FINAL SOIL, LAND USE, AND LAND CAPABILITY (AGRICULTURE IMPACT) ASSESSMENT: FOR THE PROPOSED MOKOLO CROCODILE WATER AUGMENTATION PROJECT PHASE 2 (MCWAP-2A) RIVER MANAGEMENT SYSTEM (RMS)

REF: AGR_MCWAP_23

DATE OF SUBMISSION:

18 JANUARY 2024

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PREPARED FOR

GIBB

PREPARED BY

NSOVO ENVIRONMENTAL CONSULTING

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DOCUMENT CONTROL

Report Name	Soil, Land Use, and Land Capability (Agriculture Impact) Assessment: For The Proposed Mokolo Crocodile Water Augmentation Project Phase 2 (MCWAP-2a) River Management System (Rms)
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EXECUTIVE SUMMARY

Gibb Pty Ltd appointed Nsovo Environmental Consulting to conduct an agriculture impact assessment as part of the Environmental Impact Assessment (EIA) process for the proposed construction and upgrade of three (3) gauging weirs in the Crocodile (West) River within the provinces of North West and Limpopo, South Africa. The three (3) gauging weirs, namely Beestekraal, Atlanta, and Paul Hugo, will collectively be referred to as the "Study Area" unless referring to each weir.

The project involves the design and implementation of a River Management System (RMS) to monitor and control the transfer of flows in the Crocodile River (West) from Hartbeespoort Dam to the proposed Vlieëpoort Weir, where water is to be abstracted from the river and pumped to the Steenbokpan and Lephalale areas. The flows in the Crocodile River (West) are mainly treated effluent discharged from the various Wastewater Treatment Works (WWTW) within the Crocodile River (West) catchment. The RMS must be able to monitor water transfer via the Crocodile River (West) from Hartbeespoort Dam to the extraction point at the Vlieëpoort Weir near Thabazimbi. This +/- 200 km stretch of river contains eight existing flow gauging weirs that may need remediation work to ensure accurate flow measurement.

The Atlanta and Beestekraal Weirs fall within the humid subtropical climate characterised fall within the humid subtropical climate characterized by hot and humid summers and cool to mild winters. Most summer rainfall occurs during thunderstorms that build up due to the intense surface heating and strong subtropical sun angle. The Paul Hugo Weir falls within the hot semi-arid climate characterised by hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. The mean annual rainfall ranges between 401- 601 mm. This rainfall is not deemed adequate to support rainfed agriculture and planting dates, and the length of the growing season may be affected and needs to be carefully considered.

Based on the observations during the site assessment, the dominant soils occurring within the study area are Hutton, Valsrivier/Swartland, Mispah Glenrosa, Nkonkoni/Vaalbos, Dundee (associated with the watercourse), and Witbank. Most of the soils occurring within the study area meet the conditions for agricultural suitability to a certain extent, and these conditions include:

1 Adequate depth (greater than 60 cm) to accommodate root development for most cultivated crops;
2 Good structure, as in water-stable aggregates, which allows for root penetration and water retention;
3 Sufficient distribution of high-quality and potential soils within the study area to constitute a viable economic management unit and
4 Good climatic conditions, such as sufficient rainfall and sunlight, increase crop variety.

Tables A, B, and C below depict the summary findings of the soils identified for each gauging weir study area and their respective land capability and agricultural potential status.

Table A: Summary findings for Beestekraal study area.

Beestekraal Study Area			
Soil Forms	**Area (Ha)**	**Land Capability**	**Agricultural Potential**
Vaalbos/Nkonkoni	5.96	Arable (Class IV)	Moderate
Mispah/Glenrosa	28.38	Grazing (Class VI)	Low
Krokodilerivier	4.06	Watercourse Class (V)	Very Low
Witbank	30.63	Wilderness (Class VIII)	Very Low

Table B: Summary findings for the Atlanta study area.

Atlanta Study Area			
Soil Forms	**Area (Ha)**	**Land Capability**	**Agricultural Potential**
Mispah/Glenrosa	2.12	Grazing (Class VI)	Low
Krokodilerivier	0.33	Watercourse Class (V)	Very Low
Witbank	1.31	Wilderness (Class VIII)	Very Low

Table C: Summary findings for the Paul Hugo Study Area

Atlanta Study Area			
Soil Forms	**Area (Ha)**	**Land Capability**	**Agricultural Potential**
Hutton	**4.60**	**Arable (Class II)**	**High**
Mispah/Glenrosa	2.12	Grazing (Class VI)	Low
Krokodilerivier	0.33	Watercourse Class (V)	Very Low
Witbank	1.31	Wilderness (Class VIII)	Very Low

As indicated above, the land capability and the agricultural potential range from very low to high due to adequate climatic conditions (i.e., rainfall, temperature), availability of irrigation water, and appropriate slope, which allows for intensive commercial agricultural practices.

The agricultural practices within the study area include maize, wheat, cotton and pasture cultivation, which employs the centres pivot irrigation techniques, producing high-value crops. Furthermore, despite not being approved, the Preservation and Development of Agricultural Land Framework Bill published on September 18th, 2020, automatically considers land under irrigation to have high potential. This is based on the high production capacity of irrigated agriculture, which is critical for food security at a local and regional scale. It is common for irrigated areas to indicate a high capital investment on the farm.

It is anticipated that the proposed Mokolo Crocodile Water Augmentation Project (MCWAP-2A) will have a minimal impact on the identified soils and agricultural capability since the footprint of infrastructure disturbance, which impedes agriculture, constitutes only a negligible portion of available land surface area, allowing agricultural activities to continue unhindered and

thus future cultivation is not anticipated to be hindered by the proposed developent. This is because the access roads are located along the existing road and the surface infrastructure is in areas which are not currently cultivated and are associated with the 1:100-year floodline of the Crocodile River. However, edge effects can be anticipated, which can encroach on the cultivated lands if not appropriately managed, as the proposed surface infrastructure is in proximity to the cultivated lands. Cumulative impacts are also related to an increase in the surface footprint. These impacts can be reduced by keeping the footprint minimised where possible and strictly following the integrated mitigation measures outlined in the document.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The outcomes of field verification results largely supported the screening tool due to the favorable soil and climate characteristics for commercialised agriculture. From a soil, land use, and land capability point of view, the proposed development can be considered, provided that the integrated mitigation measures are implemented accordingly to minimise the potential loss of this valuable soil.

DECLARATION OF INDEPENDENCE

- I, Tshiamo Seitsipane, in my capacity as a specialist consultant, hereby declare that I:
- Act/acted as an independent specialist to Gibb Pty Ltd for this project.
- Do not have any personal, business, or financial interest in the project except for financial remuneration for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014, as amended.
- Will not be affected by the outcome of the environmental process, of which this report forms part.
- Do not have any influence over the decisions made by the governing authorities.
- Do not object to or endorse the proposed developments but aim to present facts and my best scientific and professional opinion about the impacts of the development.
- Undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2014, as amended.

(*Pr. Nat. Sci* 114882)

DOCUMENT GUIDE

This report was compiled according to the following information guidelines for a specialist report in terms of the Environmental Impact Assessment (EIA) Sections 24(5)(a) And (h) and 44 of the National Environmental Management (NEMA), Act 1998, as summarised on the Table below.

Table A: Document guide according to Regulation (No. R. 982) as amended.

Theme-Specific Requirements as per Government Notice No. 320Agricultural Resources Theme – Very High and High Sensitivity Rating as per Screening Tool Output		
No.	**NEMA Regs (2014) - Appendix 6**	**Relevant section in the report**
2	**Agricultural Agro-Ecosystem Specialist Assessment**	
2.1	The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professionals (SACNASP).	CV Attached
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1.1
2.3	**The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:**	
2.3.1	the extent of the impact of the proposed development on the agricultural resources and	Section 4
2.3.2	whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event it does, whether the positive impact of the proposed development on agricultural resources outweighs such a negative impact.	Section 4
2.4	**The status quo of the site must be described, including the following aspects, which must be considered as a minimum in the baseline description of the agro-ecosystem:**	
2.4.1	the soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit, and slope;	Section 3.2
2.4.2	where applicable, the vegetation composition, available water sources, as agro-climatic information;	
2.4.3	the current productivity of the land-based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units;	Section 6

2.4.4	the current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure and	N/A
2.4.5	existing impacts on the site, located on a map (e.g., erosion, alien vegetation, non-agricultural infrastructure, waste, etc.).	Figures 20-23
2.5	**Assessment of impacts, including the following aspects which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem:**	
2.5.1	change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units;	Section 6
2.5.2	change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure and	N/A
2.5.3	any alternative development footprints within the preferred site would be of "medium" or "low" sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification.	Section 4
2.6	**The Agricultural Agro-Ecosystem Specialist Assessment findings must be written up in an Agricultural Agro-Ecosystem Specialist Report.**	
2.7	**This report must contain the findings of the agro-ecosystem specialist assessment and the following information, as a minimum:**	
2.7.1	Details and relevant experience, as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment, including a curriculum vitae;	Munyadzi CV
2.7.2	A signed statement of independence by the specialist;	Munyadzi
2.7.3	The duration, date, and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2.2
2.7.4	A description of the methodology used to undertake the on-site assessment, inclusive of the equipment and models used, as relevant;	Section 2
2.7.5	A map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Figures 12 - 14
2.7.6	An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development;	Section 6
2.7.7	An indication of possible long-term benefits that the project will generate in relation to the benefits of the agricultural activities on the affected land;	Section 5
2.7.8	Additional environmental impacts expected from the proposed development based on the current status quo of the land, including erosion, alien vegetation, waste, etc.;	Section 4.2

2.7.9	Information on the current agricultural activities being undertaken on adjacent land parcels;	Section 3.2
2.7.10	An identification of any areas to be avoided, including any buffers;	N/A
2.7.11	A motivation must be provided if there were development footprints identified as per paragraph 2.5.3 above that were identified as having a "medium" or "low" agriculture sensitivity and that was not considered appropriate;	Section 5
2.7.12	Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;	Section 5
2.7 .13	A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development;	Section 5
2.7.14	Any conditions to which this statement is subjected;	Section 5
2.7.15	Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and	Section 5
2.7.16	A description of the assumptions and any uncertainties or gaps in knowledge or data.	Section 1.6
2.8	**The Agricultural Agro-Ecosystem Specialist Assessment findings must be incorporated into the Basic Assessment Report or Environmental Impact Assessment Report, including the mitigation and monitoring measures identified, which are to be contained in the EMPr.**	
2.9	**A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.**	

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1 INTRODUCTION

GIBB Pty Ltd appointed Nsovo Environmental Consulting to conduct an Agriculture Impact Assessment as part of the Environmental Impact Assessment (EIA) process for the proposed construction and upgrade of three (3) gauging weirs in the Crocodile (West) River within the provinces of North West and Limpopo, South Africa. The three (3) gauging weirs, namely Beestekraal, Atlanta, and Paul Hugo, will collectively be referred to as Study Area unless referring to each individual weir.

The Study Area is the reach of the Crocodile River (West) downstream of the Hartbeespoort Dam up to the Vlieëpoort Abstraction Weir. The approximate coordinates of the locality of each flow gauging weir are presented in Table 1 and Figure 1 below.

Table 1: Locality Coordinate for the flow gauging weirs.

Flow gauging weir	Coordinates
Beestekraal Weir (Located west of the Crocodile River and downstream of Roodekopjes Dam) - A2H019*	S 25.403640°, E 27.574750°
Atlanta Weir (Located west of the Crocodile River and in the river reach in-between the Elands and Pienaars River tributary confluences) - A2H059*	S 25.206310°, E 27.557940°
Paul Hugo Weir (Construction of a new low flow gauging structure approximately 50 to 130 m downstream of Flow Gauge A2H132) – A2H116/A2H132*	S 24.69508°, E 27.40900°

***The numbers, e.g., A2H083, are the DWS numbers for the various flow gauging stations/weirs.**

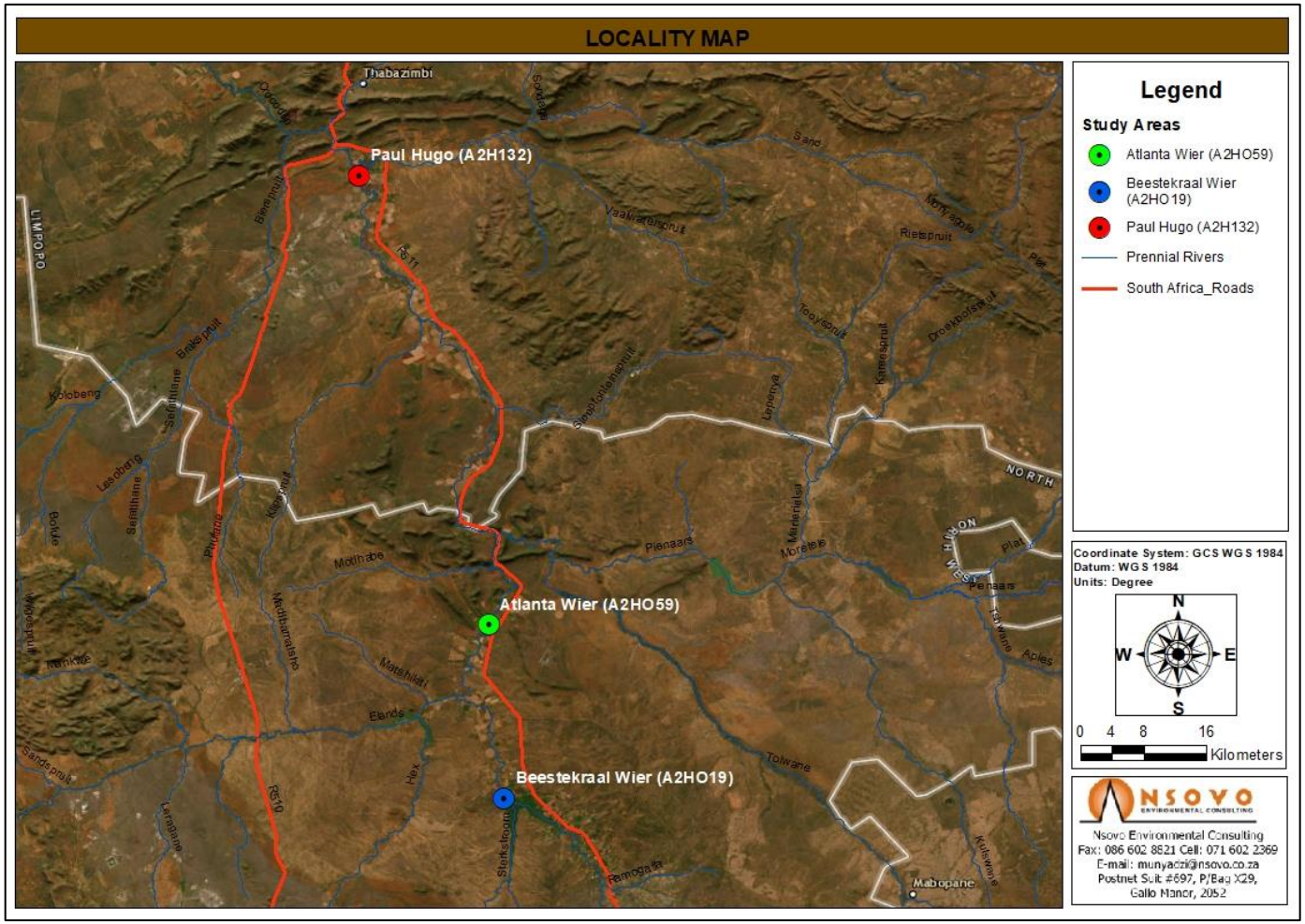

Figure 1: Locality of the study area in relation to the surrounding areas.

1.1 PROJECT DESCRIPTION

The project entails the design and implementation of a River Management System (RMS) to monitor and control the transfer of flows in the Crocodile River (West) from Hartbeespoort Dam to the proposed Vlieëpoort Weir, where water is to be abstracted from the river and pumped to the Steenbokpan and Lephalale areas. The flows in the Crocodile River (West) are mainly treated effluent discharged from the various Wastewater Treatment Works (WWTW) within the Crocodile River (West) catchment. The proposed RMS must be able to monitor water transfer via the Crocodile River (West) from Hartbeespoort Dam to the extraction point at the Vlieëpoort Weir near Thabazimbi.

Below are the summary discussions for each weir, adopted from the Report 1002540-01-01 (Zutari, 2022):

- **Beestekraal Weir – A2H019**

The Roodekopjes Dam, located approximately 400 m upstream of this weir, represents the last discharge control point into the Crocodile River (West) upstream of the proposed Vlieëpoort Weir. This weir is considered critical for the RMS, and currently, it does not provide the accurate gauging capability required for the RMS, hence the need to improve its flow measurement accuracy. Station A2H019 was therefore included in the concept design of refurbishment works.

Figure 2: Proposed concept design for the Beestekraal Weir.

- **Atlanta Weir – A2H059**

This structure is critical to the RMS as it is the first gauging station downstream of the confluence between the Elands River and the Crocodile River (West). Due to the weir being located on a river bend, sediment deposition at the left flank has adversely affected its gauging accuracy as such flow lines are not uniform across the width of the structure. Subsequently, structural changes are proposed to improve the gauging accuracy of the weir.

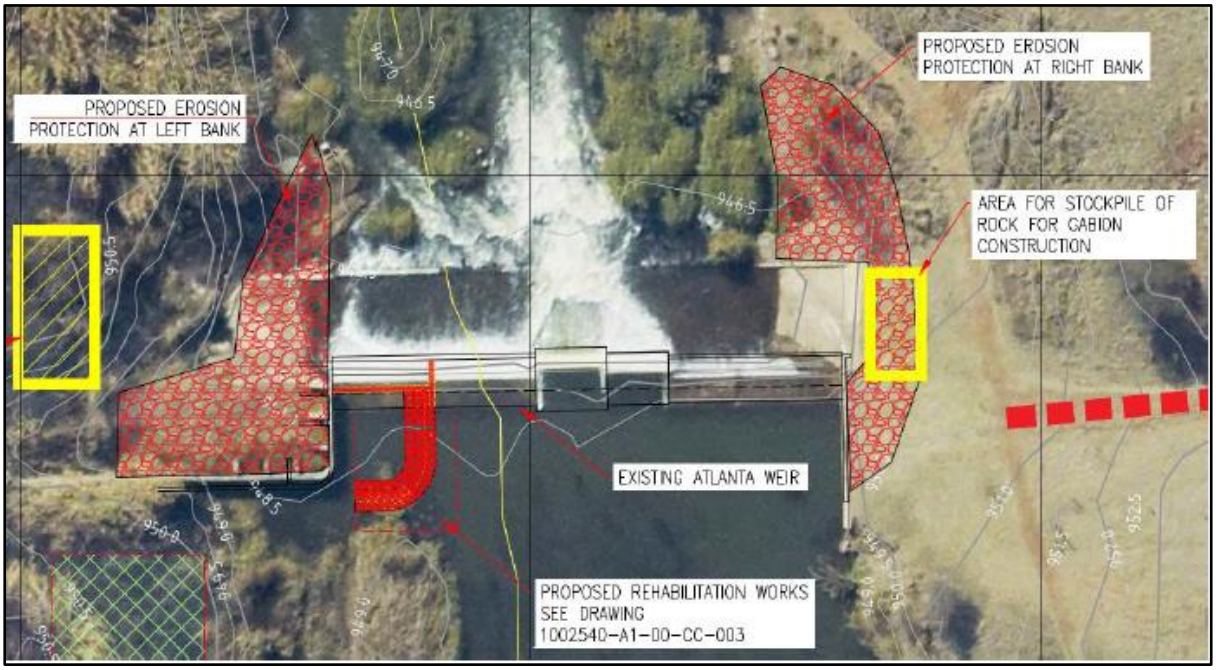

Figure 3: Proposed concept design for the Atlanta Weir.

Paul Hugo – A2H132

It is critical for the RMS that accurate measurements are recorded at this location. Low flow measurements cannot be accurately gauged at the existing structure due to its long overflow crest length (~30 m). A low flow gauging weir (Station A2H116) was provided at the end of the apron of Paul Hugo weir to measure low flows. Due to its proximity to the upstream weir, approach flow conditions are not conducive to accurate flow gauging at Station A2H116. Previous assessments recommended that no structural changes be implemented at Paul Hugo Weir, as it is owned and maintained by the Crocodile River West Irrigation Board (CRWIB). Therefore, a new weir is proposed downstream of the Paul Hugo Weir to gauge low flows accurately.

Figure 4: Layout plan of A2H116/132 and concept layout of proposed new weir downstream of Paul Hugo

1.2 AIMS AND OBJECTIVES OF THE STUDY

The objective of the Soil, Land Use, and Land Capability is to fulfill and align the proposed project with the requirements of the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) of South Africa. This act aims to promote the conservation of soil, water sources, vegetation, and the control of weeds and invader plants by managing natural agricultural resources. Thus, the proposed study aims to determine the possible impacts of the proposed development on the soils, land use, land capability, and agricultural potential and identify areas of high sensitivity within the study area. This will be achieved by considering parameters such as soil quality, drainage, topography, climate, and water availability and providing sound input to ensure that land is used sustainably and responsibly. As such, this specialist report has assessed and considered the following:

- The soil forms occurring within the study area;
- The associated land capability and agricultural sensitivity of the soils occurring within the study area;
- Discussion of the land capability and sensitivity in terms of the soils, water availability, surrounding development, and current status of land;
- Discussion of potential and actual impacts as a result of the proposed development; and
- Provide mitigation for the impacts as part of the Environmental Management Programme (EMPr).

1.3 SUITABILITY OF SOILS FOR AGRICULTURAL CULTIVATION

Assessing soil suitability for agricultural cultivation rests primarily on identifying soils suited to crop production. For soils to be classified as being suitable for crop cultivation, they must have the following properties:

- Adequate depth (greater than 60 cm) to accommodate root development for most cultivated crops;
- Good structure, as in water-stable aggregates, which allows for root penetration and water retention;
- Sufficient clay and organic matter to provide nutrients for growing crops;
- Sufficient distribution of high quality and potential soils within the study area to constitute a viable economic management unit;
- Adequate clay content and deep enough water table to allow for water storage; and
- Good climatic conditions, such as sufficient rainfall and sunlight, increase crop choice variety.

1.4 APPLICABLE LEGISLATION

The most recent South African Environmental Legislation that needs to be considered for any new or expanding development with reference to assessment and management of soil and land use includes:

- The National Environmental Management Act. 1998 (Act 107 of 1998) requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided, be minimised and remedied.
- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal.
- The Conservation of Agriculture Resources (Act 43 of 1983) requires the protection of land against soil erosion and the prevention of water logging and salinization of soils employing suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges, and watercourses is also addressed.

1.5 TERMS OF REFERENCE

The terms of reference applicable to the Soils, Land Capability, and Land Use Study include the following:

- A review of available desktop information about the study area site and compile various maps illustrating the desktop data;
- Discussion of the relevant desktop literature;
- Conduct a soil classification survey covering the study area according to the South African Soil Classification System: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);

- Determination of the current (baseline) soil physical, climatic conditions, and land uses, as well as the current land capabilities and agricultural sensitivity associated with the identified soil forms present in the study area;
- Identification and assessment of the potential impacts of the different project phases on the baseline soil, land use, and land capability properties as a result of the proposed development;
- Development of mitigation and management measures to minimize the negative impacts anticipated from the proposed development and
- Compile soil, land use, and land capability reports based on the field-finding data under current on-site conditions.

1.6 ASSUMPTIONS, ASSUMPTIONS UNCERTAINTIES, LIMITATIONS, AND GAPS

The following assumptions, uncertainties, limitations, and gaps were applicable for the soil, land use, and land capability assessment:

- It is assumed that the infrastructure components will remain as indicated on the layout and that the activities for the construction and operation of the infrastructure are limited to that typical for a project of this nature;
- The soil survey was confined to the study area outline with consideration of various land uses outside the study area;
- During the site assessment and compilation of the report, employment figures pertaining to the study area could not be sourced, and
- Soil profiles were observed using a 1.5m hand-held soil auger; thus, a description of the soil characteristics deeper than 1.5m cannot be given.

2 METHODOLOGY

The assessment of the Study Area's agricultural potential was based on a combination of desktop studies to amass general information and site visits for status quo assessment, soil classification, and characterization, and the validation of generated information from the desktop studies.

2.1 DESKTOP STUDY AND LITERATURE REVIEW

Literature review and background studies were conducted before the field assessment to gather the study area's predetermined soil, land use, and land capability data.

2.2 SITE SURVEY

A desktop assessment was followed by a field investigation to validate the predetermined soil results obtained at the desktop level. The field survey was conducted over 2 days in October 2023, wherein soil auger tests were conducted, and soils were classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). It must be noted that the season has no bearing on the soil's morphological properties over a short-term period.

2.3 LAND CAPABILITY CLASSIFICATION

A land capability class is an interpretive grouping of land units with similar potential and containing limitations or hazards for long-term intensive use of land for rainfed farming determined by the interaction of climate, soil, and terrain. It is a more general term than land suitability and is more conservation-oriented (See Table 2 below). It involves consideration of:

- Varying limitations to land use pertaining to rainfed cultivation and soil properties; and
- The risks of land damage from erosion and other causes.

Eight land capability classes were employed, with potential decreases, limitations, and hazards increasing from class 1 to class 8. Classes 1 to 4 are considered arable, whereas Class 5 is considered wet-based soils or watercourses, and Classes 6 to 8 are classified as grazing, forestry, or wildlife. This system is based on the Land Capability Classification system of the United States Department of Agriculture (USDA) Soil Conservation Service by Klingelbiel and Montgomery (1961).

Table 2: Soil Capability Classification (after Scontey *et al*., 1987).

Land Capability Group	Land Capability Class	Intensity of Land Use									
		wildlife	Forestry	Light grazing	Moderate grazing	Intensive grazing	Light cultivation	Moderate cultivation	Intensive cultivation	Very intensive cultivation	Limitations
Arable	I										There are no or few limitations. Very high arable potential. Very low erosion hazard
	II										Slight limitations. High arable potential. Low erosion hazard
	III										Moderate limitations. Some erosion hazards
	IV										Severe limitations. Low arable potential. High erosion hazard.
Grazing	V										Water course and land with wetness limitations
	VI										Limitations preclude cultivation. Suitable for perennial vegetation
	VII										Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII										Extremely severe limitations. Not suitable for grazing or afforestation.

The updated and refined land capability ratings and database for South Africa was released by the Department of Fishery and Forestry (DAFF), now the Department of Forestry Fisheries and the Environment (DFFE), in 2017. These land capability ratings were derived through a spatial evaluation modelling approach and a raster spatial data layer comprising fifteen (15) land capability evaluation values 9 (see Table 3 below). The new land capability describes the categories as 1 being the lowest and 15 being the highest. The values below 8 are generally not suitable for the production of cultivated crops. (DAFF, 2017). Soil agricultural potential is impacted by several factors (see Table 4 below). The soil agricultural potential was evaluated based on the factors mentioned and described in Table 4 by assigning qualitative criteria ratings such as High, Moderate, or Marginal to low to the updated land capability ratings.

Table 3: National Land Capability Values (DAFF, 2017).

Land Capability evaluation value	Land Capability Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

Table 4: Soil Agricultural Potential Criteria

Criteria	Description
Rock Complex	If a soil type has prevalent rocks in the upper sections of the soil, it is a limitingfactor to the soil's agricultural potential.
Flooding Risk	The risk of flooding is determined by the closeness of the soil to water sources.
Erosion Risk	The soil erosion risk is determined by combining the wind and watererosion potentials.
Slope	The slope of the site could potentially limit its agricultural use.
Texture	The texture of the soil can limit its use by being too sandy or too clayey.
Depth	The effective depth of soil is critical for the rooting zone for crops.
Drainage	The capability of soil to drain water is important as most grain crops do nottolerate submergence in water.
Mechanical Limitations	Mechanical limitations are any factors that could prevent the soil from beingtilled or ploughed.
pH	The pH of the soil is important when considering soil nutrients and fertility.
Soil Capability	This section highlights the soil type's capability to sustain agriculture.
Climate Class	The climate class highlights the prevalent climatic conditions that couldinfluence the agricultural use of a site.
Land Capability / Agricultural Potential	The land capability or agricultural potential rating for a site combines the soil capability and the climate class to arrive at the potential of the site to support agriculture.

2.4 DFFE Screening Tool

The Agricultural Agro-Ecosystem Assessment protocol provides the criteria for assessing and reporting impacts on agricultural resources for activities requiring Environmental Authorisation (EA). The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool, which, for agricultural resources, is based on the most recent land capability evaluation values provided by the Department of Forestry, Fisheries, and the Environment (DFFE). The national web-based environmental screening tool can be accessed at: https://screening.environment.gov.za/screeningtool.

The primary purpose of the Agricultural Agro-Ecosystem Assessment is to determine the site's sensitivity considering the proposed land use change (from potential agricultural land to the proposed development is sufficiently considered). The information in this report aims to enable the Competent Authority (CA) to draw sound conclusions and recommend the proposed project and its potential impacts with a specific focus on food security.

To meet this objective, the protocol requires that site sensitivity verification be conducted, and subsequent outcomes must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as indicated by the National Environmental Screening Tool;
- It must contain proof (e.g., photographs) of the current land use and environmental sensitivity pertaining to the study area;
- All data and conclusions are submitted together with the main report for the proposed development;
- It must indicate whether the proposed development will have an unacceptable impact on the agricultural production capability of the site, and if it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources and
- The report is prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

The report is thus compiled to meet the minimum report content requirements for impacts on agricultural resources by the proposed development.

2.5 DFFE SCREENING TOOL

The Screening tool for each gauging weir is presented in Figures 5, 6, and 7 below:

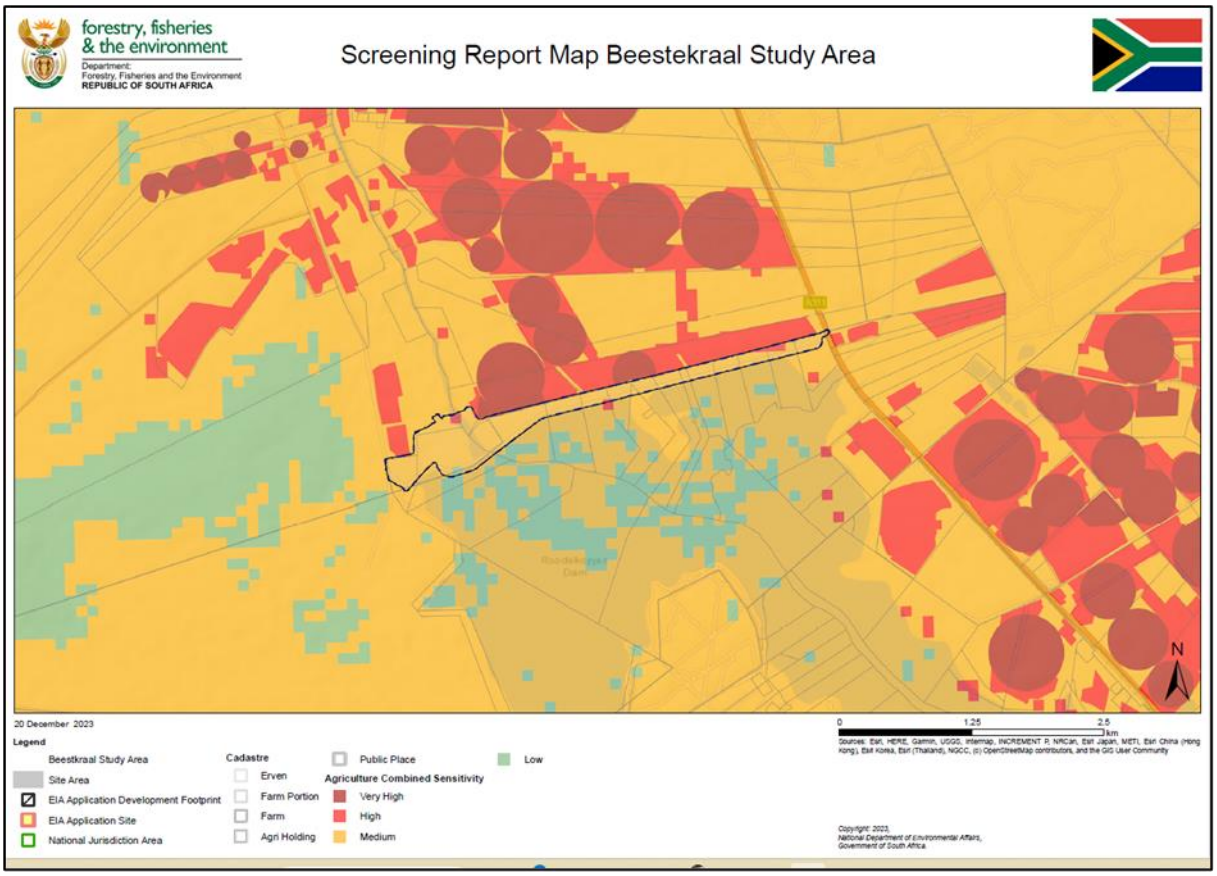

Figure 5: Screening tool sensitivity for the Beestekraal Weir.

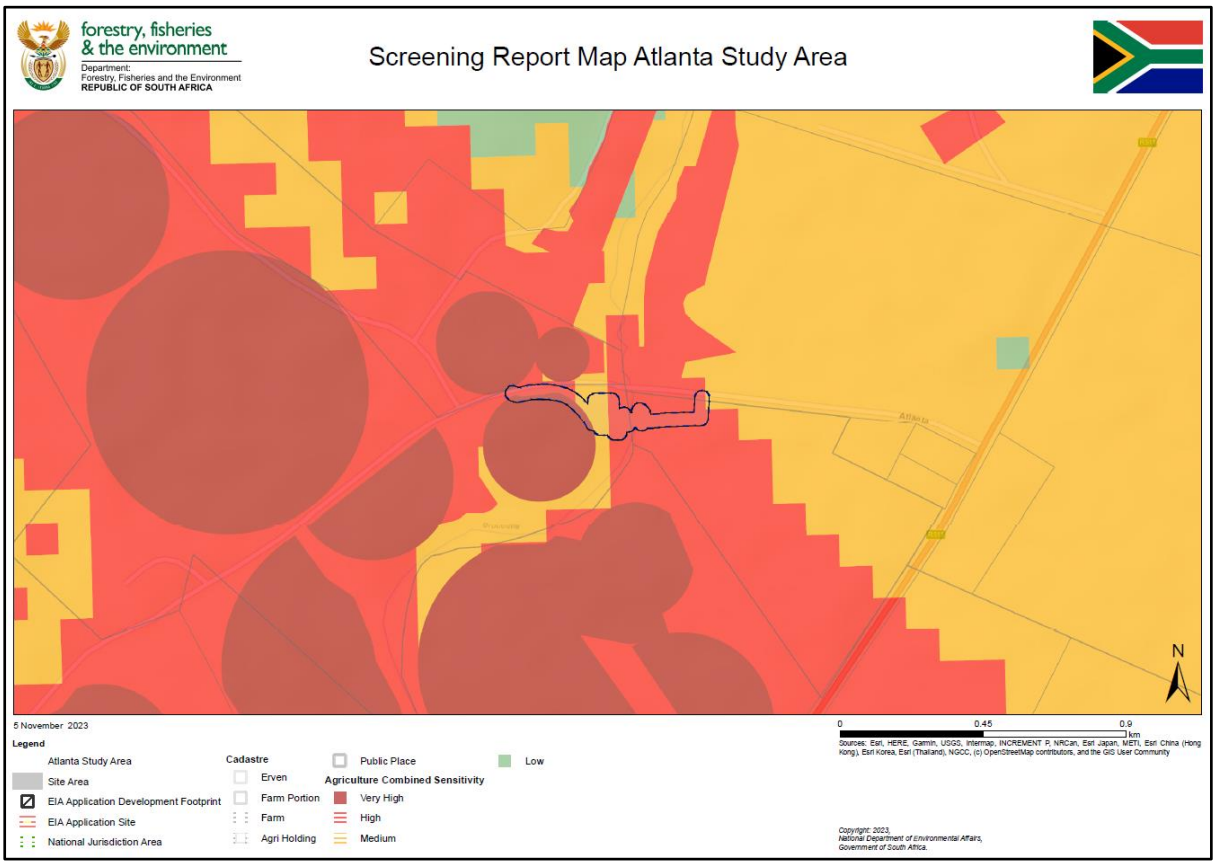

Figure 6: A screening tool for the Atlanta Weir.

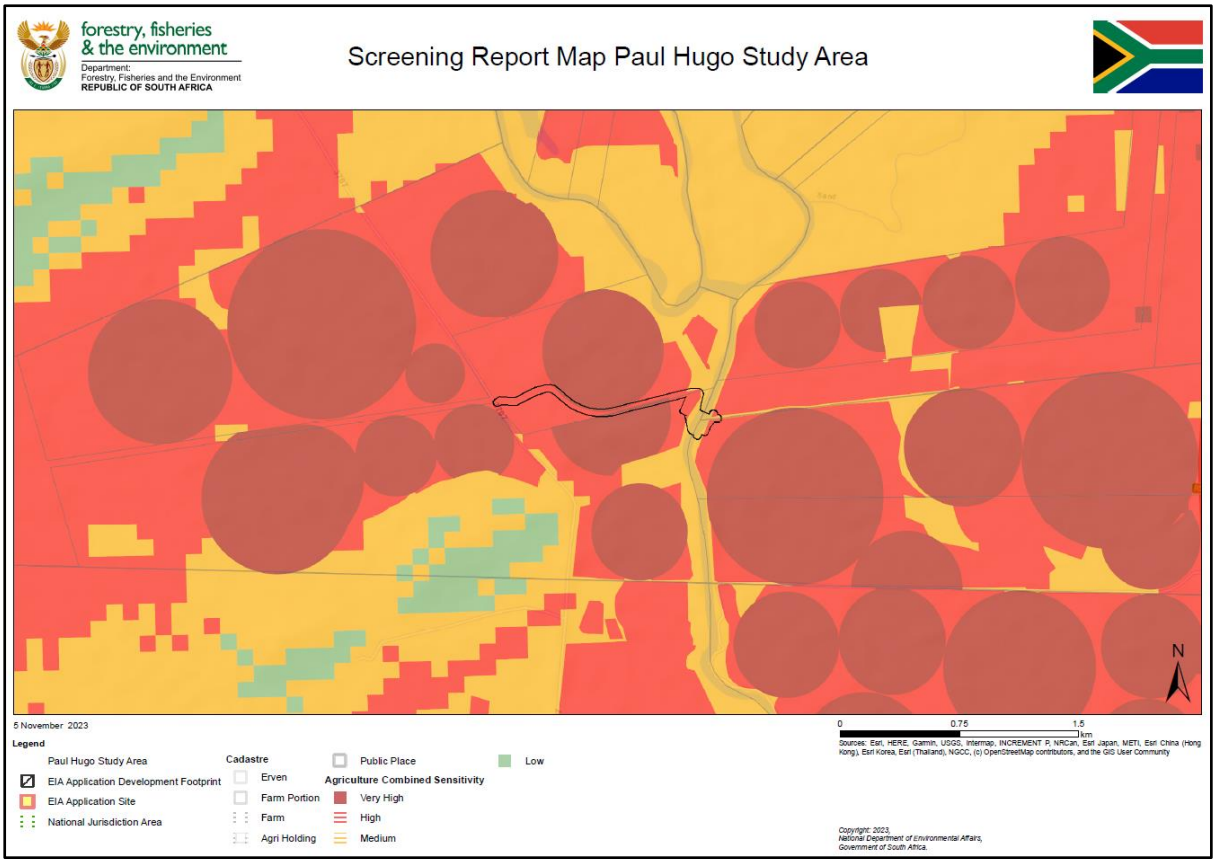

Figure 7: Screening tool sensitivity for the Paul Hugo Weir.

3 DESKTOP RESULTS AND DISCUSSIONS

3.1 CLIMATIC DATA

The Atlanta and Beestekraal Weirs falls within the humid subtropical climate characterised by hot and humid summers and cool to mild winters. Most summer rainfall occurs during thunderstorms that build up due to the intense surface heating and subtropical solid sun angle. The Paul Hugo Weir falls within the hot semi-arid climate characterised by hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. The mean annual rainfall ranges between 401 mm and 601 mm; this rainfall is not deemed adequate to support rain-fed agriculture and planting dates, and the length of the growing season may be affected and needs to be carefully considered. Figure 8 depicts the mean annual rainfall associated with the study area.

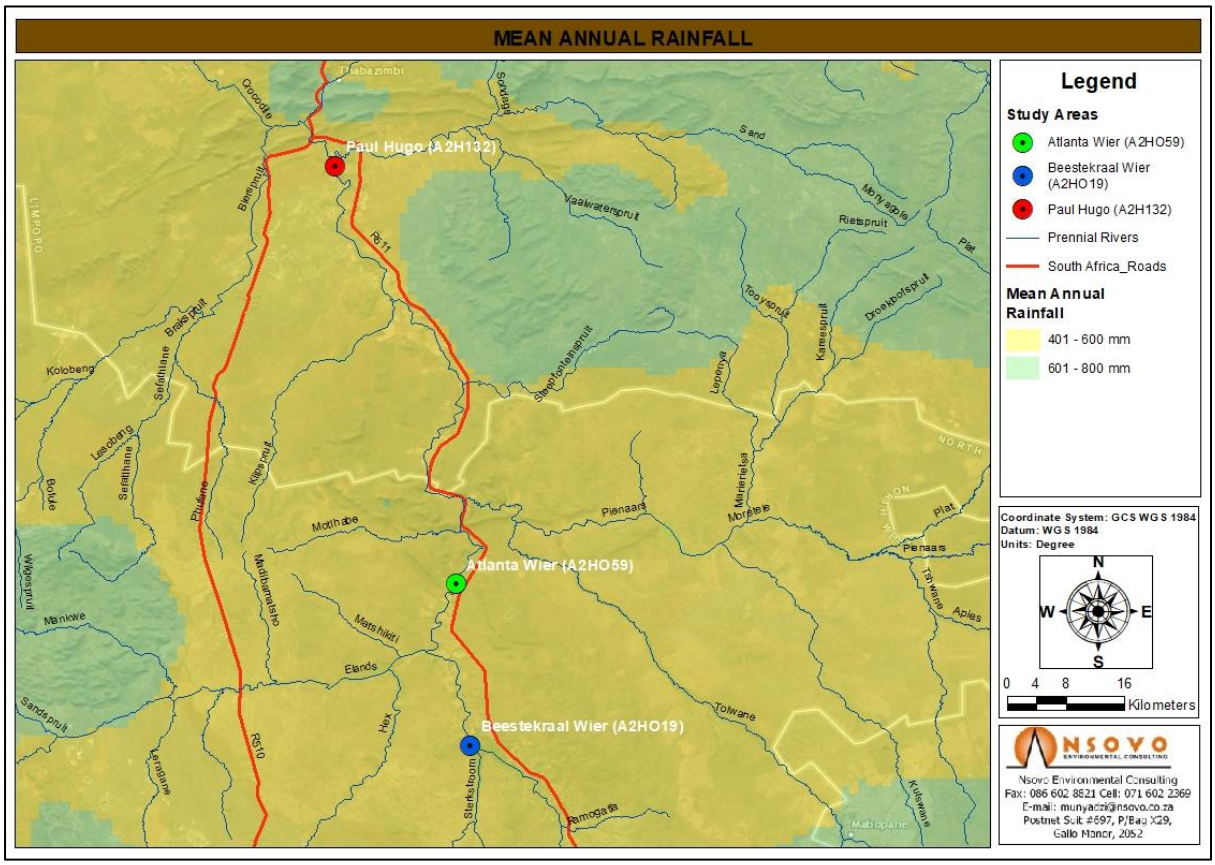

Figure 8: Mean Annual Rainfall associated with the study area.

3.2 GEOLOGY

The Rustenburg, Lebowa, and Rashoop geological lithologies underlie the soils associated with the Beestekraal and Paul Hugo Weirs. These lithologies are part of the bushveld complex. It is known for its enormous concentrations of magmatic ores, a variety of pegmatitic and hydrothermal deposits, and industrial mineral deposits formed by the metamorphism of the floor rocks of the Complex. Because of the climatic conditions, the resultant soils are typically shallow, consisting of quartz pebbles and gravel. The Transvaal, Rooiberg, and Griqualand-West lithologies underlie the Atlanta Weir. Figure 9 depicts the geological lithologies associated with the study area.

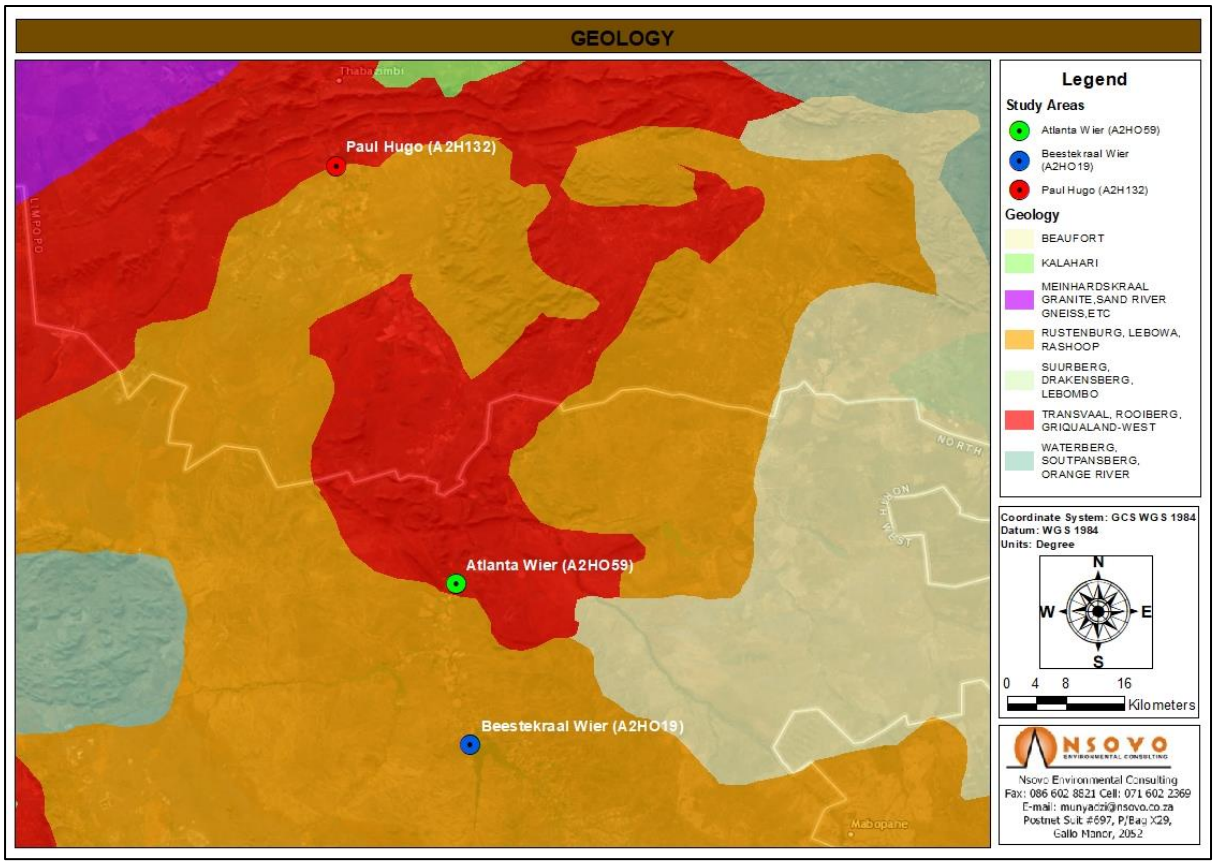

Figure 9: Geological formations associated with the study area.

3.3 CLAY CONTENT

The soils associated with the Beestekraal Weir are characterised by less than 15% clay content. The low clay content of these soils will allow for easy root penetration and water infiltration. However, these soils are prone to leaching and may be less fertile, and a robust fertiliser program may be required to cultivate these soils.

The Atlanta Weir is characterised by soils with between 15% and 35% clay content. The clay content between 15% and 35% can be considered essential as the soil can hold more water during the fallow period, thus allowing for storage, these soils tend to be high in nutrients and do not have the propensity to leach nutrients but however more inclined to be compacted and thus careful management strategies will need to be employed when cultivating on these soils.

The Paul Hugo Weir is characterised by soils with clay percentages greater than 35%. The high clay percentage may impede root penetration, and these soils are prone to waterlogging conditions, thus making cultivation difficult on these soils. Figure 10 illustrates the clay percentage associated with the study area.

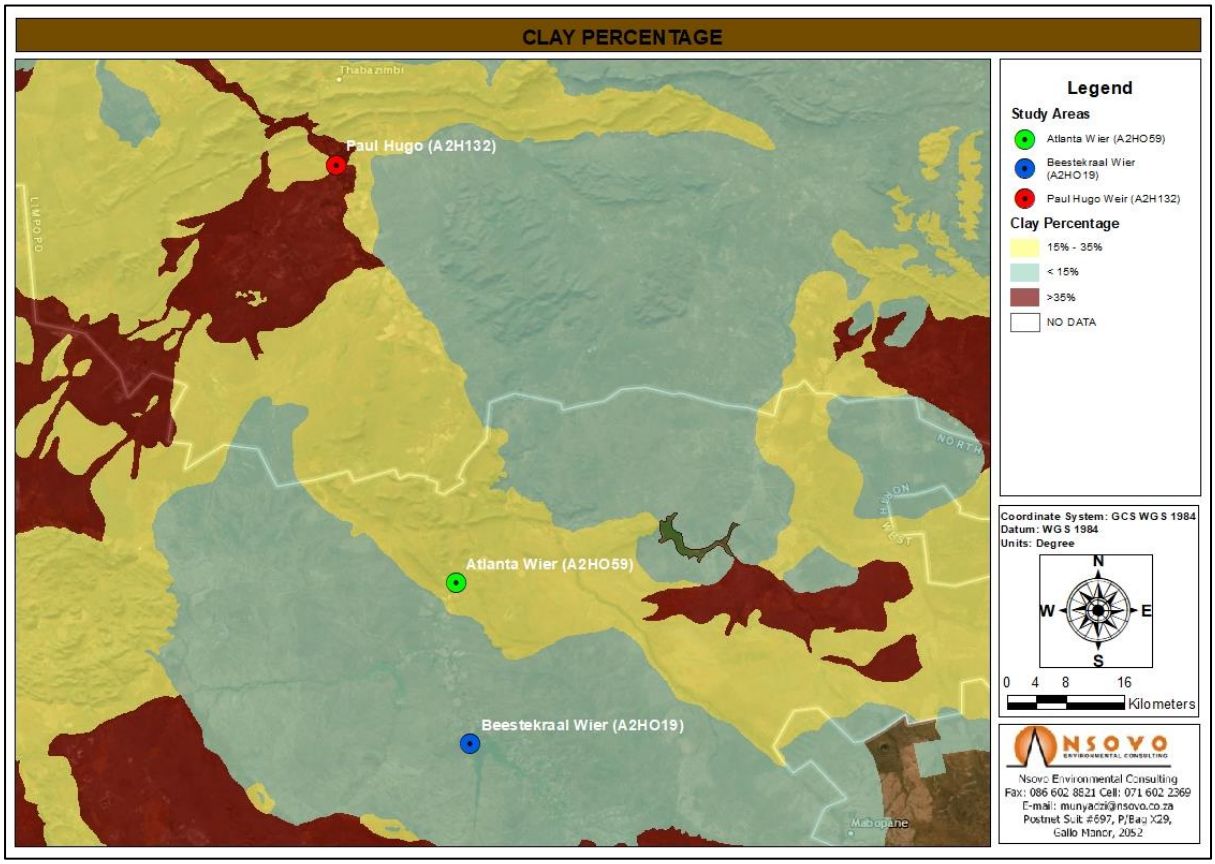

Figure 10: Clay percentage associated with the study area.

3.4 SOIL PH

The soil pH associated with the soils occurring within the Beestekraal and Atlanta Weirs ranges between 5.5 and 6.4, which is considered slightly acidic. The low pH can be attributed to other factors, which include but are not limited to;

- Parent material;
- Loss of organic matter;
- Removal of soil minerals when crops are harvested;
- Erosion of the surface layer; and
- Effects of nitrogen and sulphur fertilizers.

The Paul Hugo Weir is characterised by a soil pH between 6.5 to 7.4, which is slightly acidic to neutral. This pH range can be considered ideal for most cultivated crops, and the somewhat higher pH can be attributed to the high clay content that buffers against changes to the soil pH. Figure 11 below depicts the soil pH associated with soils within the study area.

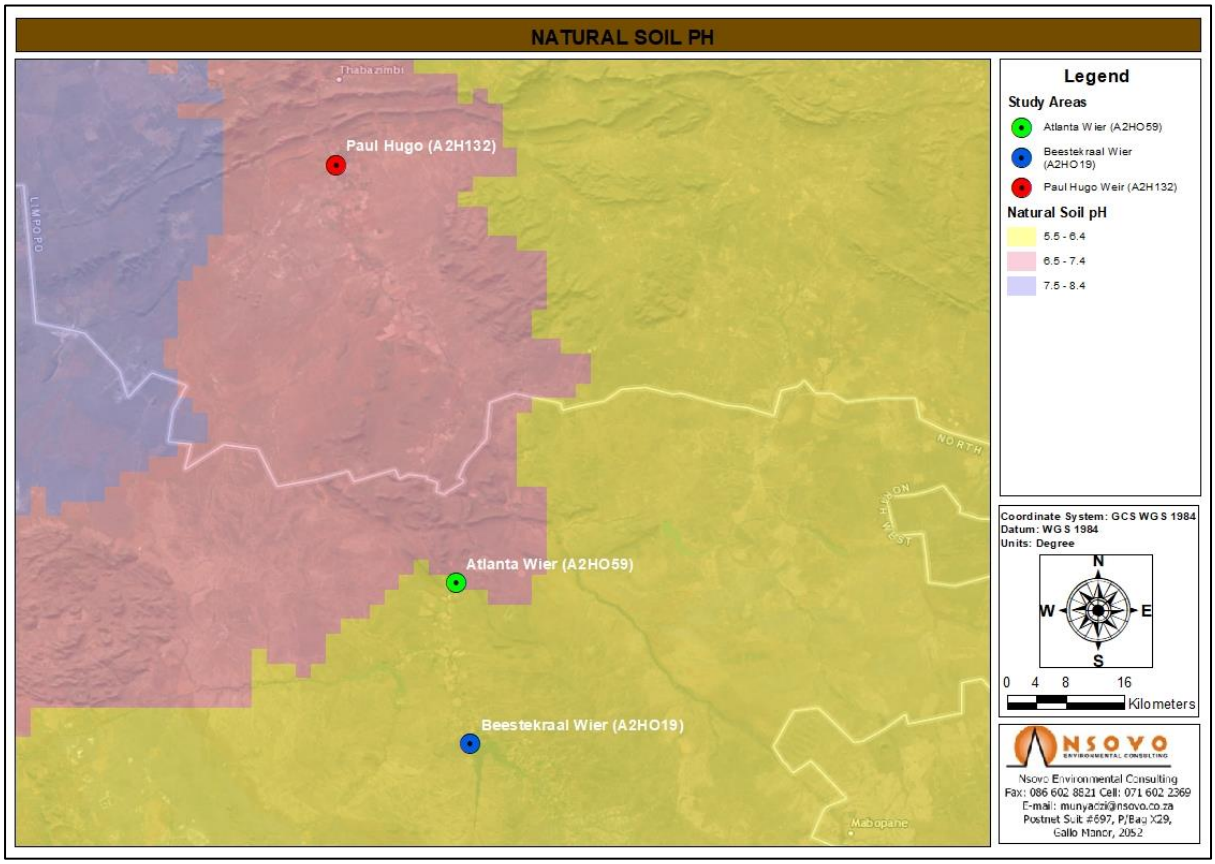

Figure 11: Soil pH associated with the project area.

3.5 SOIL AND TERRAIN (SOTER) DOMINANT SOILS

Eutric Plinthosols characterise the Beestekraal Weir. These soils are characterised by a marked textural differentiation between the top and subsoil horizons. The subsoil horizons are typically clay enriched compared to the sandier topsoil horizons because of clay illuviation, thus causing dense, firmly structured, and slowly permeable subsoil horizons. However, these soils can be cultivated due to the sandier topsoil and more fertile subsoil.

The Atlanta Weir is characterised by Ferric Luvisols. These soils are typically associated with flat terrain and generally are well aerated in the topsoil; however, clay content increases with depth due to the luviation of clay. This soil can be considered relatively fertile and can be cultivated. Whereas Paul Hugo is characterised by Calcic Vertisols. These soils typically have high clay content in the topsoil, thus, cultivation on these soils may require intensive management strategies. Figure 12 below depicts the desktop dominant soils associated with the study area.

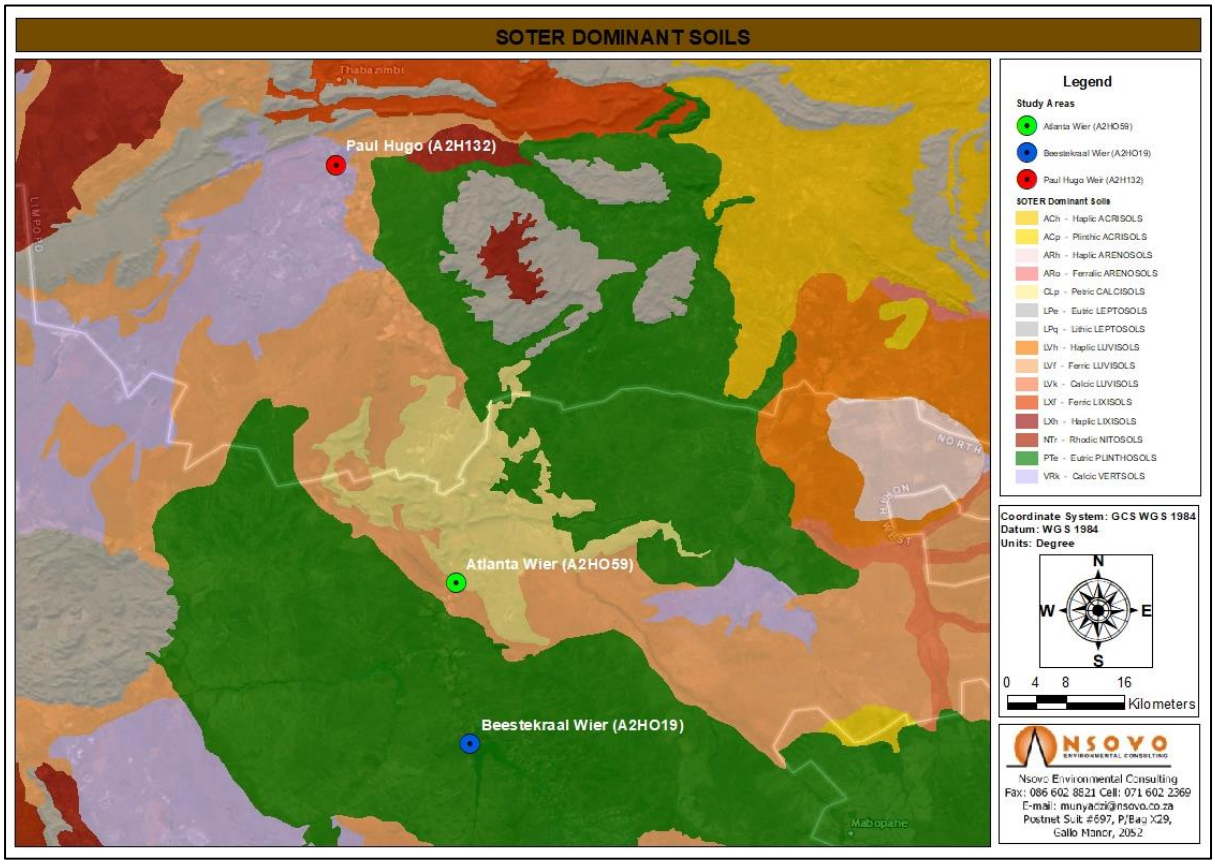

Figure 12: SOTER dominant soils associated with the study area.

3.6 DESKTOP LAND CAPABILITY

The soils associated with the Beestekraal Weir are of arable moderate potential (Class III). The soils associated with Atlanta and Paul Hugo Weirs have arable marginal potential (Class IV). Figure 13 below shows the desktop land capability associated with the study area.

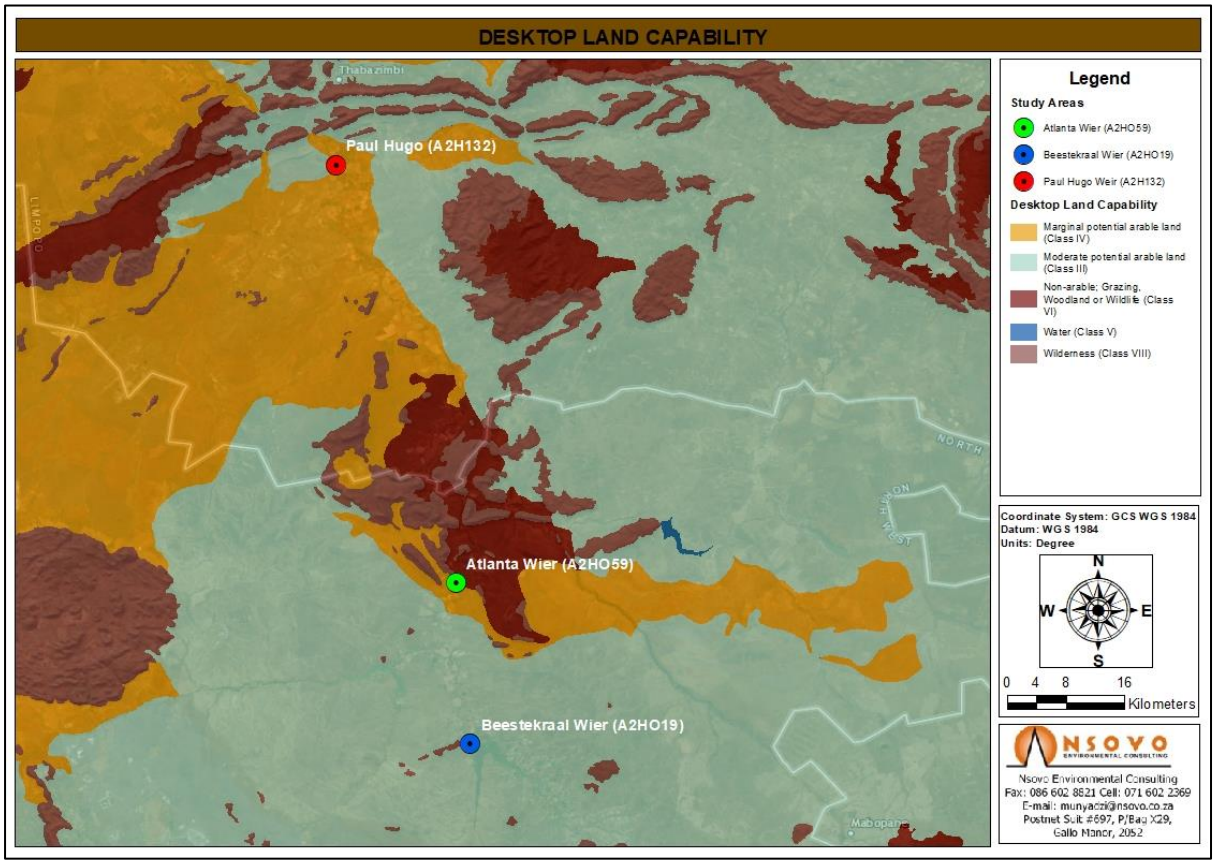

Figure 13: Desktop land capability associated with the study area.

3.7 SOIL POTENTIAL

The potential soils associated with the Beestekraal Weir are poorly suited for arable agriculture where the climate permits. In contrast, the soils associated with the Atlanta Weir are highly suited for arable agriculture where climate permits. Lastly the soils associated with the Paul Hugo weir are of intermediate suitability for arable agriculture where the climate permits. Figure 14, below, depicts the soil potential associated with the study area.

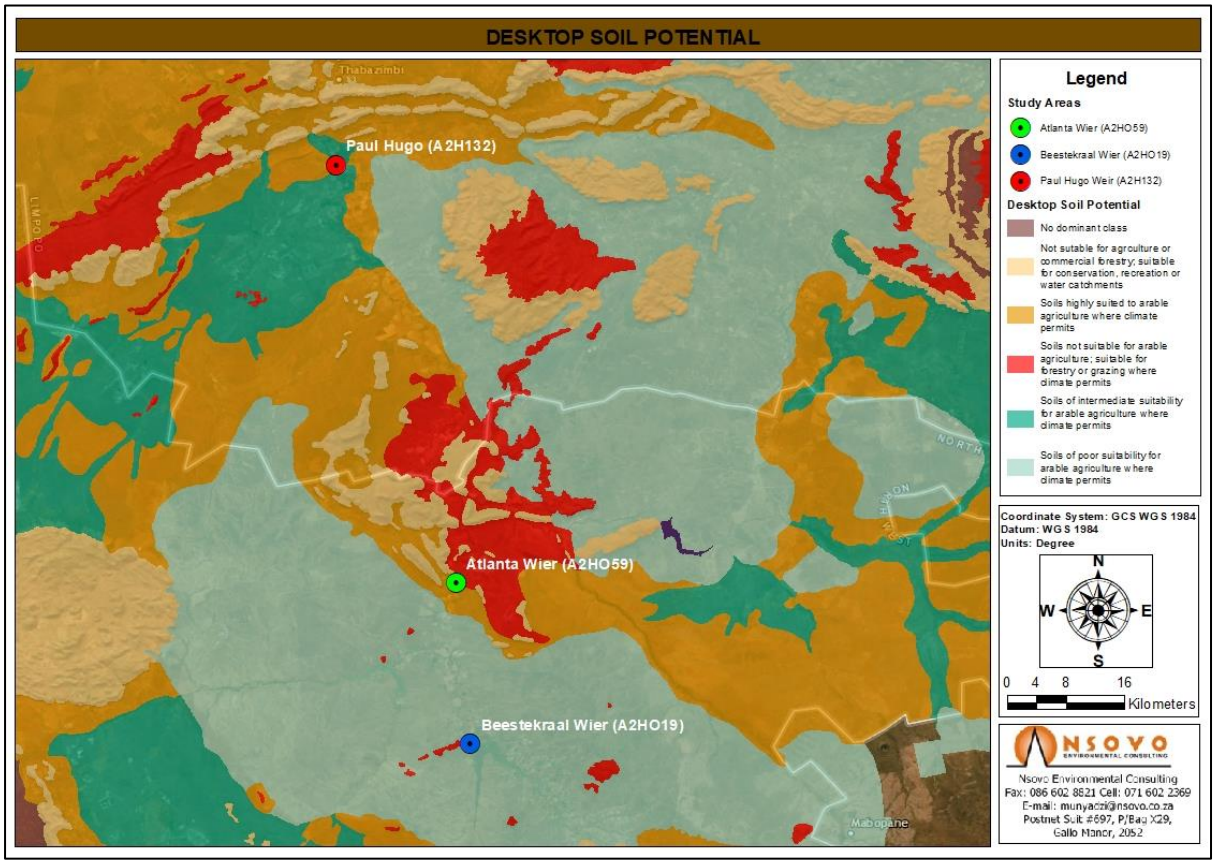

Figure 14: Soil potential associated with the study area.

4 FIELD VERIFIED RESULTS AND DISCUSSIONS

4.1 LAND USES WITHIN THE STUDY AREA

The study area was primarily dominated by cultivation activities, while the surrounding areas are characterised by gauging weirs and residential areas. The agricultural practices in proximity to the proposed developments include vegetable (cabbage), maize, cotton, wheat, and pasture cultivation. These cultivation practices were under irrigation, making use of center pivots. Figure 15 depicts the different land uses identified within the study area.

Figure 15: Land uses associated with the study area.

4.2 SOIL FORMS IN THE STUDY AREA

The section below focuses on the identified soil forms at each gauging weir and are described below. The spatial distribution of the identified soil forms within each study area is presented in Figures 21-23. The summary table depicting the area of coverage of each identified soil form is presented in Tables 5-7.

4.2.1 Hutton

The Hutton soil form is characterised by uniform red coloring, apedal to weak structure and low activity, non-swelling clay minerals. This suggests that the soil is well drained and well aerated and thus will allow for easy root penetration for any cultivated crop. These soils are easily tilled, and erosion is less prevalent because of the micro-aggregating effect caused by the iron oxides, thus reducing the dispersibility of the fine particles. However, surface sealing and hard setting are typically the problems encountered. Lower fertility status can be expected on these soils due to the low organic matter and leaching (especially in high rainfall areas), which can cause the soil to be acidic. Under irrigation, this soil can be highly productive (as was the case for the Paul Hugo study area). These soils are classified under the Arable (Class II) land capability class as they are highly suited for cultivation. Figure 16 below depicts the red apedal horizons associated with the Hutton soil formation.

Figure 16: View of the red apedal horizons associated with the Hutton soil form.

4.2.2 Vaalbos/Nkonkoni

These soils are similar to the Hutton soil formation but are characterised by a shallower depth of 1200 mm. These soils can be cultivated despite their depth and crop choice limitations.

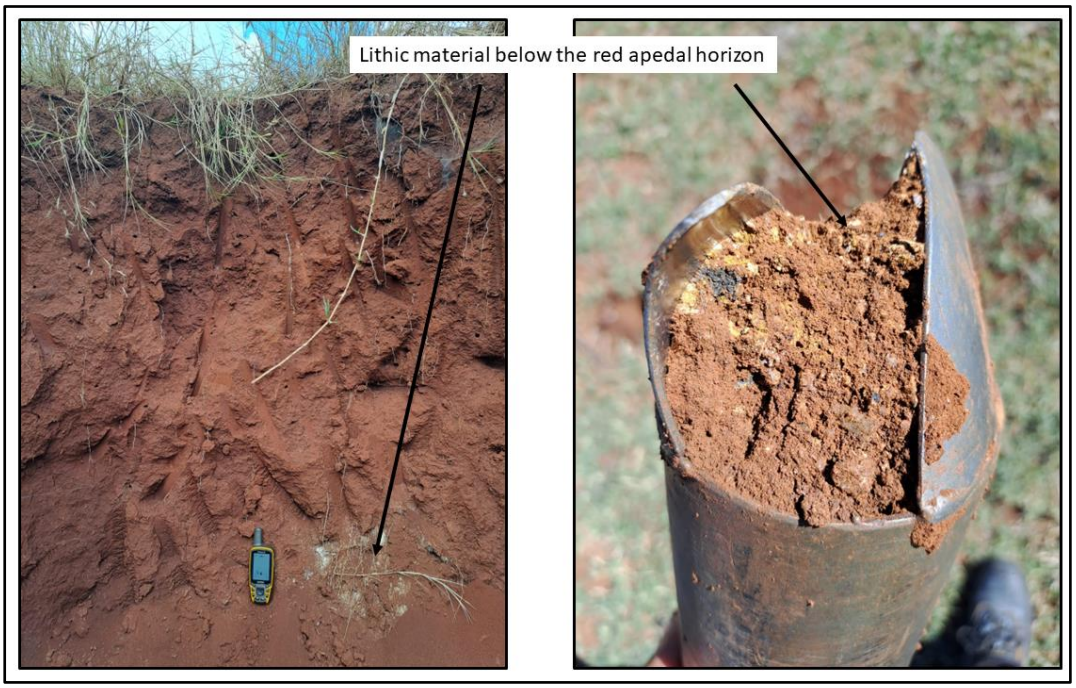

Figure 17: View of the identified Vaalbos/Nkonkoni soil form

4.2.3 Mispah/Glenrosa

The Mispah/Glenrosa are typically shallow. The shallow depth can be attributed to limited rock weathering and convex topographical conditions at the crest or scarp of the landscape, resulting in soil removal and, in some instances, leaving rocky outcrops behind. These types of soils are usually avoided for intensive use and thus left for grazing, forestry, and wildlife land uses unless intense management strategies are used, such as breaking of

the lithic/saprolite layer (as was the case for the Atlanta study area, which cabbage was produced in these soils). The Mispah/Glenrosa soil forms are classified under the Grazing (Class VI) land capability class as they are primarily suited for perennial vegetation and have limitations that preclude cultivation.

Figure 18: View of the identified shallow Mispah/Glenrosa soil forms.

4.2.4 Valrivier/ Swartland

The Swartland/Valrivier soil forms are characterised by a sandy clay topsoil underlain by a pedocutanic horizon, indicating increased clay content with depth. The pedocutanic horizon is characterised by strongly structured, dark clay horizons, with swell-shrink processes due to the high smectic clay content. The soil may swell or shrink in response to the changes in water content, thus causing the soil to crack extensively when dry and become sticky when wet. This soil can be cultivated under intensive management strategies as it is challenging to work with. These soils are classified under the Arable (Class IV) land capability class due to their severe limitations for cultivation.

Figure 19: View of the identified Swartland/Valrivier soil form.

4.2.5 Dundee

The Dundee soil form is associated with watercourses (Crocodile River) but lacks evidence of gleying and consists of fluvial, lacustrine, or aeolian deposits. These soils typically occur on low-lying terrain positions. These soils are sandy and thus lack sufficient nutrients and are prone to waterlogging during the rainy season. No cultivation is feasible on these soils as they can be prone to waterlogging conditions. These soils are classified under the Wet-based soils (Class V) land capability class, and frequent waterlogging is their main limitation.

Figure 20: View of the identified Dundee soil forms.

4.2.6 Witbank

These soils are usually disturbed by anthropogenic influences such as intentional transportation and severe physical disturbance. The diagnostic horizons are no longer arranged in any discernible order or recognizable horizonation as expected in natural soil, sometimes rendering them unsuitable for any cultivation.

Figure 21: Anthropogenically disturbed soils of the Witbank formation.

Table 5: Soil forms in hectares (ha) occurring within the Beestekraal study area.

Beestekraal study area	
Soil Forms	**Area (Ha)**
Mispah/Glenrosa	28.38
Vaalbos/Nkonkoni	5.96
Witbank	30.63
Krokodilerivier	4.06

*Infrastructure = 7.39 ha

Table 6: Soil forms in hectares (ha) occurring within the Atlanta study area.

Atlanta study area	
Soil Forms	**Area (Ha)**
Mispah/Glenrosa	2.12
Witbank	1.31
Krokodilerivier	0.33

Table 7: Soil forms in hectares (ha) occurring within the Paul Hugo study area.

Paul Hugo study area	
Soil Forms	**Area (Ha)**
Hutton	4.60
Valrivier/ Swartland	3.38
Krokodilerivier	0.67

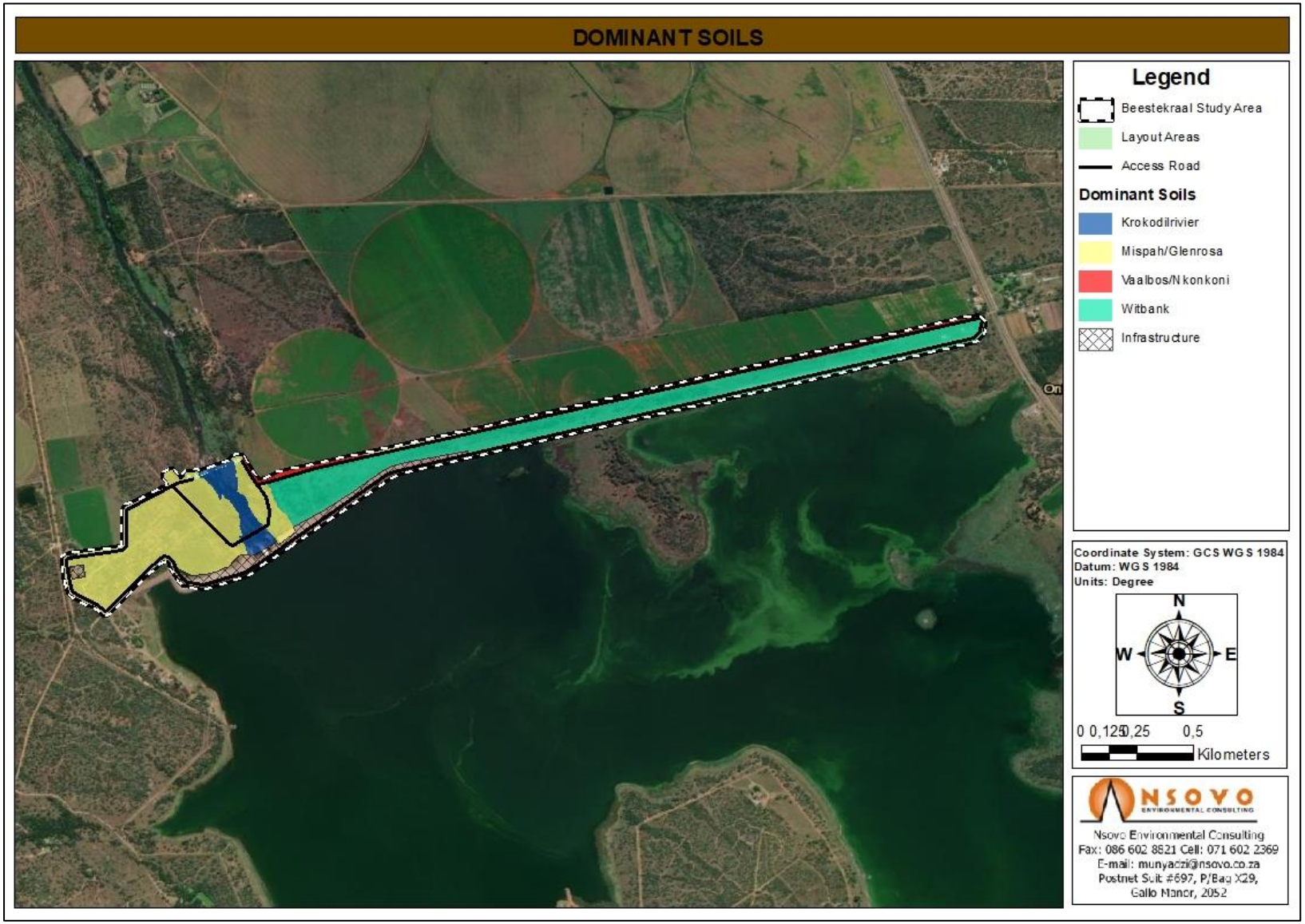

Figure 22: Dominant soils form within the Beestekraal study area.

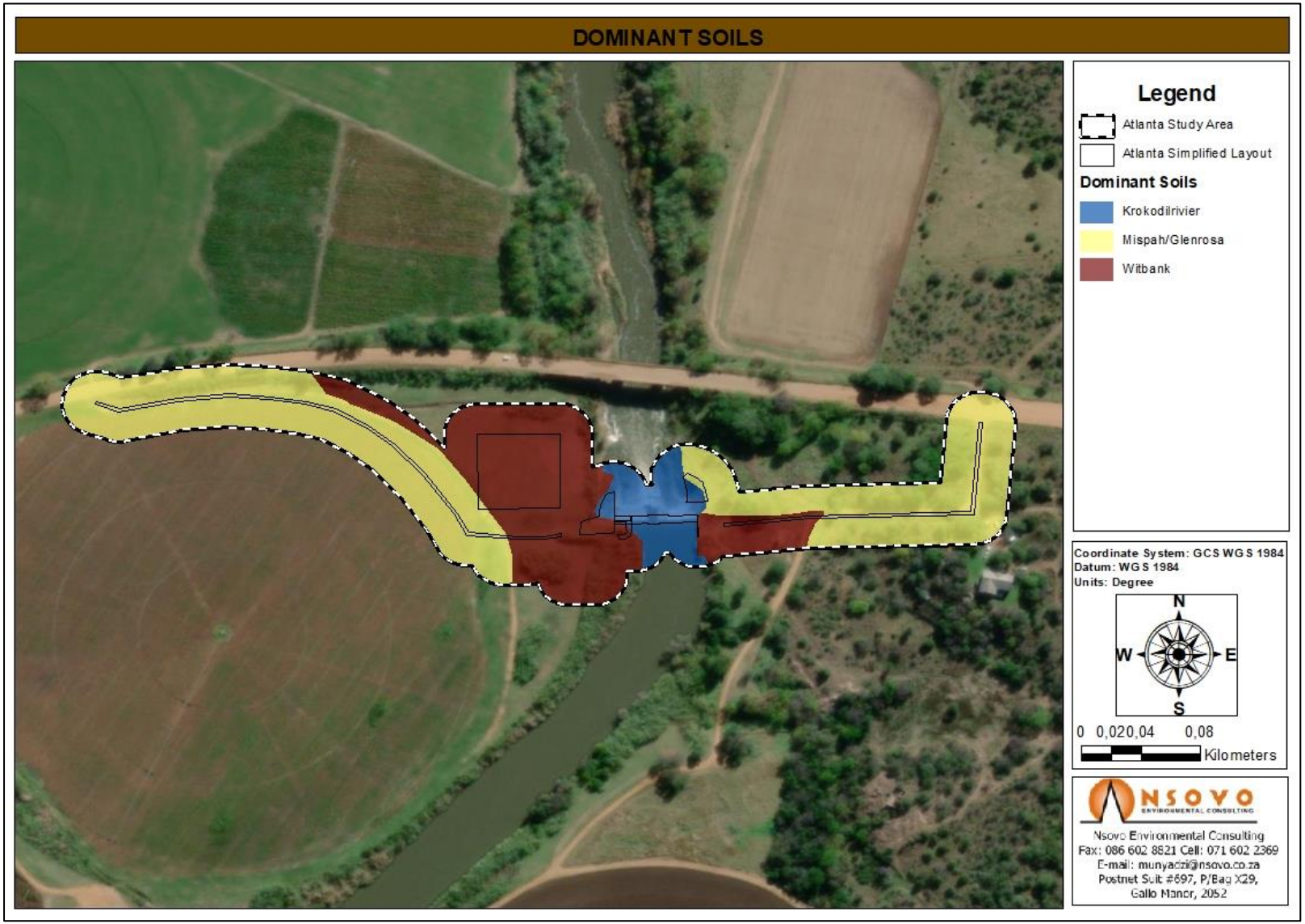

Figure 23: Dominant Soils associated with the Atlanta Weir study area.

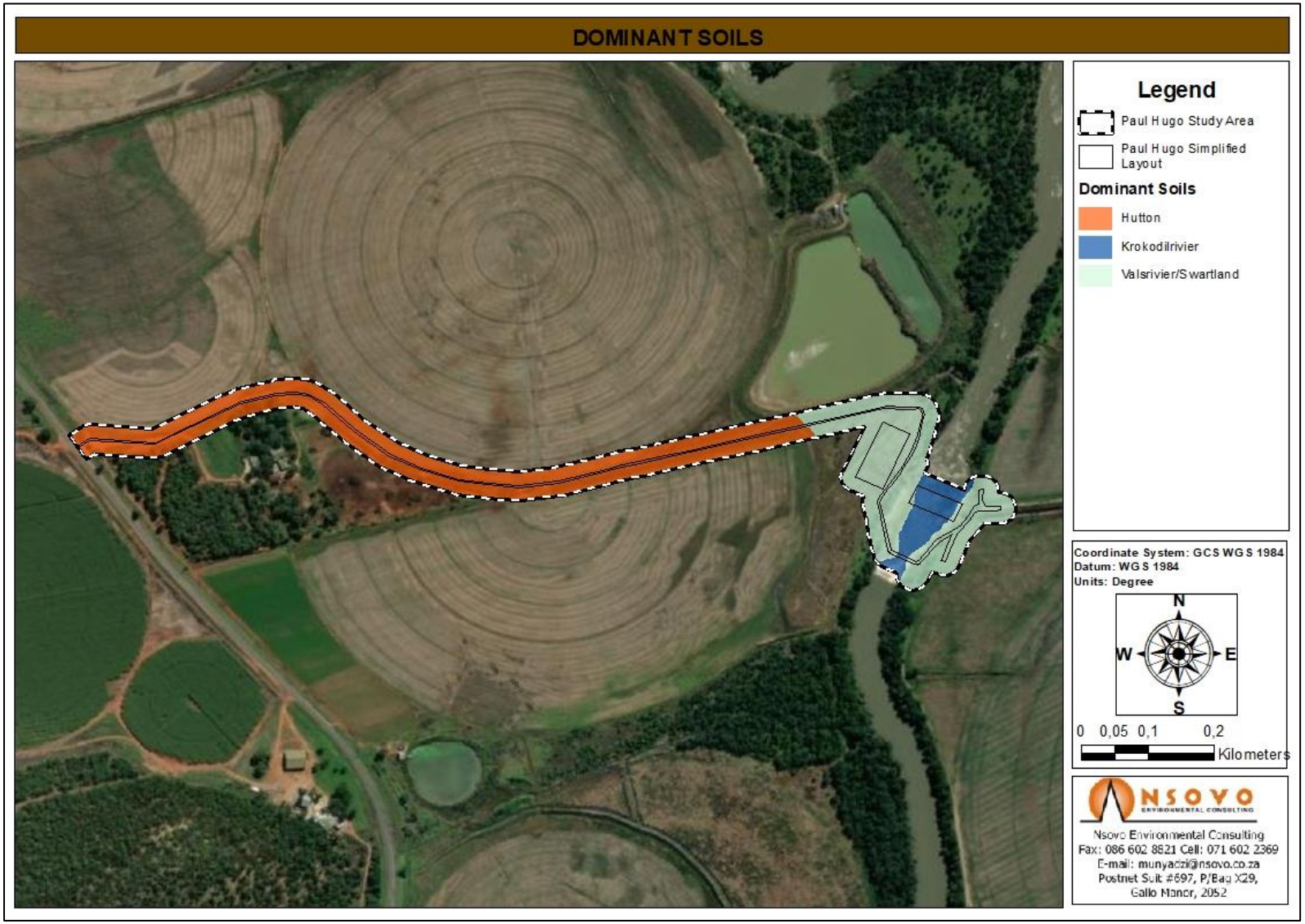

Figure 24: Dominant soils associated with the Paul Hugo Weir study area.

4.3 LAND CAPABILITY AND AGRICULTURAL SENSITIVITY

Land Capability is defined as the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of climate, soil, and terrain. The soil physical properties with which the agricultural potential for this assessment, agricultural sensitivity, was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Figures 24-28 below depict the study area's land capability and agricultural potential.

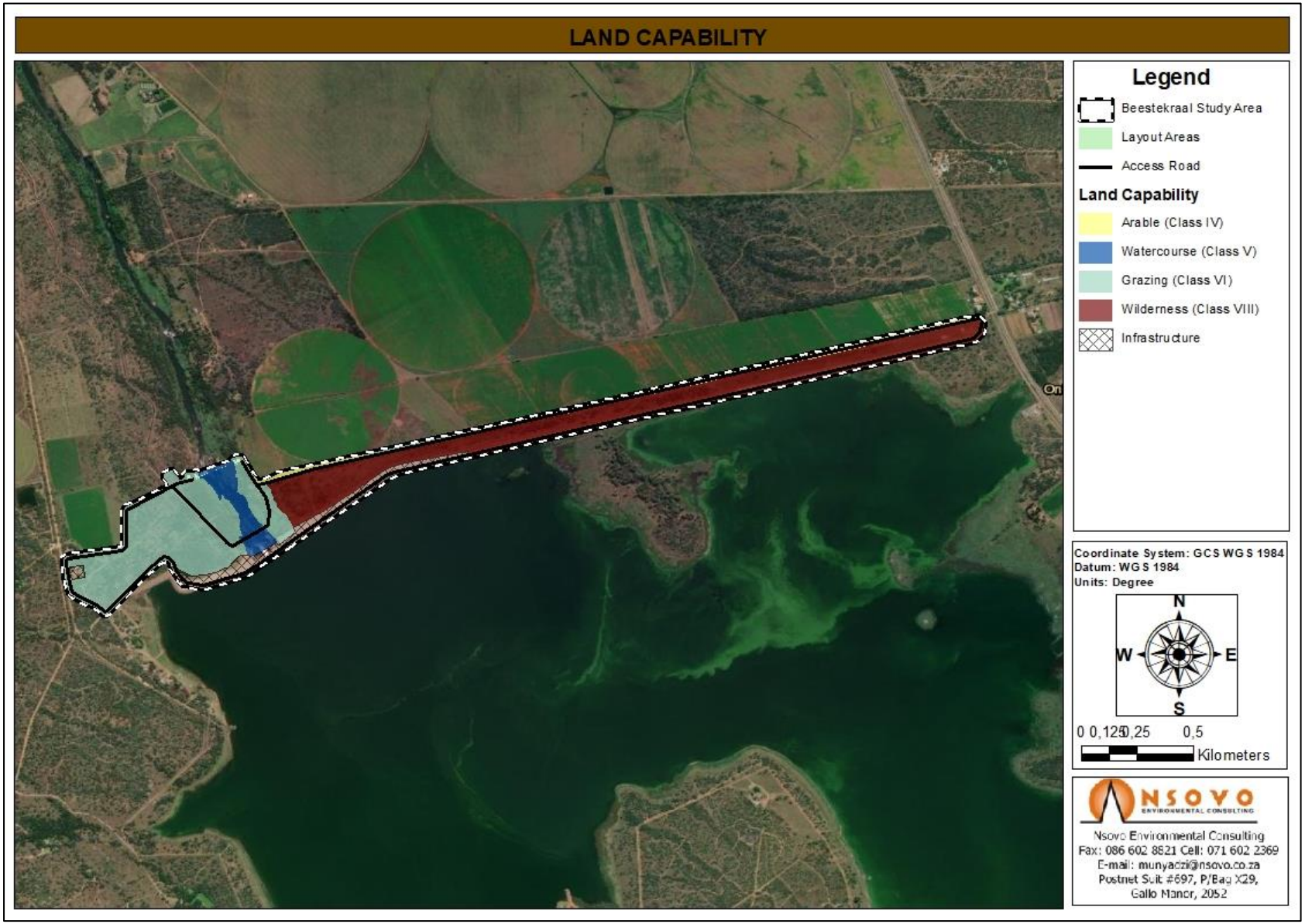

Figure 25: Map depicting land capability of soils within the Study Area.

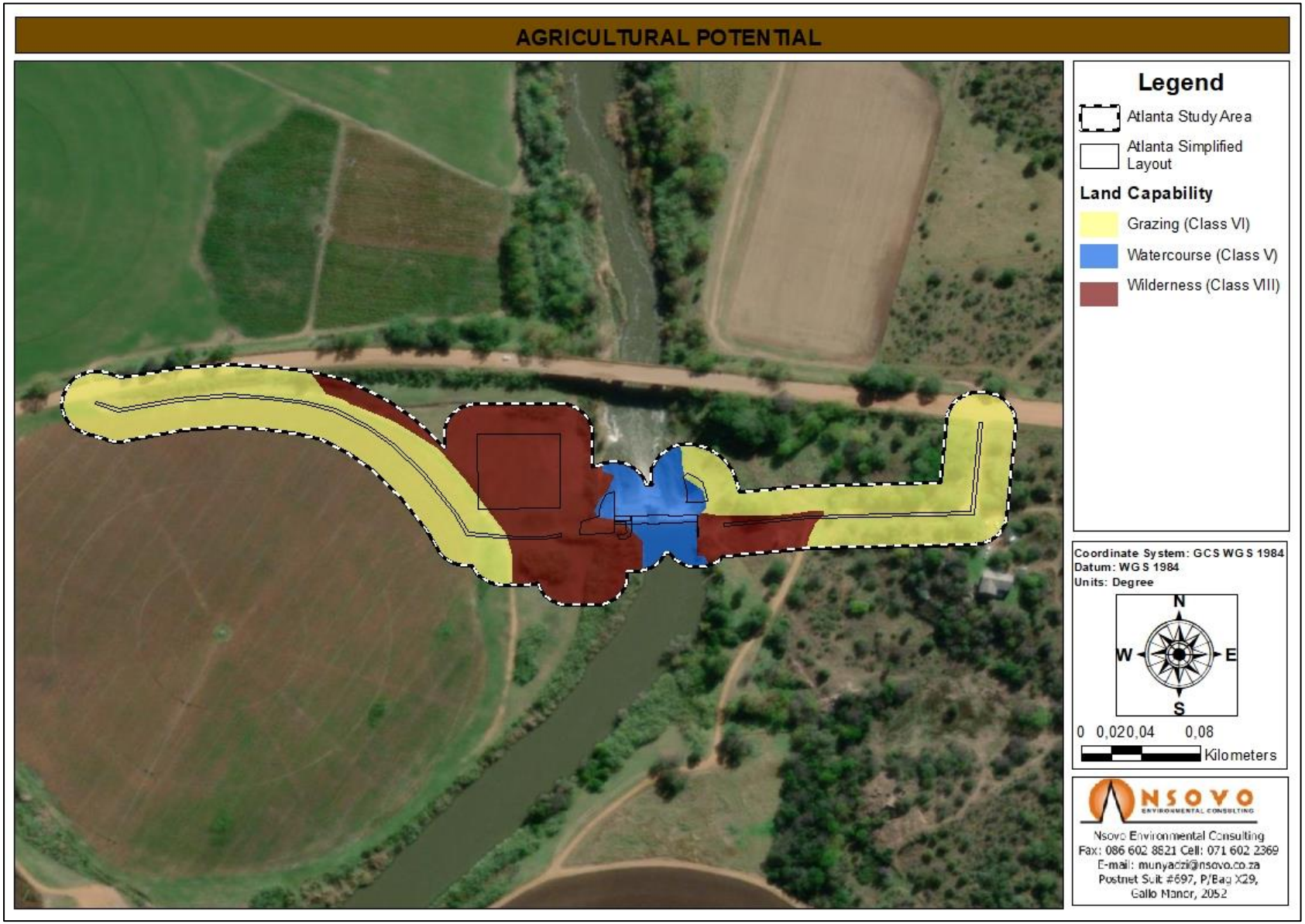

Figure 26: Land capability for soils associated with the Atlanta study area.

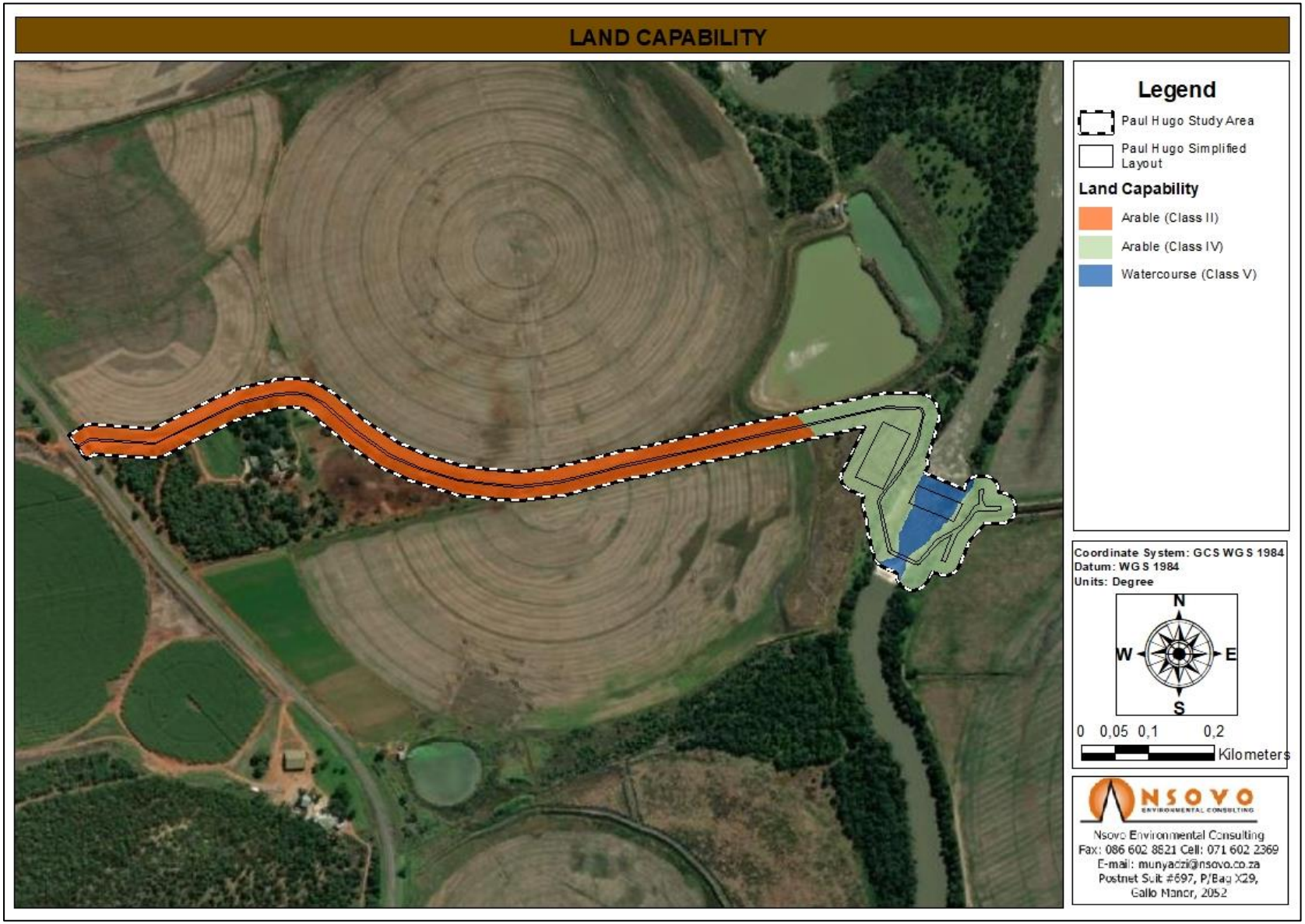

Figure 27: Land Capability for soils associated with Paul Hugo Weir study area.

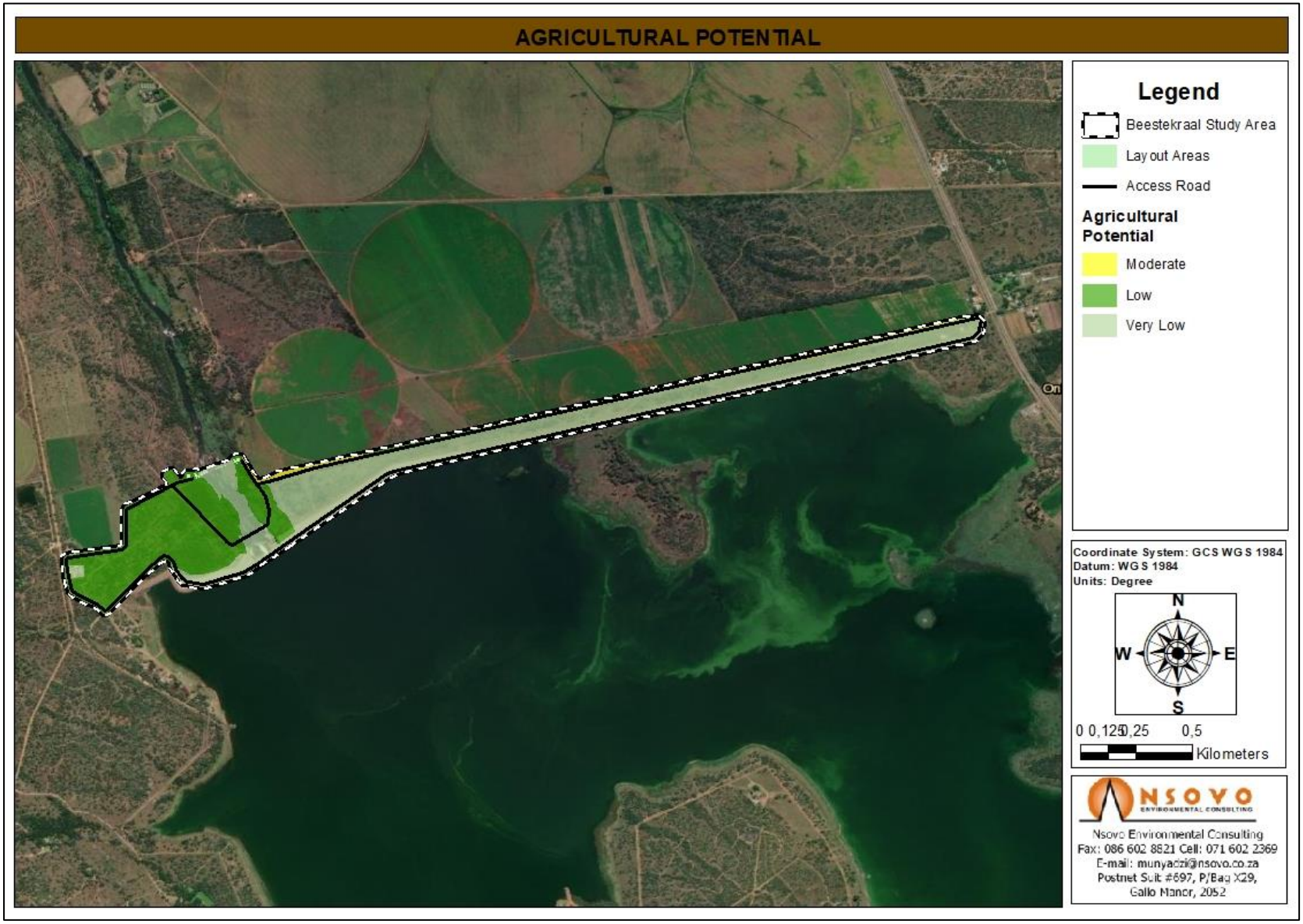

Figure 28: Agricultural potential for soils associated with the soils of the Beestekraal Weir study area

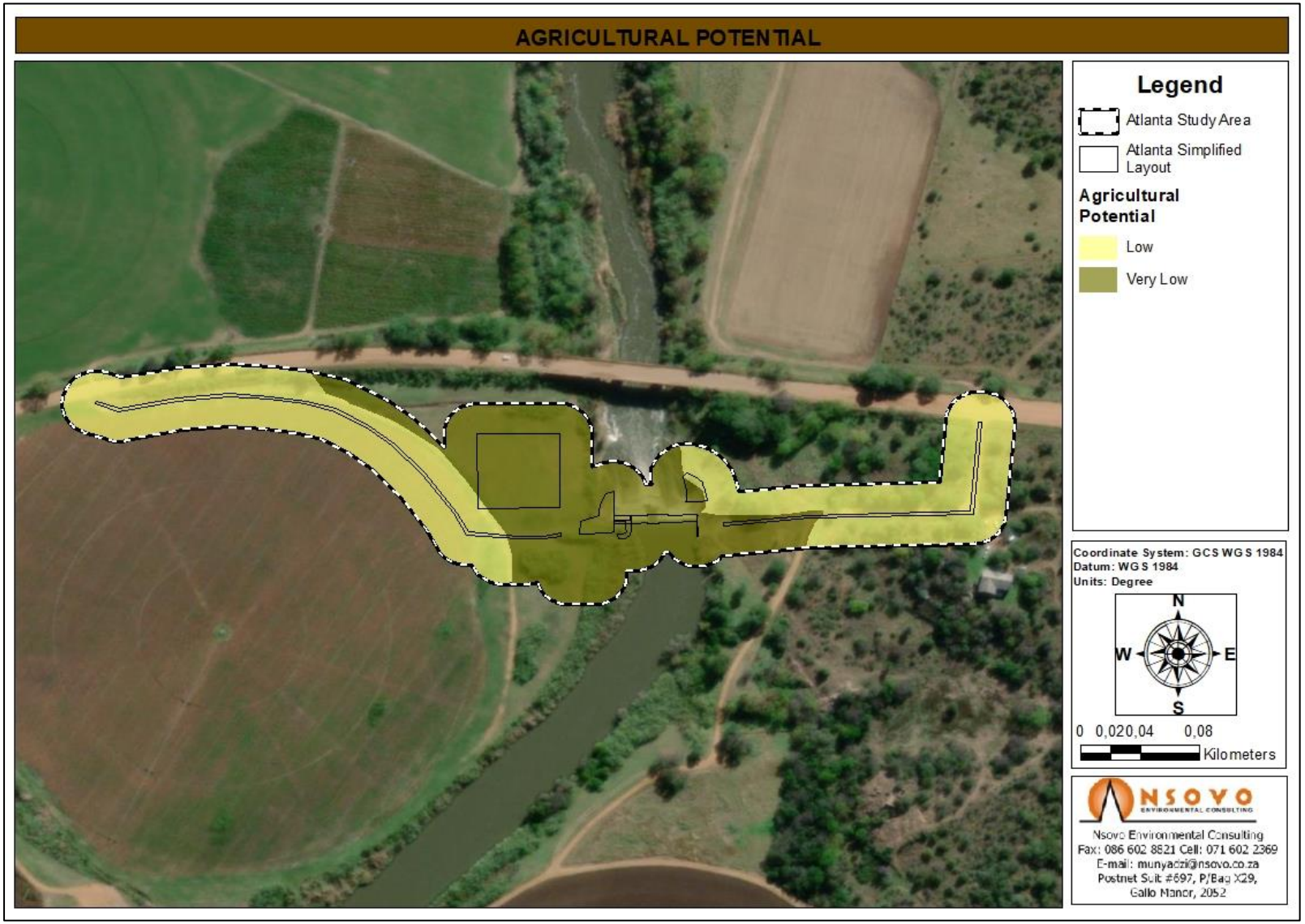

Figure 29: Agricultural potential for soils associated with the Atlanta Weir study area soils.

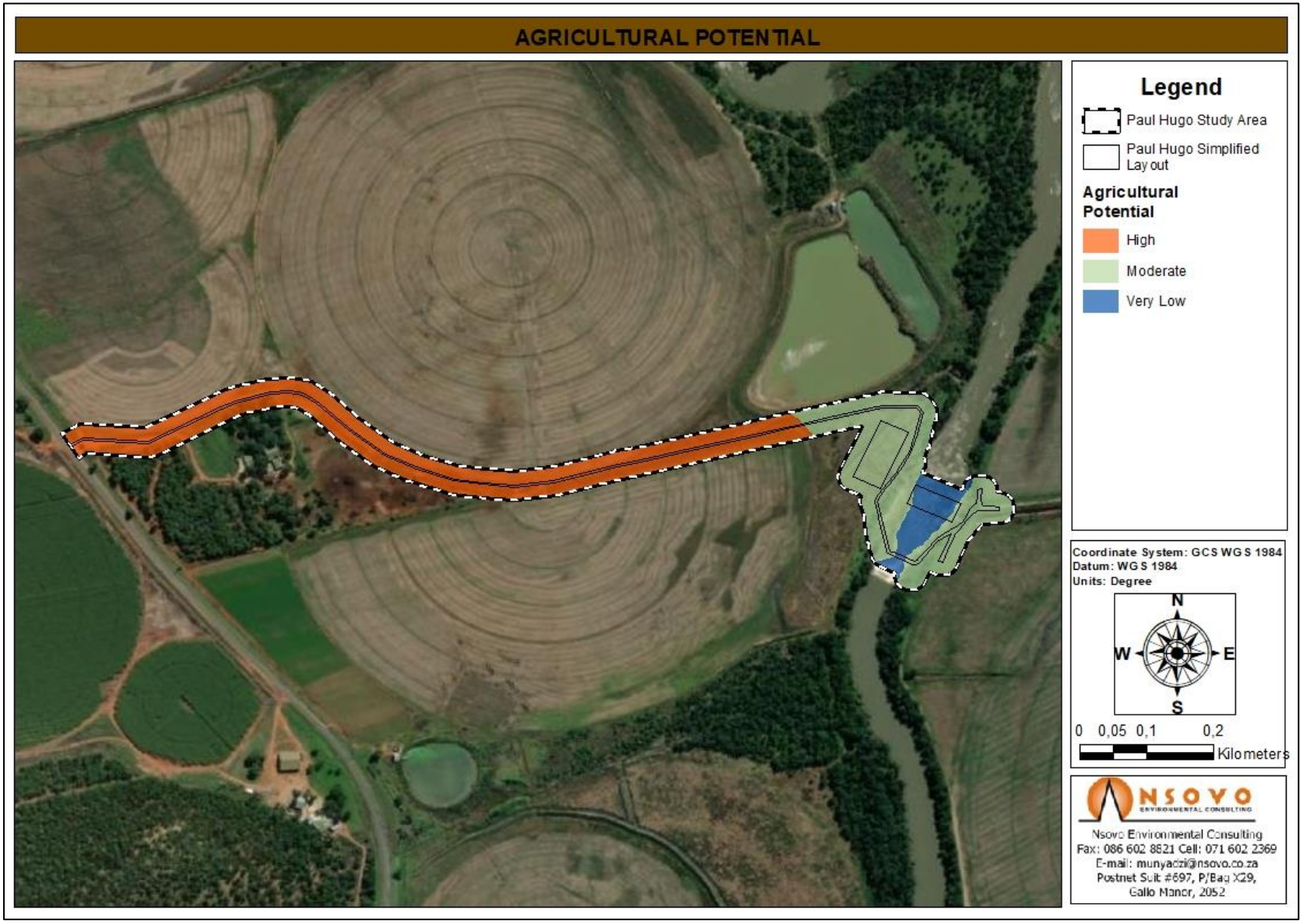

Figure 30: Agricultural potential for soils associated with the Paul Hugo Weir study area soils.

5 IMPACT ASSESSMENT

5.1 ASSESSMENT METHODOLOGY

According to the NEMA regulations (2014), all the impact assessments should provide quantified scores that show the expected impact and those that will likely result from proposed activities. Significance scoring both assesses and predicts the environmental impacts through the evaluation of the following factors;

- Probability of the impact,
- Duration of the impact,
- Extent of the impact, and
- Magnitude of the impact.

The objective of the assessment of impacts is to identify and assess all the significant impacts that may arise due to the implementation of the Proposed Development and place the consequences of the Proposed Development before the competent authority.

For each main project phase, the existing and potential future impacts and benefits (associated only with the Proposed Development) were described using the criteria listed in Appendix B. This was done in accordance with the EIA Regulations, promulgated in terms of Section 24 of the NEMA and the criteria drawn from the Integrated Environmental Management (IEM) Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the Department of Environmental Affairs (April 1998).

The assignment of significance ratings has been undertaken based on the specialist team's experience and research. Subsequently, mitigation measures have been identified and considered for each impact. The assessment is repeated to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented). Each of the above impact factors has been used to assess each potential impact using ranking scales as detailed in Appendix B.

The significance of the impacts that may occur due to the proposed activities and a description of the mitigation required to limit the identified negative impacts on the identified soils on site are presented in Section 5.2 below.

5.2 IMPACT ASSESSMENT PER PROJECT PHASE

5.2.1 Construction Phase

During the construction phase of the proposed development, the soils are anticipated to be exposed to erosion, dust emission, potential soil contamination, and loss of land capability impacts. The main envisaged activities include the following:

- Earthworks will include clearing vegetation from the surface and stripping topsoil (soil excavation) for foundation preparation where the proposed infrastructure is to be placed. These activities are the most disruptive to natural soil horizon distribution and will impact the current soil hydrological properties and functionality of soil if not appropriately mitigated;
- Frequent movement of heavy machinery increasing the likelihood of soil contamination from petroleum, oil, and grease substances; and
- Other activities in this phase that will impact soil are handling and storing building materials and different kinds of waste. This will potentially result in soil pollution when not managed properly.

The disturbance of original soil profiles and horizon sequences of these profiles during earthworks is considered a measurable deterioration in terms of erosion. This impact is localised within the development footprint. If not managed, this impact will be localised within the site boundary and have medium significance on the soil resource.

Soil chemical pollution, due to potential oil and fuel spillages from vehicles, is a moderate deterioration of the soil resource. If not managed, this impact will be localised within the site boundary and have medium significance on the soil resource.

Soil compaction will be a measurable deterioration that will occur due to the heavy vehicles commuting on the existing roads and any newly constructed access road to increase access to the gauging weirs. The impacts will be localised within the site boundary with medium consequence and significance without mitigation measures.

Beestekraal Study Construction Phase Impacts

Beestekraal Study Construction Phase Impacts

Table 8: Rating of impacts for the loss of land capability and associated mitigation measures for all the sites.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Site clearing activities, such as removing topsoil material adjacent to cultivated fields to develop a foundation for contraction of the gauging weir structures and laydown areas. Road upgrades and maintenance potentially encroaching on cultivated areas.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Less available soil material for cultivation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE RESOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations must be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Avoid permanently impacting topsoil and subsoil, but salvage the maximum depth of these when clearing areas for infrastructure. The maximum salvageable depth for the shallower soils of the Mispah/Glenrosa is 30 cm, and for the Vaalbos/Nkonkoni/it is 80 cm.				
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.				

IMPACT ON LAND CAPABILITY				
Bare soils within the access roads can be regularly dampened with water to suppress dust during construction, especially when strong wind conditions are predicted according to the local weather forecast.				
Topsoil stripping and stockpiling should not be conducted during wet periods.				
Suppose soils are going to be left in a stockpile. In that case, they must be vegetated with locally indigenous grasses and forbs to maintain biological processes, stabilise the soil, and reduce soil loss due to erosion.				
Following construction, the topsoil should be placed as the final soil layer before seeding.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and, as such, is rated as short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible.*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative.		
CONFIDENCE LEVEL				
Medium				

Table 9: Rating of impacts on soil erosion and associated mitigation measures for all the Beestekraal study areas.

IMPACT ON SOIL EROSION	
PROJECT PHASE	*Construction Phase.*
DIRECT IMPACT	*Site clearing activities include removingremoving topsoil material to create a foundation for contraction of the gauging weir structures, and laydown areas. Road upgrades and maintenance potentially encroaching on cultivated areas.*
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion.*
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources.*

IMPACT ON SOIL EROSION				
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE RESOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS), as thunderstorms can displace soils and cause sedimentation of nearby streams and rivers.				
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				
Suppose soils are going to be left in a stockpile. In that case, they must be vegetated with locally indigenous grasses and forbs to maintain biological processes, stabilise the soil, and reduce soil loss due to erosion.				
Following construction, the topsoil should be placed as the final soil layer before seeding.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		

IMPACT ON SOIL EROSION				
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 10: Rating of impacts on soil compaction and associated mitigation measures for all the Beestekraal study areas.

IMPACT ON SOIL COMPACTION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Heavy vehicle traffic within and around the infrastructure area potentially compacts the soil.*			
INDIRECT IMPACT	*Surface crusting through soil compaction.*			
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The activity associated with the impact will last 18 months-5 years.*	*-12*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-36*	*Low negative.*		

IMPACT ON SOIL COMPACTION				
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Trafficking and movement over the areas not targeted for construction must be avoided if not minimised, especially heavy machinery.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS), as thunderstorms can displace soils and cause sedimentation of nearby streams and rivers.				
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.				
Compacted soils should be ripped at least 20cm to alleviate.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and, as such, is rated as Short term.*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible.*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative.		
CONFIDENCE LEVEL				
Medium				

Table 11: Rating of impacts on soil contamination and associated mitigation measures for the Beestekraal study area.

IMPACT ON SOIL CONTAMINATION	
PROJECT PHASE	*Construction Phase.*
DIRECT IMPACT	*Direct chemical spills on soils from construction vehicles or other construction equipment used.*

IMPACT ON SOIL CONTAMINATION				
INDIRECT IMPACT	*Contamination of soil*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Ensure appropriate handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets).				
Maintenance of vehicles and equipment should be carried out in designated facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.				
Implementing regular site inspections for materials handling and storage.				
Development of detailed procedures for spill containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		

IMPACT ON SOIL CONTAMINATION				
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Atlanta Study Area Construction Phase Impacts

Table 12: Rating of impacts for the loss of land capability and associated mitigation measures for the Atlanta study area.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Construction Phase*			
DIRECT IMPACT	*Site clearing activities include removing topsoil material to create foundation for contraction of the gauging weir structures laydown areas. Road upgrades and maintenance potentially encroaching on areas cultivated with cabbage.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Less available soil material for cultivation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-21*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-3*	*The severity of the impact is rated as High negative as the natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.*	*Highly detrimental*	*Definite*

IMPACT ON LAND CAPABILITY				
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-63*	*High negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Avoid permanently impacting topsoil and subsoil but salvage the maximum depth of these when clearing areas for infrastructure. In the shallower soils of the Mispah/Glenrosa, the maximum salvageable depth is 30 cm.				
Make use of geotextiles and contours to control soil erosion and revegetation of exposed soil surfaces where possible.				
Topsoil stripping and stockpiling should not be conducted during wet periods.				
If soils are going to be left in stockpile for a significant period, they must be vegetated with locally indigenous grasses and forbs to maintain biological processes, stabilise the soil and reduce soil loss due to erosion.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 13: Rating of impacts on soil erosion and associated mitigation measures for the Atlanta study area.

IMPACT ON SOIL EROSION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Site clearing activities include removing topsoil material to create foundation for contraction of the gauging weir structures laydown areas. Road upgrades and maintenance potentially encroaching on areas cultivated with cabbage.*			
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion.*			
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS), as thunderstorms can displace soils and cause sedimentation of nearby streams and rivers.				
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				

IMPACT ON SOIL EROSION				
If soils are going to be left in stabilize the soil stockpile; they must be vegetated with locally indigenous grasses and forbs to sustain biological processes, stabilize the soil, and reduce soil loss due to erosion.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 14: Rating of impacts on soil compaction and associated mitigation measures for all the Atlanta study area.

IMPACT ON SOIL COMPACTION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Heavy vehicle traffic within and around the infrastructure area and potentially compacting the soil.*			
INDIRECT IMPACT	*Surface crusting through soil compaction.*			
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-14*	*3*

IMPACT ON SOIL COMPACTION				
EXTENT	*3*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Moderately detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Trafficking and movement over the areas not targeted for construction must be avoided if not minimised, especially heavy machinery.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS), as thunderstorms can displace soils and cause sedimentation of nearby streams and rivers.				
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.				
Compacted soils should be ripped at least 20cm to alleviate.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and, as such, is rated as Short term.*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible.*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative.		

IMPACT ON SOIL COMPACTION
CONFIDENCE LEVEL
Medium

Table 15: Rating of impacts on soil contamination and associated mitigation measures for the Atlanta study area.

IMPACT ON SOIL CONTAMINATION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Direct chemical spills on soils from construction vehicles or other construction equipment used.*			
INDIRECT IMPACT	*Contamination of soil.*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Ensure appropriate handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets).				

IMPACT ON SOIL CONTAMINATION				
Maintenance of vehicles and equipment should be carried out in designated facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.				
Implementing regular site inspections for materials handling and storage.				
Development of detailed procedures for spill containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Paul Hugo Study Area Construction Phase Impacts

Table 16: Rating of impacts for the loss of land capability and associated mitigation measures for the Paul Hugo study area.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Construction Phase*			
DIRECT IMPACT	*Site clearing activities include removing topsoil material to create foundation for contraction of the gauging weir structures laydown areas. Road upgrades and maintenance potentially encroaching on areas cultivated with Maize and Wheat.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Less available soil material for cultivation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**

IMPACT ON LAND CAPABILITY				
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-21*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-3*	*The severity of the impact is rated as High negative as the natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.*	*Highly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-63*	*High negative*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible and avoid construction on active agricultural soils.				
Avoid permanently impacting topsoil and subsoil but salvage the maximum depth of these when clearing areas for infrastructure. For the soils of the Hutton formation, the maximum salvageable depth is 150 cm, and for the Valsrivier/Swartland, 120 cm.				
Make use of geotextiles and contours to control soil erosion and revegetation of exposed soil surfaces where possible.				
Topsoil stripping and stockpiling should not be conducted during wet periods.				
If soils are going to be left in stockpile for a significant period, they must be vegetated with locally indigenous grasses and forbs to maintain biological processes, stabilise the soil and reduce soil loss due to erosion.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*

IMPACT ON LAND CAPABILITY				
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 17: Rating of impacts on soil erosion and associated mitigation measures for the Paul Hugo study area.

IMPACT ON SOIL EROSION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Site clearing activities include removing topsoil material to create foundation for contraction of the gauging weir structures laydown areas. Road upgrades and maintenance potentially encroaching on areas cultivated with cabbage.*			
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion.*			
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-21*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-3*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Highly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-63*	*Highly negative*		

IMPACT ON SOIL EROSION				
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Soils with finer particles of silt and clay associated with the soils of Valsrivier/Swartland are more susceptible to erosion by water due to a lower permeability and therefore vegetation clearing should occur in parallel with the construction progress to minimise erosion and/or run-off.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS) as thunderstorms can displace soils and causing sedimentation of nearby streams and rivers.				
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				
Stockpiled soils must be vegetated with locally indigenous grasses and forbs to maintain biological processes, stabilise the soil and reduce soil loss due to erosion.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	-5	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 18: Rating of impacts on soil compaction and associated mitigation measures for all the Paul Hugo study area.

IMPACT ON SOIL COMPACTION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Heavy vehicle traffic within and around the infrastructure area and potentially compacting the soil.*			
INDIRECT IMPACT	*Surface crusting through soil compaction.*			
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Moderately detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Trafficking and movement over the areas not targeted for construction must be avoided if not minimised, especially heavy machinery.				
No site clearing activities should take place during periods of excessive rainfall or characterised as thunderstorms. This information can be obtained through the South African Weather Service (SAWS) as thunderstorms can displace soils and causing sedimentation of nearby streams and rivers.				
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.				
Compacted soils should be ripped at least 20cm to alleviate compaction.				
Consideration needs to be given to the use of water for dust suppression– the use of binding agents like molasses should be considered for unsealed roads and dust suppression.				

IMPACT ON SOIL COMPACTION				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and, as such, is rated as Short term.*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible.*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative.		
CONFIDENCE LEVEL				
Medium				

Table 19: Rating of impacts on soil contamination and associated mitigation measures for the Paul Hugo study area.

IMPACT ON SOIL CONTAMINATION				
PROJECT PHASE	*Construction Phase.*			
DIRECT IMPACT	*Direct chemical spills on soils from construction vehicles or other construction equipment used.*			
INDIRECT IMPACT	*Contamination of soil.*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*3*	*The duration of the activity associated with the impact will last 18 months-5 years.*	*-14*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		

IMPACT ON SOIL CONTAMINATION				
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative.*		
PROPOSED MITIGATION MEASURES				
The project operations should be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Ensure appropriate handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets).				
Maintenance of vehicles and equipment should be carried out in designated facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.				
Implementing regular site inspections for materials handling and storage.				
Development of detailed procedures for spill containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	2	*The duration of the activity associated with the impact will last 6-18 months and as such, is rated as Short term*	*-5*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	10	very low negative		
CONFIDENCE LEVEL				
Medium				

5.3 OPERATIONAL PHASE

The operational phase includes the completion and operation of the proposed gauging weirs, and the perceived impacts include possible runoff, resulting in an erosion risk, constant disturbances of soils by maintenance vehicles and machinery, increasing the risk of soil compaction and poor waste management, resulting in waste materials being improperly stored increasing the risk of soil compaction.

The main envisaged operational activities that will impact soil, land use, and land capability include the following:

- General activities, including transport on access roads, that will result in soil compaction or generation of runoff, respectively.
- Waste generation (non-mineral waste) and accidental spills and leaks may result in soil chemical pollution if not managed.

The disturbance of original soil profiles and horizon sequences of these profiles is a measurable deterioration, leading to soil erosion. This impact is reversible overtime but will be localised within the site boundary. This impact is possible and will have medium significance if not managed.

Soil chemical pollution, as a result of pollutants leaching into subsurface soil horizons where waste is stored or from leaking maintenance vehicles, is a moderate deterioration of the soil resource. If not mitigated properly, this impact will be localised within the site boundary and have medium significance on the soil resource.

Soil compaction will be a measurable deterioration that will occur due to the movement of vehicles on the soil surfaces (including access roads). This is a reversible impact over time impact that will be localised within the site boundary with medium consequence and significance if not mitigated properly.

The current land capability and land use of areas with active cultivation will not be lost as agricultural practices can continue unhindered.

Beestekraal Study Area Operational Phase Impacts

Table 20: Rating of impacts for the loss of land capability and associated mitigation measures for the Beestekraal study area.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Operation of the gaging weirs constant traffic, and frequent disturbances of soils resulting in loss of land capability.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Decreased productivity of soil material*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than five years.*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Maintenance vehicles should stick to demarcated roads as far as practically possible to minimise soil compaction of adjacent soils.				
Effective soil cover and adequate protection from wind (dust) and dirty water contamination through revegetation or rock cladding				

IMPACT ON LAND CAPABILITY				
Regularly clean and maintain all haulage ways, conveyancing routes and service ways, drains and storm water control facilities.				
Soil replacement and the preparation of a seedbed to facilitate and accelerate the revegetation program and to limit potential erosion and siltation of the surrounding water sources.				
Measures such as speed humps and signage should be implemented to reduce speeding and airborne dust.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than five years.*	-7	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 21: Rating of impacts for soil erosion and associated mitigation measures for the Beestekraal study area.

IMPACT ON SOIL EROSION				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Frequent disturbances of soils, resulting in risk of soil erosion.*			
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion*			
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management)				
In relation to the wetlands and watercourses, any areas where active erosion is observed must be immediately rehabilitated (re-shaping of slopes, revegetation with indigenous species where necessary, etc.) in such a way as to ensure that the hydrology and geomorphological characteristics of the area are re-instated to conditions which are as natural as possible.				

IMPACT ON SOIL EROSION				
Erosion controls must be regularly maintained, at least fortnightly, particularly if rain is forecast or immediately following a rainfall event.				
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit soil erosion.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-6*	*2*
EXTENT	1	*The impact only affects the area in which the proposed activity will occur.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	12	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 22: Rating of impacts on soil compaction and associated mitigation measures for the Beestekraal study area.

IMPACT ON SOIL COMPACTION	
PROJECT PHASE	*Operational Phase.*
DIRECT IMPACT	*Constant heavy vehicle traffic within and around the infrastructure area and potentially compacting the soil.*
INDIRECT IMPACT	*Surface crusting through soil compaction.*
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*

IMPACT ON SOIL COMPACTION				
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE RESOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management).				
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-7*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*

IMPACT ON SOIL COMPACTION				
IMPACT ON IRREPLACEABLE RESOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 23: Rating of impacts on soil contamination and associated mitigation measures for the Beestekraal study area.

IMPACT ON SOIL CONTAMINATION				
PROJECT PHASE	*Operational Phase.*			
DIRECT IMPACT	*Leaching of hydrocarbon chemicals into the soils from maintenance equipment leads to alteration of the soil chemical status as well as contamination of groundwater. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.*			
INDIRECT IMPACT	*Contamination of soi*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-16*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified*	*Slightly detrimental*	*Definite*

IMPACT ON SOIL CONTAMINATION				
		way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected		
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.				
Maintenance vehicles should be checked for leakages of hydrocarbons before the commencement of maintenance activities.				
Implementing regular site inspections for materials handling and storage.				
Ensure that the necessary materials and equipment for dealing with spills and leaks are available on-site, where practicable.				
In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, break down, and encapsulate a minor hydrocarbon spillage.				
Development of detailed procedures for spills containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-7*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*

IMPACT ON SOIL CONTAMINATION				
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Atlanta Study Area Operational Phase Impacts

Table 24: Rating of impacts for the loss of land capability and associated mitigation measures for the Atlanta study area.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Operation of the gaging weirs, constant traffic, and frequent soil disturbances result in loss of land capability.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Decreased productivity of soil material*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-16*	*3*
EXTENT	*3*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified*	*Moderately detrimental*	*Definite*

IMPACT ON LAND CAPABILITY				
		way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected		
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Maintenance vehicles should stick to demarcated roads as far as practically possible to minimise soil compaction of adjacent soils.				
Effective soil cover and adequate protection from wind (dust) and dirty water contamination through revegetation or rock cladding.				
Regular cleaning and maintenance of all haulage ways, conveyancing routes and service ways, drains, and stormwater control facilities.				
Soil replacement and the preparation of a seedbed to facilitate and accelerate the revegetation program and to limit potential erosion and siltation of the surrounding water sources.				
Measures such as speed humps and signage should be implemented to reduce speeding and airborne dust.				
Following the construction phase, the topsoil should be placed as the final soil layer prior to seeding.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	-7	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		

IMPACT ON LAND CAPABILITY
CONFIDENCE LEVEL
Medium

Table 25: Rating of impacts for soil erosion and associated mitigation measures for the Atlanta study area.

IMPACT ON SOIL EROSION				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Frequent disturbances of soils, resulting in risk of soil erosion.*			
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion*			
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		

IMPACT ON SOIL EROSION				
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management)				
In relation to the wetlands and watercourses, any areas where active erosion is observed must be immediately rehabilitated (re-shaping of slopes, revegetation with indigenous species where necessary, etc.) in such a way as to ensure that the hydrology and geomorphological characteristics of the area are re-instated to conditions which are as natural as possible.				
Erosion controls must be regularly maintained, at least fortnightly or monthly, particularly if rain is forecast or immediately following a rainfall event.				
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit soil erosion.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-6*	*2*
EXTENT	1	*The impact only affects the area in which the proposed activity will occur.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	12	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 26: Rating of impacts on soil compaction and associated mitigation measures for the Atlanta study area.

IMPACT ON SOIL COMPACTION				
PROJECT PHASE	*Operational Phase.*			
DIRECT IMPACT	*Constant heavy vehicle traffic within and around the infrastructure area and potentially compacting the soil.*			
INDIRECT IMPACT	*Surface crusting through soil compaction.*			
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management).				
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery.				
Access roads should be inspected and maintained as necessary.				

IMPACT ON SOIL COMPACTION				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	-7	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 27: Rating of impacts on soil contamination and associated mitigation measures for the Atlanta study area.

IMPACT ON SOIL CONTAMINATION				
PROJECT PHASE	*Operational Phase.*			
DIRECT IMPACT	*Leaching of hydrocarbon chemicals into the soils from maintenance equipment leads to alteration of the soil chemical status as well as contamination of groundwater. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.*			
INDIRECT IMPACT	*Contamination of soil.*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				

IMPACT ON SOIL CONTAMINATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-16*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Moderately detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.				
Maintenance vehicles should be checked for leakages of hydrocarbons before the commencement of maintenance activities.				
Implementing regular site inspections for materials handling and storage.				
Ensure that the necessary materials and equipment for dealing with spills and leaks are available on-site, where practicable.				
In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, break down, and encapsulate a minor hydrocarbon spillage.				
Development of detailed procedures for spill containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-7*	*2*

IMPACT ON SOIL CONTAMINATION				
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Paul Hugo Study Area Operational Phase Impacts

Table 28: Rating of impacts for the loss of land capability and associated mitigation measures for the Paul Hugo study area.

IMPACT ON LAND CAPABILITY				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Operation of the gaging weirs and constant traffic, and frequent disturbances of soils resulting in loss of land capability.*			
INDIRECT IMPACT	*Loss of valuable topsoil material.*			
CUMULATIVE IMPACT	*Decreased productivity of soil material*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-24*	*2*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		

IMPACT ON LAND CAPABILITY				
SEVERITY	*-3*	*The severity of the impact is rated as High negative as the natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.*	*Highly detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.				
Maintenance vehicles should stick to demarcated roads as far as practically possible to minimise soil compaction of adjacent soils.				
Effective soil cover and adequate protection from wind (dust) and dirty water contamination through revegetation or rock cladding.				
Regular cleaning and maintenance of all haulage ways, conveyancing routes and service ways, drains, and stormwater control facilities.				
Soil replacement and the preparation of a seedbed to facilitate and accelerate the revegetation program and to limit potential erosion and siltation of the surrounding water sources.				
Measures such as speed humps and signage should be implemented to reduce speeding and airborne dust.				
Following the construction phase, the topsoil should be placed as the final soil layer before seeding.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	*-7*	*2*
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*

IMPACT ON LAND CAPABILITY				
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 29: Rating of impacts for soil erosion and associated mitigation measures for the Paul Hugo study area.

IMPACT ON SOIL EROSION				
PROJECT PHASE	*Operational Phase*			
DIRECT IMPACT	*Frequent disturbances of soils, resulting in risk of soil erosion.*			
INDIRECT IMPACT	*Loss of valuable topsoil material through soil erosion*			
CUMULATIVE IMPACT	*Loss of fertile topsoil and sedimentation of nearby water sources*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years*	*-14*	*3*
EXTENT	*2*	*The impact will affect only the development area.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Slightly detrimental*	*Definite*

IMPACT ON SOIL EROSION				
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-42*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management)				
High clay soils of the Valrivier/Swartland formation should be revegetated and monitored to control erosion by absorbing some of the water and providing additional resistance so the water doesn't flow as fast and reduce sedimentation of the nearby water source.				
In relation to the wetlands and watercourses, any areas where active erosion is observed must be immediately rehabilitated (re-shaping of slopes, revegetation with indigenous species where necessary, etc.) in such a way as to ensure that the hydrology and geomorphological characteristics of the area are re-instated to conditions which are as natural as possible.				
Erosion controls must be regularly maintained, at least fortnightly or monthly, particularly if rain is forecast or immediately following a rainfall event.				
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit soil erosion.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	-6	2
EXTENT	1	*The impact only affects the area in which the proposed activity will occur.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	12	very low negative		

IMPACT ON SOIL EROSION
CONFIDENCE LEVEL
Medium

Table 30: Rating of impacts on soil compaction and associated mitigation measures for the Paul Hugo study area.

IMPACT ON SOIL COMPACTION				
PROJECT PHASE	*Operational Phase.*			
DIRECT IMPACT	*Constant heavy vehicle traffic within and around the infrastructure area and potentially compacting the soil.*			
INDIRECT IMPACT	*Surface crusting through soil compaction.*			
CUMULATIVE IMPACT	*Increased bulk density and reduced infiltrability of the soil cause increased runoff in the absence of vegetation.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-16*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Moderately detrimental*	*Definite*
IMPACT ON IRREPLACEABLE REOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		

IMPACT ON SOIL COMPACTION				
PROPOSED MITIGATION MEASURES				
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects (impacts on areas beyond the construction footprint due to ineffective care and management).				
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	-7	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

Table 31: Rating of impacts on soil contamination and associated mitigation measures for the Paul Hugo study area.

IMPACT ON SOIL CONTAMINATION				
PROJECT PHASE	*Operational Phase.*			
DIRECT IMPACT	*Leaching of hydrocarbon chemicals into the soils from maintenance equipment leads to alteration of the soil chemical status as well as contamination of groundwater. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.*			
INDIRECT IMPACT	*Contamination of soi*			
CUMULATIVE IMPACT	*Change in the soil chemical status of soil which may impact soil fertility status.*			
DIMENSION	**RATING**	**MOTIVATION**	**CONSEQUENCE**	**LIKELIHOOD**
PRE-MITIGATION				
DURATION	*4*	*The duration of the activity associated with the impact will last more than 5 years.*	*-16*	*3*
EXTENT	*3*	*The impact affects the development area and adjacent properties due to potential pollution migration.*		
SEVERITY	*-2*	*The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected*	*Moderately detrimental*	*Definite*
IMPACT ON IRREPLACEABLE RESOURCES	*1*	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	*-48*	*Moderate negative*		
PROPOSED MITIGATION MEASURES				
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.				
Maintenance vehicles should be checked for leakages of hydrocarbons before the commencement of maintenance activities.				
Implementing regular site inspections for materials handling and storage.				

IMPACT ON SOIL CONTAMINATION				
Ensure that the necessary materials and equipment for dealing with spills and leaks are available on-site, where practicable.				
In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, break down, and, where possible, encapsulate a minor hydrocarbon spillage.				
Development of detailed procedures for spill containment and soil clean up.				
Access roads should be inspected and maintained as necessary.				
POST-MITIGATION				
DURATION	4	*The duration of the activity associated with the impact will last more than 5 years.*	-7	2
EXTENT	2	*The impact will affect only the development area.*		
SEVERITY	-1	*Negligible*	*Negligible*	*Likely*
IMPACT ON IRREPLACEABLE REOURCES	1	*Irreplaceable resources will be impacted.*		
SIGNIFICANCE	14	very low negative		
CONFIDENCE LEVEL				
Medium				

5.4 IMPACT STATEMENT AND SCREENING TOOL VERIFICATION

The agricultural practices within the study area include maize, cotton, wheat, and pasture cultivation, which employs the centres pivot irrigation techniques, producing high-value crops. Furthermore, despite not being approved, the Preservation and Development of Agricultural Land Framework Bill published on September 18th, 2020, automatically considers land under irrigation to have high potential. This is based on the high production capacity of irrigated agriculture, which is critical for food security at a local and regional scale. It is common for irrigated areas to indicate a high capital investment on the farm.

The land capability of the surrounding soils, as well as the agricultural potential, are very low to high due to adequate climatic conditions (i.e., rainfall, temperature), availability of irrigation water, and appropriate slope, which allows for intensive commercial agricultural practices.

It is anticipated that the proposed Mokolo Crocodile Water Augmentation Project (MCWAP-2A) will have a minimal impact on the identified soils and agricultural capability since the footprint of infrastructure disturbance, which impedes agriculture, constitutes only a negligible portion of available land surface area, allowing agricultural activities to continue unhindered and thus future cultivation is not anticipated to be hindered by the proposed development. This is because the access roads are located along the existing road, and the surface infrastructure is in areas that are not currently cultivated and are associated with the 1:100-year flood line of the Crocodile River. However, edge effects can be anticipated, which can encroach on the cultivated lands if not managed properly, as the proposed surface infrastructure is in proximity to the cultivated lands. Cumulative impacts are also related to an increase in the surface footprint. These impacts can be reduced by keeping the footprint minimised where possible and strictly following the integrated mitigation measures outlined in the document.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The outcomes of the field verification results mainlylargely supported the screening tool due to the favorable soil and climate characteristics for commercialised agriculture.

It is the opinion of the specialist that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area are made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

5.5 CURRENT LAND PRODUCTIVITY ANALYSIS

This section presents the production figures for each gauging weir study area. The estimated production figures were sourced from the National Agricultural Resources Atlas of South Africa. Employment figures could not be sourced during the time of the assessment: (https://ndagis.nda.agric.za/portal/apps/webappviewer/index.html?id=8b72eb2a25c04660a1ab2b562f6ec0bf).

5.5.1 Production figures for maize cultivation around the Beestekraal gauging weir:

Cultivated Land within the Beestekraal study area = 6 ha
Expected yield = 15 tons/ha
Total Yield = 6 ha * 16 ton/ha
= 96 tons
Price of maize =R3 635/ton
Financial Yield = 96 * 3 635
= R348 960 Per production season (before input costs are considered). This amount only reflects the affected area within the Beestekraal Weir study area.

5.5.2 Production figures for maize cultivation around the Atlanta gauging weir:

Cultivated Land within the study area outline = 2 ha
Expected yield = 97 tons/ha
Total Yield = 2 ha * 97 ton/ha
= 194 tons
Price of maize =R3 635/ton
Financial Yield = 194 * 3 635
= R705 190 Per production season (before input costs are considered). This amount only reflects the affected area within the Atlanta Weir study area.

5.5.3 Production figures for maize cultivation around the Paul Hugo gauging weir:

Cultivated Land within the study area outline = 5 ha
Expected yield = 97 tons/ha
Total Yield = 5 ha * 97 ton/ha
= 485 tons
Price of maize =R3 635/ton
Financial Yield = 485 * 3 635
= R1 762 975 Per production season (before input costs are considered). This amount only reflects the affected area within the Paul Hugo weir study area.

6 CONCLUSION

Gibb Pty Ltd appointed Nsovo Environmental Consulting to conduct an agriculture impact assessment as part of the Environmental Impact Assessment (EIA) process for the proposed construction and upgrade of three (3) gauging weirs in the Crocodile (West) River within the provinces of North West and Limpopo, South Africa. The three (3) gauging weirs, namely Beestekraal, Atlanta, and Paul Hugo, will collectively be referred to as Study Area unless referring to each individual weir.

The Atlanta and Beestekraal Weirs falls within the humid subtropical climate characterised by hot and humid summers, and cool to mild winters. Most summer rainfall occurs during thunderstorms that build up due to the intense surface heating and strong subtropical sun angle. The Paul Hugo Weir falls within the hot semi-arid climate characterised by hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. The mean annual rainfall ranges between 401- 601 mm; this rainfall is not deemed adequate to support rainfed agriculture and planting dates, and the length of the growing season may be affected and needs to be carefully considered.

The land capability of the surrounding soils as well as the agricultural potential are moderate to high due to adequate climatic conditions (i.e., rainfall, temperature), availability of irrigation water and appropriate slope which allows for intensive commercial agricultural practices.

It is anticipated that the proposed Mokolo Crocodile Water Augmentation Project (MCWAP-2A) will have a minimal impact on the identified soils and agricultural capability since the footprint of infrastructure disturbance, which impedes agriculture, constitutes only a negligible portion of available land surface area, allowing agricultural activities to continue unhindered and thus future cultivation is not anticipated to be hindered by the proposed development. This is because the access roads are located along the existing road, and the surface infrastructure is in areas that are not currently cultivated and are associated with the 1:100-year flood line of the Crocodile River. However, edge effects can be anticipated, which can encroach on the cultivated lands if not managed properly, as the proposed surface infrastructure is in proximity to the cultivated lands. Cumulative impacts are also related to an increase in the surface footprint. These impacts can be reduced by keeping the footprint minimised where possible and strictly following the integrated mitigation measures outlined in the document.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The outcomes of the field verification results largely supported the screening tool due to the favorable soil and climate characteristics for commercialised agriculture.

From a soil, land use and land capability point of view the proposed development can be considered provided that the integrated mitigation measures are implemented accordingly, to minimise the potential loss of these valuable soils

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8 APPENDIX A: INDEMNITY

- This report is based on survey and assessment techniques, which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- This report is based on a desktop investigation using available information and data on the site to be affected, in situ fieldwork, surveys, assessments, and the specialist's best scientific and professional knowledge.
- The Precautionary Principle has been applied throughout this investigation.
- The findings, results, observations, conclusions, and recommendations given in this report are based on the specialist's best scientific and professional knowledge and information available at the time of the study.
- Additional information may become known or available later in the process for which no allowance could have been made at the time of this report.
- The specialist reserves the right to modify this report, recommendations, and conclusions at any stage should additional information become available.
- Information and recommendations in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist as specified above.
- Acceptance of this report, in any physical or digital form, confirms acknowledgment of these terms and liabilities.

Tshiamo Setsipane

24 January 2024

9 APPENDIX B: IMPACT ASSESSMENT METHODOLOGY

The assignment of significance ratings has been undertaken based on the experience of the EIA team, as well as through research. Subsequently, mitigation measures have been identified and considered for each impact,. The assessment is repeated to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented).

Table 1: Criteria and rating Scales which were used in the Assessment of the Potential Impacts

CRITERIA	RATING SCALES	NOTES
Nature	Positive	An evaluation of the effect of the impact related to the proposed development.
	Negative	
Extent	Footprint	The impact only affects the area in which the proposed activity will occur.
	Site	The impact will affect only the development area.
	Local	The impact affects the development area and adjacent properties.
	Regional	The effect of the impact extends beyond municipal boundaries.
	National	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International	The effect of the impact extends beyond country borders.
Duration	Temporary	The duration of the activity associated with the impact will last 0-6 months.
	Short term	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term	The duration of the activity associated with the impact will last 18 months-5 years.
	Long term	The duration of the activity associated with the impact will last more than 5 years.
Severity	High negative	The severity of the impact is rated as High negative as the natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
	Moderate negative	The severity of the impact is rated as Moderate negative as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and

CRITERIA	RATING SCALES	NOTES
		valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	Low negative	The severity of the impact is rated as Low negative as the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally affected.
	Low positive	The severity of the impact is rated as Low positive as the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally improved
	Moderate positive	The severity of the impact is rated as Moderate positive as the affected environment is altered, but natural, cultural, and social functions and processes continue albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are positively affected.
	High positive	The severity of the impact is rated as Highly positive as the natural, cultural, or social functions and processes are altered to the extent that valued, important, sensitive, or vulnerable systems or communities are substantially positively affected.
Potential for impact on irreplaceable resources	No	No irreplaceable resources will be impacted.
	Yes	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental	
	Moderately detrimental	
	Slightly detrimental	
	Negligible	
	Slightly beneficial	
	Moderately beneficial	
	Highly beneficial	
	Extremely beneficial	
Probability (the likelihood of the impact occurring)	Unlikely	It is highly unlikely or less than 50 % likely that an impact will occur.
	Likely	It is between 50 and 75 % certain that the impact will occur.
	Definite	It is more than 75 % certain that the impact will occur, or the impact will occur.
Significance	Very high - negative	A function of Consequence and Probability.

CRITERIA	RATING SCALES	NOTES
	High - negative	
	Moderate - negative	
	Low - negative	
	Very low	
	Low - positive	
	Moderate - positive	
	High - positive	
	Very high - positive	

Table 2: Explanation of Assessment Criteria

CRITERIA	EXPLANATION
Nature	This is an evaluation of the type of effect (change) the construction, operation, and management of the proposed development would have on the affected environment. Will the impact change in the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. Extent of the impact is described as: footprint (affecting only the footprint of the development), site (limited to the site) and regional (limited to the immediate surroundings and closest towns to the site). Extent or scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid "double counting, specialists have been requested to indicate spatial significance under "intensity" or "impact on irreplaceable resources" but not under "extent" as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced should it be impacted. A resource could be replaced by natural processes (e.g., natural colonisation from surrounding areas), artificial means (e.g., reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in some instances. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those that are lost). Should it not be possible to replace a resource, the resource is irreplaceable,

CRITERIA	EXPLANATION
	e.g., red data species that are restricted to a particular site or habitat of a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact actually occurring is based on the professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between the likelihood of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact actually occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures must be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the EAP team were required to indicate the degree of confidence (low, medium, or high) that there are predictions made for each impact based on the available information and their level of knowledge and expertise. Degree of confidence is not considered in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

Table 3: Impact Assessment Criteria and Rating Scales.

Duration		Extent		Irreplaceable Resources		Severity		Consequence = (Duration+Extent+Irr) x Severity		Likelihood		Significance = Consequence * Likelihood		Confidence
1	Temporary	1	Footprint	1	Yes	-3	High - negative	-25 to -33	Extremely detrimental	1	Unlikely	-73 to -99	Very high - negative	Low
2	Short term	2	Site	0	No	-2	Moderate - negative	-19 to -24	Highly detrimental	2	Likely	-55 to -72	High - negative	Medium
3	Medium-term	3	Local			-1	Low -negative	-13 to -18	Moderately detrimental	3	Definite	-37 to -54	Moderate - negative	High
4	Long term	4	Regional			0	Negligible	-7 to -12	Slightly detrimental			-19 to -36	Low - negative	
		5	National			1	Low -positive	0 to -6	Negligible			0 to -18	Very low - negative	
		6	International			2	Moderate - positive							
						3	High - positive	0 to 6	Negligible			0 to 18	Very Low - positive	
								7 to 12	Slightly beneficial			19 to 36	Low - positive	
								13 to 18	Moderately beneficial			37 to 54	Moderate - positive	
								19 to 24	Highly beneficial			55 to 72	High - positive	
								25 to 33	Extremely beneficial			73 to 99	Very high - positive	

Ascribing Significance for Decision-Making

The best way of expressing the environmental costs/impacts and the inherent benefit implications for decision-making is to present them as risks. Risk is defined as the consequence (implication) of an event multiplied by the probability (likelihood)1 of that event. Many risks are accepted or tolerated daily because even if the consequence of the event is serious, the likelihood that the event will occur is low. A practical example is the consequence of a parachute not opening, is potentially death but the likelihood of such an event happening is so low that parachutists are prepared to take that risk and hurl themselves out of an airplane. The risk is low because the likelihood of the consequence is low even if the consequence is potentially severe.

It is also necessary to distinguish between the event itself (as the cause) and the consequence. Again, using the parachute example, the consequence of concern in the event that the parachute does not open is serious injury or death, but it does not necessarily follow that if a parachute does not open that the parachutist will die.

Various contingencies are provided to minimise the likelihood of the consequence (serious injury or death) in the event of the parachute not opening, such as a reserve parachute. In risk terms this means distinguishing between the inherent risk (the risk that a parachutist will die if the parachute does not open) and the residual risk (the risk that the parachutist will die if the parachute does not open but with the contingency of a reserve parachute) i.e. the risk before and after mitigation.

Consequence

The ascription of significance for decision-making becomes then relatively simple. It requires the consequences to be ranked and likelihood to be defined of that consequence. In **Table 4,** a scoring system for consequence ranking is shown. Two important features should be noted in the table, namely that the scoring doubles as the risk increases and that there is no equivalent 'high' score in respect of benefits as there is for the costs. This high negative score serves to expressexpress the potential for a fatal flaw, which would be defined as an impact that cannot be mitigated effectively and where the associated risk is accordingly untenable. Stated differently, the high score on the costs, which is not matched on the benefits side, highlights that such a fatal flaw cannot be 'traded off' by a benefit and would render the proposed project unacceptable.

1 Because 'probability' has a specific mathematical/empirical connotation the term 'likelihood' is preferred in a qualitative application and is accordingly the term used in this document.

Table 4: Ranking of Consequences

Environmental Cost	Inherent risk
Human health – morbidity / mortality, loss of species	High
Material reductions in faunal populations, loss of livelihoods, individual economic loss	Moderate – high
Material reductions in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance	Moderate – low
Negative change – with no other consequences	Low
Environmental Benefits	Inherent benefit
Net improvement in human welfare	Moderate – high
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic Development	Moderate – Low
Positive change – with no other consequences	Low

Likelihood

Although the principle is one of probability, the term 'likelihood' is used to express a qualitative rather than quantitative assessment because the term 'probability' tends to denote a mathematical/empirical expression. A set of likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring is presented in
Table 5.

Table 5: Likelihood Categories and Definitions

Likelihood Descriptors	Definitions
Highly unlikely	The possibility of the consequence occurring is negligible
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely.
Likely	The consequence may not occur, but a balance of probability suggests it will
Highly likely	The consequence may still not occur, but it is most likely that it will
Definite	The consequence will definitely occur.

It is particularly important to recognise that the likelihood question is asked twice. The first time the question is asked is the likelihood of the cause and the second as to the likelihood of the consequence. In the tables that follow the likelihood is presented of the cause and then the likelihood of the consequence is presented. A high likelihood of a cause does not necessarily translate into a high likelihood of the consequence. As such the likelihood of the consequence is not a mathematical or statistical 'average' of the causes but rather a qualitative estimate.

Residual Risk

The residual risk is then determined by the consequence and the likelihood of that consequence. The residual risk categories are shown in Table 6, where consequence scoring is shown in the rows and likelihood in the columns. The implications for decision-making of the different residual risk categories are shown in Table 7.

Table 6: Residual Risk Categories

		Residual risk				
Consequence	High	Moderate	High	High	Fatally flawed	
	Moderate – high	Low	Moderate	High	High	High
	Moderate	Low	Moderate	Moderate	Moderate	Moderate
	Moderate – low	Low	Low	Low	Low	Moderate
	Low	Low	Low	Low	Low	Low
		Highly unlikely	Unlikely but possible	Likely	Highly likely	Definite
		Likelihood				

Table 7: Implications for Decision-Making of the Different Residual Risk Categories

Rating	Nature of implication for Decision – Making
Low	Project can be authorised with low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised