or very low.

The project impacts were assessed on the basis of discrete alternatives '*Alternative A: Site Layout Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Location Alternative*'. The environmental assessment included an analysis of 30 key environmental aspects of the project that were relevant to the area and the activity, as well as six (6) specialist studies and engagements with relevant stakeholders. Of the 30 environmental aspects analysed, the significance was determined as follows: 12 were rated high, eight (8) were rated medium-high, five (5) were rated medium, three (3) were rated low, one (1) very low, and one (1) negligible. With the implementation of suitable mitigation measures, 27 of the impacts were rated negligible and three (3) were rated very low. Overall Mean significance: Nature of a project without mitigation is medium-high, while with mitigation the impacts are considered negligible.

All specialist studies concluded that the of the proposed development will have little to minor impacts on environment, with proper implementation of mitigation measures. Notwithstanding, these impacts can be mitigated with appropriate measure detailed in and EMPr and implemented during the project.

The EAP and Aquatic Specialist proposed a buffer determination along the site development footprint. The 15-buffer determination along the develop is considered the viable option to offset impact within downstream and upstream riparian zone. The areas outside the buffer zone must be marked as “No-Go” areas. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

Due the nature of works which involve working within the watercourses (stream and riparian) as a result of bulk earthworks for construction of an instream earth-filled dam. It is therefore, highly recommended that the planned activities be undertaken during dry period, where the stream of low peak flows condition.

22 CONCLUSION AND EAP OPINION

In view of the foregoing, it is evident that with proper implementation of mitigation measures as outlined in (***Section 15.1***) and EMPr, the proposed will not have significant negative environmental impacts in the area.

The proposed instream earth-filled dam is position within the low-lying area fed by proposed an un-named stream traversing across the farm to which headwater spring is the current source where the current abstraction takes place. The preliminary feasibility design provides that the catchment size within the study area is 7.8km^2, with a run-off intensity of 28.667 cumec and as a result the instream dam can yield 20 194m^3 which will be sufficient water to augment the current water supply in order to meet the water supply requirement at the farm.

The proposed development of instream earth-filled dam is in response to KZN DARD need for development of an instream storage dam has been adopted with focus on a cost effective and environmentally compatible process, to increase the capacity of water supply to Kokstad

Research Station throughout the year, thus improve capability of research station to conduct its activities for future planned research programmes. To realise this goal and to ensure that the Sustainable Development Goal 6 and the NDP objectives are realised through this project, the National Web-Based Environmental Screening Tool (NWBEST) was used to generate the environmental sensitivity report of the proposed development site. Additionally, an Initial Site Sensitivity Verification study was undertaken to confirm or dispute the environmental sensitivity as identified by the NWBEST was conducted.

The decision to grant or refuse authorisation in terms of Section 24 of NEMA must be made in the light of the provisions of the Principles of NEMA. Section 24 provides that, in order to give effect to the general objectives of integrated environmental management laid down in NEMA, the potential impact on the environment of listed activities must be considered, investigated, assessed, and reported on to the CA charged by the Act with deciding applications for EA. A Draft Basic Assessment Report (DBAR) concerning the impact of the proposed KZN DARD Instream Earth-filled Dam for Kokstad Research Station including mitigation actions, has been compiled and submitted as prescribed and authorisation may only be issued after consideration of such report.

We submit that the environmental process undertaken thus far complies with these requirements and that this report covers the full suite of potential environmental issues related to the proposed KZN DARD Instream Earth-filled Dam for Kokstad Research Station. All potential impacts have been evaluated and responded to by either complete avoidance where possible, or by recommendation of the most appropriate and feasible mitigation measures. The preferred/mitigated development proposal presented in this report is responsive to the integrated results of the assessment of potential impacts made by the various specialists on the project team.

Based on comparative evaluation of the various alternatives, including the No-Go option, it is evident that the preferred '*Alternative A: Site Layout Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Location Alternative*' for the proposed KZN DARD Instream Earth-filled Dam for Kokstad Research Station can meet the required objections to offset the No-Go option (subject to the implementation of recommended development mitigation measures). This DBAR therefore, concludes that the

proposed development has been considered via a balanced approach, mindful of cumulative impacts, need and desirability of the project and that the overall negative environmental impacts will be of very low significance. As such, the project can be considered for environmental authorisation subject to implementation of the recommended phased approach and specialist mitigation measures as specified in the EMPr. Due the nature of works which involve working within the watercourses as a result of pipeline stream crossing it is highly recommended that the planned activities be undertaken during dry period, where the streams and river are dry and of low peak flows condition. The Project is planned to take place during winter months mostly preferable March 2024/ August 2024.

This Draft Basic Assessment Report is available for a review and comment period of 30 days, from ***08th of August 2023*** to the ***6th of September 2023***. Comments and submissions received in response to this report will be submitted to DFFE (the competent authority).

Written submissions must be addressed to:

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APPENDICES

APPENDIX A. DECLARATION OF INFORMATION

APPENDIX B. ENVIRONMENTAL MANAGEMENT PLAN(EMPR)

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APPENDIX E. PUBLIC PARTICIPATION PROCESS

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APPENDIX F. EAP'S CV(S)

F-1: Principal EAP (Phumzile Lembede)

F-2: Study Lead/EAP (Dumisani Myeni)

APPENDIX G. SPECIALIST STUDIES

G-1: Aquatic Ecological Impact Assessment

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APPENDIX H: SCREENING SENSITIVITY VERIFICATION REPORT

APPENDIX I: ENVIRONMENTAL SCREENING REPORT