DRAFT ENVIRONMENT IMPACT ASSESSMENT REPORT

in support of an

ENVIRONMENTAL AUTHORIZATION

for the

PROPOSED DAM ON ARBEIDSGENOT FARM, MOORREESBURG
REMAINDER OF FARM BAKOVEND 403, GOUDA DISTRICT

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DEA&DP REFERENCE NUMBER: 16/3/3/6/7/2/F5/17/2120/17

PROJECT DETAILS

eco impact Environmental Health & Safety Legal Consulting	**Title:** Proposed Dam on Arbeidsgenot Farm, Moorreesburg Remainder of Farm Bakovend 403, Gouda District.	
Eco Impact No:1-07/2019	**Date:** July 2019	**Report Status:** Draft EI Report
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Verification	Capacity	Name	Signature	Date
Author	Principle EAP	Nicolaas Hanekom		15/07//2019

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GLOSSARY OF TERMS

“Alluvial” Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc

"Activity" means an activity identified in Government Notice Numbers. R. 327, 325 and 324 of 2017 as a listed activity.

"Alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to property, activity, design or technology.

"Applicant" means a person who has submitted or intends to submit an application;

"Application" means an application for an environmental authorization in terms of Chapter 3 of the Environmental Impact Assessment Regulations, 2010.

"Associated Infrastructure" means any building or infrastructure that is necessary for the functioning of a facility or activity or that is used for an ancillary service or use from the facility.

“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.

"Cumulative impact" in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

"Environmental impact assessment' in relation to an application to which scoping must be applied, means the process of collecting, organizing, analysing, interpreting and communicating information that is relevant to the consideration of that application.

“Environment” The environment has been defined as “The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group”. These circumstances include biophysical, social, economic, historical, cultural and political aspects.

“Environmental Assessment Practitioner” Person or company, independent of the applicant (developer), that manages the environmental assessment process of a proposed project on behalf of the applicant.

“Environmental Impact Report” In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

"Environmental management plan" means an environmental management plan in relation to identified or specified activities envisaged in Chapter 5 of the National Environmental Management Act and described in regulation 34;

“Heritage resources” This means any place or object of cultural significance. It also includes archaeological resources.

“Hydromorphic / hydric soil” Soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring growth and regeneration of hydrophytic vegetation. These soils are found in and associated with wetlands.

"Interested and Affected Party" means an interested and affected party contemplated in section 24(4) (d) of the Act, and which in terms of that section includes -
(a) any person, group of persons or organization interested in or affected by an activity; and
(b) any organ of state that may have jurisdiction over any aspect of the activity;

"Public Participation Process" means a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters; *"Registered Interested and Affected Party", in relation to an application, means an interested and affected party whose name is recorded in the register opened for that application in terms of regulation 57.*

“Red Data species” All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

“Riparian” The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

“Scoping Report” An “issues-based” report which forms the first phase of an Environmental Impact Assessment process.

"Significant impact" means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment;

"The Act" means the National Environmental Management Act, 1998 (Act No.107 of 1998).

ABBREVIATIONS

BID: Background Information Document
DEA&DP: Department of Environmental Affairs and Development Planning
DWS: Department of Water and Sanitation
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EMPr: Environmental Management Programme
EIA: Environmental Impact Assessment
EIAr: Environmental Impact Assessment Report
FSR: Final Scoping Report
GPS: Global Positioning System
HIA: Heritage Impact Assessment
I&APs: Interested and Affected Parties
IDP: Integrated Development Plan
MAR: Mean annual rainfall
NEMA: National Environmental Management Act
NEMBA: National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
NEM:WA: National Environmental Management: Waste Act
NEM:AQA: National Environmental Management: Air Quality Act
NHRA: National Heritage Resources Act
NSBA: National Spatial Biodiversity Assessment
NWA: National Water Act, 1998 (Act No. 36 of 1998)
PPP: Public Participation Process
SACNASP: South African Council for Natural Scientific Professions
SANBI: South African National Biodiversity Institute
SDF: Spatial Development Framework
SG: Surveyor General
ToR: Terms of Reference
GNR 327: National Environmental Management Act 107 of 1998, Environmental Impact Assessment Regulations Listing Notice 1 of 2014, Published under Government Notice R983 in Government Gazette 38282 of 4 December 2014 and amended by GN 327 in GG 40772 of 2017/04/07.
GNR 325: National Environmental Management Act 107 of 1998, Environmental Impact Assessment Regulations Listing Notice 2 of 2014, Published under Government Notice R984 in Government Gazette 38282 of 4 December 2014 and amended by GN 325 in GG 40772 of 2017/04/07.
GNR 324: National Environmental Management Act 107 of 1998, Environmental Impact Assessment Regulations Listing Notice 3 of 2014, Published under Government Notice R985 in Government Gazette 38282 of 4 December 2014 and amended by GN 324 in GG 40772 of 2017/04/07.
GNR 326: National Environmental Management Act 107 of 1998, Environmental Impact Assessment Regulations, 2014 Published under Government Notice R982 in Government Gazette 38282 of 4 December 2014 and amended by GN 326 in GG 40772 on 2017/04/07.

1. INTRODUCTION

This report has been prepared in compliance with the requirements of Regulations contained in Government Notices No's GNR 327, 325, 324 and GNR 326 as promulgated in terms of the National Environmental Management Act 107 of 1998, known as the Environmental Impact Assessment **(EIA)** Regulations.

The purpose of these Regulations is to regulate procedures and set criteria as contemplated in Chapter 5 of the Act to enable the submission, processing, consideration and decision-making regarding applications for environmental authorization of activities and matters pertaining thereto.

Requirement	Section in Report
(a) details of- (iii) the EAP who prepared the report; and	Section 1.2 page 18.
(iv) the expertise of the EAP, including a curriculum vitae;	Section 1.2 page 18 and Appendix H for curriculum vitae.
(b) the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:	Section 3.1 and Appendix B.
(i) the 21-digit Surveyor General code of each cadastral land parcel;	Section 3.1 page 35.
(ii) where available, the physical address and farm name; and	No physical address. Farm name include Section 3.1. page 35.
(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	GPS co-ordinates on page 36-38.
(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	Appendix B.
(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;	GPS co-ordinates on page 38.
(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	GPS co-ordinates on page 36-38.
(d) a description of the scope of the proposed activity, including-	Section 3.1 page 38-42.
(i) all listed and specified activities triggered and being applied for; and	Listed activities specified on pages 28 and 81-82.
(ii) a description of the associated structures and infrastructure related to the development;	Pages 38-42.
(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;	Chapter 2.

(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 development footprint within the approved site as contemplated in the accepted scoping report;	Chapter 6.
(g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Environmental Impact Statement on page 164.
(h) a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	Pages 66-67.
(i) details of the development footprint alternatives considered;	Page 67.
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Chapter 5 and Appendix D.
(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;	Will be included in the final EIAr. None to date.
(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 4.
(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-	Chapter 8.
(aa) can be reversed;	Chapter 8.
(bb) may cause irreplaceable loss of resources; and	Chapter 8.
(cc) can be avoided, managed or mitigated;	Chapter 8.
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 8.1 pages 70-71.
(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;	Chapter 8.
(viii) the possible mitigation measures that could be applied and level of residual risk;	Chapter 8.

(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Alternative development footprints for the activity were investigated.
(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Page 168.
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including-	Chapter 8.
(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Chapter 8.
(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;	Chapter 8.
(j) an assessment of each identified potentially significant impact and risk, including-	Chapter 8.
(i) cumulative impacts;	Chapter 8.
(ii) the nature, significance and consequences of the impact and risk;	Chapter 8.
(iii) the extent and duration of the impact and risk;	Chapter 8.
(iv) the probability of the impact and risk occurring;	Chapter 8.
(v) the degree to which the impact and risk can be reversed;	Chapter 8.
(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	Chapter 8.
(vii) the degree to which the impact and risk can be mitigated;	Chapter 8.
(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 8.2.
(l) an environmental impact statement which contains-	Pages 164-167.
(i) a summary of the key findings of the environmental impact assessment:	Pages 164-167.

(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	Appendix B.
(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Pages 159-161.
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in The EMPr as well as for inclusion as conditions of authorisation;	Pages 169-170.
(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Chapter 8.
(o) 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;	Pages 169-170.
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1.6 page 22. Pages 162 and 164.
(q) 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;	Pages 164-167.
(r) 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;	Does include operational aspects.
(s) an undertaking under oath or affirmation by the EAP in relation to-	Will be included in the final EIAr.
(i) the correctness of the information provided in the reports;	Will be included in the final EIAr.
(ii) the inclusion of comments and inputs from stakeholders and I&APs;	Will be included in the final EIAr.
(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	Will be included in the final EIAr.
(iv) any information provided by the EAP to	Will be included in the final EIAr.

interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	
(t) where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	None included in the EIR. The financial provision requirements associated with the EMPr will be costed and included in the financial documents that will be supplied by the preferred bidder once selected as a preferred bidder in the South African Renewable Energy Feed-in Tarif ("REFIT") program to reach financial close and approval to commence with construction and operation of the facility.
(u) an indication of any deviation from the approved scoping report, including the plan of study, including-	None.
(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	Page 123.
(ii) a motivation for the deviation;	Page 123.
(v) any specific information that may be required by the competent authority; and	As per comments and response report in Appendix D.
(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable

1.1 Background and Purpose of the Environmental Impact Report

The property and proposed dam site are situated west of the Berg River east of the Moorreesburg to Gouda gravel road approximately 23km east of Moorreesburg. The dam's 0.2 km^2 catchment is located in the quaternary catchment G10J. The proposed dam will have a storage capacity of 324 000m^3, dam wall height of 13.5m and a surface area of 6.2ha. The dam wall will be constructed using a cut and fill process. Soil and clay will be cut from the dam basin and dam wall area that will also help to increase the depth of the dam and decrease the catchment basin that will lower water evaporation as the surface of the dam is smaller. The cut material will be used to fill and construct the dam wall. No other material is needed to construct the dam wall.

The overall area is characterised by ploughed and planted lands used for agriculture. The dam will impact on a disturbed tributary of the Berg River which has been classified as an ecological support area. Take note that the tributary has no ecological functioning left other than the transport of water from the agricultural lands.

Associated infrastructure
The farm has two existing abstraction points on the Berg River south and north-east of the farmhouse. The existing pipelines (125 & 165mm dia) from these abstraction points will be upgraded to 250mm dia each to fill the proposed dam. An additional abstraction point with a 250mm dia pipeline (130m long) is proposed just below (to the north) of the proposed dam, which will be the shortest route to fill the dam.

A new power line cable up to 600 volts will be installed on poles above ground from the north-

eastern abstraction point to the new point. All areas to be irrigated from the new dam will be located within existing cultivated lands. A raft abstraction pump from the dam basin will be used for bulk conveyance to the areas.

Eco Impact Legal Consulting Pty Ltd (Eco Impact) have been appointed as the independent environmental assessment practitioner **(EAP)** for this project as required in terms of the regulations. Eco Impact will be managing the application for authorization, having already submitted an Application form, draft and final Scoping Reports to the Department of Environmental Affairs and Development Planning **(DEA&DP)**, and will be preparing the final EIAr for submission to DEA&DP following this draft EIAr phase.

The EIA will be evaluated by DEA&DP who will either issue an Environmental Authorization (with conditions), or alternatively, refuse the application for authorization.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this EIAr.

1.2. Environmental Assessment Practitioner

This report has been prepared by Mr. Nicolaas Hanekom of Eco Impact.

Name of the Environmental Assessment Practitioner ("EAP") responsible for the application:	Eco Impact Legal Consulting (Pty) Ltd		
Company name (if any):	Nicolaas Hanekom		
Postal address:	P.O. Box 45070		
	Claremont	Postal code:	7735
Telephone:	021 671 1660	Cell:	083 666 8046
E-mail:	admin@ecoimpact.co.za	Fax:	021 671 9976

The role of the EAP is to manage the application for an EA on behalf of the applicant. The EAP must adhere to all relevant legislation and guidelines, ensuring that the reports contain all the necessary and relevant information required by the competent authority to make a decision. It is the responsibility of the EAP to perform all work relating to the application in an objective, appropriate and responsible manner.

Eco Impact is appointed as the independent environmental assessment practitioner (EAP) for this project as required in terms of the regulations. Eco Impact is an environmental consultancy established in 2008.

Nicolaas Hanekom is a registered Professional Natural Scientist (Ecology) with the South African Council for Natural Scientific Professions ("SACNASP") and a qualified Environmental Assessment Practitioner ("EAP") who holds a Masters Technologiae, Nature Conservation ("Vegetation Ecology and Biodiversity Assessment") degree from the Cape Peninsula University of Technology.

He further qualified in Environmental Management Systems ISO 14001:2004, at the

Centre for Environmental Management, North-West University, as well as Environmental Management Systems ISO 14001:2004 Audit: Internal Auditors Course to ISO 19011:2003 level, from the Centre for Environmental Management, North-West University qualifying him to audit to ISO/SANS environmental compliance and EMS standards.

Nicolaas has presented lectures in two subjects at the Cape Peninsula University of Technology. He has over 26 years of environmental planning experience, working for Free State and Western Cape departments of environmental affairs, where he reviewed and commented on development (EIA) and mine permit or right applications in the West Coast Region. He has also been involved in the implementation of numerous environmental management programmes and systems, environmental auditing, environmental impacts for environmental authorizations, mine rights and permits, waste licenses, Atmospheric Emissions Licenses, applications for water use authorizations and management and rectification of environmental impacts on sites and facilities

Refer to Appendix H for a copy of the EAP's CV.

1.3. The EIA Process to Date

The current EIA process for the proposed development application was initiated by Eco Impact in October 2017. As required by the Regulation under NEMA, this initially consisted of a Scoping phase during which members of the public were notified of the process, and invited to submit comments and raise any issues and concerns. The purpose of the Scoping process was to identify the environmental impacts and range of feasible alternatives requiring more detailed investigation in the EIA. The Scoping process culminated in the compilation of a Scoping Report (Eco Impact April 2019) containing the following information:

- A detailed background to the project;
- An overview of the legal requirements for the proposed activities;
- The terms of reference for the EIA, and overview of the approach to and scope of the environmental investigation;
- A description of the public participation process undertaken for the project;
- A detailed description of the proposed activities and the full range of identified project alternatives;
- An overview of the affected environment; and
- A summary of the potential environmental impacts identified by the public, literature review and professional inputs.

The Scoping Report outlined the full range of potential environmental impacts and feasible project alternatives and how these were derived. Moreover, included with the Scoping Report was a Plan of Study for EIA, which outlined in detail the proposed approach to the subsequent and final phase of the EIA process, *viz.* the (EIAr) phase. The aforementioned documents were submitted to DEA&DP and accepted.

We are now in the Environmental Impact Report (EIAr) Phase of the EIA process, and the sequence of documents produced thus far are as follows:

- The Department of Environmental Affairs and Development Planning (DEA&DP)

Application Form, providing the formal application for the projects.
- The Draft and Final Scoping Reports, outlining the findings of the Scoping Process and reflecting public comment in this regard.
- The Plan of Study for EIA, describing the proposed approach to the Environmental Impact Report phase.

1.4. Structure and Scope of this Report

As outlined above, the EIA process undertaken to date has culminated in the production of a comprehensive Scoping Report which provides detailed information relevant to the project. However, for the sake of being succinct, information contained within the Scoping Report is not repeated within this EIAr unless it has direct bearing on the issues under discussion. **Accordingly, to ensure a holistic understanding of the project, the nature of the activities and the substance of the environmental process, it is critical that this EIAr is read in conjunction with the Final Scoping Report** (Eco Impact April 2019).

The structure of this EIAr has been informed by NEMA GNR 326 Appendix 3 and the need for a clear and succinct document to facilitate informed decision-making by the applicant and environmental authorities.

The EIAr contains the following information:

- Details of the EAP who compiled the report and the expertise of the EAP to carry out an environmental impact assessment
- A detailed description of the proposed activity
- A description of the property on which the activity is to be undertaken and the location of the activity on the property
- A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity
- Details of the public participation process conducted
- A description of the need and desirability of the proposed activity
- A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity
- An indication of the methodology used in determining the significance of potential environmental impacts
- A description and comparative assessment of all alternatives identified during the environmental impact assessment process
- A summary of the findings and recommendations of any specialist report or report on a specialised process
- A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- An assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of the impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can

be mitigated
- A description of any assumptions, uncertainties and gaps in knowledge
- A reasoned opinion as to whether the 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
- An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, and a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives
- A draft environmental management programme
- Copies of any specialist reports and reports on specialized processes
- Any specific information that may be required by the competent authority

1.5. Approach to the Project

1.5.1. The EIAr phase

As outlined in the Scoping Report, there are three distinct phases in the EIA process, as required in terms of the NEMA, namely the Initial Application, the Scoping Report and the EIAr phases. This Report covers the final phase, *viz.* the EIAr phase. The Initial Application phase entailed the submission of the Application Form, whilst the Scoping Report phase entailed the compilation and submission of the Scoping Report and Plan of Study for EIA.

The purpose of the EIAr is to describe and assess the range of feasible alternatives identified during the Scoping process in terms of the potential environmental impacts identified. The ultimate purpose of the EIAr is to provide a basis for informed decision-making, firstly by the applicant with respect to the option they wish to pursue, and secondly by the environmental authority regarding the environmental acceptability of the applicant's preferred option.

The approach to the EIAr phase entailed the following:
- Undertaking a further review of relevant literature;
- Appointing various specialists to undertake the specialist studies identified during the Scoping Report phase:
    - Nicolaas Hanekom - Eco Impact – Freshwater Ecology Specialist
    - Review specialists (Freshwater Ecology) - Avhafarei Phamphe (Pr.Sci.Nat-Ecological Science) – Nemai Consulting
    - Consulting Engineer – Ingeprop; DJ Hagen Pr Eng

Consultation with the public forms an integral component of this investigation and enables I&APs *e.g.* landowners, local authorities, businesses, informal traders, environmental groups, civic associations and communities, to comment on the potential environmental impacts associated with the feasible alternatives and to identify additional issues which they feel have not been adequately addressed in the EIAr. A detailed summary of the public participation process, and the comments submitted by I&APs, is provided in Section 5 and in Appendix D.

1.5.2. Authority involvement

In accordance with the requirements of GNR 326, a Scoping Report and a Plan of Study for EIA for the proposed project were compiled and submitted to the competent authorities. DEA&DP accepted the Final Scoping report on the 10th of June 2019. Note: As per GNR 326, the Final EIAr must be submitted within 106 days of the acceptance of the scoping. The period of 15 December to 5 January must be excluded in the reckoning of days. Hence the final EIAr

must be submitted by 30 September 2019.

1.5.3 Decision making

The Final EIAr will be completed and all I&AP will be incorporated into the report. The EIAr will be submitted to DEA&DP for review and decision making. The competent authority must within 107 days of receipt of the environmental impact assessment report and EMPr issue a decision.

Once DEA&DP have reviewed the document and are satisfied that it contains sufficient information to make an informed decision, DEA&DP will determine the environmental acceptability of the applicant's preferred options. Thereafter DEA&DP will issue an Environmental Authorization outlining the decision. Following the issuing of the Environmental Authorization, DEA&DP's decision will be communicated to all identified I&APs and there will be an appeal period within which I&APs will have an opportunity to appeal against the decision to the Minister of the Department of Environmental Affairs and Development Planning in terms of the NEMA.

1.6 Assumptions and Limitations

In undertaking this investigation and compiling the Scoping Report and EIAr, the following has been assumed:

- The information provided by the client, engineers and specialists is accurate and unbiased.
- The scope of this investigation is limited to assessing the environmental impacts associated with the development.
- Should the proposed project be authorised, the applicant will incorporate the recommendations and mitigation measures outlined in the EIAr into the detailed design and construction contract specifications and operational management system for the proposed project.

1.7 The Legal Framework in South Africa

The following legislation is applicable to this project and has been considered in the preparation of the EI Report. Allocation of applicable environmental legislation has been done with the latest legislation:

Table 1: Applicable legislation

Environmental Legislation	Description of Activity
National Environmental Management Act, 1998 (Act No. 107 of 1998) and relevant regulations	Various general activities as described below, including but not limited to the control of emergency incidents and the care and remediation of environmental damage.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) and relevant regulations	The requirements for, waste removal and transportation, waste disposal, littering and the requirements for an integrated waste management plan
National Water Act, 1998 (Act No. 36 of 1998) and relevant regulations	The use of water, including any water purification and effluent treatment facilities, dams and irrigation systems.

Environmental Legislation	Description of Activity
Atmospheric Pollution Prevention Act, 45 of 1965 Regulations Only	Activities that result in emissions of dust, vehicle emissions and noxious or offensive gasses.
Conservation of Agricultural Resources Act, 43 Of 1983	Weeds and the tolerance thereof, which applies in both urban and other areas.
National Environmental Management: Air Quality Act, 39 Of 2004 And Relevant Regulations	Activities that may affect the air quality on site and the environment surrounding it.
Constitution of the Republic of South Africa, 1996	General application to individual rights of all on and adjacent to the Sites
National Heritage Resources Act 25 of 1999	Development of the site and dealing with graves and burial sites and any structures older than 60 years.
National Environmental Management: Biodiversity Act 10 of 2004	The management and conservation of biological diversity and the sustainable use of indigenous biological resources.
National Veld and Forest Fire Act 101 of 1998	Any activities that could result in the start of veld fires.

Policies

An environmental policy is derived from the guiding principle whereby an organization first defines the scope of its commitment to the environment. The policy is a public document that communicates the organization's overall approach to managing its interaction with the environment.

Various components of Environmental Management are strongly influenced by the environmental policies in terms of their scope and level of resource allocation. As a rule, objectives and targets are set to achieve compliance with the environmental policy, and overall environmental performance is evaluated against the organization's stated intent reflecting a level of commitment.

Policy must meet the following criteria:

- It must be relevant to the nature of an organization's activities, and the specific environmental aspects associated with those activities;
- It must consider specific local environmental conditions;
- It must consider relevant environmental legislation;
- It must define and formulate the organization's fundamental approach to environmental management; and
- It must set a precedent for communication and liaison with all stakeholders.

Policies considered in the compilation of this document include:

- National Spatial Development Framework;
- Provincial Spatial Development Framework for the Western Cape;

- Framework for a conservation plan for the Cape Floristic Region.

Guidelines

The following guidelines are applicable to this project, and have been considered in the preparation of the EI Report:

- Guideline on Public Participation;
- Information of Generic Terms of Reference and Project Schedules;
- Interpretation guidelines under NEMA;
- Circular EADP 0028/2014: One Environmental Management System;
- Guideline for Involving Biodiversity Specialists in the EIA Process (2005);
- Guideline for Involving a Heritage Specialist in an EIA Process (2005);
- Guideline for the Review of Specialist Input in the EIA process (June 2005);
- Guideline for Environmental Management Plans (June 2005);
- Guideline on Alternatives (March 2013); and
- Guideline on Need and Desirability (March 2013).

Table 2: Listed activities identified are as follows:

Government Notice R. 983 Activity No(s) as amended:	Describe the relevant **Basic Assessment Activity(ies)** in writing as per **Listing Notice 1** (GN No. R. 983)	Describe the portion of the development as per the project description that relates to the applicable listed activity
12	The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; where such development occurs- (a) within a watercourse;	Proposed dam of more than 100m² in size within 32m of a watercourse and within a watercourse.
19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from- (i) a watercourse;	Proposed infrastructure development within a watercourse.
Government Notice R. 985 Activity No(s) as amended:	Describe the relevant **Basic Assessment Activity(ies)** in writing as per **Listing Notice 3** (GN No. R. 985)	Describe the portion of the development as per the project description that relates to the applicable listed activity
NA		
Government Notice R. 984	Describe the relevant **Scoping and EIA Activity(ies)** in writing	Describe the portion of the development as per the project

Activity No(s) as amended:	as per **Listing Notice 2** (GN No. R. 984)	description that relates to the applicable listed activity
16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more.	The proposed dam will have a storage capacity of 324 000m^3, dam wall height of 13.5m and a surface area of 6.2ha.

2. DESCRIPTION OF THE PROPERTY AND PROPOSED ACTIVITY

2.1 General Site Information

The property and proposed dam site is situated west of the Berg River east of the Moorreesburg to Gouda gravel road approximately 23km east of Moorreesburg.

Property Details: Remainder of Farm Bakovend 403, Gouda district.
282.73ha
C04600000000040300000
Latitude (S) 33° 11‘ 34“
Longitude (E) 18° 55‘ 41“

Photos of areas that give a visual perspective of all parts of the site:
See Appendix C.

2.2 Technical Details for the Proposed Facility

Storage capacity: 324 000m^3
Wall Height: 13.5m
Surface area at full capacity: 6.2ha

A description of the property and the proposed activity
The property and proposed dam site is situated west of the Berg River east of the Moorreesburg to Gouda gravel road approximately 23km east of Moorreesburg. The dam’s 0.2 km^2 catchment is located in the quaternary catchment G10J. The proposed dam will have a storage capacity of 324 000m^3, dam wall height of 13.5m and a surface area of 6.2ha. The dam wall will be constructed using a cut and fill process. Soil and clay will be cut from the dam basin and dam wall area that will also help to increase the depth of the dam and decrease the catchment basin that will lower water evaporation as the surface of the dam is smaller. The cut material will be used to fill and construct the dam wall. No other material is needed to construct the dam wall.

The overall area is characterised by ploughed and planted lands used for agriculture. The dam will impact on a disturbed tributary of the Berg River which has been classified as an ecological support area. Take note that the tributary has no ecological functioning left other than the transport of water from the agricultural lands.

Associated infrastructure
The farm has two existing abstraction points on the Berg River south and north-east of the farmhouse. The existing pipelines (125 & 165mm dia) from these abstraction points will be upgraded to 250mm dia each to fill the proposed dam. An additional abstraction point with a 250mm dia pipeline (130m long) is proposed just below (to the north) of the proposed dam, which will be the shortest route to fill the dam.

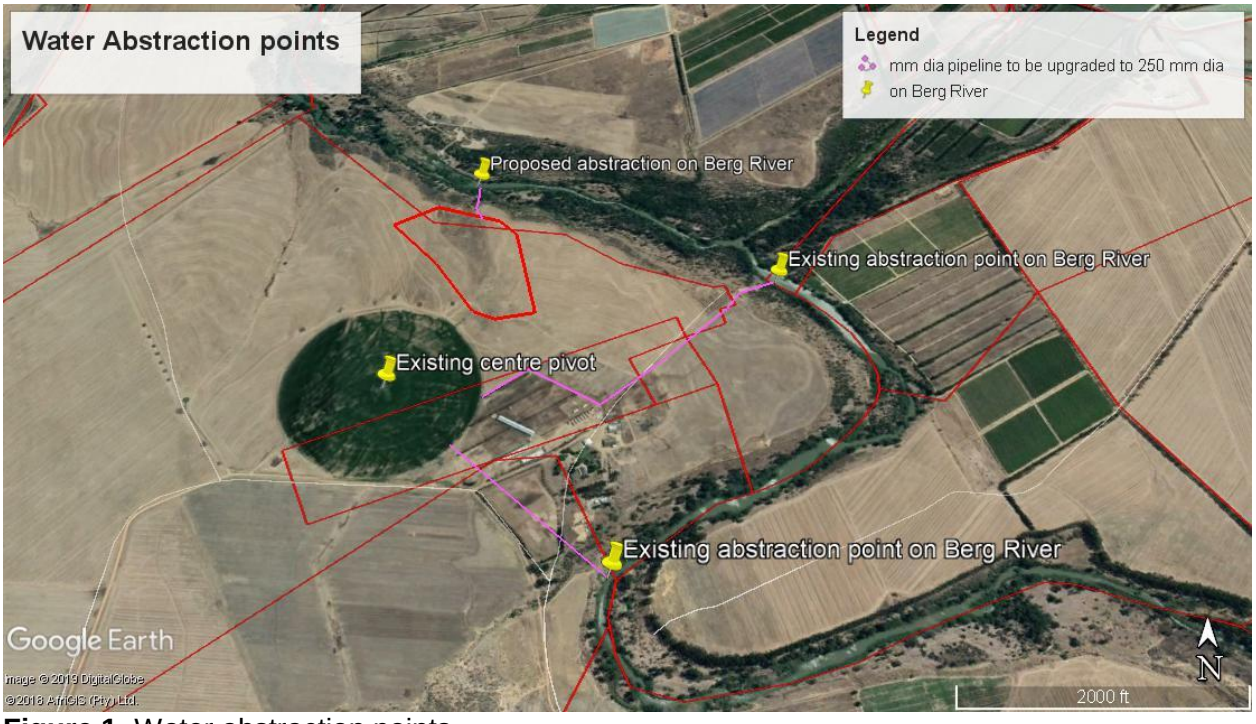
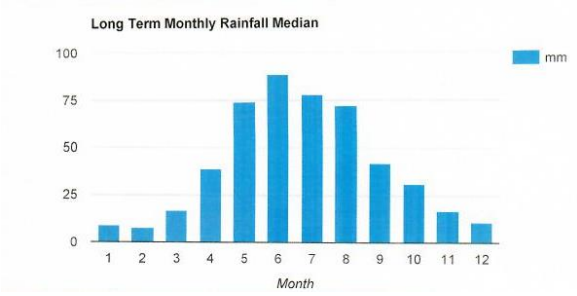


Figure 1: Water abstraction points

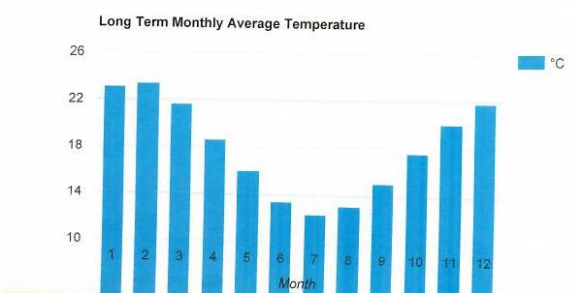
A new power line will be required from the north-eastern abstraction point to the new point. All areas to be irrigated from the new dam will be located within existing cultivated lands. A raft abstraction pump from the dam basin will be used for bulk conveyance to the areas. The bulk conveyance pipelines will be all less than 200mm dia and must still be designed.

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Climate
The area normally receives about 471mm of rain per year, with rainfall occurring mainly from April to October. The chart below shows the average rainfall values per month. It receives the lowest rainfall (2mm) in February and the highest (88mm) in June.



The monthly distribution of average daily maximum temperatures (chart below) shows that the average midday temperatures range from 7°C in July to 23.4°C in February.



3.2 Topography

The area is characterised by a plain landscape with associated low slopes and an average slope of 3.02% towards the north and east (Berg River).

3.3 Geology and Geohydrology

The site, as shown below in Figure 2, is on the Porterville Formation of the Malmesbury Group. It appears to be underlain by phyllite shale, schist and greywacke with dark-grey limestone, sporadic quartzitic sandstone beds and conglomerate beds (Npo (dark yellow) on the map).

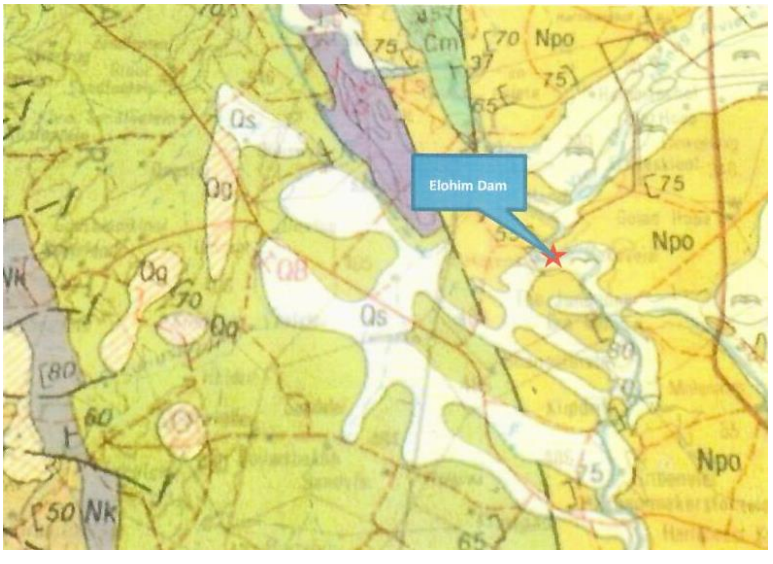


Figure 2: Regional geology

Several test pits were excavated near the proposed dam site in January 2017. Test pits 3, 5 and 7 contained clayey sand and sandy lean clay under the topsoil overburden, with test pit 4 containing sand. Test pits 2 and 3 are located on the right abutment, to give an indication of the possible depth of the core trench depth. A good impermeable foundation in weathered shale at about 1.5m depth is present. Alluvial sandy material is present in the river section (test pits 1 and 4) and the depth to an acceptable shale foundation is not considered to be more than 6m.

Based on previous experience in shale foundations care must be taken to excavate the core trench foundation to below permeable features for example quartz vines[1] (Refer to specialist report attached for more detail).

[1] DJ. Hagen and Joseph Mbenga, 3 April 2017. Ingeprop Elohim dam report.

3.4 Surface Water Features

A degraded and transformed non-perennial drainage line which is a no name tributary of the Berg River runs through the proposed dam site.

The dam's 0.2km^2 catchment is located in the quaternary catchment G10J. The catchment is shown in Figure 3 below.

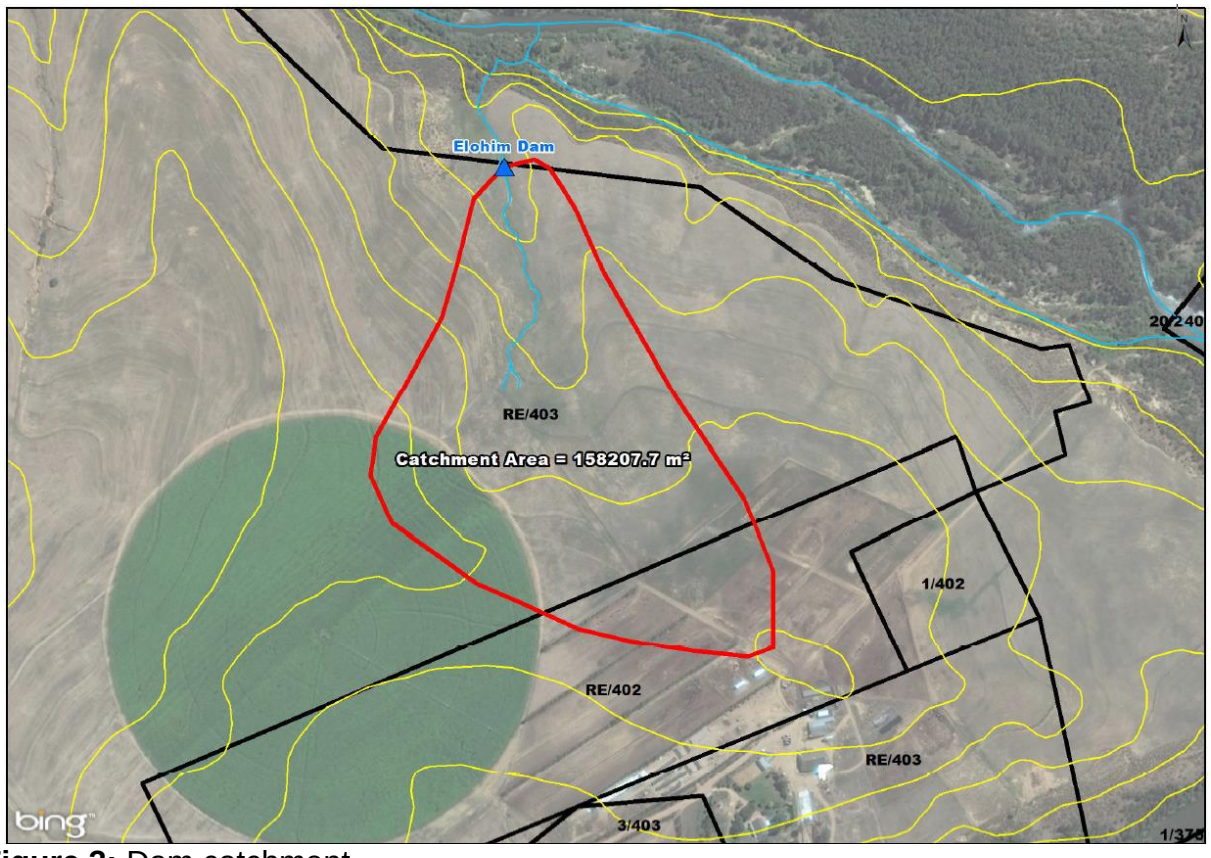


Figure 3: Dam catchment

The catchment MAP's from WRC2012 study (Bailey & Pitman, 2015) and Wide Area Augmentation System (WAAS, 2007) Satellites are shown in Figure 4 below. The WRC MAP of 471 mm is considered more representative.

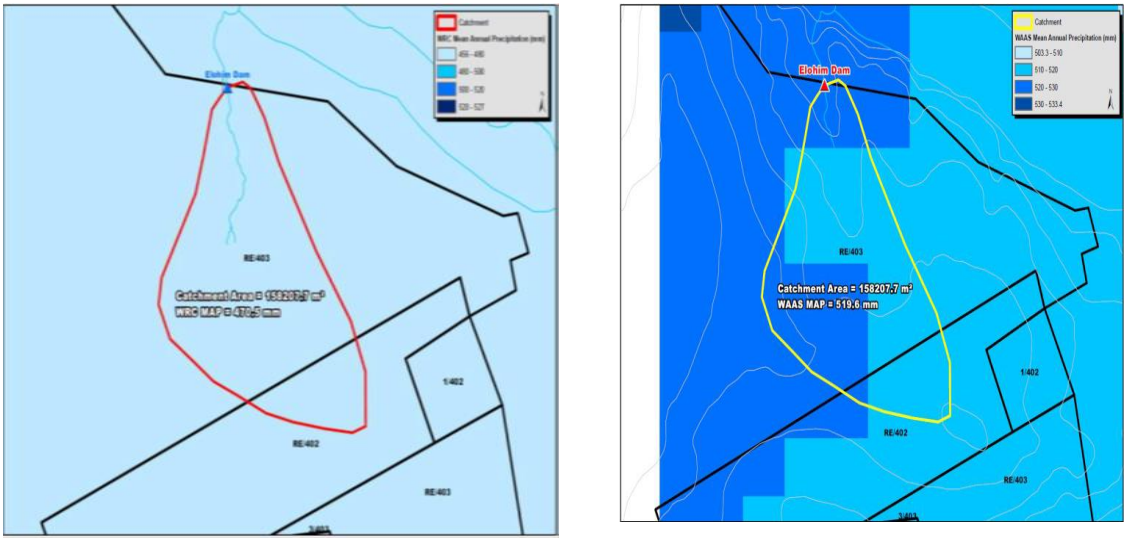


Figure 4: Catchment area and weighted MAP's

The Mean Annual Runoff (MAR) from the catchment is estimated at less than 10 000 m^3 (little runoff from sandy overburden soils) and therefore negligible.

3.5 Flora

According to Mucina and Rutherford (2006) the type of natural vegetation originally occurred on the site is classified as Swartland Shale Renosterveld (*Critically Endangered*). The vast majority of Swartland Shale Renosterveld has been lost (the target of saving 26% is now unattainable, as 90% is already completely transformed for farming). Remnants survive in tiny isolated patches within farmland, usually only on rougher, steeper ground that cannot be cultivated. Only a few pockets are actually protected, and most surviving areas are threatened by invasive alien plants such as *Acacia saligna* ("Port Jackson"), *Acacia mearnsii* and a variety of other invasive trees, grasses and herbs[2]&[3].

Take note that the tributary has no ecological functioning left other than the transport of water from the agricultural lands. The site is currently ploughed and planted with wheat except for a small portion the non-perennial drainage line, which was ploughed and disturbed in the past, but is currently used for grazing after the harvest is removed.

3.6 Socio-Economic Elements

According to the household survey the Swartland Municipality has an urban population of 83 218[4]. The rural population is 11588, thus giving a total of 94 806. The table below gives a breakdown per area as indicated. The literacy rate for the West Coast District as a whole is 76.1% compared with an overall provincial rate of 82.4%. Literacy rates vary across the local municipalities with the District with a high of 85.3% in Saldanha Bay and low of 70.5% in Bergrivier. Of particular concern is the mismatch of the prevailing

[2] http://www.calflora.net/southafrica/capeflora.html
[3] *"Environmental resources and downloads. City of Cape Town. Environmental Resource Management Dept"*.
[4] https://www.westerncape.gov.za/text/2012/11/swartland-idp-2012-2017_0.pdf

literacy rate across the West Coast District when compared to the Provincial literacy rate. Naturally this has major labour market implications down the line especially on the skill level composition of the labour force as well as the cost and efficiency of gearing the labour force towards the required skill levels for newly introduced industries within the region. The poverty rate is a cause for concern in general. For the year 2010, Bergrivier (33.8%); Matzikama (31.7%) and Cederberg (42.7%) recorded alarming levels of poverty. Saldanha Bay has consistently recorded low poverty rates relative to its neighbouring municipalities but there was a slight increase from 22.3% in 2001 to 23.9% in 2010. Swartland's poverty rate has declined substantially from 32.8% in 2001 to 26.8% in 2010.

Moorreesburg Dry Land Farming

The modelling[5] results for the Moorreesburg case study can be summarised as follows:

- Climate data from four global climate models (GCMs) were applied in the Agricultural Production Systems Simulator (APSIM) modelling to project intermediate future yield for wheat. The different GCM projections (20-year average) range from a 4% decrease to a 4% increase compared to present yield. The overall average yield between the four models equals the average present yield.
- Data from five GCMs was used in (Crop Critical Climate Threshold) CCCT modelling. Despite relatively small variances between the different GCM projections, no major changes in yield, from the present to the intermediate future, are projected. This result concurs with the APSIM crop modelling results, which increases confidence in the CCCT modelling technique.
- Both climate change financial modelling techniques (APSIM crop modelling and CCCT modelling technique) indicate that intermediate climate scenarios from different GCMs pose a very marginal threat to the financial vulnerability of farming systems in the Moorreesburg dryland wheat producing area.
- The impact of intermediate climate scenarios on financial vulnerability will be more severe on farming systems that are highly geared (high debt levels).
- Adaptation strategies to counter the impact of climate change on financial vulnerability were included in the model. These strategies include Cropping systems and Production practices.
- The above adaptation strategies seem not only to counter the impact of climate change, but to positively impact on profitability.

The proposed dam will have a positive impact on the agricultural potential of the property. Winter water will be stored for irrigation in summer to plant pastures for animal feed that will increase the sustainability of the farm.

A provisional total project cost estimate for the project can be summarised as follows:

[5] Johnston, P.A. September 2016. Modelling impacts of climate change on selected South African crop farming systems Report to the Water Research Commission and Department of Agriculture, Forestry and Fisheries.

Table 3: Cost estimate of the proposed dam

Item No and description	Cost (million R, excluding VAT)
1. Construction	
1.1 Proposed Dam	4.7
1.2 Pipelines and pump stations	1.3
Sub-total	**6.0**
2 Professional costs	
2.1 Engineering of dam	0.4
2.2 Authorisation processes	0.3
Sub-total	**0.7**
Total	**6.7**

Proposed construction period is 5 months.

3.7 Visual Elements

The proposed development will not be visible from any public road and will fit in with the surrounding agricultural landscape.

3.8 Agricultural Potential

The proposed dam will have a positive impact on the agricultural potential of the property. Winter water will be stored for irrigation in summer to plant pastures for animal feed that will increase the sustainability of the farm.

3.9 Existing Services

The proposed dam will not impact on any existing services.

4. PUBLIC PARTICIPATION PROCESS

4.1. Introduction

As outlined previously, public participation forms an integral component of the EIA process. The public participation process for the project initiation and Scoping Report phase was outlined in detail in the Scoping Report, and that for the EIAr was summarised in the Plan of Study for EIA. The purpose of this chapter is to provide a brief summary of the public consultation process undertaken to date and provide a more detailed overview of the public participation in the EIAr phase.

4.2. Summary of Public Participation to Date

The public participation process to date has entailed the following key components

Potential I&AP's were notified about the project by:

- Fixing notice boards at the boundary of the property
- Giving written notice to adjacent property owners and dwellers, the municipal councillor of the ward within which the site is located, the local municipality and organs of state having jurisdiction in respect of any aspect of the project

- Placing an advertisement in the local newspaper
- Additionally, the Scoping and Environmental Impact Reports was prepared and made available to any I&AP, as advised on the notice boards, notices and advertisements.

The Scoping Report was included for statutory comment with the written notice as sent to the commenting organs of state. List of Potentially Interested and Affected Parties was compiled. Each neighbour received a written notice inviting them to register and give comments on the proposed development. List of Registered Interested and Affected Parties was compiled. A summary of issues raised by Interested and Affected Parties was compiled. The draft EIAr was sent to all key departments and registered Interested and Affected Parties for a 30-day commenting period.

4.3. Authority Involvement

Liaison with the relevant authorities plays a crucial role in the successful completion of any EIA process. In addition to the interaction with DEA&DP, the key departments on the registered list were provided with the relevant project documentation and invited to submit comment.

4.4. Comments on the Draft Environmental Impact Report

Comments on the Draft Environmental Impact Report from key departments and I&APs have been incorporated into the report.

4.5. Decision and Appeal Period

The Final EIAr has been completed and all I&AP comments have been incorporated into the report to be submitted to DEA&DP for review and decision.

Once they have reviewed the document and are satisfied that it contains sufficient information to make an informed decision, DEA&DP will use the information contained within the EIAr to determine the environmental acceptability of the applicant's preferred options. Thereafter DEA&DP will issue an Environmental Authorization outlining the nature of their decision and the Conditions of Approval attached to any authorisation should the proposed activity be approved.

Following the issuing of the Environmental Authorization, I&APS will be notified of DEA&DP's decision by means of letters and there will be an appeal period during which I&AP's will have an opportunity to appeal against the decision.

Public Participation information attached as Appendix D.

5. NEED & DESIRABILITY OF THE ACTIVITY

The applicant would like to construct a new dam to utilize their existing winter enlistment of 45.6ha at 7 000m^3/ha (320 000m^3) under the Benede-Bergrivier Irrigation Board. There is no need to irrigate in winter as a result of the natural rainfall. There is however a need to irrigate in summer to produce fodder for the dairy cattle on the farm. The proposed dam's water that will be stored in winter will be used in summer to irrigate planted pastures (most likely maize) that will be used a feed to livestock on the farm in summer. The stored winter water in the dam can also be used to supply drinking water to the dairy cattle on the property in summer. The proposed dam is located on an unnamed tributary of the Berg River. The proposed dam will be

filled solely by pumping from the Berg River under the existing irrigation scheme. The Benede-Bergrivier Irrigation Board confirmed the enlistment of Arbeidsgenot Landgoed to be 17ha summer and 45.6ha winter with an allocation of 7 000m^3/ha/a each amounting to 438 200 m^3/a.

Correspondence with Aurecon, who are doing the Validation & Verification (V&V) study in this area for the Department of Water and Sanitation at present, indicated that only the above enlistment will be allocated to the farm. There are therefore no other water sources. The V&V forms provided by Aurecon are also contained in **Appendix A** of the attached specialist report under Appendix F.

6. IDENTIFIED POTENTIAL ALTERNATIVES

Introduction

As outlined previously, the purpose of the Scoping Report phase is to identify the range of feasible alternatives and potential environmental impacts requiring more detailed investigation and assessment in the EIAr.

A detailed description of the proposed activities as well as the full range of project alternatives was provided in the Scoping Report. The potential biophysical and social impacts associated with the project alternatives were outlined in the Scoping Report. These included potential impacts that may arise during the operational phase, as well as the potential construction related impacts (i.e. short-term impacts). Some of these impacts were screened out during the Scoping Phase, while others were identified as requiring more detailed assessment during this EIAr phase.

This chapter provides a brief review of the feasible alternatives and potential environmental impacts, for the proposed project, identified for further assessment during the EIAr phase. It should be noted that some of the alternatives have been revisited and revised in light of new information that has become available since the publication of the Scoping Report.

The following alternatives as per the guideline exists

6.1. PROPERTY AND LOCATION/SITE ALTERNATIVES

An on-channel dam option on the Berg River was discarded due to environmental concerns and the high cost of a spillway. Three alternative site locations were considered during the planning stage on different properties in close proximity that belong to the applicant. (Site 1, Site 2-upstream and Site 2-downstream) as shown in the figure below.

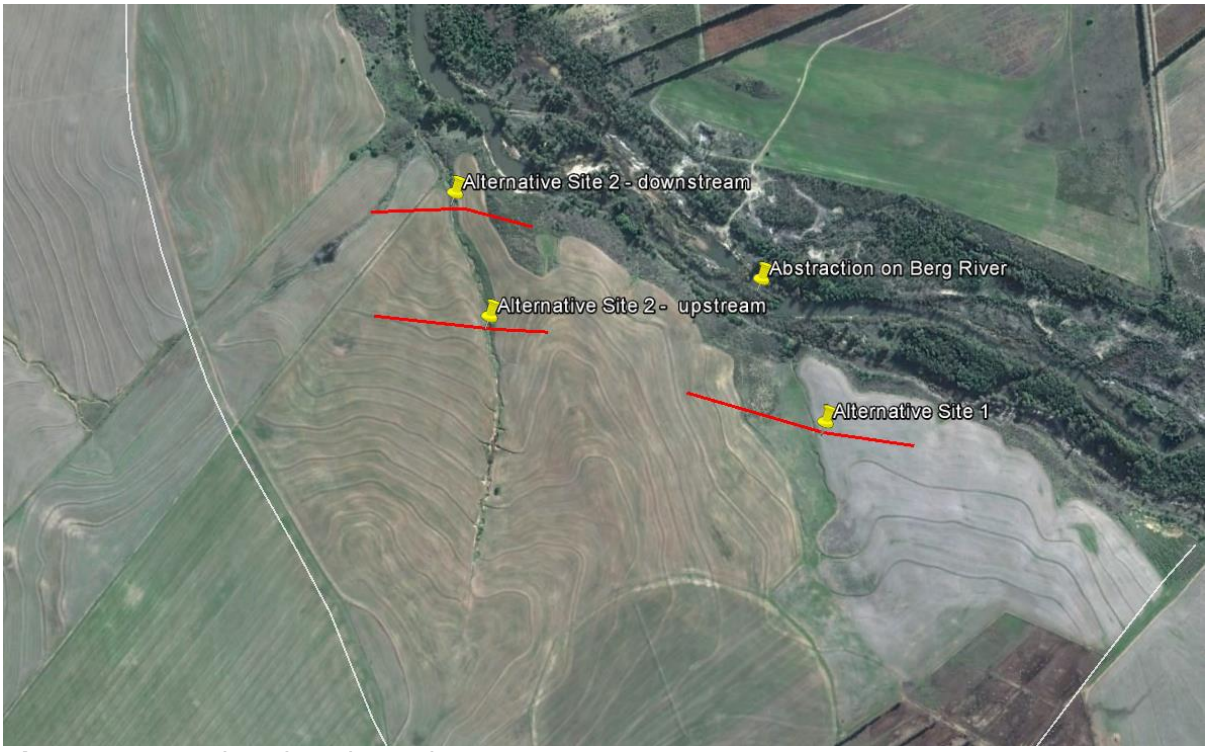


Figure 5a: Dam location alternatives

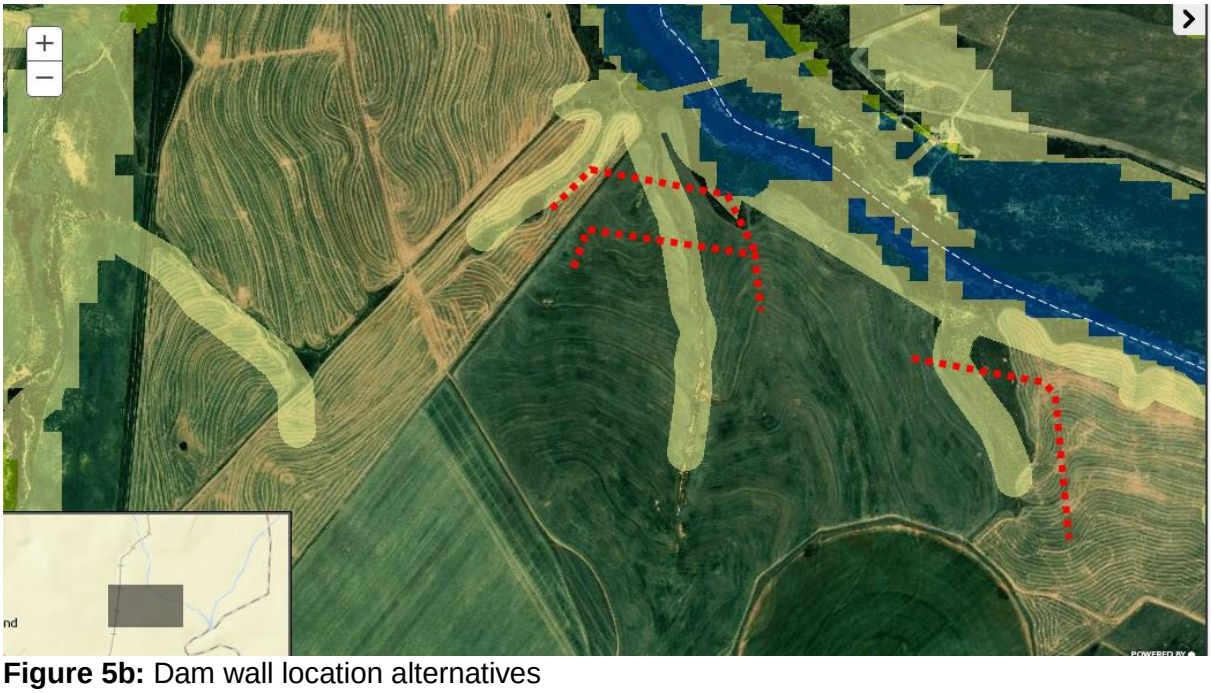


Figure 5b: Dam wall location alternatives

6.2. ACTIVITY ALTERNATIVES

Alternative land uses or activities were not considered as they are not feasible. The applicant must build the dam to store the winter water for irrigation in summer in order to use his existing water right.

6.3. Design or layout alternatives

Various dam options were compared based on 5m contour survey information for target storage capacities of 300 000m^3 and 700 000m^3 and dam Site 1 was found to be the most economical dam site with a water/wall ratio of 2.8 for the 300 000m^3 dam size. The water/wall ratio of Site 2 -upstream was 2.3 and Site 2 -downstream 2.2 for the same dam size. The dam options are shown in Figure 6 below. Full details of the options are provided in **Appendix F** of the attached specialist report).

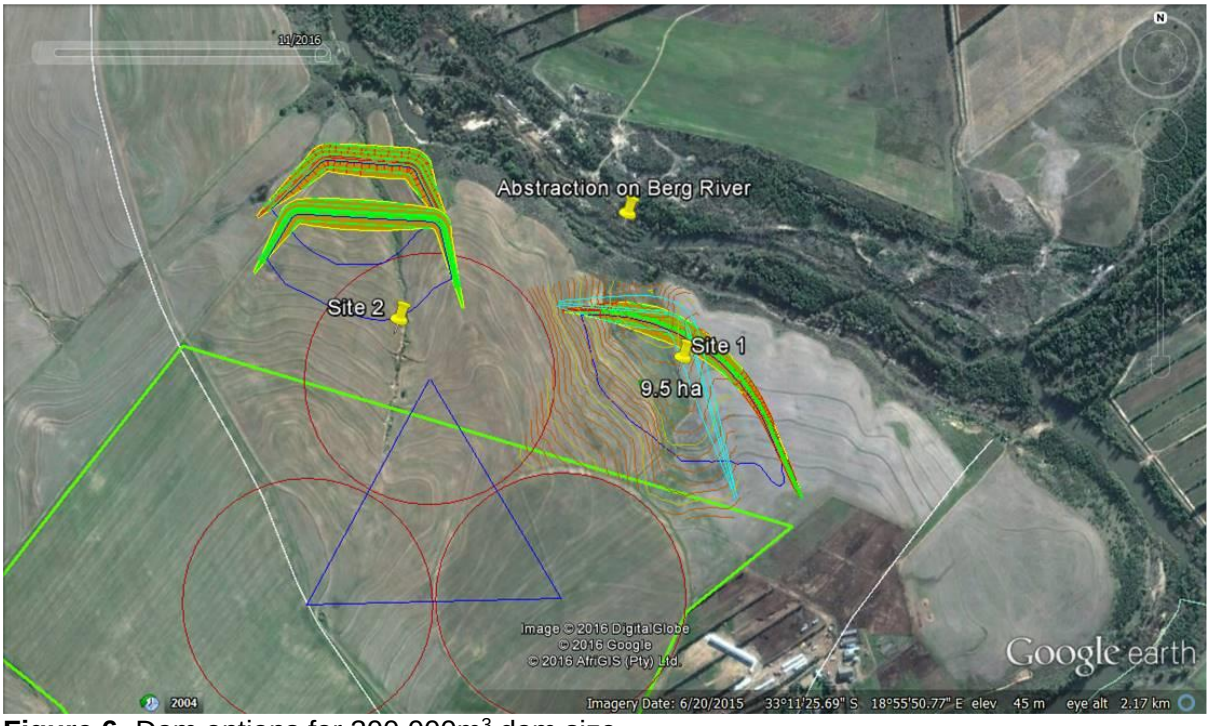


Figure 6: Dam options for 300 000m^3 dam size

The selected Site 1 was surveyed by Billy West. For the proposed zoned earth-fill dam, all the options were analysed, with the target storage capacity required of 320 000m^3 and compared on the basis of the water/wall ratio (the amount of earthworks required for a certain storage). Refer to the full results in **Appendix F** of the attached specialist report**.**

The water/wall ratio represents the volume of water gained per volume of fill required to construct the dam embankment. This is a good indication for selecting the most economical dam design alternative.

The six options analyses did not differ much in results. Option 6 (Preferred Site) was selected with straight flanks and far enough upstream of the Berg River. Refer to the layout drawing under **Appendix F** in attached specialist report and Figure 7 below. The total footprint of the dam wall and basin is 8.8ha.

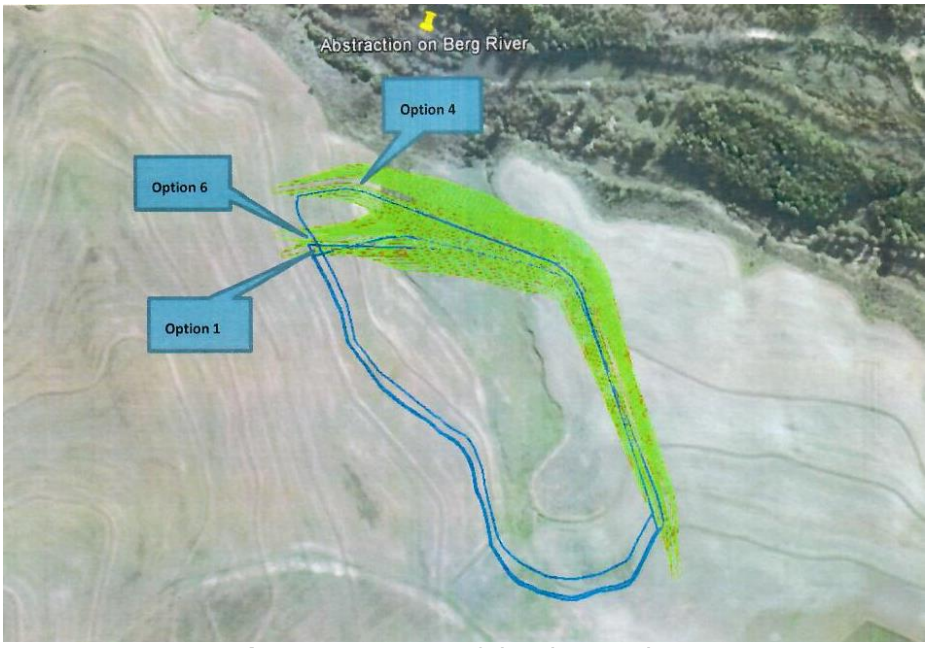


Figure 7: Layout of the dam options

6.4. Technology alternatives

No technology alternatives were assessed. No feasible technology alternatives exist. The dam is constructed as per established dam design and construction standards taking dam safety in consideration.

6.5. OPERATIONAL ALTERNATIVES

The only two operational alternatives applicable and assessed in the planning phase was the filling of the dam. Two options exist. The one is to build the dam instream of the Berg River in order to fill the dam when the river flows and the other option is to build the dam out of the Berg River stream and the dam is filled by pumping the water into the dam. An on-channel dam option on the Berg River was discarded due to environmental concerns and the high cost of a spillway.

6.6 THE OPTION OF NOT IMPLEMENTING THE ACTIVITY (THE NO-GO OPTION)

The No-Go option will result in the site remaining as it is presently.

7. IMPACT ASSESSMENT

7.1. Assessment Methodology

INTRODUCTION

Below is the assessment methodology utilized in determining the significance of the construction, operational and decommission impacts of the proposed activities, and where applicable the possible alternatives, on the biophysical and socio-economic environment. The methodology is broadly consistent to that described in DEA's Guideline Document on the EIA Regulations (1998).

ASSESSMENT METHODOLOGY

This section outlines the methodology used to assess the significance of the potential environmental impacts. For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the document represents the full range of plausible and pragmatic measures *but does not necessarily imply that they should or will all be implemented*. The decision as to which mitigation measures to implement lies with the applicant and ultimately with DEADP. The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Assessment criteria for the evaluation of impacts:

Criteria	**Description**		
Nature	a description of what causes the effect, what will be affected, and how it will be affected.		
	Type	**Score**	**Description**
Extent (E)	None (No)	1	Footprint
	Site (S)	2	On site or within 100 m of the site
	Local (L)	3	Within a 20 km radius of the centre of the site
	Regional (R)	4	Beyond a 20 km radius of the site
	National (Na)	5	Crossing provincial boundaries or on a national / land wide scale
Duration (D)	Short term (S)	1	0 – 1 years
	Short to medium (S-M)	2	2 – 5 years
	Medium term (M)	3	5 – 15 years
	Long term (L)	4	> 15 years
	Permanent(P)	5	Will not cease
Magnitude (M)	Small (S)	0	will have no effect on the environment
	Minor (Mi)	2	will not result in an impact on processes
	Low (L)	4	will cause a slight impact on processes
	Moderate (Mo)	6	processes continuing but in a modified way
	High (H)	8	processes are altered to the extent that they temporarily cease
	Very high (VH)	10	results in complete destruction of patterns and permanent cessation of processes.
Probability (P) the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned	Very improbable (VP)	1	probably will not happen
	Improbable (I)	2	some possibility, but low likelihood
	Probable (P)	3	distinct possibility
	Highly probable (HP)	4	most likely
	Definite (D)	5	impact will occur regardless of any prevention measures
Significance (S)	Determined through a synthesis of the characteristics described above: **S = (E+D+M) x P** Significance can be assessed as low, medium or high		
Low: < 30 points:	The impact would not have a direct influence on the decision to develop in the area		
Medium: 30 – 60 points:	The impact could influence the decision to develop in the area unless it is effectively mitigated		
High: < 60 points:	The impact must have an influence on the decision process to develop in the area		
No significance	When no impact will occur or the impact will not affect the environment		
Status	Positive (+)		Negative (-)
The degree to which the impact can be reversed	Completely reversible (R)	90-100%	The impact can be mostly to completely reversed with the implementation of the correct mitigation and rehabilitation measures.
	Partly reversible (PR)	6-89%	The impact can be partly reversed providing that mitigation measures as stipulated in the EMP are implemented and rehabilitation measures are undertaken
	Irreversible (IR)	0-5%	The impact cannot be reversed, regardless of the mitigation or rehabilitation measures taking place

Criteria	Description		
The degree to which the impact may cause irreplaceable loss of resources	Resource will not be lost (R)	1	The resource will not be lost or destroyed provided that mitigation and rehabilitation measures as stipulated in the EMP are implemented
	Resource may be partly destroyed (PR)	2	Partial loss or destruction of the resources will occur even though all management and mitigation measures as stipulated in the EMP are implemented
	Resource cannot be replaced (IR)	3	The resource cannot be replaced no matter which management or mitigation measures are implemented.
The degree to which the impact can be mitigated	Completely mitigable (CM)	1	The impact can be completely mitigated providing that all management and mitigation measures as stipulated in the EMP are implemented
	Partly mitigatible (PM)	2	The impact cannot be completely mitigated even though all management and mitigation measures as stipulated in the EMP are implemented. Implementation of these measures will provide a measure of mitigatibility
	Un-mitigatible (UM)	3	The impact cannot be mitigated no matter which management or mitigation measures are implemented.

7.2. Summary of Findings and Recommendations of specialist

7.2.1. Dam Design report

An on-channel dam option in the Berg River was discarded due to environmental concerns and the high cost of a spillway. Three alternatives sites location were considered during the planning stage. Various dam options were compared based on 5 m contour survey information for target storage capacities of 300 000 m^3 and 700 000 m^3 and dam site 1 was found to be the most economical dam site with a water/wall ratio of 2.8 for the 300 000 m^3 dam size. The water/wall ratio of site 2 -upstream was 2.3 and site 2 – downstream 2.2 for the same dam size. The selected site 1 was surveyed by Billy West. For the proposed zoned earthfill dam, all the options were analysed, with the target storage capacity required of 320 000 m^3 and compared on the basis of the water/wall ratio (the amount of earthworks required for a certain storage). The water/wall ratio represents the volume of water gained per volume of fill required to construct the dam embankment. This is a good indication for selecting the most economical dam design alternative. The six options analyses did not differ much in results. Option 6 was selected with straight flanks and far enough upstream of the Berg River. The total footprint of the dam wall and basin is 8.8 ha.

7.2.2. Freshwater Ecology Impact Assessment Study

Eco Impact Legal Consulting (Pty) Ltd was appointed to undertake a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the freshwater and riparian resources as part of the Water Use Authorization application.

The main water features within the study area comprise of the Berg River and its minor tributary.

There are no significant wetland habitats within the study area. Those that do occur are closely associated with the watercourses in which they occur. The following comments are made with regards to the wetland habitats in the area:

- The Berg River approximately 50m downstream of the site consists largely of valley bottom wetland habitat. This wetland habitat is closely associated with the Berg River and the proposed dam will not have any impact on it.

The watercourses within the study area have already been subjected to modification as a result of the surrounding agricultural activities. All three proposed dam locations will have the same

impact on freshwater ecology. These impacts relate largely to the loss of the indigenous vegetation within the riparian zones and the associated growth of invasive alien plants. The proposed dam will result largely in a localized loss or modification of some habitat within the basin of the proposed dam.

The farm has two existing abstraction points on the Berg River south and north-east of the farmhouse. The existing pipelines (125 & 165mm dia) from these abstraction points will be upgraded to 250mm dia each to fill the proposed dam. An additional abstraction point with a 250mm dia pipeline (130m long) is proposed just below (to the north) of the proposed dam, which will be the shortest route to fill the dam. All pipes to be upgraded is on disturbed areas and will not impact on any vegetation or freshwater ecology features.

A new power cable of up to 600 volts will be installed on poles above ground from the north-eastern abstraction point to the new point. This power cable will not result in the clearing of any vegetation or impact on any freshwater ecology features and will be constructed on disturbed areas outside the 1 in 100 year flood line area of the Berg River. No formal structures (pump house) will be constructed. A movable pump, submersible abstraction pipe into the Berg River and pipelines will be used that will be connected to a fix pipe coupling at the dam.

All areas to be irrigated from the new dam will be located within existing cultivated lands. A raft abstraction pump from the dam basin will be used for bulk conveyance to the areas.

Most of the impacts would be during the construction phase. With effective implementation of the recommended mitigation measures, including the environmental water requirements and implementation of an approved River MMP, the condition of the streams could be maintained at the desired level of ecosystem functioning.

The proposed new abstraction point impact on the Berg River is of low significance as long as the management and mitigation measures included in the EMPr and MMP are adhered to. No vegetation may be cleared.

From the assessment of freshwater features within the study area, it can be concluded that there are no significant freshwater features that would potentially be impacted by the proposed dam and infrastructure upgrades. The valley bottom wetland downstream of dam site associated with the Beg River will not be impacted. No water will be required to be released from the dam to maintain the downstream channel. The Berg River, when flowing in winter, will push water upstream into the non-perennial river towards the dam wall to maintain the relevant downstream river ecological functioning.

The Department of Water and Sanitation, Western Cape Regional Office should be approached for approval of the water use aspects of the proposed activities.

Riparian Vegetation Response Assessment Index (VEGRAI)

The score attained for the VEGRAI indicated that the riparian system impacted by the proposed dam falls into the category E and this indicates that the loss of natural habitat, biota and basic ecosystem functions is extensive.

Ecological Importance and Sensitivity (EIS)

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale. The median of the resultant score is calculated to derive the EIS category.

The non-perennial river is considered to be of low ecological importance. The non-perennial river and proposed dam areas was also not identified as a Critical Biodiversity area or important area from a terrestrial ecology and botanical perspective.

The overall Ecological and Importance of the non-perennial river where the proposed dam expansion is planned is assessed to be Low.

This confirms the assessment results of the NFEPA study and State of the River report findings.

Mitigation measures for inclusion in the EMPr

Essential mitigation measures:

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the water courses and wetlands, its riparian zones and 32m buffer areas is regarded as no go and no impact areas.
- Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the water courses and wetlands.
- Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation
- Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream
- Allow only essential construction personnel within 32m of all riparian systems;
- Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development.
- Invasive vegetation to be removed during construction (the material that cannot be used for fire wood) to be disposed of at landfill site in such a manner that seeds must not be able to spread from the disposal site or during transportation.
- At no point may construction equipment stand unauthorised within or near the river.
- All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.
- Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.

Operational Phase

- The amount abstracted from the Berg River should be reduced by the amount impeded from the catchment.

- Monitoring of the volume abstracted from the Berg River and that stored within the dam should be undertaken.

Conditions for inclusion in the environmental authorisation

- Appointment of Environmental Control Officer during construction phase.

Monitoring requirements for inclusion in the EMPr or Environmental Authorisation

- On-going aquatic ecological monitoring must take place by a suitably qualified assessor as per the conditions of the Water Use Authorization.

7.3. Impacts Assessed

The following impacts have been identified and assessed:

SUMMARY OF IMPACTS
Positive:
- Job creation;
- Water security during summer months.

Negative:
- Soil and dust erosion;
- Loss of freshwater ecological habitat;
- Degradation / loss of naturally occurring / indigenous flora and habitats
- Flow modification;
- Water quality impairment

Alternative Site 1(Preferred alternative)

Dam Construction	**Geographical and Physical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Disturbance to soil which is caused during the construction of the dam wall may lead to erosion of the site and surrounds.**
Extent and duration of impact:	**Extent 1 (footprint) & Duration 1**
Magnitude:	**2**
Consequence of impact or risk:	**Clearing and excavation activities can result in erosion and dust.**
Probability of occurrence:	**2 (I)**
Degree to which the impact may cause irreplaceable loss of resources:	**2 (PR)**
Degree to which the impact can be reversed:	**PR**
Indirect impacts:	**Disturbance to surface area can result in erosion and dust generation**

Cumulative impact prior to mitigation:	**Exposing soil may lead to erosion and dust generation if not mitigated.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**1 (CM)**
Proposed mitigation:	• **Access to roads and other areas must be controlled to avoid disturbance of areas outside the development footprint. Personnel should be restricted to the immediate construction areas only.** • **Monitor construction areas frequently for signs of erosion and if signs of erosion are detected implement repair and preventative measures immediately.** • **Strict compliance with the EMPr and MMP.**
Residual impacts:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Cumulative impact post mitigation:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 1. Preferred Alternative

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, thereby reducing biodiversity. Modification of habitats for agriculture as well as surface mining and urban development are the main causes of habitat destruction in**

	this case. Additional causes of habitat destruction include water pollution, introduction of alien species and overgrazing. The non-perennial riverine systems have very low flows as part of their annual hydrological cycles and are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been impaired or impacted already as a result of existing dams, road crossings, channelization upstream and historical agricultural impacts and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.
Extent and duration of impact:	**Extent 2 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Loss of freshwater ecological habitat**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of freshwater ecological habitat**
Cumulative impact prior to mitigation:	***Riparian zone*** **Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns.** **Construction of the dam wall.** **Alien invasive vegetation encroachment.** ***Instream zone*** **Loss of aquatic refugia.** **Altered substrate conditions due to the deposition of silt.** **Altered depth and flow regimes in the non-perennial river.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**Essential mitigation measures:** • **Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the**

	loss of aquatic habitats in the area. • **Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the non-perennial river, its riparian zones and 32m buffer areas is regarded as no-go and no impact areas.** • **On-going aquatic ecological monitoring must take place as per the water use authorization by a suitably qualified assessor.** • **Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the watercourses.** • **Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation.** • **Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream.** **Recommended mitigation measures** • **Permit only essential construction personnel within 32m of all riparian systems;** • **Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.**
Residual impacts:	**Loss of freshwater ecological habitat**
Cumulative impact post mitigation:	**Loss of freshwater ecological habitat**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**

Nature of impact:	**Not Applicable.**

Alternative Site 1. Preferred Alternative

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**A localised loss of riparian habitat and modification of the stream bed or banks of the watercourse at the dam site and immediately downstream is likely to occur as a result of the dam construction as well as the pipeline construction. This impact is however likely to be small due to the fact that the habitat within the watercourse for the preferred dam site as well as the watercourse and dam basin catchment that will be impacted by the dam are already largely modified.** **Special precaution is to be taken during the construction of the infrastructure that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.**
Extent and duration of impact:	**Extent 3 & Duration 2**
Magnitude:	**4**
Consequence of impact or risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly Reversible (PR)**
Indirect impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact prior to mitigation:	**None as a result of the degraded habitat at the proposed dam impact area.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	• **Undertake construction activities only in identified and specifically demarcated areas.** • **Invasive vegetation to be removed during construction**

	to be disposed of at landfill site if not use for fire wood, in such a manner that seeds must not be able to spread from the disposal site or during transportation. • **At no point may construction equipment stand unauthorised within or near the river.** • **All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.** • **Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.**
Residual impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact post mitigation:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**

Alternative Site 1. Preferred Alternative

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**Not Applicable**
OPERATIONAL PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**The proposal is to store 320 000 cubic meters of allocated water from the Berg River in a newly constructed dam that would be constructed within a minor tributary of the Berg. Flow within the minor tributary would only occur for a short**

	period of time in winter. The dam's catchment of 0.2 km^2 is located in the quaternary catchment G10J. The Water Research Commission MAP indicate a rainfall of 471 mm. The Mean Annual Runoff (MAR) from the catchment is estimated at less than 10 000 m^3 (little runoff from sandy overburden soils) and therefore neglible.
Extent and duration of impact:	**Extent 1 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Flow modification**
Probability of occurrence:	**2**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of significantly impacted upon habitat and bed/bank modification.**
Cumulative impact prior to mitigation:	**There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May to October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of an E category (largely modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 2 000 m^3. There is however only a very short stretch of the watercourse (about 30m) downstream of the proposed dam that would benefit from any environmental flow release.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**The tributary in which the dam is proposed as well as that associated with the pump station and pipeline still contains some indigenous vegetation within the watercourse but also contains invasive alien plants. It is important that the disturbed area is rehabilitated and that ongoing monitoring and management of invasive alien plants with the watercourses are undertaken. Follow up work should be carried out after rehabilitation to ensure that no invasive alien plants establish themselves within the watercourse**

	adjacent to the dam as well as downstream of the dam. **All of the above recommendations should be included in a River Management Maintenance Plan (MMP) for the project that would form part of the Environmental Management Plan.**
Residual impacts:	**Flow modification**
Cumulative impact post mitigation:	**Flow modification**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Impact on sensitive environments (rivers, wetlands etc.)**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 1. Preferred Alternative

Dam Construction	**Socio-Economic Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Temporary jobs will be created for the construction of the dam wall.**
Extent and duration of impact:	**Extent 2 (On site or within 100 m of the site) & Duration 1 (0 – 1 years)**
Consequence of impact or risk:	**Influx of contract workers due to lack of skills.** **Influx of job seekers due to jobs created.** **Littering.**
Probability of occurrence:	**4 (most likely)**
Degree to which the impact may cause irreplaceable loss of resources:	**NA – Positive**
Degree to which the impact can be reversed:	**NA – Positive**
Indirect impacts:	**NA – Positive**
Cumulative impact prior to mitigation:	**NA – Positive**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 – Low (positive)**
Degree to which the impact can be avoided:	**NA – Positive**
Degree to which the impact can be managed:	**NA – Positive**
Degree to which the impact can be mitigated:	**NA – Positive**
Proposed mitigation:	**Local contractors, employing or seeking to employ local (historically disadvantaged individuals (HDIs) from the region who are suitably qualified, should get preference.**

	The municipality, local community and local community organizations should be informed of the project and potential job opportunities by the developer.
Residual impacts:	**NA – Positive**
Cumulative impact post mitigation:	**NA – Positive**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low (positive)**
OPERATIONAL PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 1. Preferred Alternative

Dam Construction	**Cultural-Historical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains**
Extent and duration of impact:	**Extent 1 (Footprint) & Duration 5 (Will not cease)**
Magnitude:	**2**
Consequence of impact or risk:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Probability of occurrence:	**2 (some possibility, but low likelihood)**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly reversible (PR)**
Indirect impacts:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Cumulative impact prior to mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 – Low**
Degree to which the impact can be avoided:	**High**

Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2-Partly mitigatable (PM)**
Proposed mitigation:	**Should any burials, fossils or other historical material be encountered during construction, work must cease immediately and HWC must be contacted.**
Residual impacts:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Cumulative impact post mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**

Alternative Site 2, upstream (Alternative)

Dam Construction	**Geographical and Physical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Disturbance to soil which is caused during the construction of the dam wall may lead to erosion of the site and surrounds.**
Extent and duration of impact:	**Extent 1 (footprint) & Duration 1**
Magnitude:	**2**
Consequence of impact or risk:	**Clearing and excavation activities can result in erosion and dust.**
Probability of occurrence:	**2 (I)**
Degree to which the impact may cause irreplaceable loss of resources:	**2 (PR)**
Degree to which the impact can be reversed:	**PR**
Indirect impacts:	**Disturbance to surface area can result in erosion and dust generation**
Cumulative impact prior to	**Exposing soil may lead to erosion and dust generation if**

mitigation:	**not mitigated.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**1 (CM)**
Proposed mitigation:	• **Access to roads and other areas must be controlled to avoid disturbance of areas outside the development footprint. Personnel should be restricted to the immediate construction areas only.** • **Monitor construction areas frequently for signs of erosion and if signs of erosion are detected implement repair and preventative measures immediately.** • **Strict compliance with the EMPr and MMP.**
Residual impacts:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Cumulative impact post mitigation:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, upstream (Alternative)

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, thereby reducing biodiversity. Modification of habitats for agriculture as well as surface mining and urban development are the main causes of habitat destruction in this case. Additional causes of habitat destruction include**

	water pollution, introduction of alien species and overgrazing. The non-perennial riverine systems have very low flows as part of their annual hydrological cycles and are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been impaired or impacted already as a result of existing dams, road crossings, channelization upstream and historical agricultural impacts and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.
Extent and duration of impact:	**Extent 2 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Loss of freshwater ecological habitat**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of freshwater ecological habitat**
Cumulative impact prior to mitigation:	***Riparian zone*** **Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns.** **Construction of the dam wall.** **Alien invasive vegetation encroachment.** ***Instream zone*** **Loss of aquatic refugia.** **Altered substrate conditions due to the deposition of silt.** **Altered depth and flow regimes in the non-perennial river.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**Essential mitigation measures:** • **Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.**

	• **Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the non-perennial river, its riparian zones and 32m buffer areas is regarded as no-go and no impact areas.** • **On-going aquatic ecological monitoring must take place as per the water use authorization by a suitably qualified assessor.** • **Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the watercourses.** • **Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation.** • **Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream.** **Recommended mitigation measures** • **Permit only essential construction personnel within 32m of all riparian systems;** • **Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.**
Residual impacts:	**Loss of freshwater ecological habitat**
Cumulative impact post mitigation:	**Loss of freshwater ecological habitat**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**

Alternative Site 2, upstream (Alternative)

Dam Construction	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**A localised loss of riparian habitat and modification of the stream bed or banks of the watercourse at the dam site and immediately downstream is likely to occur as a result of the dam construction as well as the pipeline construction. This impact is however likely to be small due to the fact that the habitat within the watercourse for the preferred dam site as well as the watercourse and dam basin catchment that will be impacted by the dam are already largely modified.** **Special precaution is to be taken during the construction of the infrastructure that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.**
Extent and duration of impact:	**Extent 3 & Duration 2**
Magnitude:	**4**
Consequence of impact or risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly Reversible (PR)**
Indirect impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact prior to mitigation:	**None as a result of the degraded habitat at the proposed dam impact area.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	• **Undertake construction activities only in identified and specifically demarcated areas.** • **Invasive vegetation to be removed during construction to be disposed of at landfill site if not use for fire wood, in such a manner that seeds must not be able to spread**

	from the disposal site or during transportation. • **At no point may construction equipment stand unauthorised within or near the river.** • **All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.** • **Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.**
Residual impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact post mitigation:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**

Alternative Site 2, upstream (Alternative)

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**Not Applicable**
OPERATIONAL PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**The proposal is to store 320 000 cubic meters of allocated water from the Berg River in a newly constructed dam that would be constructed within a minor tributary of the Berg. Flow within the minor tributary would only occur for a short period of time in winter. The dam's catchment of 0.2 km² is located in the quaternary catchment G10J. The Water**

	Research Commission MAP indicate a rainfall of 471 mm. The Mean Annual Runoff (MAR) from the catchment is estimated at less than 10 000 m^3 (little runoff from sandy overburden soils) and therefore neglible.
Extent and duration of impact:	**Extent 1 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Flow modification**
Probability of occurrence:	**2**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of significantly impacted upon habitat and bed/bank modification.**
Cumulative impact prior to mitigation:	**There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May to October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of an E category (largely modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 2 000 m^3. There is however only a very short stretch of the watercourse (about 30m) downstream of the proposed dam that would benefit from any environmental flow release.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**The tributary in which the dam is proposed as well as that associated with the pump station and pipeline still contains some indigenous vegetation within the watercourse but also contains invasive alien plants. It is important that the disturbed area is rehabilitated and that ongoing monitoring and management of invasive alien plants with the watercourses are undertaken. Follow up work should be carried out after rehabilitation to ensure that no invasive alien plants establish themselves within the watercourse adjacent to the dam as well as downstream of the dam.** **All of the above recommendations should be included in a**

	River Management Maintenance Plan (MMP) for the project that would form part of the Environmental Management Plan.
Residual impacts:	**Flow modification**
Cumulative impact post mitigation:	**Flow modification**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Impact on sensitive environments (rivers, wetlands etc.)**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, upstream (Alternative)

Dam Construction	**Socio-Economic Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Temporary jobs will be created for the construction of the dam wall.**
Extent and duration of impact:	**Extent 2 (On site or within 100 m of the site) & Duration 1 (0 – 1 years)**
Consequence of impact or risk:	**Influx of contract workers due to lack of skills.** **Influx of job seekers due to jobs created.** **Littering.**
Probability of occurrence:	**4 (most likely)**
Degree to which the impact may cause irreplaceable loss of resources:	**NA – Positive**
Degree to which the impact can be reversed:	**NA – Positive**
Indirect impacts:	**NA – Positive**
Cumulative impact prior to mitigation:	**NA – Positive**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 – Low (positive)**
Degree to which the impact can be avoided:	**NA – Positive**
Degree to which the impact can be managed:	**NA – Positive**
Degree to which the impact can be mitigated:	**NA – Positive**
Proposed mitigation:	**Local contractors, employing or seeking to employ local (historically disadvantaged individuals (HDIs) from the region who are suitably qualified, should get preference. The municipality, local community and local community organizations should be informed of the project and**

	potential job opportunities by the developer.
Residual impacts:	**NA – Positive**
Cumulative impact post mitigation:	**NA – Positive**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low (positive)**
OPERATIONAL PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, upstream (Alternative)

Dam Construction	**Cultural-Historical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains**
Extent and duration of impact:	**Extent 1 (Footprint) & Duration 5 (Will not cease)**
Magnitude:	**2**
Consequence of impact or risk:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Probability of occurrence:	**2 (some possibility, but low likelihood)**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly reversible (PR)**
Indirect impacts:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Cumulative impact prior to mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 – Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**

Degree to which the impact can be mitigated:	**2-Partly mitigatable (PM)**
Proposed mitigation:	**Should any burials, fossils or other historical material be encountered during construction, work must cease immediately and HWC must be contacted.**
Residual impacts:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Cumulative impact post mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**

Alternative Site 2, downstream (Alternative)

Dam Construction	**Geographical and Physical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Disturbance to soil which is caused during the construction of the dam wall may lead to erosion of the site and surrounds.**
Extent and duration of impact:	**Extent 1 (footprint) & Duration 1**
Magnitude:	**2**
Consequence of impact or risk:	**Clearing and excavation activities can result in erosion and dust.**
Probability of occurrence:	**2 (I)**
Degree to which the impact may cause irreplaceable loss of resources:	**2 (PR)**
Degree to which the impact can be reversed:	**PR**
Indirect impacts:	**Disturbance to surface area can result in erosion and dust generation**
Cumulative impact prior to mitigation:	**Exposing soil may lead to erosion and dust generation if not mitigated.**
Significance rating of impact	**8 - Low**

prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**1 (CM)**
Proposed mitigation:	• **Access to roads and other areas must be controlled to avoid disturbance of areas outside the development footprint. Personnel should be restricted to the immediate construction areas only.** • **Monitor construction areas frequently for signs of erosion and if signs of erosion are detected implement repair and preventative measures immediately.** • **Strict compliance with the EMPr and MMP.**
Residual impacts:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Cumulative impact post mitigation:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, downstream (Alternative)

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, thereby reducing biodiversity. Modification of habitats for agriculture as well as surface mining and urban development are the main causes of habitat destruction in this case. Additional causes of habitat destruction include water pollution, introduction of alien species and overgrazing. The non-perennial riverine systems have very**

	low flows as part of their annual hydrological cycles and are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been impaired or impacted already as a result of existing dams, road crossings, channelization upstream and historical agricultural impacts and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.
Extent and duration of impact:	**Extent 2 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Loss of freshwater ecological habitat**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of freshwater ecological habitat**
Cumulative impact prior to mitigation:	***Riparian zone*** **Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns.** **Construction of the dam wall.** **Alien invasive vegetation encroachment.** ***Instream zone*** **Loss of aquatic refugia.** **Altered substrate conditions due to the deposition of silt.** **Altered depth and flow regimes in the non-perennial river.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**Essential mitigation measures:** • **Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.** • **Keep all demarcated sensitive zones outside of the**

	construction area off limits during the construction phase of the project. The non-impacted areas of the non-perennial river, its riparian zones and 32m buffer areas is regarded as no-go and no impact areas. • **On-going aquatic ecological monitoring must take place as per the water use authorization by a suitably qualified assessor.** • **Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the watercourses.** • **Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation.** • **Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream.** **Recommended mitigation measures** • **Permit only essential construction personnel within 32m of all riparian systems;** • **Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.**
Residual impacts:	**Loss of freshwater ecological habitat**
Cumulative impact post mitigation:	**Loss of freshwater ecological habitat**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**

Alternative Site 2, downstream (Alternative)

Dam Construction	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**A localised loss of riparian habitat and modification of the stream bed or banks of the watercourse at the dam site and immediately downstream is likely to occur as a result of the dam construction as well as the pipeline construction. This impact is however likely to be small due to the fact that the habitat within the watercourse for the preferred dam site as well as the watercourse and dam basin catchment that will be impacted by the dam are already largely modified.** **Special precaution is to be taken during the construction of the infrastructure that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.**
Extent and duration of impact:	**Extent 3 & Duration 2**
Magnitude:	**4**
Consequence of impact or risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly Reversible (PR)**
Indirect impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact prior to mitigation:	**None as a result of the degraded habitat at the proposed dam impact area.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	• **Undertake construction activities only in identified and specifically demarcated areas.** • **Invasive vegetation to be removed during construction to be disposed of at landfill site if not use for fire wood, in such a manner that seeds must not be able to spread**

	from the disposal site or during transportation. • **At no point may construction equipment stand unauthorised within or near the river.** • **All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.** • **Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.**
Residual impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact post mitigation:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**

Alternative Site 2, downstream (Alternative)

Dam Construction	**Biological Aspect Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**Not Applicable**
OPERATIONAL PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**The proposal is to store 320 000 cubic meters of allocated water from the Berg River in a newly constructed dam that would be constructed within a minor tributary of the Berg. Flow within the minor tributary would only occur for a short period of time in winter. The dam's catchment of 0.2 km^2 is located in the quaternary catchment G10J. The Water**

	Research Commission MAP indicate a rainfall of 471 mm. The Mean Annual Runoff (MAR) from the catchment is estimated at less than 10 000 m3 (little runoff from sandy overburden soils) and therefore neglible.
Extent and duration of impact:	**Extent 1 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Flow modification**
Probability of occurrence:	**2**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of significantly impacted upon habitat and bed/bank modification.**
Cumulative impact prior to mitigation:	**There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May to October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of an E category (largely modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 2 000 m^3. There is however only a very short stretch of the watercourse (about 30m) downstream of the proposed dam that would benefit from any environmental flow release.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**The tributary in which the dam is proposed as well as that associated with the pump station and pipeline still contains some indigenous vegetation within the watercourse but also contains invasive alien plants. It is important that the disturbed area is rehabilitated and that ongoing monitoring and management of invasive alien plants with the watercourses are undertaken. Follow up work should be carried out after rehabilitation to ensure that no invasive alien plants establish themselves within the watercourse adjacent to the dam as well as downstream of the dam.** **All of the above recommendations should be included in a**

	River Management Maintenance Plan (MMP) for the project that would form part of the Environmental Management Plan.
Residual impacts:	**Flow modification**
Cumulative impact post mitigation:	**Flow modification**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Impact on sensitive environments (rivers, wetlands etc.)**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, downstream (Alternative)

Dam Construction	**Socio-Economic Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Temporary jobs will be created for the construction of the dam wall.**
Extent and duration of impact:	**Extent 2 (On site or within 100 m of the site) & Duration 1 (0 – 1 years)**
Consequence of impact or risk:	**Influx of contract workers due to lack of skills.** **Influx of job seekers due to jobs created.** **Littering.**
Probability of occurrence:	**4 (most likely)**
Degree to which the impact may cause irreplaceable loss of resources:	**NA – Positive**
Degree to which the impact can be reversed:	**NA – Positive**
Indirect impacts:	**NA – Positive**
Cumulative impact prior to mitigation:	**NA – Positive**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 – Low (positive)**
Degree to which the impact can be avoided:	**NA – Positive**
Degree to which the impact can be managed:	**NA – Positive**
Degree to which the impact can be mitigated:	**NA – Positive**
Proposed mitigation:	**Local contractors, employing or seeking to employ local (historically disadvantaged individuals (HDIs) from the region who are suitably qualified, should get preference. The municipality, local community and local community organizations should be informed of the project and**

	potential job opportunities by the developer.
Residual impacts:	**NA – Positive**
Cumulative impact post mitigation:	**NA – Positive**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low (positive)**
OPERATIONAL PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Similar to that in the development phase.**

Alternative Site 2, downstream (Alternative)

Dam Construction	**Cultural-Historical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains**
Extent and duration of impact:	**Extent 1 (Footprint) & Duration 5 (Will not cease)**
Magnitude:	**2**
Consequence of impact or risk:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Probability of occurrence:	**2 (some possibility, but low likelihood)**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly reversible (PR)**
Indirect impacts:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Cumulative impact prior to mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 – Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**

Degree to which the impact can be mitigated:	**2-Partly mitigatable (PM)**
Proposed mitigation:	**Should any burials, fossils or other historical material be encountered during construction, work must cease immediately and HWC must be contacted.**
Residual impacts:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Cumulative impact post mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**

7.4. Environmental Impact Statement

IMPACT SUMMARY

Positive:
- Job creation;
- Water security during summer months.

Negative:
- Soil and dust erosion;
- Loss of freshwater ecological habitat;
- Degradation / loss of naturally occurring / indigenous flora and habitats
- Flow modification;
- Water quality impairment
- Impact on archaeological, paleontological and heritage remains, etc.

Development Phase:
- Soil erosion and dust **(Low impact prior to mitigation and low impact with mitigation)**;
- Loss of freshwater ecological habitat **(Medium impact prior to mitigation and low impact with mitigation)**;
- Degradation / loss of naturally occurring / indigenous flora and habitats **(Medium impact prior to mitigation and low impact with mitigation)**;
- Water quality impairment **(Low impact prior to mitigation and low impact with**

mitigation);
- Increase in jobs **(Low- POSITIVE)**;
- Impact on archaeological, paleontological and heritage remains **(Low impact prior to mitigation and low impact with mitigation)**.

Operational Phase:
- Flow modification **(Low impact prior to mitigation and low impact with mitigation).**

Decommissioning and Closure Phase:
- Soil erosion and dust **(Low impact prior to mitigation and low impact with mitigation)**;
- Loss of freshwater ecological habitat **(Medium impact prior to mitigation and low impact with mitigation)**;
- Degradation / loss of naturally occurring / indigenous flora and habitats **(Medium impact prior to mitigation and low impact with mitigation)**;
- Water quality impairment **(Low impact prior to mitigation and low impact with mitigation);**
- Increase in jobs **(Low- POSITIVE);**

Impact on archaeological, paleontological and heritage remains **(Low impact prior to mitigation and low impact with mitigation)**.

No Go Option
The impact that will result from the no-go option will mean that the dam will not be built, and the allocated winter water right will not be able to be utilized.

Additional Management, Mitigation and Monitoring Measures

Refer to Appendix G for more details in EMP.

Adequacy of the Assessment Methods Used
Based on the EAP's assessment, issues raised by I&AP's and the project team, specialist studies were undertaken to provide information to address the concerns and assess the impacts of the proposed development on the environment.

The various specialists have provided baseline information. This information has been used by the planning team to inform the current development proposals. The specialists are provided with set criteria for undertaking their assessments, to allow for comparative assessment of all issues. These criteria are detailed in the Terms of Reference to each specialist. These criteria are based on the EIA Regulations.

Gaps in Knowledge
The EAP has no detailed knowledge regarding the engineer and dam design studies conducted. He is only familiar with the environmental and Ecological aspects.

Underlying Assumptions
Qualified Specialists were appointed and guided by the terms of reference for specialists and the EAP presumes that the information and assessment findings are correct and feasible.

Subjectivity in Assigning Significance
To facilitate informed decision-making, EIAs must endeavour to come to terms with the significance of the potential environmental impacts associated with particular development

activities. Despite their attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, EIA processes can never completely escape the subjectivity inherent in attempting to define significance. Recognising this, we have attempted to address potential subjectivity in the current process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above.
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail in the Plan of Study for EIA and in this EIAr. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing toward determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the EIAr with a clear summary of how the assessor derived the assigned significance.
- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

Consideration of Cumulative Impacts

Various cumulative impacts could be associated with the proposed Development, namely:

Positive:

- Job creation;
- Water security during summer months.

Negative:

- Soil and dust erosion;
- Loss of freshwater ecological habitat;
- Degradation / loss of naturally occurring / indigenous flora and habitats
- Flow modification;
- Water quality impairment

Impact on archaeological, paleontological and heritage remains, etc.

Uncertainties

- None identified at this stage

ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account. This section provides a summary of the assessment conclusions for the proposed development. In doing so, it draws on the information gathered as part of the Assessment process and the knowledge gained by the environmental assessment practitioner during the course of the process and presents an informed opinion of the environmental impacts associated with the proposed project.

Alternative 1 (Preferred alternative) and alternative designs and locations

Development Phase:

- Soil erosion and dust **(Low impact prior to mitigation and low impact with mitigation)**;
- Loss of freshwater ecological habitat **(Medium impact prior to mitigation and low impact with mitigation)**;
- Degradation / loss of naturally occurring / indigenous flora and habitats **(Medium impact prior to mitigation and low impact with mitigation)**;
- Water quality impairment **(Low impact prior to mitigation and low impact with mitigation);**
- Increase in jobs **(Low- POSITIVE)**;
- Impact on archaeological, paleontological and heritage remains **(Low impact prior to mitigation and low impact with mitigation)**.

Operational Phase:

- Flow modification **(Low impact prior to mitigation and low impact with mitigation).**

Decommissioning and Closure Phase:

- Soil erosion and dust **(Low impact prior to mitigation and low impact with mitigation)**;
- Loss of freshwater ecological habitat **(Medium impact prior to mitigation and low impact with mitigation)**;
- Degradation / loss of naturally occurring / indigenous flora and habitats **(Medium impact prior to mitigation and low impact with mitigation)**;
- Water quality impairment **(Low impact prior to mitigation and low impact with mitigation);**
- Increase in jobs **(Low- POSITIVE);**

Impact on archaeological, paleontological and heritage remains **(Low impact prior to mitigation and low impact with mitigation)**.

No Go Option

The impact that will result from the no-go option will mean that the dam will not be built, and the allocated winter water right will not be able to be utilized.

8. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This EIAr has provided a comprehensive assessment of the potential environmental impacts, identified by the EIA team and I&APs, associated with the development proposed.

The significance of the potential environmental (biophysical and social) impacts associated with the proposed project is summarised as follows:

Level of Confidence in Assessment

For all of the impacts assessed in this report, and for all of the proposed developments, the EIA team is confident in their assessment, with a confidence rating of either “sure” or “certain”. Accordingly, the information contained within the Final Scoping Report and this EIAr is

deemed adequate to inform the applicant's decision regarding which options to pursue and DEA&DP determination of the environmental acceptability of the chosen options.

Considerations in the Identification of the Preferred Option

Following the finalisation of the EIAr the next step in the EIA process would be for the applicant to identify their preferred options, utilising this EIAr together with the relevant technical and financial considerations to inform their decision. It should be noted that it is not the role of the EIAr to recommend the preferred option, but to provide a comparison between the various options considered, specifically in terms of their potential environmental impacts. However, it is appropriate to guide the applicant in their identification of their preferred option by highlighting the following environmental implications of the various alternative options assessed in this investigation:

In terms of the Development:

- None of the impacts are so significant or unmanageable as to suggest that the development should not proceed. Failure to implement the project would preclude the realisation of certain significant socio- economic.

Alternative 1 as per Appendix B1: Site Development Plan – Alternative 1 is the Preferred layout.

Recommendations

The EIAr has outlined various mitigation measures, which, if implemented, could minimise the negative impacts, and enhance the positive effects associated with the proposed projects. Careful consideration must be given to the implementation of these measures, especially those relating to the design and layout of the proposed projects, and where appropriate, these, and any others identified by DEA&DP must be enforced as Conditions of Approval in the Environmental Authorization. The most pertinent mitigation measures for each of the proposed developments are included in the EMP.

EA Conditions

The construction of the proposed facility should be implemented according to the EMP to adequately mitigate and manage potential impacts associated with construction activities. The construction activities and relevant rehabilitation of disturbed areas should be monitored against the approved EMP, the Environmental Authorization and all other relevant environmental legislation.

Relevant conditions to be adhered to include:

Essential mitigation measures:

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.
- Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the water courses and wetlands, its riparian zones and 32m buffer areas is regarded as no go and no impact areas.

- Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the water courses and wetlands.
- Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation
- Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream
- Allow only essential construction personnel within 32m of all riparian systems;
- Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development.
- Invasive vegetation to be removed during construction (the material that cannot be used for fire wood) to be disposed of at landfill site in such a manner that seeds must not be able to spread from the disposal site or during transportation.
- At no point may construction equipment stand unauthorised within or near the river.
- All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.
- Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.

Operational Phase

- The amount abstracted from the Berg River should be reduced by the amount impeded from the catchment.
- Monitoring of the volume abstracted from the Berg River and that stored within the dam should be undertaken.

Conditions for inclusion in the environmental authorisation

- Appointment of Environmental Control Officer during construction phase.

Monitoring requirements for inclusion in the EMPr or Environmental Authorisation

On-going aquatic ecological monitoring must take place by a suitably qualified assessor as per the conditions of the Water Use Authorization.

The Way Forward

The next stage of the public participation process involves the submitting of this EIAr to all key departments and registered I&APs

Cognisance will be taken of all comments when compiling the final report, and the comments, together with the study team and client's responses thereto, will be included as an appendix in the Final EIAr. Where necessary, the report will be updated accordingly.

Once the Final EIAr has been completed and all I&AP comments have been incorporated into the report, it will be submitted to the applicant for review. On the basis of the findings of the EIAr as well as other financial and technical considerations, the applicant will decide whether they would like to proceed with the project and if so which of the alternatives they would like to seek authorisation for. At this point, the Final EIAr together with a letter from the applicant motivating for their preferred options and indicating which mitigation measures they are prepared to commit to, would be submitted to DEA&DP for their review and decision.

Once they have reviewed the document and are satisfied that it contains sufficient information to make an informed decision, DEA&DP will use the information contained within the EIAr to determine the environmental acceptability of applicant's preferred options. Thereafter DEA&DP will issue an Environmental Authorization outlining the nature of their decision and the Conditions of Approval attached to any authorisation should the proposed activity be approved.

Following the issuing of the Environmental Authorization, I&APS will be notified of DEA&DP decision and there will be an appeal period during which I&APs will have an opportunity to appeal against the decision to the Minister of Environmental Affairs and Development Management in terms of the National Environment Management Act.