Wetland & Aquatic Biodiversity Impact Assessment for the proposed Duyker Eiland Prospecting Right Application, Western Cape Province

Draft Report

Prepared for:

Nextec (Pty) Ltd.

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DOCUMENT REVIEW AND EXPERTISE OF SPECIALISTS

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In addition, this report has been compiled in line with the requirements of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) and EIA regulations (2014), as amended. Information reported herein may be based on the interpretation of public domain data collected by Elemental Sustainbility (Pty) Ltd, and/or information supplied by the applicant and/or its other advisors and associates. The data has been accepted in good faith as being accurate and valid. This document may contain information of a specialised and/or highly technical nature and the reader is advised to seek clarification on any elements which may be unclear to it.

EXECUTIVE SUMMARY

The proponent intends to prospect six (6) mineral commodities including Phosphate Ore (P), Heavy Minerals (HM), Leucoxene (Lx), Rutile (Rt), Monazite (Mz) and Zirconium Ore (Zr) on several properties located approximately 5.5 km west of St Helena Bay, Western Cape. Elemental Sustainability (Elemental) was appointed to conduct a Wetland and Aquatic Biodiversity Impact Assessment for the proposed project.

A site visit was undertaken on the 5th of June 2022 to assess the present ecological status of the area and to determine the impacts of the proposed drill holes on the surrounding aquatic biodiversity. A baseline desktop assessment was undertaken of all available data. Google Earth images were studied in order to determine the position of possible aquatic features in the study area. All possible aquatic features in the vicinity were subsequently surveyed in order to determine the delineation thereof. The method described by the Department of Water Affairs and Forestry (DWAF, 2005) was followed in the delineation of the wetlands and riparian zones in the study area.

The following methodologies were utilised:

- Delineation of wetlands and riparian areas (Department of Water Affairs and Forestry, 2005; 2008); and
- Impact Assessment and mitigation measures.

The study focussed on the aquatic features situated within the vicinity of the proposed drilling locations, and within a 500 m radius. No aquatic features were found to overlap with the footprints of the proposed drill hole locations. The majority of the proposed drill holes were located predominantly on cultivated farmland or fallow land / old agricultural fields.

The study area falls within the Berg Water Management Area (WMA) and is situated within the Quaternary Catchment G10M.

There are several wetlands identified within the proposed study area according to the National Wetland Map version 5 (NWM5 2018), including two (2) channelled valley-bottom wetlands located in the south of the study area, as well as a channelled valley-bottom wetland located in the east of the study area. However, the proposed drill holes are located outside of the 500 m DWS Regulated Area for all the wetlands within the study area. Given the limited scale of the project - each drill hole is between 5 and 25 metres (m) deep and approximately 82 mm in diameter - as well as the fact that the wetlands are separated from the drill holes by intensely cultivated land, it is unlikely that any of the wetlands located within the study area will be impacted by the proposed drill holes.

According to river line vector data of the 1:50 000 topography maps for the Western Cape produced by the Department of Rural Development and Land Reform (National Geo-spatial Information (DRDLR)), there are several unnamed, non-perennial (ephemeral) drainage lines mapped within the north of the study area. All proposed drill hole locations occur outside of the 100 m DWS Regulated Area for these ephemeral streams, and it is unlikely that the streams will be impacted by the proposed drill holes.

Flowing from the east to the south-west of the study area are two (2) mapped unnamed, non-perennial drainage lines. These two (2) unnamed, non-perennial drainage lines converge in the southwest of the study area and flow into a channelled valley bottom wetland. The northern unnamed non-perennial drainage line, which flows through the central portion of the study area, on Portion 1 of Farm Schuitjes Klip 22, occurs within 100 m of a single drill hole. This drainage line has been significantly modified by the surrounding agricultural activities and as a result is now more representative of an artificial drainage channel than a natural non-perennial river.

As the mapped non-perennial drainage line was considered to be artificial in nature and is most likely used to drain the surrounding agricultural land, the National Biodiversity Assessment (NBA 2018), was used as a measure of this system's Ecological Condition. Although the drainage channel itself is not mapped in the National Biodiversity Assessment (NBA, 2018) the channelled valley bottom wetland and associated stream located approximately 400 m downstream of the drainage channel in the southwest of the study area is classified as Seriously Modified, with a Present Ecological Condition (PES) of E. The surrounding catchment area, and the inflowing drainage lines, have been significantly modified by the surrounding agricultural activities. As the drainage channel is located approximately 400 m upstream of the wetland, within the same catchment area, the PES of E (Seriously Modified) is deemed to be an adequate representation of the system.

Impacts to the artificial drainage channel located within 100 m of one (1) drill hole, include potential spillage and release of potentially contaminated runoff as well as increased sediment input, as a result of the drilling activities within the 100 m regulated buffer area. Both impacts were of a "Low" significance prior to the recommended mitigation measures, and of a "Very Low" significance subsequent to implementation of mitigation measures.

The important factors relevant to the project are summarised in the table below.

NEMA Impact Assessment	The impacts associated with the proposed project are "Low" prior to mitigation taking place. With mitigation fully implemented, the significance of impacts can be reduced to Very Low.
DWS Risk Assessment	All aspects of the proposed activities fall within the LOW-risk category. Therefore, a General Authorization will likely be required or alternatively the relevant borehole (that falls within 100 m of a drainage line) could be moved to fall outside of the 100 m regulated area.
Mitigation Measures	Refer to Section 6.3.
Does the Specialist support the Application?	Based on the findings made in the report the impacts associated with the proposed drill holes for the prospecting right application can be mitigated to an acceptable level. The specialist can support the application if all mitigation measures provided in this report, as well as general good practice, are adhered to.

EIA REGULATIONS: SPECIALIST REPORT GUIDE

Government Notice R982 as published in Government Gazette 38282 dated 4 December 2014 and as amended by Government Notice R517 in Government Gazette 44701 dated 11 June 2021, outlines in Appendix 6 the requirements for specialist reports. The table below provides an overview of the requirements and the applicable sections of this report.

GNR982 as amended by GNR517	Report Section
(1) A specialist report prepared in terms of these Regulations must contain—	
(a) details of—	
(i) the specialist who prepared the report; and	Page xiv
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix A
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page xiv
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5 and Section 6
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4 and 5
(g) an identification of any areas to be avoided, including buffers;	N/A
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6 and 7
(k) any mitigation measures for inclusion in the EMPr;	Section 6.3
(l) any conditions for inclusion in the environmental authorisation;	Section 6.3
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6.3
(n) a reasoned opinion—	Conclusions (Section 8)
(i) whether the proposed activity, activities or portions thereof should be authorised;	Conclusions (Section 8)

GNR982 as amended by GNR517	Report Section
(i) regarding the acceptability of the proposed activity or activities; and	Conclusions (Section 8)
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Conclusions (Section 8)
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
(q) any other information requested by the competent authority.	Not applicable
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

CONTENT OF SPECIALIST REPORTS – GN320

On 20 March 2020 "*Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the NEMA when applying for environmental authorization*" was published in GN 320 (Government Gazette 43110).

One of the themes identified and covered by this protocol is Aquatic Biodiversity. It is important to note that the protocol replaces the requirements of Appendix 6 of the EIA Impact regulations as outlined above. The protocol, as published, is outlined below.

GNR320 Site verification requirements:

NR.	CONTENT	REPORT SECTION
1	The site sensitivity verification must be undertaken by an Environmental Assessment Practitioner or a specialist.	Section 2
2	The sensitivity verification must be undertaken through the use of: a. A desktop analyses, using satellite imagery; b. A preliminary on-site inspection; and c. Any other available and relevant information.	Section 4 & 5
3	The outcome of the site sensitivity verification must be recorded in the form of a report that:	
	a. Confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructures, the change in vegetation cover status etc.;	Section 2
	b. Contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and	Section 5
	c. Is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.	This report will be attached to the relevant assessment report as specialist scope of work

The following baseline descriptions must be included in the report:

Content of specialist report GN320 - Aquatic Assessment

NR.	REQUIREMENT	REPORT SECTION
2.3.1	A description of the aquatic biodiversity and ecosystems on the site, including; (a) aquatic ecosystem types; and (b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 4 & 5
2.3.2	The threat status of the ecosystem and species as identified by the screening tool;	Section 4
2.3.3	An indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free-flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	Section 4

2.3.4	A description of the ecological importance and sensitivity of the aquatic ecosystem including: (a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and (b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 5
2.4	The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	N/A
2.5	Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions:	Section 6 An impact assessment was undertaken
2.5.1.	Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 8
2.5.2	Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?	Section 8
2.5.3	How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:	Refer below:
	(a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);	Section 5
	(b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);	Refer to Section 6
	(c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and	Refer to Section 6
	(d) to what extent will the risks associated with water uses and related activities change;	Refer to Section 6
2.5.4	How will the proposed development impact on the functioning of the aquatic feature? This must include:	Refer below:
	(a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);	Refer to Section 6
	(b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);	Refer to Section 6

	(c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland);	Refer to Section 6
	(d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);	With mitigation, the impacted is expected to be very low
	(e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and	No impact expected.
	(f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	No loss expected
2.5.5	How will the proposed development impact on key ecosystems regulating and supporting services especially: (a) flood attenuation; (b) streamflow regulation; (c) sediment trapping; (d) phosphate assimilation; (e) nitrate assimilation; (f) toxicant assimilation; (g) erosion control; and (h) carbon storage?	Impact is expected to be very low if mitigation is applied.
2.5.6	How will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	No impact expected
2.6	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: (a) size of the estuary; (b) availability of sediment; (c) wave action in the mouth; (d) protection of the mouth; (e) beach slope; (f) volume of mean annual runoff; and (g) extent of saline intrusion (especially relevant to permanently open systems).	N/A

Content of compliance statement (Low Sensitivity) or specialist assessment (High sensitivity):

NR.	CONTENT	REPORT SECTION
The compliance statement / assessment must be prepared by a suitably qualified specialist registered with the SACNASP, with expertise in the field of aquatic sciences.		The Author is suitably qualified Appendix A
The compliance statement / assessment must: be applicable to the preferred site and the proposed development footprint;		A Specialist Assessment was completed
2.7	The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix A
2.7.2	A signed statement of independence by the specialist;	Page xiv
2.7.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 1.3
2.7.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	Section 3
2.7.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data;	Section 1.3
2.7.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	N/A
2.7.7	Additional environmental impacts expected from the proposed development;	Section 6.3
2.7.8	Any direct, indirect and cumulative impacts of the proposed development on site;	Section 6.3
2.7.9	The degree to which impacts and risks can be mitigated;	Section 6.3
2.7.10	The degree to which the impacts and risks can be reversed;	Section 6.3
2.7.11	The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 6.3
2.7.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	N/A
2.7.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	Section 6.3
2.7.14	A motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	N/A
2.7.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	Section 8
2.7.16	Any conditions to which this statement is subjected.	Section 6.3

SPECIALIST DECLARATION

I, Kimberley van Zyl, hereby declare that:

- I acted as the independent specialist and performed the work in an objective manner, even if the findings and conclusions are not favourable to the applicant;
- I do not have any financial interest in the undertaking of this project or projects, other than remuneration for the work performed in terms of the National Environmental Management Act 107 of 1998;
- The contents of this report comply with the relevant legislative requirements,
- I have the relevant expertise required to conduct a specialist report of this nature in terms of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) and the National Water Act (NWA) (Act no. 36 of 1998);
- I understand that any false information published in this document is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act;
- I am a professionally registered scientist with the South African Council for Natural Scientific Professions (SACNASP);
- I have been accredited as a South African Scoring System Version 5 (SASS5) aquatic biomonitoring practitioner by the National Department of Water and Sanitation (DWS);
- I undertake to disclose and provide to the competent authority all material and information in my possession regarding this project as required in terms of National Environmental Management Act 107 of 1998; and
- Based on the information provided to me by the client and in addition to information obtained during this study, I have presented the results and conclusion regarding this project to the best of my professional ability.

Kimberley van Zyl
Pr.Sci.Nat. (no. 117097)

Date: 20 June 2022

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ABBREVIATIONS

BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
DAFF	Department of Agriculture, Forestry and Fisheries (Now DFFE)
DEA	Department of Environmental Affairs
DEFF	Department of Environmental Affairs, Forestry and Fisheries (Now DFFE)
DFFE	Department of Forestry, Fisheries and the Environment
DHSWS	Department of Human Settlements, Water and Sanitation (Former)
DWA	Department of Water Affairs (Former)
DWS	Department of Water and Sanitation (Current)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme / Plan
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorization
GIS	Geographic Information Systems
GPS	Global Positioning System
HGM	Hydro-Geomorphic
IAPS	Invasive Alien Plant Species
LC	Least Concern
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAT	Mean Annual Temperature
NA	Not Assessed

NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
PES	Present Ecological State
RHP	River Health Programme
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Area Database
SASS	South African Scoring System (Version 5)
SOTER	Soil and Terrain
TEMP	Temperature
VU	Vulnerable
WMA	Water Management Area
WRC	Water Research Commission
WULA	Water Use Licence Application

1. INTRODUCTION

1.1 Activity Description

The proponent intends to prospect six (6) mineral commodities including Phosphate Ore (P), Heavy Minerals (HM), Leucoxene (Lx), Rutile (Rt), Monazite (Mz) and Zirconium Ore (Zr) on the following properties located approximately 5.5 km west of St Helena Bay, Western Cape (**Figure 1**):

- The Farm Duyker Eiland 6:
  - A section of Portion 4;
  - A section of Portion 5;
  - A section of Portion 7;
  - Portion 11; and
  - Portion 14.
- The Farm Schuitjes Klip 22:
  - Portion 1; and
  - Portion 3.

The proposed study area consists of the proposed locations for the drill holes and is approximately 2,889.38 Ha in extent, of which approximately 0.73 m^2 is anticipated to be disturbed for the placement of drill holes (**Figure 1**).

The project will entail a one (1) year non-invasive geophysical survey period (Phase 1), a three (3) year invasive drilling period (Phase 2 and Phase 3) and a further 1-year non-invasive resource determination period (Phase 4). Phase 2 which will continue for one (1) year and will consist of the drilling of forty-nine (49) drill holes, each between 5 and 25 metres (m) deep and approximately 82 mm in diameter. Phase 2 will cover a total area of approximately 0.26 m^2. Phase 3, where similar drilling will continue for a further two (2) years, will consist of an additional eighty-nine (89) drill holes covering a total area of approximately 0.47 m^2. A further twelve (12) months (Phase 4) will consist of non-invasive prospecting in the form of data validation, geological modelling, resource estimation and pre-feasibility studies.

The drilling method which will be used is known as air-core drilling whereby a drill machine (drill rig) with an on-board compressor is mounted on a 4 x 4 Toyota Landcruiser. This drilling method is similar to reverse circulation drilling however, it does not require the use of any water. The drill rig that will be used is a Wallis Mantis 75 hydraulic top-drive rig, which is expected to complete the drilling of 1 drill hole in a period of less than half an hour. Once the drilling of a drill hole is completed, the site will be pegged with a steel spring wire and PVC flags before the commencement of the drilling of the subsequent drill hole. The locations of the drill holes will be surveyed using a high-accuracy differential Global Positioning System (GPS). A rig-mounted rotary splitter will be used to collect a representative sample of the drilled rock (drill core). Each metre of drill core will be logged by a geologist, placed in a sample bag, numbered and moved to an off-site location where it will be prepared to be sent to an accredited testing laboratory.

There will be no clearing of drill pads and no topsoil will be removed. Excess sand material will be returned to the drill hole for them to be backfilled. A plastic lining will be placed beneath the drill rig in the event of any oil spillages and no sump pools will be required as no water will be used. In addition, no bulk sampling will be carried out during this prospecting programme and as far as possible, existing roads will be utilised to access the drill sites. Approximately twenty (20) workers will be employed and will be housed in an off-site location. There will not be a need for a site camp or any additional structures or infrastructure.

The proposed site comprises of several properties on which a Windfarm development application has been submitted. Therefore, specialist studies have previously been conducted, including an Aquatic Biodiversity Impact Assessment conducted by Scientific Aquatic Services (SAS), in 2018 (SAS, 2018).

1.2 Scope of Work

Elemental was appointed to conduct a Wetland & Aquatic Biodiversity Impact Assessment for the project. The Terms of Reference (ToR) for this study included the following:

- Conduct a baseline review of any existing studies, reports and data for the area (predominantly the Aquatic Biodiversity Impact Assessment conducted by Scientific Aquatic Services (SAS) in 2018);
- Undertake a site visit and delineate any freshwater features on the proposed sites;
- Undertake a site assessment to determine the ecological condition of the freshwater features on the site and to identify possible aquatic biodiversity constraints on the proposed sites;
- Determine any set-back distances or minimum buffers from and/or around the aquatic features on the proposed sites;
- Compilation of a Wetland & Aquatic Biodiversity Impact Assessment Report; and
- Liaison with EAP and Project Team.

1.3 Assumptions and Limitations

The following limitations and assumptions apply to this assessment:

- Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of report compilation;
- The fieldwork component of the assessment comprised of one assessment only, at the start of the winter rainfall season (5th of June 2022). No temporal trends for the respective seasons have been assessed. This will however not have a significant impact on the conclusion made regarding the potential impacts of the development;
- The study focussed on the identification, delineation and functional assessment of aquatic features found within the proposed footprint area (i.e. the proposed location of the drill holes) and those occurring within 500 m (wetlands) and 100m (watercourse/drainage features) of the proposed footprint area which was deemed sufficient for the purposes of this assessment;
- Description of the depth of the regional water table, geohydrological and hydropedological processes falls outside the scope of the current assessment;
- Only existing access routes were assessed. Should any new roads be constructed that are located within the DWS Regulated Areas for aquatic features, these will need to be assessed in an updated Wetland & Aquatic Biodiversity Impact Assessment;
- Access was limited onto two (2) farms, Farm Duyker Eiland 6 Portion 7 and Farm Schuitjes Klip 22 Portion 3 by the current landowners. However, a follow up survey is not deemed necessary as there are no wetlands or rivers located within 500 m and 100 m respectively, of the proposed location for drill holes on these two (2) properties.

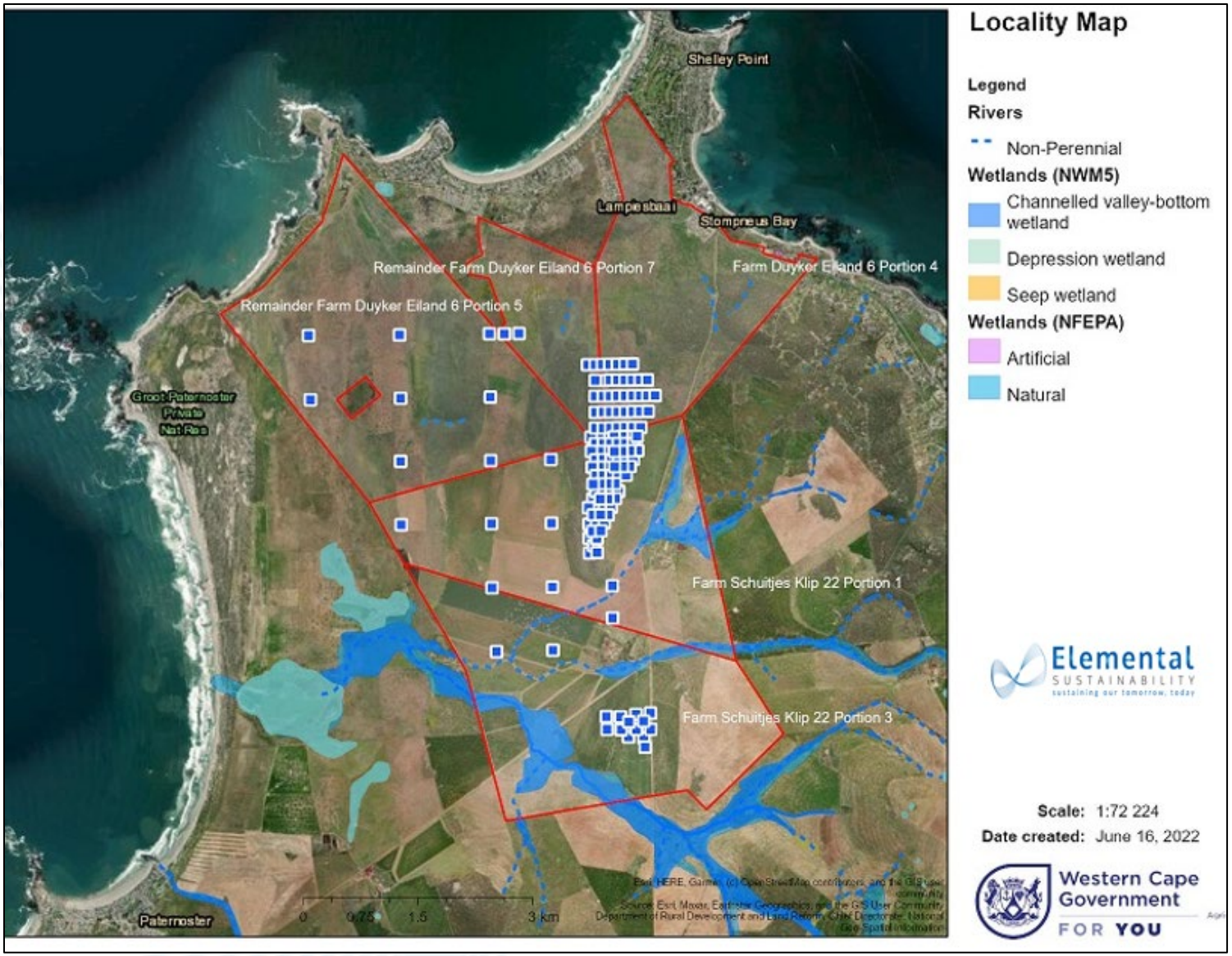


Figure 1: Locality Map indicating the drilling locations on the proposed prospecting sites

1.4 Legislative Requirements

1.4.1 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act (No. 36 of 1998) defines a watercourse, wetland and riparian habitat as follows:

- A watercourse means - (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
- A wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
- A riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

Section 21 of the NWA lists eleven (11) activities that constitute water uses that require a Water Use License (WUL) prior to the activities commencing unless the use is excluded. Activities that directly and indirectly alter the characteristics of watercourses are considered Section 21(c) and 21(i) water uses and are the most common water uses.

A limit of applicability has been established in GN509 of 2016 which established a regulated zone 500 m wide around each watercourse within which water uses 21 (c) and (i) must be assessed. It also specified a risk matrix that must be applied during assessment and detailed that should there be “Low Risk” (c) and (i) water uses, these can be registered under a General Authorisation (GA) process. “Medium” and “High” risk water uses require application for a Water Use Licence (WUL).

1.4.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) was created to establish:

- principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance; and
- procedures for co-ordinating environmental functions exercised by organs of the state to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment.

Listed Activities that may negatively affect watercourses are included in three (3) Listing Notices in the Environmental Impact Assessment (EIA) Regulations (2017) published under Section 24 (5) and 44 of NEMA. Listed activities require Environmental Authorisation (EA) subject to conducting either a Basic Assessment or full Environmental Impact Assessment (EIA) prior to the project activities commencing.

1.4.3 Other Relevant Legislation, Guidelines and Protocols

The following legislative requirements may apply to this study:

- Convention on Biological Diversity (Rio de Janeiro, 1992);
- The Ramsar Convention;

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- The IUCN (International Union for Conservation of Nature);
- Constitution of the Republic of South Africa (Act 108 of 1996);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003);
- National Water Act (NWA) (Act No. 36 of 1998);
  - Regulations and Guidelines on Water Use under the NWA.
  - GN 267 (Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals).
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 287 of 2002);
- Environmental Conservation Act (ECA), (Act No. 73 of 1989);
- Soil Conservation Act (Act No. 76 of 1969);
- National Spatial Biodiversity Assessment, 2011 (as available from South African National Biodiversity Institute (SANBI) and recently updated in 2018 (made available in 2019));
- National Protected Areas Expansion Strategy (NPAES 2008); and
- Provincial Specifications:
  - Western Cape Biodiversity Spatial Plan (WCBSP), 2017.

2. SITE SENSITIVITY VERIFICATION

The Department of Environmental Affairs National Web-Based Environmental Screening Tool ('the screening tool') indicates that the aquatic biodiversity theme is of "Very High" sensitivity for the proposed project study area (DFFE 2022). The classification trigger is the location of Aquatic CBAs, as well as river, wetland, and estuary presence within the proposed study area.

As per the requirements of GN 320 of 2020 the potential environmental sensitivity of the site - as identified by the national web-based environmental screening tool - must be confirmed by undertaking an Initial Site Sensitivity Verification. The Initial Site Sensitivity Verification was undertaken by means of a desktop assessment of the site, as well as a field assessment on the 5th of June 2022.

There are several wetlands identified within the proposed study area according to the National Wetland Map version 5 (NWM5 2018), including two (2) channelled valley-bottom wetlands located in the south of the study area, as well as a channelled valley-bottom wetland located in the east of the study area. No estuary is present within the proposed study area.

The wetlands identified within the study area are all listed in the National Freshwater Ecosystem Priority Areas (NFEPA 2011) wetlands database. The wetlands associated with the study area are listed as Critical Biodiversity Areas (CBAs), whilst the mapped drainage lines are listed as Ecological Support Areas: Restore from other land use (ESA2) within the Western Cape Biodiversity Spatial Plan (WCBSP 2017). The proposed drill holes are located outside of the 500 m DWS Regulated Area for all the wetlands within the study area.

According to river line vector data of the 1:50 000 topography maps for the Western Cape produced by the Department of Rural Development and Land Reform (National Geo-spatial Information (DRDLR)), there are several unnamed, non-perennial (ephemeral) drainage lines mapped within the north of the study area. All proposed drill hole locations occur outside of the 100 m DWS Regulated Area for these ephemeral streams.

In addition, there are two (2) unnamed, non-perennial drainage lines mapped as flowing from the east to the south-west of the study area. These two (2) unnamed, non-perennial drainage lines converge in the southwest of the study area and flow into a channelled valley bottom wetland. The northern unnamed non perennial drainage line, which flows through the central portion of the study area, on Portion 1 of Farm Schuitjes Klip 22,

occurs within 100 m of a single drill hole. This drainage line has been significantly modified by the surrounding agricultural activities and as a result is now more representative of an artificial drainage channel than a natural non-perennial river.

The site was deemed to be of "Very High" aquatic sensitivity given the confirmed presence of aquatic features onsite, as per the screening tool. A full Wetland & Aquatic Biodiversity Impact Assessment is required as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

3. METHODOLOGY

A detailed description of the methodology is provided in the subsections below. The desktop assessment is used as the point of departure. Subsequently, a site visit was undertaken on the 5th of June 2022.

3.1 Literature Review and Desktop Assessment

A desktop assessment was undertaken of all available data. This involved the investigation of aerial photography, GIS databases, government records and previous studies, including literature reviews pertaining to the study area to determine the theoretical importance and sensitivity of the aquatic ecosystems involved. The study area was mapped using Geographical Information Systems (GIS) (e.g. ArcGIS) to better understand the surrounding environment.

3.2 Determination of the Extent of the Study Area

The study area for infield assessment comprised all aquatic features within 500 m of the proposed drill holes. The aquatic features likely to be impacted were identified using the 'Likelihood of Impact' guidelines in **Table 1** below.

Table 1: Qualitative 'Likelihood of Impact' ratings and descriptions

Likelihood of Impact Rating	Description of Rating Guidelines
Definite	These resources are likely to require impact assessment and a Water Use License in terms of Section 21 (c) & (i) of the National Water Act for the following reasons: • resources located within the footprint of the proposed development activity and will be impacted by the project; and/or • resources located within 15 m upstream and/or upslope of the proposed development activity and trigger requirements for Environmental Authorisation according to the NEMA: EIA regulations; and/or • resources located within 15 m or downslope of the development and trigger requirements for Environmental Authorisation according to the NEMA: EIA regulations; and/or • resources located downstream within the following parameters: ▪ within 15 m downstream of a low risk development; ▪ within 50 m downstream of a moderate risk development; and/or ▪ within 100 m downstream of a high-risk development e.g. mining, large industrial land uses.
Likely / Possible	These resources may require impact assessment and a Water Use License in terms of Section 21 (c) & (i) of the National Water Act for the following reasons: • resources located within 32m but greater than 15m upstream, upslope or downslope of the proposed development; and/or

	• resources located within a range at which they are likely to incur indirect impacts associated with the development (such as water pollution, sedimentation and erosion) based on development land use intensity and development area. This is generally resources located downstream within the following parameters: ▪ within 32m downstream of a low risk development; ▪ within 100m downstream of a moderate risk development; and/or ▪ within 500m downstream of a high-risk development (note that the extent of the affected area downstream could be greater than 500m for high risk developments or developments that have extensive water quality and flow impacts e.g. dams / abstraction and treatment plants).
Unlikely	These resources are unlikely to require impact assessment or Water Use License in terms of Section 21 (c) & (i) of the National Water Act for the following reasons: • resources located a distance upstream, upslope or downslope (>32m) of the proposed development and which are unlikely to be impacted by the development project; and/or • resources located downstream but well beyond the range at which they are likely to incur impacts associated with the development (such as water pollution, sedimentation, and erosion). This is generally resources located downstream within the following parameters: • greater than 32m downstream of a low risk development; ▪ greater than 100m downstream of a moderate risk development; and/or ▪ greater than 500m downstream of a high-risk development (note that the extent of the affected area downstream could be greater than 500m for high risk developments or developments that have extensive water quality and flow impacts e.g. dams / abstraction and treatment plants).
None	These resources will not require impact assessment or a Water Use License in terms of Section 21 (c) & (i) of the National Water Act for the following reasons: • resources located within another adjacent sub-catchment, and which will not be impacted by the development in any way, shape or form.

3.3 Field Survey

A field assessment was conducted on the 5th of June 2022 to supplement and confirm the findings of the desktop analysis. A walkover field survey of the aquatic features was conducted where accessible. Verification of the aquatic features identified during the desktop assessment, and their current status was also included. The following assessment tools were implemented where relevant:

Table 2: Recommended Assessment Tools for Wetlands/Rivers

Aquatic Element	Method	Tool	Applicable to Study
Drainage Line 1	Delineation	"National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa." (Ollis *et al*, 2013).	Yes
	Classification	"A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas." (DWAF, 2005).	Yes

		"Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas" (DWAF, 2008).	

3.4 Classification System for Wetlands and Other Aquatic Systems

All wetland or riparian features encountered were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems, hereafter referred to as the "Classification System" (Ollis *et al*. 2013). The same approach of classifying wetlands in terms of a functional unit was followed. HGM units encompass three key elements (Kotze et al, 2005):

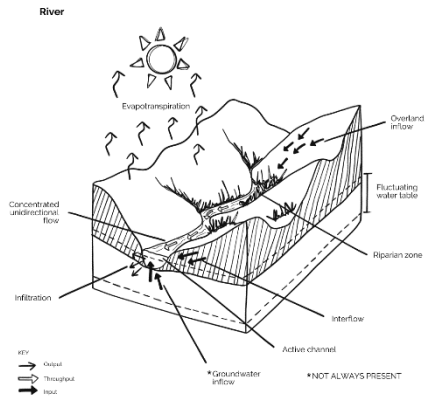
- **Geomorphic setting** - This refers to the landform, its position in the landscape and how it evolved (e.g. through the deposition of river borne sediment);
- **Water source** - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
- **Hydrodynamics** - This refers to how water moves through the wetland.

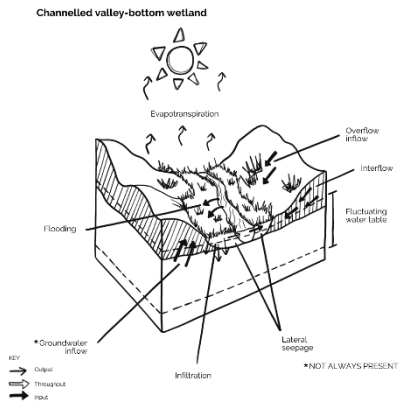
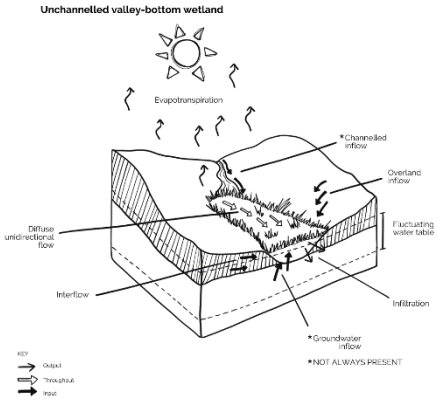
A summary of Levels 1 to 4 of the Classification System is presented in **Tables 3 and 4**, below.

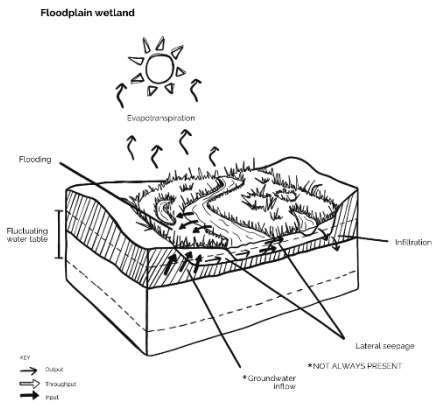
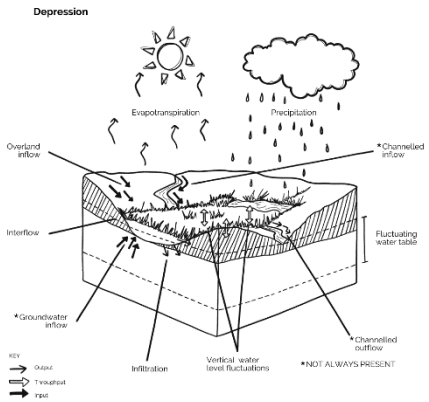
Table 3: Level 3 classification structure for Inland Systems

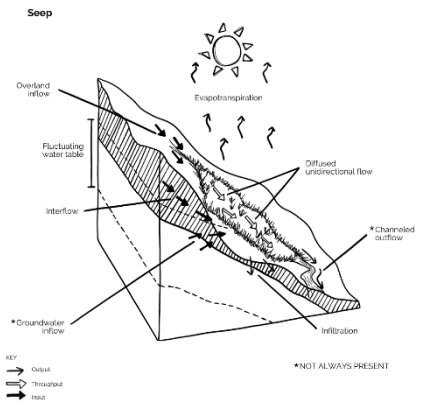
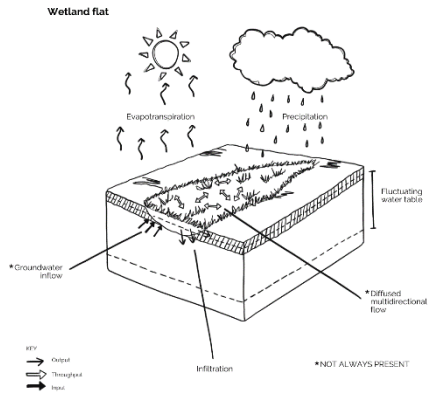
Wetland / Aquatic Ecosystem Context		
Level 1: System	**Level 2: Regional Setting**	**Level 3: Landscape Unit**
Inland Systems	DWA Level 1 Ecoregions Or NFEPA WetVeg Groups Or Other Special Framework	**Valley Floor** - gently sloping lowest surface of a valley, excluding mountain headwater zones.
		Slope - located on the side of a mountain, hill or valley that is steeper than lowland or upland floodplain zones.
		Plain - extensive area of low relief. Different from valley floors in that they do not lie between two side slopes, characteristic of lowland or upland floodplains.
		Bench (Hilltop / Saddle / Shelf) - an area of mostly level or nearly level high ground, including hilltops/crests, saddles and shelves/terraces/ledges.

Table 4: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C (Ollis *et al.* 2013)

Functional Unit			
Level 4: Hydrogeomorphic (HGM) Unit			
HGM Type		**Longitudinal Zonation / Landform / Outflow Drainage**	**Landform / Inflow Drainage**
A		**B**	**C**
River: A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.		Mountain Headwater Stream	Active Channel
			Riparian Zone
		Mountain Stream	Active Channel
			Riparian Zone
		Transitional	Active Channel
			Riparian Zone
		Upper Foothills	Active Channel
			Riparian Zone
		Lower Foothills	Active Channel
			Riparian Zone
		Lowland River	Active Channel
			Riparian Zone
		Rejuvenated Bedrock Fall	Active Channel
			Riparian Zone
		Rejuvenated Foothills	Active Channel
			Riparian Zone
		Upland Floodplain	Active Channel
			Riparian Zone

Channelled Valley-Bottom Wetland: A valley-bottom wetland with a river channel running through it.		Not Applicable	Not Applicable
		Not Applicable	Not Applicable
Unchannelled Valley-Bottom Wetland: A valley-bottom wetland without a river channel running through it.		Not Applicable	Not Applicable
		Not Applicable	Not Applicable

Floodplain Wetland: The mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank.		Floodplain Depression	Not Applicable
		Floodplain Flat	Not Applicable
Depression: Landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.		Exorheic	With Channel Inflow
			Without Channel Inflow
		Endorheic	With Channel Inflow
			Without Channel Inflow
		Dammed	With Channel Inflow
			Without Channel Inflow

Seep: A wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.		With Channel Inflow	Not Applicable
		Without Channel Inflow	Not Applicable
Wetland Flat: A level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.		Not Applicable	Not Applicable

3.5 Wetland Delineation

Wetlands are regarded as an area of land on which the period of saturation of water is enough to allow for the development of hydric/hydromorphic soils, which in normal circumstances would support hydrophilic vegetation (i.e. vegetation adapted to grow in differing levels of saturated and anaerobic soil conditions).

To delineate any wetland the following criteria are used in line with Department of Water Affairs (DWA): A practical field procedure for identification and delineation of wetlands and riparian areas, Edition 1 September 2005. The draft updated report of the abovementioned guideline was used, as it provides a guideline to the delineation of wetland areas: Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. DWA (2008) Draft report.

3.5.1 Desktop Delineation

For this study, a desktop delineation of wetlands potentially affected by the proposed drill hole sites was determined during the desktop assessment and confirmed in field during the site assessment on the 5th of June 2022. The wetlands were identified using a range of tools, including:

- 1: 50 000 Topographical Maps;
- Historical Maps;
- Recent aerial and satellite imagery, including Google Earth, ArcGIS and QGIS; and the
- Aquatic Biodiversity Impact Assessment conducted by Scientific Aquatic Services (SAS) in 2018.

3.5.2 In-field Assessment

The following indicators stipulated in the National Delineation Guidelines were considered in the field. Not necessarily all these indicators were used at each site:

- Soil form indicator: Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation.
- Vegetation indicator: The presence of water loving plants (hydrophytes).
- Soil wetness indicator: A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.
- Terrain indicator: Topographical location of the wetland in relation to the landscape.

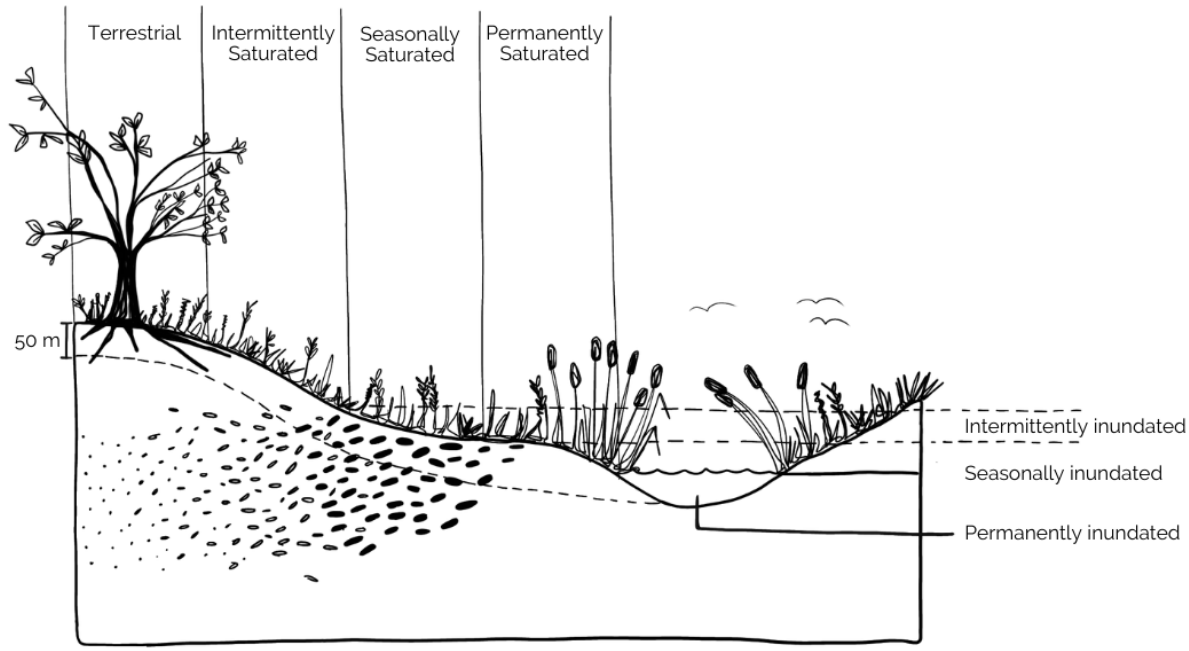


Figure 2: Typical cross-section of a wetland indicating changes in the soil wetness and vegetation indicators (Ollis *et al.* 2013)

3.5.3 Difficult to Delineate Areas

Table 5 contains a summary of wetland types or wetland-like areas which are difficult to delineate, along with the best approach to take in such circumstances. However, none are applicable to the current study area.

Table 5: List of difficult to delineate sites (Job, 2009)

Type of Site	Recommended Approach
Some or all, wetland indicators are present but is a non-natural wetland (e.g. some dams, road islands)	• Decide on the relative permanence of the change and whether the area can now be said to be functioning as a wetland. • Time field observations during the wet season, when natural hydrology is at its peak, to help to differentiate between naturally occurring versus human-induced wetland. • Decide appropriate policy/management i.e. can certain land uses be allowed due to "low" wetland functional value, or does the wetland perform key functions despite being artificial.
Indicators of soil wetness are present but no longer a functioning wetland (e.g. wetland has been drained)	• Look for evidence of ditches, canals, dikes, berms, or subsurface drainage tiles. • Decide whether the area is currently functioning as a wetland.
Indicators of soil wetness are present but no longer a	• Decide whether indicators were formed in the distant past when conditions were wetter than the area today.

Type of Site	Recommended Approach
functioning wetland (e.g. relic / historical wetland)	• Obtain the assistance of an experienced soil scientist.
Some, or all, wetland indicators are absent at certain times of year (e.g. annual vegetation or seasonal saturation)	• Thoroughly document soil and landscape conditions, develop rationale for considering the area to be a wetland. • Recommend that the site be revisited in the wet season.
Some, or all, wetland indicators are absent due to human disturbance (e.g. vegetation has been cleared, wetland has been ploughed or filled)	• Thoroughly document landscape conditions and any remnant vegetation, soil, hydrology indicators, develop rationale for considering the area to be wetland. • Certain cases (illegal fill) may justify that the fill be removed, and the wetland rehabilitated.

4. RECEIVING ENVIRONMENT DESCRIPTION

A review of desktop resources was undertaken and a summary of key desktop information relevant to this assessment is provided below.

4.1 Biophysical Context

The study area under evaluation is mainly flat, with a number of granite and limestone outcrops. According to the Council for Geoscience geological map (ENPAT), the soils in this region consist predominantly of red dystrophic and/or mesotrophic soils, as well as Glenrosa and Mizpah forms. Lime occurs regularly in upland and/or valley bottom positions in this area. The soil is derived from carbonate-, siliciclastic, and rocks as well as in-situ weathered granite rock (**Table 6**).

The soil types and descriptions map developed by the Department of Agriculture, Forestry and Fisheries obtained from CapeFarmMapper ver.2.6.8., indicates that the soils in this region are red-yellow well drained soils lacking a strong texture contrast. The clay percentage (%) of both the top- and sub-soil of the study area are variable. The topsoil clay % range between 3 and 12% and the subsoil between 8 and 24% (Strydom & Botha, 2022).

According to the South African Atlas of Climatology and Agrohydrology (Schulze 2009) obtained from CapeFarmMapper ver.2.6.10, the mean annual rainfall received for the area is 229 mm (**Table 6**). The lowest rainfall month in the area is February with a mean annual rainfall of 1 mm, while June has the highest mean annual rainfall (36 mm). The mean annual temperature for the area is 16.0°C (**Table 6**) with July being the coldest month (12.9°C) and February being the warmest (18.50°C – 19.5°C) (Schulze 2009).

The proposed drilling holes are predominantly located within fallow land / old fields and cultivated land. Historically, these areas would have been covered by Saldanha Flats Strandveld and Saldanha Granite Strandveld. There are a number of drill holes proposed along the ridgeline of two limestone outcrops which are not cultivated and are in a natural / near natural condition. According to the South African National Biodiversity Institute (SANBI) Vegetation Map 2018 (SANBI 2018), the natural vegetation in this area consists of Saldanha Limestone Strandveld which is listed as a Critically Endangered (CR) ecosystem that is Moderately Protected (MP) (**Table 6**).

The general biophysical characteristics of the proposed study area are summarised in **Table 6**.

Table 6: General characteristics of the proposed study area

Site attribute	Description	Data source
Eco-region	Southwestern Coastal Belt	Department of Water Affairs Level 1 Ecoregions (Department of Water and Sanitation 2011)
Terrestrial Vegetation Type (**Figure 3**)	Saldanha Flats Strandveld (EN – PP) Saldanha Granite Strandveld (CR – PP) Saldanha Limestone Strandveld (CR – PP)	National Vegetation Map of South Africa, 2018 (SANBI 2018)
Dominant Geology and Soils	This region has predominantly red dystrophic and/or mesotrophic soils, as well as Glenrosa and Mizpah forms. Lime is generally present in part or most of the landscape. Limestone, Sedimentary Rock, and Granite are the dominant Geology formations.	Cape Farm Mapper (ENPAT 2021)
Soil Erodibility Factor (K)	0.4 (Moderate Erodibility) – 0.63 (High Erodibility)	SA Atlas of Climatology and Agrohydrology (Schulze 2009)
Soil Depth & Clay Percentage (%)	0 – 120 cm & <15%	Soil types and descriptions for the Western Cape, Department of Agriculture, Forestry and Fisheries (DAFF 2021)
Mean Annual Precipitation (mm)	229 mm	SA Atlas of Climatology and Agrohydrology (Schulze 2009)
Rainfall seasonality	Winter rainfall	
Mean Annual Temperature (°C)	16.0°C	
Water Management Area (**Figure 4**)	Berg WMA	Water Management Areas (DWAF 2011)
Quaternary Catchment (**Figure 4**)	G10M	South African Quaternary Catchments Database (Schulze et al. 2007)
Wetland Vegetation Group (for wetlands within the applicable terrestrial vegetation type)	Western Strandveld	NFEPA Wetland Vegetation Types (SANBI 2011)

4.1 Biodiversity Planning Context

The study area under evaluation is located within the Berg Water Management Area, quaternary catchment G10M (**Figure 5**). The proposed sites are not located within a sub-quaternary catchment demarcated as a Freshwater Priority Area (FEPA) (CSIR 2011). The regional setting, in terms of the Level 1 Department of Water Affairs (DWA) (now Department of Water and Sanitation) Ecoregions, is within the Southwestern Coastal Belt (**Table 6**).

According to river line vector data of the 1:50 000 topography maps for the Western Cape produced by the Department of Rural Development and Land Reform (National Geo-spatial Information (DRDLR)), there are several unnamed, non-perennial drainage lines mapped within the north of the study area, none of which is located within 100 m of proposed drill holes (**Figure 4**).

In addition, there are two (2) unnamed, non-perennial drainage lines mapped as flowing from the east to the south-west of the study area. These two (2) unnamed, non-perennial drainage lines converge in the southwest of the study area and flow into a channelled valley bottom wetland. The northern unnamed non perennial drainage line, which flows through the central portion of the study area, on Portion 1 of Farm Schuitjes Klip 22, occurs within 100 m of a single drill hole (**Figure 14)**.

There are several wetlands identified within the proposed study area according to the National Wetland Map version 5 (NWM5 2018), including two (2) channelled valley-bottom wetlands located in the south of the study area, as well as a channelled valley-bottom wetland located in the east of the study area (**Figure 4**). The wetlands identified within the study area are all listed in the National Freshwater Ecosystem Priority Areas (NFEPA 2011) wetlands database. The proposed drill holes are located outside of the 500 m DWS Regulated Area for all the wetlands within the study area (**Figure 14**).

The wetlands associated with the study area are listed as Critical Biodiversity Areas (CBAs), whilst the mapped drainage lines are listed as ecological support areas: Restore from other land use (ESA2) within the Western Cape Biodiversity Spatial Plan (WCBSP 2017). A number of additional terrestrial CBAs and ESA's are indicated within the proposed study area (**Figure 5**).

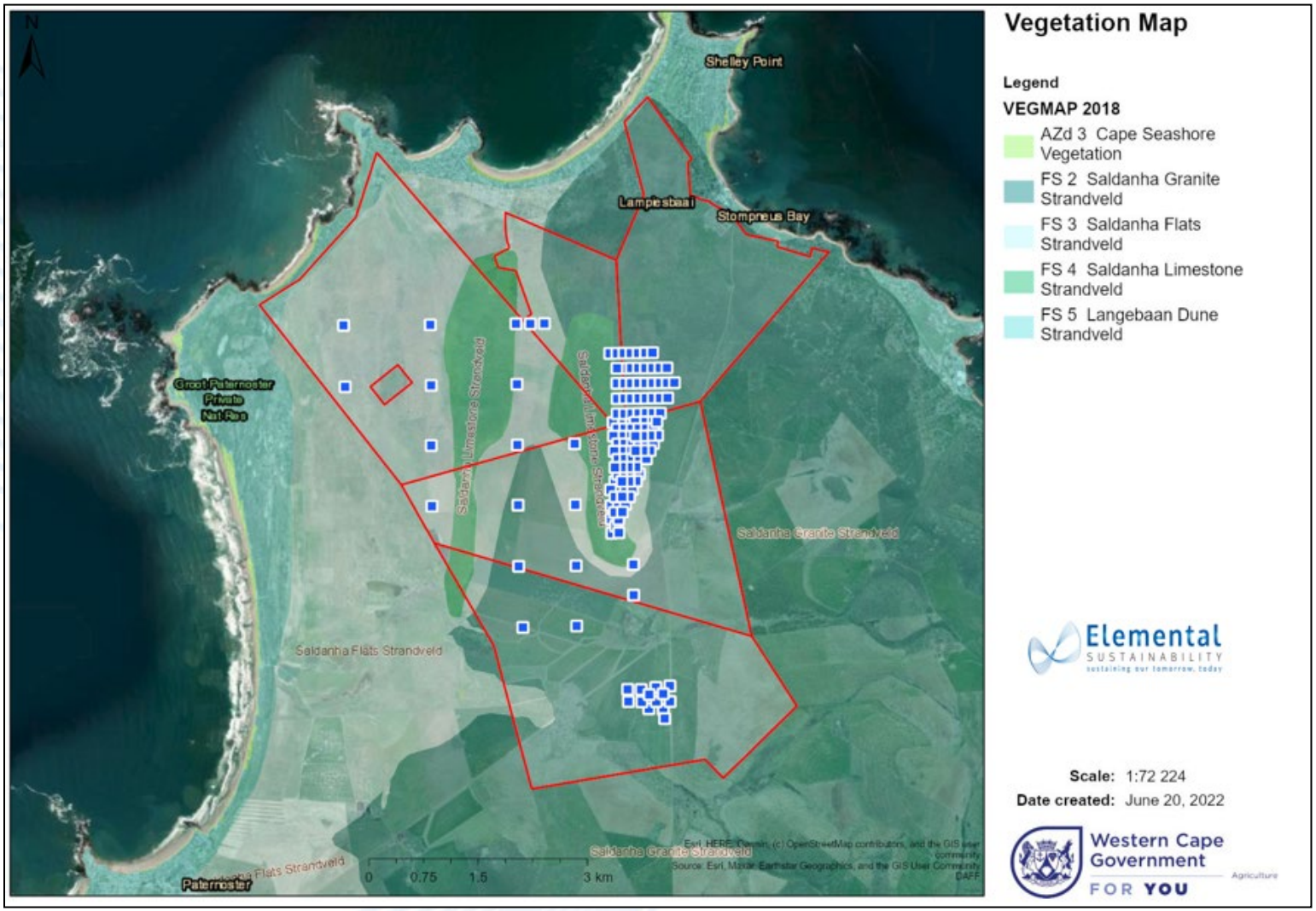


Figure 3: Vegetation Map (VegMap 2018)

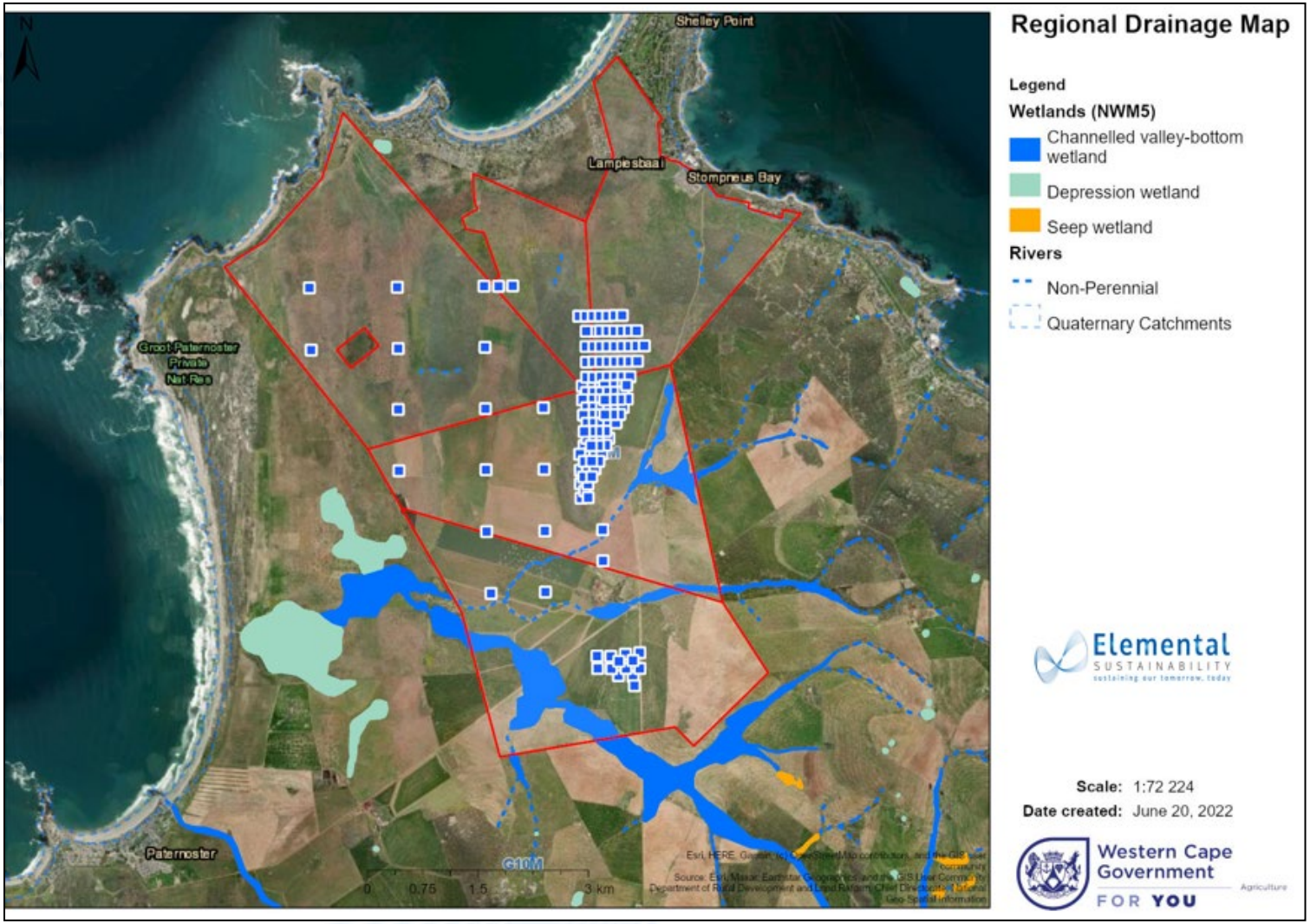


Figure 4: Regional Drainage Map

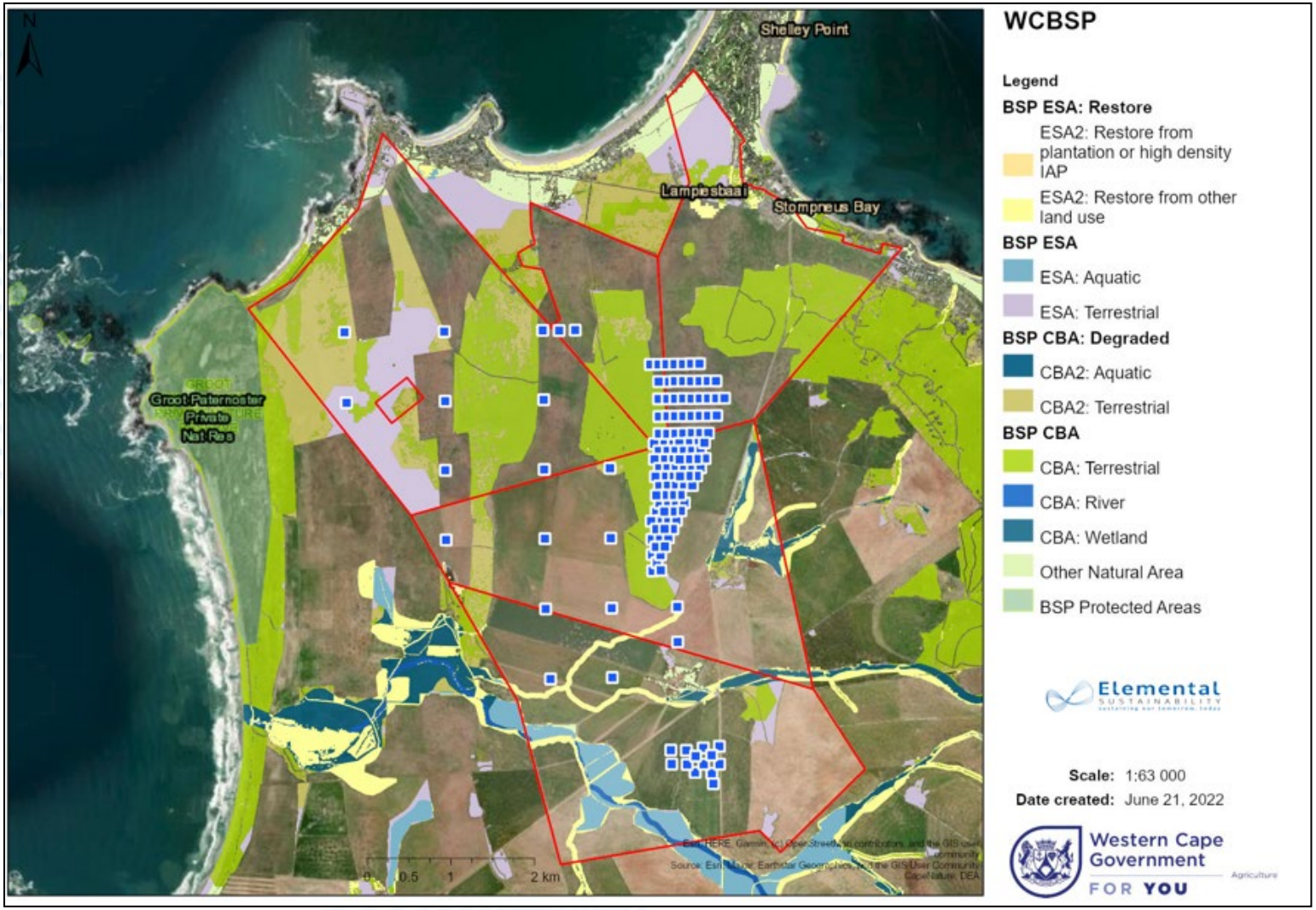


Figure 5:Critical Biodiversity Areas Map (WCBSP 2017)

5. RESULTS OF THE ASSESSMENT

5.1 Site Description

The study area and its surrounds has been severely transformed over the years. The dominant land use in the area is crop cultivation (non-irrigated) (**Figure 6**) and other farming related land uses such as small villages and fallow land / old fields (**Figure 7**). Other land uses surrounding the proposed drill hole locations include natural low shrublands (**Figure 8**), wind farming, and farmland used for recreational 4 X 4 trails.

Access was restricted to Farm Duyker Eiland 6 Portion 7 and Farm Schuitjes Klip 22 Portion 3. Located on Farm Schuitjes Klip 22 Portion 3 in the south of the study area, is a mapped unnamed non-perennial drainage line and two channelled valley bottom wetlands. None of the proposed locations for drill holes are located within 500 m of the wetlands, or within 100 m of the rivers or drainage lines.

Located in the eastern portion of the study area, on Portion 1 of Farm Schuitjes Klip 22, is a channelled valley bottom wetland (**Figure 9**). The northern portion of the channelled valley bottom wetland is dominated by *Phragmites australis* and *Scirpoides dioecus* (**Figure 10**), whilst further south the wetland is dominated by *Sarcocornia* spp. (**Figure 11**). The wetland has been significantly impacted by agricultural activities, including livestock trampling and overgrazing as well as a dirt road which crosses the southern portion of the wetland. This eastern channelled valley bottom wetland is unlikely to be impacted by the proposed drill holes. The wetland is located more than 500 m from the proposed drill hole locations and is hydrologically separated as a result of intensive agricultural fields and a dirt road.

According to river line vector data of the 1:50 000 topography maps for the Western Cape produced by the Department of Rural Development and Land Reform (National Geo-spatial Information (DRDLR)), there are several unnamed, non-perennial drainage lines mapped within the north of the study area (**Figure 11**). These streams have a clearly defined channel; and it is likely that there is flow immediately after substantial heavy rainfall in the area. These ephemeral streams are located more than 100 m from the proposed drill holes and are thus unlikely to be impacted upon by the proposed project (**Figure 14**).

An unnamed non perennial drainage line flows through the central portion of the study area on Portion 1 of Farm Schuitjes Klip 22. This drainage line is located within 100 m of a single drill hole (**Figure 14**). The drainage line flows from the eastern channelled valley bottom wetland to the southwestern portion of Farm Schuitjes Klip 22 Portion 3 and converges with a channelled valley bottom wetland located west of the study area.

Erosion is present along certain portions of the drainage line due to the surrounding cultivated fields, associated soil disturbance and increased runoff (**Figure 12**). The drainage channel has limited to no riparian vegetation, with *Atriplex nummularia* being the dominant vegetation present along the banks. The drainage line has been significantly modified by the surrounding agricultural activities (**Figure 13**) and as a result is now more representative of an artificial drainage channel than a natural non-perennial river. Given the topography of the region and the proposed location of the one (1) drill hole within the 100 m DWS Regulated Area (**Figure 14**), only this one (1) non-perennial drainage line was further assessed in this Wetland & Aquatic Biodiversity Impact Assessment.

Figure 6: Non irrigated crop cultivation, the dominant land use in the study area

Figure 7: Fallow land / old fields located in the northeast of the study area

Figure 8: Natural vegetation located on limestone outcrops

Figure 9: Northern portion of the eastern channelled valley bottom wetland

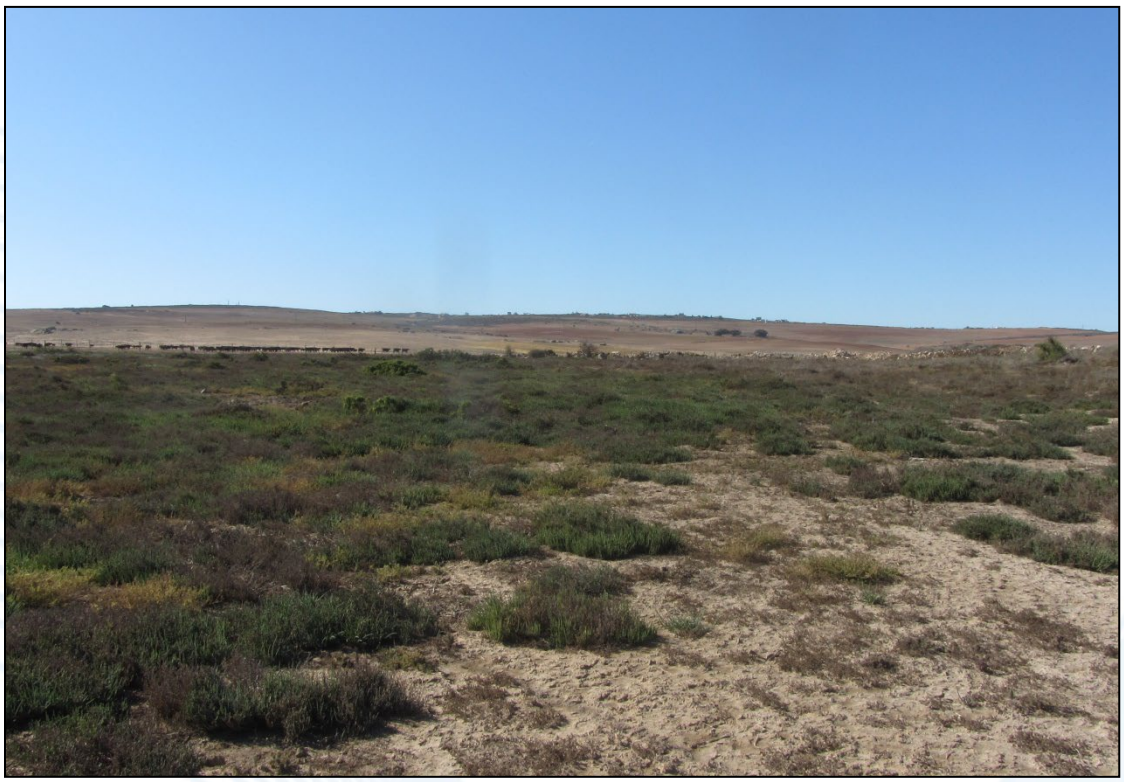


Figure 10: Southern portion of the eastern channelled valley bottom wetland

Figure 11: Several ephemeral streams are located in the north of the study area

Figure 12: Drainage channel located within 100 m of a proposed drill hole

Figure 13: Overview of the drainage channel traversing cultivated land

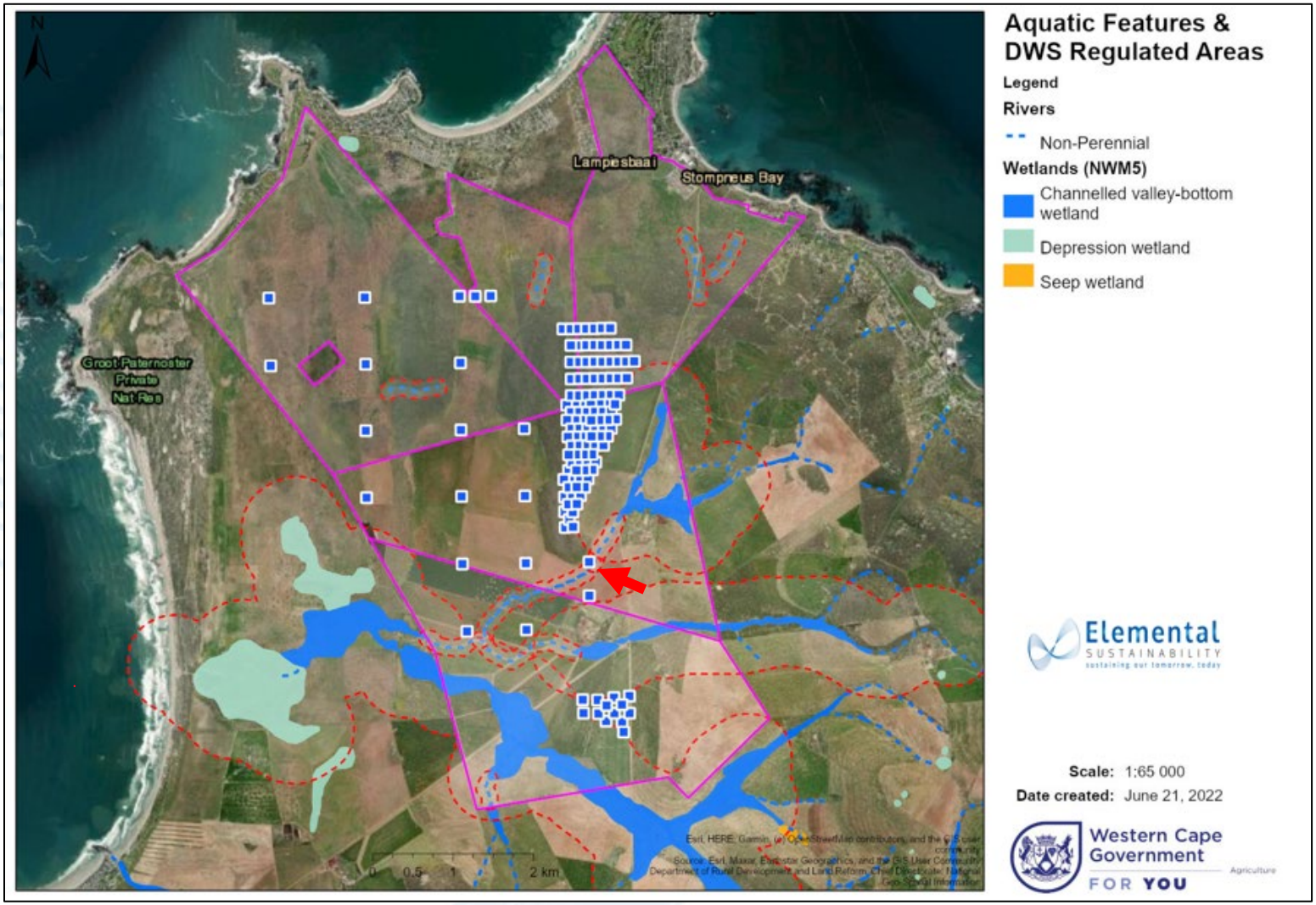


Figure 14: Proposed drill holes along with the 500 m & 100 m radius within which aquatic features require assessment. The red arrow indicates the drill hole proposed in the 100 m Regulated Area of the artificial drainage channel

5.2 Aquatic Feature Classification and System Characterisation

The aquatic biodiversity assessment focussed on the aquatic features within 500 m of the proposed drill hole locations for wetlands and within 100 m of the proposed drill hole locations for the drainage lines (**Figure 14**). There was a single drill location located approximately 65 m from the drainage channel in the central portion of the study area on Portion 1 of Farm Schuitjes Klip 22. Therefore, the focus of the assessment was the unnamed, non-perennial drainage line located within the southern portion of the study area.

Within the assessment area, one (1) drainage line was identified and assessed further (**Table 7; Figure 14**). The impacts of activities such as crop production, erosion, and road networks within the greater catchment were taken into consideration during the assessment.

Table 7: Classification of the aquatic features within the 100 m DWS Regulated Area

Drainage Line	Level 3: Landscape Unit	Level 4: Hydrogeomorphic (HGM) Unit
Drainage Line 1	Valley Floor	Artificial Drainage Channel

5.2.1 Aquatic Description and Delineation

The drainage line was delineated on a desktop level with the use of digital satellite imagery and topographical maps. Portions of the features were then verified during the field survey according to the guidelines advocated by DWA (2005, 2008) and the wetland delineations as presented in this report are regarded as a best estimate of the boundaries based on the site conditions present at the time of assessment. Only Drainage Line 1 was assessed (**Figure 14**).

During the assessment, the following indicators were used to ascertain the boundaries of the riparian area:

- Terrain units were used as the primary indicator, along with aerial imagery that indicated riparian boundaries.
- Vegetation was considered informative.

5.2.2 National Biodiversity Assessment, 2018

As the mapped non-perennial drainage line was considered to be artificial in nature (**Figure 12**), most likely used to drain the surrounding agricultural land (**Figure 13**), the National Biodiversity Assessment (NBA), 2018, was used as a measure of this system's Ecological Condition.

Although the drainage channel is not mapped in the National Biodiversity Assessment (NBA, 2018) the channelled valley bottom wetland and associated stream located approximately 400 m downstream of the drainage channel in the southwest of the study area is classified as Seriously Modified with a Present Ecological Condition (PES) of E. The surrounding catchment area, and the inflowing drainage lines, have been significantly modified by the surrounding agricultural activities. As the drainage channel is located approximately 400 m upstream of the wetland, within the same catchment area, this PES is deemed to be an adequate representation of the system.

6. NEMA IMPACT ASSESSMENT

All forms of development, albeit for mining, industrial, urban, or residential purposes, will have an immediate effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof.

6.1 Potential Impacts

The potential impacts of the proposed prospecting activities are limited to Construction and Operational Phase impacts including:

Construction & Operational Phases:

- Potential spillage and release of potentially contaminated runoff into the artificial drainage channel, as a result of the drilling activities and associated vehicles within the 100 m DWS Regulated Area; and
- Increased sediment input into the artificial drainage channel as a result of the drilling activities within the 100 m DWS Regulated Area.

6.2 Ecological Impact Assessment Methodology

Impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders, and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects, and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An environmental aspect is an 'element of an organizations activities, products and services which can interact with the environment'. The interaction of an aspect with the environment may result in an impact.
- Environmental risks/impacts are the consequences of these aspects on environmental resources or receptors of value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- Receptors can comprise, but are not limited to, people or human-made systems, such as residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- Resources include components of the biophysical environment.
- Frequency of activity refers to how often the proposed activity will take place.

- Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the receptor.
- Severity refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- Spatial extent refers to the geographical scale of the impact.
- Duration refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (**Table 8**). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts.

The NEMA Regulations require that an impact assessment provide quantified scores indicating the expected impact, and the cumulative impact of a proposed activity. The following format was utilised during this assessment:

- *Direct impacts* - Impacts caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- *Indirect impacts* - Indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
- *Cumulative impacts* result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Risks/Impacts were assessed for the following stages of the project cycle:

- Construction and Operational Phases are assessed in one as the drilling of holes for prospecting is seen to be a singular activity.

Table 8: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS	
Frequency of Impact	**Rating**
Almost Never / Almost Impossible	1
Very Seldom / Highly Unlikely	2
Infrequent / Unlikely / Seldom	3
Often / Regularly / Likely / Possible	4
Daily / Highly Likely / Definitely	5
Frequency of Activity / Duration of Aspect	**Rating**

Annually or less / Low	1
6 Months / Temporary	2
Monthly / Infrequent	3
Weekly / Life of Operation / Regularly / Likely	4
Daily / Permanent / High	5
CONSEQUENCE DESCRIPTORS	
Severity of Impact	**Rating**
Insignificant / Non-harmful	1
Small / Potentially Harmful	2
Significant / Slightly Harmful	3
Great / Harmful	4
Disastrous / Extremely Harmful	5
Spatial Scope of Impact	**Rating**
Activity specific	1
Mine specific (within the site boundary)	2
Local area (within 5 km of the site boundary)	3
Regional	4
National	5
Duration of Impact	**Rating**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post Closure / Permanent	5

Table 9: Significance Rating Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (frequency of the activity and the frequency of the impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 10: Positive / Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very High	126 - 150	Critically consider the viability of proposed projects. Improve current management of existing projects significantly and immediately.	Maintain current management
High	101 - 125	Comprehensively consider the viability of proposed projects. Improve current management of existing projects significant	Maintain current management
Medium – High	76 - 100	Consider the viability of proposed projects. Improve current management of existing projects.	Maintain current management
Medium – Low	51 - 75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy.	Maintain current management and/or proposed project criteria and strive for continuous improvement.
Low	26 - 50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy.	Maintain current management and/or proposed project criteria and strive for continuous improvement.
Very Low	1 - 25	Maintain current management and/or proposed project criteria and strive for continuous improvement.	Maintain current management and/or proposed project criteria and strive for continuous improvement.

6.3 Impact Assessment Tables and Mitigation Measures

Table 11: Alteration of water quality due to pollution impact ratings

Nature: Changes in water quality due to pollution.		
Activity: The mishandling of hazardous substances and/or improper maintenance of machinery during the drilling operation may cause oil and diesel leaks and spills resulting in the loss of sensitive biota if it reaches the artificial drainage line.		
Mitigation Measures: A plastic lining / drip trays should be placed beneath the drill rig in the event of any oil spillages. Only portable chemical toilets, if any, should be used. Vehicles should keep to demarcated routes where possible and all vehicles must be regularly inspected for leaks; any spills should be cleaned up immediately and correctly disposed of; and littering must be prevented by effective site management and the provision of bins.		
	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Unlikely (3)	Almost impossible (1)
Frequency of Activity / Duration of Aspect	Temporary (2)	Temporary (2)
Severity	Potentially Harmful (2)	Insignificant (1)
Spatial Scale	Activity Specific (1)	Activity Specific (1)
Duration	Life of Operation (4)	Life of Operation (4)
Significance	**35 Low**	**18 Very Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Cumulative impacts: None expected.		
Residual Risks: None expected.		

Table 12: Alteration of the amount of sediment entering the water resource and associated change in turbidity impact ratings

Nature: Changes in sediment entering and exiting the system may result in smothering of vegetation and habitats and lead to loss of niche habitats. Sedimentation and erosion could lead to the degradation of the artificial drainage channel but is unlikely due to the distances between the proposed activities and the drainage channel in the area.		
Activity: Changing the amount of sediment entering the artificial drainage channel and associated change in turbidity (increasing or decreasing the amount). Possible sources of the impacts include: • Clearing of surface vegetation will expose the soils, which in rainy events could wash into the stream, causing sedimentation. • Disturbance of soil surface.		
Mitigation Measures: Remove only the vegetation where essential for drilling purposes and do not allow any disturbance to the adjoining natural vegetation cover. Cover any cleared areas with straw to minimise sedimentation by wind.		
	Without Mitigation	**With Mitigation**
CONSTRUCTION & OPERATIONAL PHASE		
Frequency of Impact	Unlikely (3)	Highly Unlikely (2)
Frequency of Activity / Duration of Aspect	Temporary (2)	Temporary (2)
Severity	Potentially Harmful (2)	Insignificant (1)
Spatial Scale	Activity Specific (1)	Activity Specific (1)
Duration	Life of Operation (4)	Life of Operation (4)
Significance	**35** **Low**	**24** **Very Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Cumulative impacts: None expected.		
Residual Risks: None expected.		

7. DWS RISK ASSESSMENT (C & I WATER USES)

According to the DWS Regulation GN1199 all wetlands occurring within 500 m of the development should be considered as sensitive features. Development within 500 m of wetlands or within 100m of a watercourse trigger the Water Use Licence Application (WULA) process.

In Chapter 4 of the National Water Act (Act 36 of 1998), general principles for regulating water use are set out. Of specific relevance to the operations, is section 21 (c) and (i): impeding or diverting the flow in a watercourse or altering the bed, banks, course, or characteristics of a watercourse. In general, a water use must be licensed unless it is listed in Schedule I as an existing lawful use, which is permissible under a general authorisation, or if a responsible authority waives the need for a license.

The risk assessment followed the approach prescribed by the Department of Water and Sanitation (DWS) Notice 509 of 2016 (General Authorisation in terms of Section 39 of the National Water Act (36 of 1998) for water uses as defined in Section 21 (c) and (i).

The following Formula is used:

CONSEQUENCE = SEVERITY + SPATIAL SCALE + DURATION

LIKELIHOOD = FREQUENCY OF THE ACTIVITY + FREQUENCY OF THE IMPACT +LEGAL ISSUES + DETECTION

RISK = CONSEQUENCE x LIKELIHOOD

This risk assessment matrix assists in quantifying expected impacts and the scores are useful in evaluating how the proposed activities should be authorised. **Table 13** below provides a description of the classes to establish the appropriate channel of authorisation. Risk is determined after considering all listed mitigation measures.

Table 13: Risk scores, classes, and the appropriate authorization process (Extract from DWS, 2016)

Rating	Class	Management Description	Authorisation	Delegation
1 - 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands are excluded.	GA	Regional Head
56 - 169	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.	WUL	Regional Head
170 - 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.	WUL	Director General

Table 14: The DWS (2016) risk assessment matrix for the proposed activities

Project Phase	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSE
Construction & Operational Phase	Drilling of holes	Potential release of potentially contaminated runoff into the artificial drainage channel, as a result of the drilling activities and associated vehicles within the 100 m regulated buffer area	1	3	2	2	2	1	1	4,0	1	1	5	3	10	40,0	L	80%	Refer to Section 6	N	PES – E (Seriously Modified) (NBA, 2018) EIS – N/A
	Drilling of holes	Increased sediment input into the artificial drainage channel, as a result of the drilling activities within the 100 m regulated buffer area	1	2	2	2	1,75	1	2	4,75	2	1	5	2	10	47,5	L	80%	Refer to Section 6	N	

RISK MATRIX (Based on DWS 2015 publication: Section 21 C and I water use Risk Assessment Protocol):
NAME and REGISTRATION No of SACNASP Professional member: K van Zyl Reg no. 117097

Signature:

Date: 14 June 2022

8. CONCLUSION

The aquatic biodiversity impact assessment focussed on the aquatic features situated within the footprint of the proposed drilling locations, and within the extended 500 m DWS Regulated Area. No aquatic features were identified within the proposed footprint area for all drill hole locations.

There are several wetlands identified within the proposed study area according to the National Wetland Map version 5 (NWM5 2018), including two (2) channelled valley-bottom wetlands located in the south of the study area, as well as a channelled valley-bottom wetland located in the east of the study area.

However, the proposed drill holes are located outside of the 500 m DWS Regulated Area for all the wetlands within the study area. Given the limited scale of the project - each drill hole is between 5 and 25 metres (m) deep and approximately 82 mm in diameter - as well as the fact that the wetlands are separated from the drill holes by intensely cultivated land, it is unlikely that any of the wetlands located within the study area will be impacted by the proposed drill holes.

According to river line vector data of the 1:50 000 topography maps for the Western Cape produced by the Department of Rural Development and Land Reform (National Geo-spatial Information (DRDLR)), there are several unnamed, non-perennial drainage lines mapped within the north of the study area. These streams have a clearly defined channel; and it is likely that there is flow immediately after substantial heavy rainfall in the area. These ephemeral streams are located more than 100 m from the proposed drill holes and are thus unlikely to be impacted upon by the proposed project.

An unnamed non perennial drainage line flows through the central portion of the study area on Portion 1 of Farm Schuitjes Klip 22. This drainage line is located within 100 m of a single drill hole. The drainage line flows from the eastern channelled valley bottom wetland to the southwestern portion of Farm Schuitjes Klip 22 Portion 3 and converges with a channelled valley bottom wetland located west of the study area.

Erosion is present along certain portions of the drainage line due to the surrounding cultivated fields, associated soil disturbance and increased runoff. The drainage channel has limited to no riparian vegetation, with *Atriplex nummularia* being the dominant vegetation present along the banks. The drainage line has been significantly modified by the surrounding agricultural activities and as a result is now more representative of an artificial drainage channel than a natural non-perennial river. Given the topography of the region and the proposed location of the one (1) drill hole within the 100 m DWS Regulated Area, only this one (1) non-perennial drainage line was further assessed in this Wetland & Aquatic Biodiversity Impact Assessment.

As the mapped non-perennial drainage line was considered to be artificial in nature and is most likely used to drain the surrounding agricultural land, the National Biodiversity Assessment (NBA 2018), was used as a measure of this system's Ecological Condition. Although the drainage channel itself is not mapped in the National Biodiversity Assessment (NBA, 2018) the channelled valley bottom wetland and associated stream located approximately 400 m downstream of the drainage channel in the southwest of the study area is classified as Seriously Modified, with a Present Ecological Condition (PES) of E. The surrounding catchment area, and the inflowing drainage lines, have been significantly modified by the surrounding agricultural activities. As the drainage channel is located approximately 400 m upstream of the wetland, within the same catchment area, the PES of E (Seriously Modified) is deemed to be an adequate representation of the system.

Impacts to the artificial drainage channel located within 100 m of one (1) drill hole, include potential spillage and release of potentially contaminated runoff as well as increased sediment input, as a result of the drilling activities within the 100 m regulated buffer area. Both impacts were of a "Low" significance prior to the recommended mitigation measures, and of a "Very Low" significance subsequent to implementation of mitigation measures.

The important factors relevant to the project are summarised in the table below.

NEMA Impact Assessment	The impacts associated with the proposed project are "Low" prior to mitigation taking place. With mitigation fully implemented, the significance of impacts can be reduced to Very Low.
DWS Risk Assessment	All aspects of the proposed activities fall within the LOW-risk category. Therefore, a General Authorization will likely be required or alternatively the relevant borehole (that falls within 100 m of a drainage line) could be moved to fall outside of the 100 m regulated area.
Mitigation Measures	Refer to Section 6.3.
Does the Specialist support the Application?	Based on the findings made in the report the impacts associated with the proposed drill holes for the prospecting right application can be mitigated to an acceptable level. The specialist can support the application if all mitigation measures provided in this report, as well as general good practice, are adhered to.

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APPENDIX A: SPECIALIST CURRICULUM VITAE AND QUALIFICATIONS

- Résumé -

KIMBERLEY VAN ZYL
Pr.Sci.Nat., MSc.; BSc. Hons; BSc.

Nationality: South African, British (UK) Date of Birth: 16th January 1990

kimannep@gmail.com
+27 78 275 8815

WORK EXPERIENCE

2021 – Current

Elemental Sustainability
ECOLOGIST / ENVIRONMENTAL SPECIALIST
RESPONSIBILITIES

- Scoping and Environmental Impact Assessments (S&EIA).
- Basic Assessments (BA).
- Management of the Public Participation Process for S&EIA and BA projects.
- Water Use License Applications.
- Aquatic Biodiversity Impact Assessments.
- Aquatic Biodiversity Bio monitoring Assessments.
- Assist with proposal writing.

2019 - 2021

Resource Management Services (RMS) **JUNIOR**

ENVIRONMENTAL CONSULTANT RESPONSIBILITIES

- Scoping and Environmental Impact Assessments (S&EIA).
- Basic Assessments.
- Management of the Public Participation Process for S&EIA and BA projects.
- Water Use License Applications.
- Aquatic Biodiversity Impact Assessments.

2016 - 2019

Iggdrasil Scientific Services
ECOLOGIST

RESPONSIBILITIES

- Specialist Aquatic Biodiversity Impact Assessments.
- Specialist terrestrial ecological surveys.
- Assist with botanical and diatom surveys.
- Conduct in situ water quality analysis.
- ArcGIS data collection, analysis, and mapping.
- Administrative duties.
- Assist with proposal writing.

INDUSTRY CERTIFICATIONS

MEMBERSHIP AND ASSOCIATIONS

- Professional Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP).
- South African Society for Aquatic Scientists.
- Department of Water and Sanitation SASS5 practitioners (Freshwater Aquatic Zoology).

ADDITIONAL COURSES COMPLETED

2020
- Tools for Wetland Assessment Short Course

2019
- Snake Awareness, First Aid for Snake Bite & Venomous Snake Handling - African Snakebite Institute.
- Exploring Geographical Information Systems – University of South Africa.

2018
- Advanced Grass Identification - Africa Land-Use Training.

2017
- Wetland course, back to basics - Department of Water and Sanitation.

2016
- MIRAI (Macro invertebrate Response Assessment Index) - Department of Water and Sanitation.
- SASS5 Aquatic Biomonitoring Training Course - GroundTruth Consultants.
- Invasive Species and Herbicide Training - South African Green Industries Council (SAGIC).

EDUCATION

University of Pretoria
Master of Science (Water Resource Management)

2012 - 2014 *Title of Thesis: Application of the SWAT hydrological model in a small, mountainous catchment in South Africa.*

- Achievements: Golden Key International Honour Society
- Core Modules: Water Supply, Water Conservation, Water Quality Management, Environmental Law, Environmental Change, and Geographic Information Systems (GIS).

University of Pretoria
Bachelor of Science Honours (Zoology and Entomology)

2011 *Title of Thesis: Spatial congruence between bird distribution patterns and protected areas of South Africa*.

University of Pretoria
Bachelor of Science (Zoology and Entomology) 2008 – 2010

LANGUAGE SKILLS

- English - fluent
- French - basic
- Afrikaans – basic

REFERENCES

- **Larry Eichstadt -** Director - *Resource Management Services*
  -larry@rmsenviro.co.za
- **Peter Kimberg** - Biodiversity and Aquatic Specialist - *Golder Associates*
  -pkimberg@golder.com (+44 797 149 2968).
- **Dr Peter le Roux** - Ecology Lecturer - *University of Pretoria*
  -peter.c.leroux@gmail.com (+27 72 928 1926).

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Kimberley Anne van Zyl

Registration Number: 117097

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **13 September 2017** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code