APPENDIX 3

GROUNDWATER IMPACT ASSESSMENT REPORT

NOVEMBER 2024

Groundwater Impact Assessment for the Proposed Cape Winelands Airport, Fisantekraal, Western Cape

Prepared by
GEOSS
01 October 2024

GROUNDWATER AND EARTH SCIENCES
GEOSS
SOUTH AFRICA (Pty) Ltd

Executive Summary

GEOSS South Africa (Pty) Ltd was appointed by PHS Consulting to complete a groundwater impact assessment for the proposed Cape Winelands Airport (CWA). The assessment aims to determine the hydrogeological conditions of the site and the potential impacts that the development may have on the groundwater resources.

This study and other studies undertaken in the area have found that the site is underlain by alluvium, colluvium, and weathered bedrock of the Malmesbury Group and Cape Granite Suite (GEOSS, 2022b). A large geological structure, specifically the Colenso Fault, is mapped on the northeastern boundary of the Cape Winelands Airport. The aquifer in the area is classified as a "fractured" aquifer with potential borehole yields between 0.5 – 5.0 L/s. The groundwater quality of the area, based on one laboratory sample, hydrocensus data and the NGA data indicate that the EC ranges from 19.7 mS/m to 632 mS/m which means the groundwater quality ranges from "ideal" to "poor" (in terms of EC). Based on this study, it was observed that there are a number of groundwater users in the surrounding area and it was found that the majority of the users abstract groundwater from the fractured aquifer. The water levels range from 1.24 mbgl to 71 mbgl.

Overall, the site has a low to low/medium vulnerability classification which means that the susceptibility of the aquifer to contamination from anthropogenic activities is low to medium. The clay found underlying the site does provide some degree of protection to the underlying fractured rock aquifer. However, it must be noted that the vulnerability does increase to the northeast where the Colenso Fault system is located. This area should be considered as a sensitive area in terms of groundwater.

Given the fact that there are groundwater users and the proximity of the Colenso Fault to the CWA, a no-go area for high-risk activities is proposed for the northeastern section of the study area. This no-go area does not include the majority of activities planned for the site, but only certain high-risk activities such as the aviation fuel farm, retail service station or other activities that are considered high risk to groundwater.

The following recommendations are made in this report:

- Development should proceed, but mitigation, protection and monitoring measures will need to be implemented.
- No high-risk activities are to take place in the no-go area delineated in the proximity of the Colenso fault.
- A standalone groundwater monitoring programme report must be designed and finalised once the intricate details of all the planned facilities and activities are known. Recommendations for monitoring are provided in this impact assessment report.

Client Information:

Prepared for	PHS Consulting PO Box 1752 Hermanus 7200
Contact Person	Amanda Fritz-Whyte
Contact Email	amanda@phsconsulting.co.za
Contact Number	082 327 2100 / 028 312 1734

Author Information:

Prepared by	GEOSS South Africa (Pty) Ltd Unit 12, Technostell Building 9 Quantum Street, TechnoPark, Stellenbosch 7600
Contact Email	info@geoss.co.za
Contact Number	(021) 880 1079

Document Information and History:

Report Name	**Groundwater Impact Assessment for the Proposed Cape Winelands Airport, Fisantekraal, Western Cape**		
Report No	2023/07-03		
Suggested Citation	GEOSS (2024). Groundwater Impact Assessment for the Proposed Cape Winelands Airport, Fisantekraal, Western Cape. GEOSS Report Number: 2023/07-03. GEOSS – South Africa (Pty) Ltd. Stellenbosch, South Africa.		
GEOSS Project Number	2023_09-5269		
Cover Photo	Photo captured during a GEOSS site visit		
Issue	Version	Date	Revisions
1	1.0 (Draft)	8 March 2024	-
2	1.1	9 September 2024	Updated development alternatives and desktop assessment, updated risk assessments and inclusion of a recommended GMP.
3	1.2	1 October 2024	Updated risk assessment.

Principal Author(s):

	Principal Author	Author 2	Author 3
Name	Shane Teek	Louis Jonk	Zita Harilall
Qualification	MEng	MSc (Geology)	MSc (Geology)
SACNASP No.	126397	121278	134005
Registration	Earth Science (Pr.Sci.Nat)	Earth Science (Pr.Sci.Nat)	Earth Science (Pr.Sci.Nat)

Principal Reviewer(s):

	Principal Reviewer
	
Name	Julian Conrad
Qualification	MSc (Hydrogeology)
SACNASP No.	400159/05
Registration	Earth Science (Pr.Sci.Nat)

Table of Contents

List of Tables

List of Figures

List of Maps

Abbreviations

ATM	Air traffic movements
BH	Borehole
BTEX	Benzene, toluene, ethylbenzene and xylenes
CGS	Council for Geoscience
CWA	Cape Winelands Airport
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water Affairs and Sanitation
EC	electrical conductivity
GA	General Authorisation
GA	general aviation
GRO	Gasoline Range Organics
L/s	litres per second
m	metres
m^3/ha/a	cubic metres per hectare per annum
mamsl	metres above mean sea level
mbch	metres below collar height
mbgl	metres below ground level
mm	millimetre
mm/a	millimetres per annum
mS/m	milli-Siemens per metre
NGA	National Groundwater Archive
SDP	site development plan
TDS	total dissolved solids
TOC	total organic carbon
TPH	Total Petroleum Hydrocarbons
UST	underground storage tank
WARMS	Water Authorisation and Registration Management System

Glossary of Terms

aquifer	a geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)].
borehole	includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
electrical conductivity	the ability of groundwater to conduct electrical current, due to the presence of charged ionic species in solution (Freeze and Cherry, 1979).
fractured aquifer	Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
intergranular aquifer	An aquifer in which groundwater is stored in and flows through open pore spaces in the unconsolidated Quaternary deposits.
groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e., the water table marks the upper surface of groundwater systems.

SPECIALIST EXPERTISE

CURRICULUM VITAE – Shane Teek

GENERAL

Nationality:	South African
Profession:	Geotechnical Specialist and Hydrogeologist.
Specialization:	Soil classification and characterization for determination of engineering properties. Geotechnical data analysis and interpretation; factual reporting. Groundwater exploration, development, sampling, and monitoring.
Position in firm:	Geotechnical Geologist & Hydrogeologist at GEOSS South Africa (Pty) Ltd.
Date commenced:	17 July 2021.
Year of birth & ID #:	1994 – 9404135162084.
Language skills:	English (good - speaking, reading and writing). Afrikaans (good - speaking, reading and writing).

KEY SKILLS

- Geotechnical investigations.
- Groundwater impact and contamination assessments.
- Compilation of factual and interpretative reports.
- Field mapping.
- Soil and rock profiling.
- Laboratory testing.
- Material classification and material use determination.
- Supervision of geotechnical contractors.
- Groundwater geophysics and conducting hydrocensus studies.
- Groundwater development - borehole drilling and test pumping supervision and analysis.
- Groundwater monitoring - development and analysis of groundwater level and quality data.
- Groundwater management - sustainable aquifer development and management.
- ArcGIS, QGIS, Python, FLAC/SLOPE, Midas GTS NX.

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2021	M.Eng. (Civil Engineering – Cum Laude)	University of Stellenbosch, South Africa.
2016	B.Sc. Hons. (Earth Science)	University of Stellenbosch, South Africa.
2015	B.Sc. (Geology: Earth Science)	University of Stellenbosch, South Africa.

Courses and symposiums

2021	Geotechnical Workshop (GSSA; course presenters: various including Prof Peter Day).
2018	Advanced Foundation Design (Course presenter: Prof Peter Day, Dr Marius de Wet).
2018	Advanced Geotechnics (Course presenters: Prof Peter Day, Prof Nico de Koker, Dr Richard Walls).
2018	Advanced Soil Behaviour (Course presenter: Dr Marius de Wet).
2018	GEO254 (Course presenter: Dr Nanine Fouché).
2018	GEO354 (Course presenter: Dr Marius de Wet).

EMPLOYMENT RECORD

July 2021 to present	GEOSS South Africa (Pty) Ltd, South Africa.
Jan 2020 to June 2021	Geotechnics Africa Western Cape, South Africa.
Feb 2019 to July 2019	Polytechnique Montréal, Canada.
Jan 2019 to Dec 2021	Geocroukamp, South Africa.
Jan 2017 to Dec 2017	Remote Exploration Services, South Africa.

CURRICULUM VITAE – Louis Jonk

GENERAL

Nationality:	South African
Profession:	Geotechnical Specialist
Specialization:	Soil classification and characterization for engineering purposes. Groundwater exploration and sampling.
Position in firm:	Geotechnical Geologist at GEOSS South Africa (Pty) Ltd.
Date commenced:	9 January 2023
Year of birth & ID #:	1993 – 9307215060088
Language skills:	English (good - speaking, reading and writing). Afrikaans (good - speaking, reading and writing).

KEY SKILLS

- Geotechnical investigations
- Compilation of factual reports.
- Field mapping.
- Soil and rock profiling.
- Material classification and material use determination.
- Supervision of geotechnical contractors.
- ArcGIS, QGIS, Python, FLAC/SLOPE; DotPlot

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2018	M.Sc. (Geology– Cum Laude)	Stellenbosch University, South Africa
2015	B.Sc. Hons. (Earth Science)	Stellenbosch University, South Africa
2014	B.Sc. (Geology: Earth Science)	Stellenbosch University, South Africa

Memberships/Organisations

- Geological Society of South Africa – Member No. 969970
- South African Council for National Scientific Professions (SACNASP) Mem. No. 121278/21
- Palaeontological Society of South Africa (PSSA)

EMPLOYMENT RECORD

Jan 2023 to present	GEOSS South Africa (Pty) Ltd, South Africa
April 2020 to Dec 2022	Council for Geoscience, South Africa
March 2019 to February 2022	JWGeotec (Pty) Ltd, South Africa
April 2018 to March 2020	Iziko Museums of South Africa, South Africa

CURRICULUM VITAE – Zita Harilall

GENERAL

Nationality:	South African
Profession:	Hydrogeologist
Specialization:	Groundwater impact and contamination assessments, groundwater management and monitoring including stable and radioisotope analysis.
Position in firm:	Hydrogeologist at GEOSS South Africa (Pty) Ltd
Date commenced:	November 2018
Language skills:	English (mother tongue) Afrikaans (average)

KEY SKILLS

- Groundwater impact and contamination – investigation and assessment of industrial activities on groundwater resources.
- Groundwater sampling and monitoring – development and implementation of groundwater monitoring and management programmes; analysis of groundwater level and quality (chemistry) data.
- Advanced chemistry monitoring and residence time determination – stable and radioisotope analysis.
- Writing of hydrogeological reports
- Conducting hydrocensus studies
- ArcMap / Geochemist's Workbench / WISH and typical software skills.

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2020	M.Sc. (Geology)	Stellenbosch University, South Africa
2017	B.Sc. (Hons) Earth Science	Stellenbosch University, South Africa
2016	B.Sc. Earth Science	Stellenbosch University, South Africa

Courses and symposiums

2016	Introduction to C++ (US)
2017	Introduction to Micromine (US)
2018	Introduction to R (AEON – NMU)
2018	ArcGIS and Spatial Statistics (AEON – NMU)
2019	International Symposium of Isotope Hydrology (IAEA) [poster]
2019	Groundwater Age Dating using Noble Gas Concentrations (US)
2020	International Association of Hydrogeologists (IAH)
2022	NICOLA: Resiliency, Nature and Climate Solutions: Striving for Sustainable Land Management
2023	International Association of Hydrogeologists (IAH) – 50th Annual Congress
2024	Water Governance in South Africa

Memberships/Organisations

- South African Council for National Scientific Professions (SACNASP) – Mem. No. 134005 (Pr.Sci. Nat)
- Groundwater Division (GWD) of the GSSA – Mem No. 2742/22
- Network for Industrially Contaminated Land in Africa (NICOLA) – Mem No. NM60b/2022
- Golden Key Honours Society

EMPLOYMENT RECORD

January 2023 – present:	GEOSS South Africa (Pty) Ltd, Stellenbosch *Project Hydrogeologist: Impact and Contamination Business Unit Leader*
January 2020 – December 2022:	GEOSS South Africa (Pty) Ltd, Stellenbosch *Project Hydrogeologist*
November 2018 – December 2019:	GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd, Stellenbosch *Student Hydrogeologist*

SPECIALIST DECLARATION

We, Shane Teek, Louis Jonk and Zita Harilall, as the appointed independent specialist(s) hereby declare that we:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to our specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- are fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- are aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

GEOSS South Africa (Pty) Ltd
Shane Teek
Pr.Sci.Nat (126397)
01 October 2024

GEOSS South Africa (Pty) Ltd
Louis Jonk
Pr.Sci.Nat (121278)
01 October 2024

GEOSS South Africa (Pty) Ltd
Zita Harilall
Pr.Sci.Nat (134005)
01 October 2024

1 Introduction

GEOSS South Africa (Pty) Ltd was appointed to conduct a groundwater impact assessment for the proposed Cape Winelands Airport (CWA) in Fisantekraal, Western Cape, to determine whether the proposed development will have an impact on the groundwater resources in the area. The study site is located north of the R312 (Lichtenburg Road), between the R302 and the R304. The surrounding area is predominantly zoned for agriculture. A locality map is presented in **Map 1**. A topocadastral map illustrating the land uses is presented in **Map 2**.

2 Scope of Work

The objectives of the impact assessment are to assess the hydrogeological setting, and ascertain whether the proposed development options pose a risk to groundwater in the area. There are a number of key steps for reaching the objective, these include:

Task 1: Obtaining all relevant data to the project i.e., obtaining data from relevant groundwater databases, relevant geological and geohydrological maps as well as site development plans for the proposed development.

Task 2: Complete a site visit entailing a hydrocensus of boreholes in the area in order to measure yields and water quality (pH, EC and TDS). Samples will be sent to an accredited laboratory for a chemical analysis.

Task 3: Analyse the data using hydrogeological methods and address the questions raised in the project objectives as set out by the client.

Task 4: Identify and evaluate all the risks associated with the development to groundwater resources and users.

Task 5: Documenting all the available data into a comprehensive report, including indicating areas of concern.

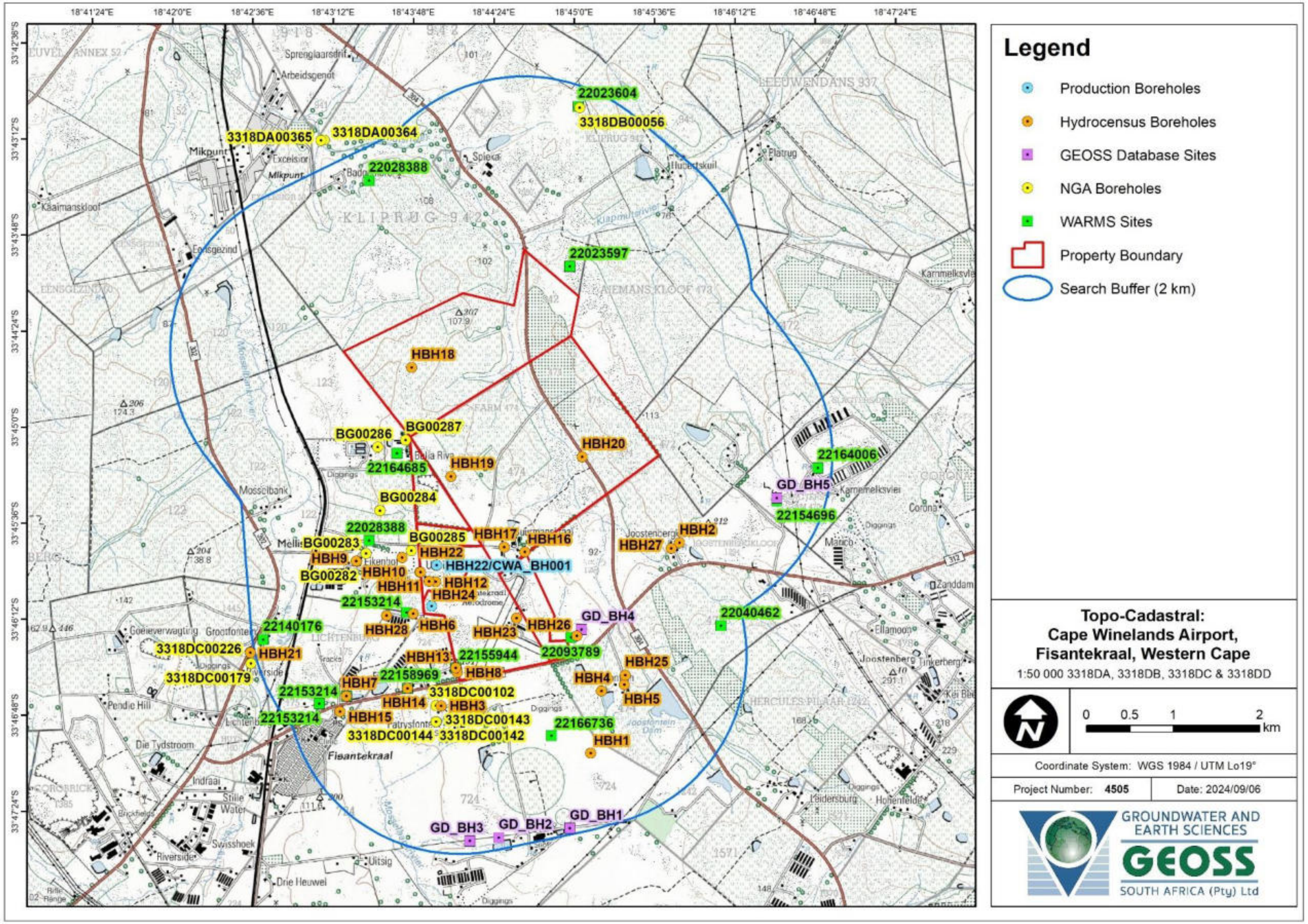
The assessment has been conducted in accordance with accepted best practice principles, particularly DEA&DP Guidelines for involving Hydrogeologists in the EIA Process (June 2005).

3 Methodology

The procedure adopted for this study involved a desktop study followed by a site visit. The initial desktop study involved obtaining and reviewing all relevant data for the project. This included reviewing relevant site plans, reports and geological maps of the area and analysing data from multiple groundwater databases, which included information on groundwater yield and quality.

A site visit was then conducted to collect additional data and verify as much of the existing data as possible. This included undertaking a hydrocensus and noting any subsurface conditions where possible. All collected data was analysed and interpreted to assess the potential risks associated with the intended site development as they pertain to groundwater.

Map 1: Locality map indicating the location of the proposed Cape Winelands Airport, Fisantekraal, Western Cape.



Map 2: The study site with the property boundary, hydrocensus, NGA, and WARMS boreholes superimposed on a 1:50 000 scale topocadastral map (3318DA, 3318DB, 3318DC & 3318DD).

4 Regional Setting

4.1 Site Context

The study area is situated in Fisantekraal, located approximately 13 kilometres northeast of Durbanville, and 25 km northeast of Cape Town International Airport (**Map 1**). The area earmarked for development covers a number of land parcels, namely:

- Portion 10 of Farm 724 Joostenberg Vlakte
- Portion 4 of Farm 474 Joostenberg Kloof
- Remainder of Farm 724 Joostenberg Vlakte
- Portion 7 of the Farm 942 Kliprug
- Remainder of Farm 474 Joostenberg Kloof
- Portion 23 of Farm 724 Joostenberg Vlakte

The study site is located north of the R312 (Lichtenburg Road), between the R302 and the R304. The surrounding area is predominantly zoned for agriculture. The site is mainly surrounded by agricultural farms, livestock farms and poultry farms. Some areas are also used for recreational activities and a waste water treatment facility (WWTF) is also located to the northwest of the boundary.

There are two rivers that flow toward the northwest. The Klapmuts River passes the CWA to the north, and the Mosselbank River passes the CWA on the western side. **Map 2** shows a more detailed view of the study site with relevant information (hydrocensus borehole positions on and near the property discussed in **Section 7**) superimposed on a 1:50 000 topocadastral map.

4.2 Site History

The site, originally known as Fisantekraal Airfield, was constructed around 1943. The site served as an operational base for the South African Airforce until the war concluded in 1945 (Aikman Associates, 2020; Cape Winelands Aero, 2024). The site was then operated as an airfield under state control with facilities leased for private pilot training facilities. The site was transferred into private ownership in 1993 (Aikman Associates, 2020) and has since served as a general aviation facility, however, private and corporate aircraft occasionally make use of the airfield for passenger transport (Cape Winelands Aero, 2024). The airfield was acquired by Cape Winelands Airport Limited in 2020 and is now earmarked for further development.

4.3 Topography

The topography of the site and surrounds is characterised by rolling hills. The typical on-site elevation is between 90 - 120 m above mean sea level (mamsl). The site is situated in quaternary catchment G21E which has a general authorisation of 150 m^3/a.

4.4 Climate

The Fisantekraal area experiences a Mediterranean climate with mild, wet winters and warm, dry summers. **Figure 1** shows the monthly average air temperature and **Figure 2** shows the monthly median rainfall and evaporation distribution for the Fisantekraal area (Schulze, 2009). The long term (1950 – 2000) mean annual precipitation for the Strand area is 532 mm/a. The rainfall typically exceeds evaporation rates in the winter months between May and August.

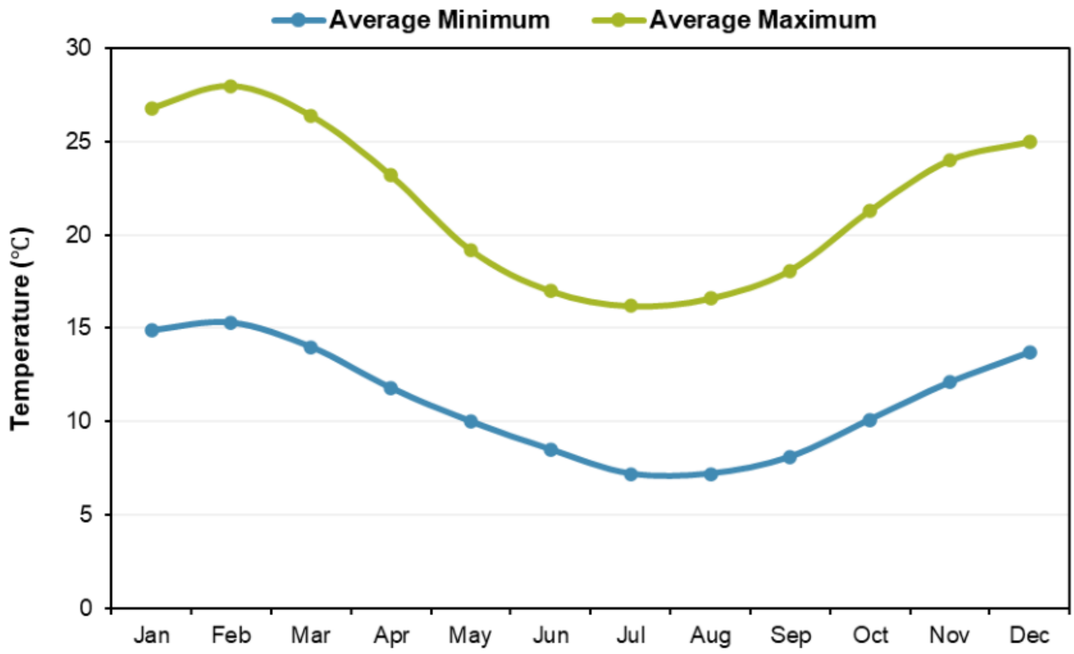


Figure 1: Monthly average minimum and maximum air temperatures for the study area (Schulze, 2009).

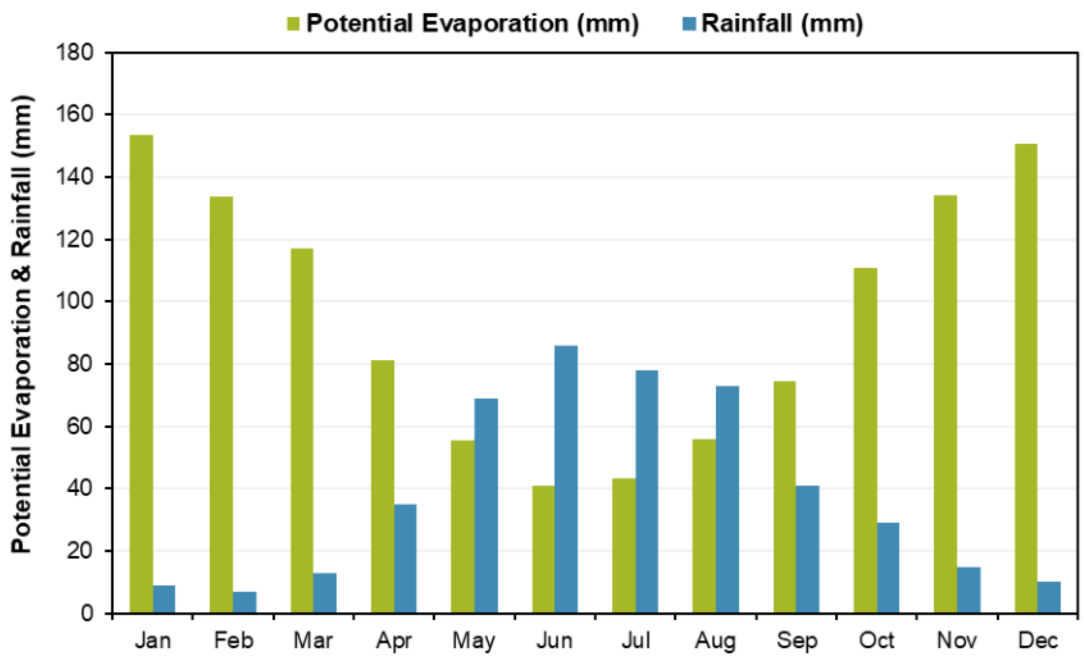


Figure 2: Monthly average rainfall and evaporation distribution for the study area (Schulze, 2009).

4.5 Proposed Development

The existing footprint of the airfield covers approximately 150 ha. Several of the neighbouring properties have been acquired, therefore taking the proposed development area up to 660 ha. The development will comprise a combination of mixed office, retail, aircraft hangers of varying sizes, parking spaces, heliports, commercial buildings, hotels, terminal buildings and administrative buildings with a total estimated building area of 395 000 m^2 (Zutari, 2024). There are currently three development options that are being investigated for the current study site (CWA Ltd, 2024):

1. Alternative 1: No-go Option (No further development)
2. Alternative 2: Initial Preferred Alternative (Expansion of the site)
3. Alternative 3: New Preferred Alternative (Expansion of the site)

All development options are presented in **Appendix A**. These development options are briefly discussed in the sections below.

4.5.1 Alternative 1: No-go Option

There are currently four concrete strips that are 90 m in width, each in varying lengths between 700 m and 1 500 m (Figure 1). The information presented in this section is based on the Cape Winelands Airport Development Project Description (CWA Ltd, 2024). Details for the existing runways are detailed in **Table 1** and illustrated in **Figure 3**.

Table 1: Details for the current runways at Cape Winelands Airport (CWA Ltd, 2023)

Runway	Length (m)
Runway 01-19	1 080
Runway 03-21	1 454
Runway 05-23	1 050
Runway 14-32	1 230

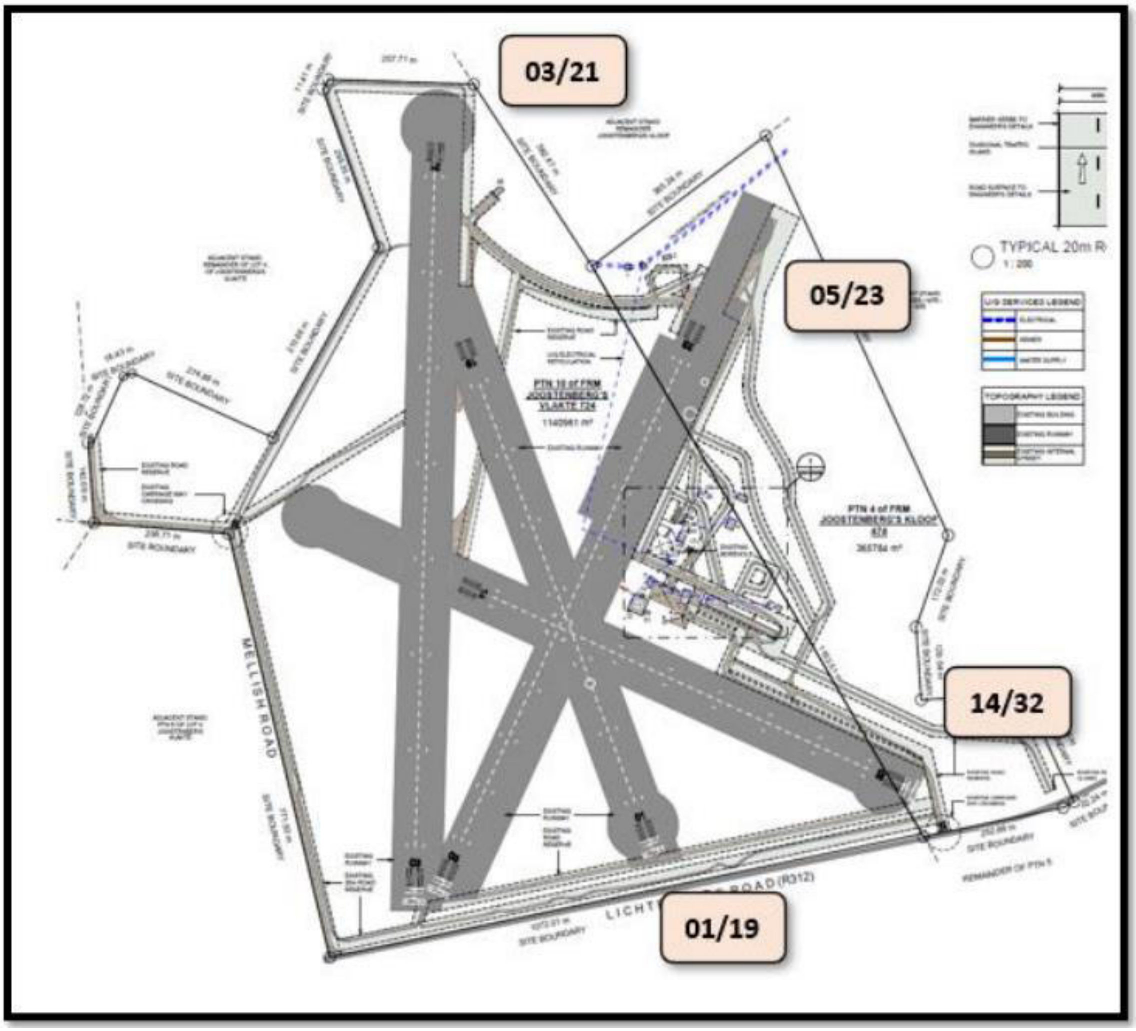


Figure 3: Current site layout indicating the four existing concrete strips (No-go development option)

The first alternative is not considered to be viable as it does not create any value to the region, various stakeholders, customers and the communities (CWA, 2023b). The assessment of the second and third alternatives are currently preferred as it will provide improved infrastructure, service delivery and value to the region, stakeholders, customers and the communities. The detailed feasibility study discussing the three development alternatives are documented in the Runway Alternatives Report (Version 4) (CWA Ltd, 2024).

4.5.2 Alternative 2: Initial Preferred Alternative

The 'initial preferred alternative' development option is planned to occur over two phases. The Phase 1 and Phase 2 plans for the initial preferred development alternative have been provided in **Figure 4** and **Figure 5**, respectively.

During Phase 1 of this development alternative, the following runways will be included:

- Primary Runway at orientation 01-19 and length of 3 500 m, Code 4F Runway (45 m wide) .
- Secondary Runway at orientation 14-32 and length of 700 m, Code 1A Cross Runway (18 m wide). This runway is an existing runway and will enable light aircraft operations.

During Phase 2 of this development alternative:

- The secondary runway (14-32) will be decommissioned.

The main characteristics of the planned runways are as follows:

Table 2: Dimensions of two runways in Phase 1 (CWA Ltd, 2023)

Runway designation	RWY length (m)	RWY width (m)	RWY shoulders width	Overall width (m)
01-19	3 500	45	2 x 15 m	75
14-32	700	18	-	18

Source: NACO

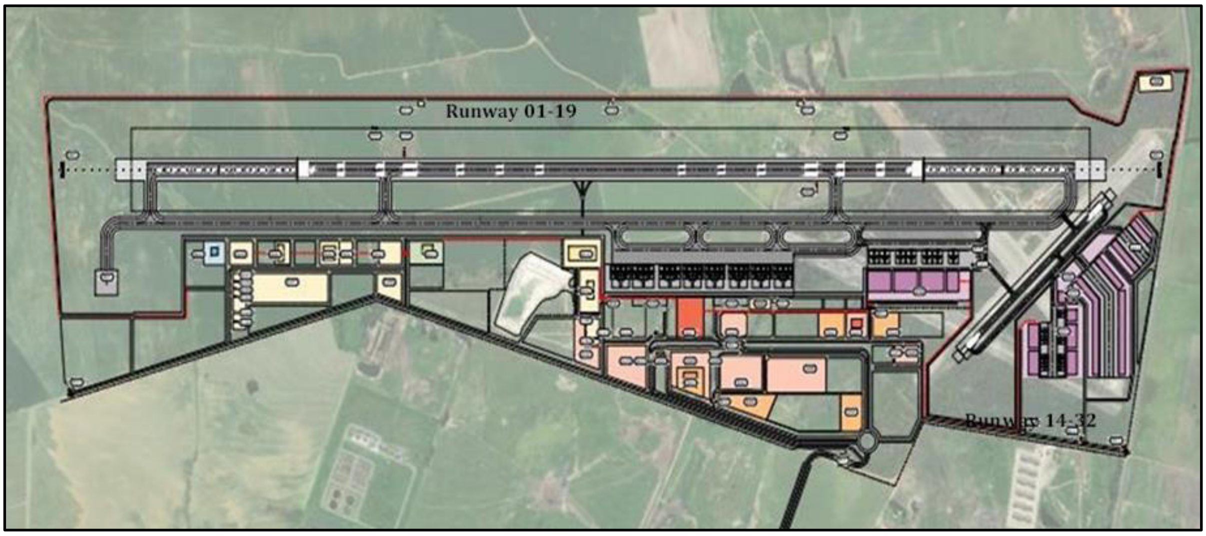


Figure 4: Initial Preferred Development Option (Phase 1) for the CWA (CWA Ltd, 2023b).

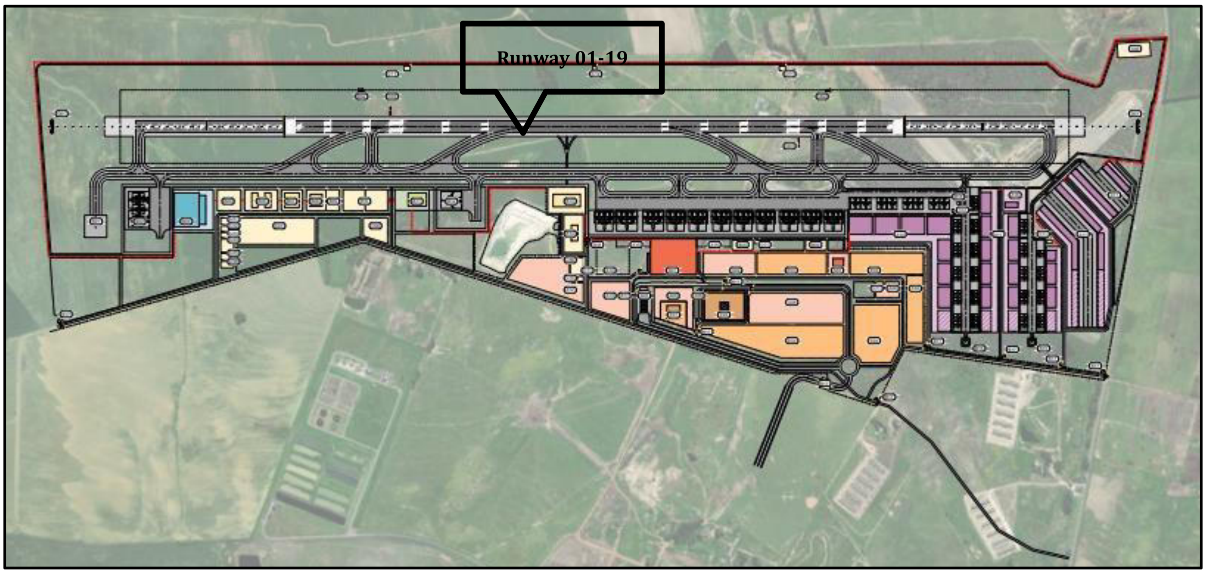


Figure 5: Initial Preferred Development Option (Phase 2) for the CWA (CWA Ltd, 2023b).

4.5.3 Alternative 3: New Preferred Alternative

The 'new preferred alternative' development option will host the same precincts mentioned in Alternative 2 with the main difference being that the secondary runway (14-32) will no longer be included in the development. The Phase 1 and Phase 2 plans for the new preferred development alternative have been provided in **Figure 6** and **Figure 7**, respectively.

During Phase 1 of this development:

- The airport will comprise of only one runway which will be at an orientation of 01-19 and a length of 3.5 km (details in **Table 2**) and will be constructed to serve up to Code 4F instrument operations. This runway will be shared by all operators, including scheduled commercial as well as general aviation where intersection take-off points will be introduced on the runway to improve efficiency for general aviation operations (CWA Ltd, 2024).

During Phase 2 of this development:

- The airport development will focus on the continued development of the various precincts with the main runway shared by all operators, including scheduled commercial as well as general aviation (CWA Ltd, 2024).

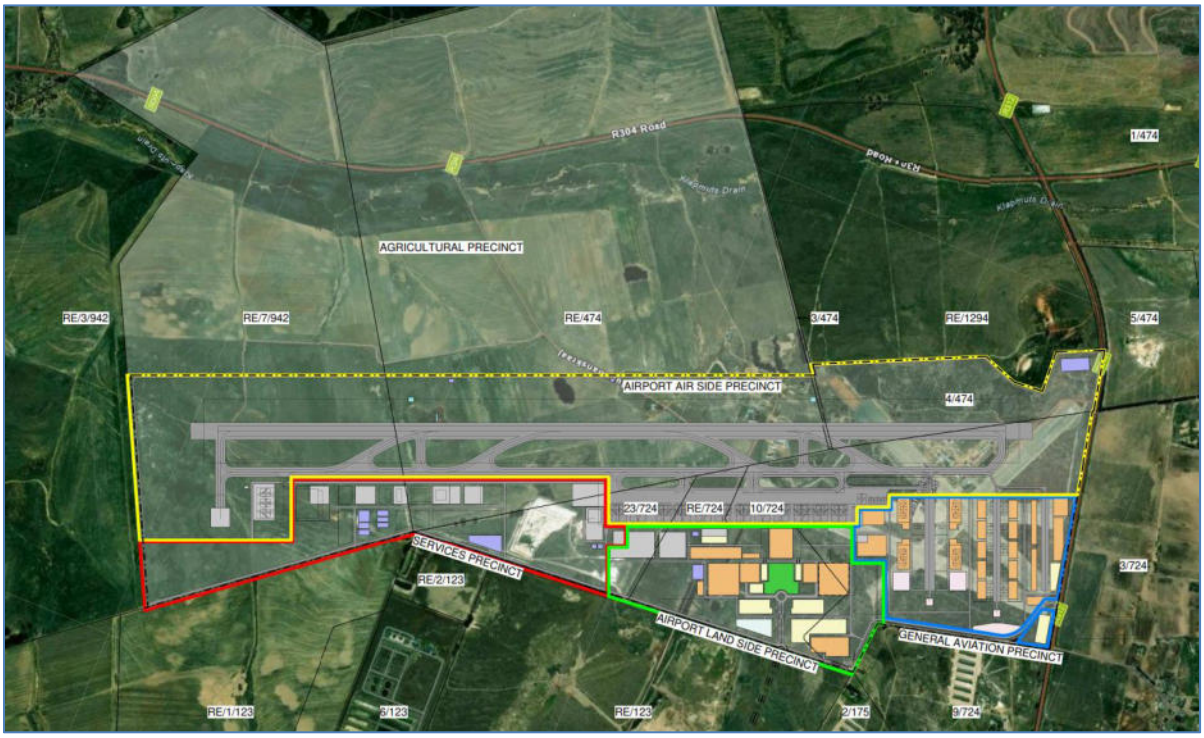


Figure 6: New Preferred Development Option (Phase 1) for the CWA (CWA Ltd, August 2024).

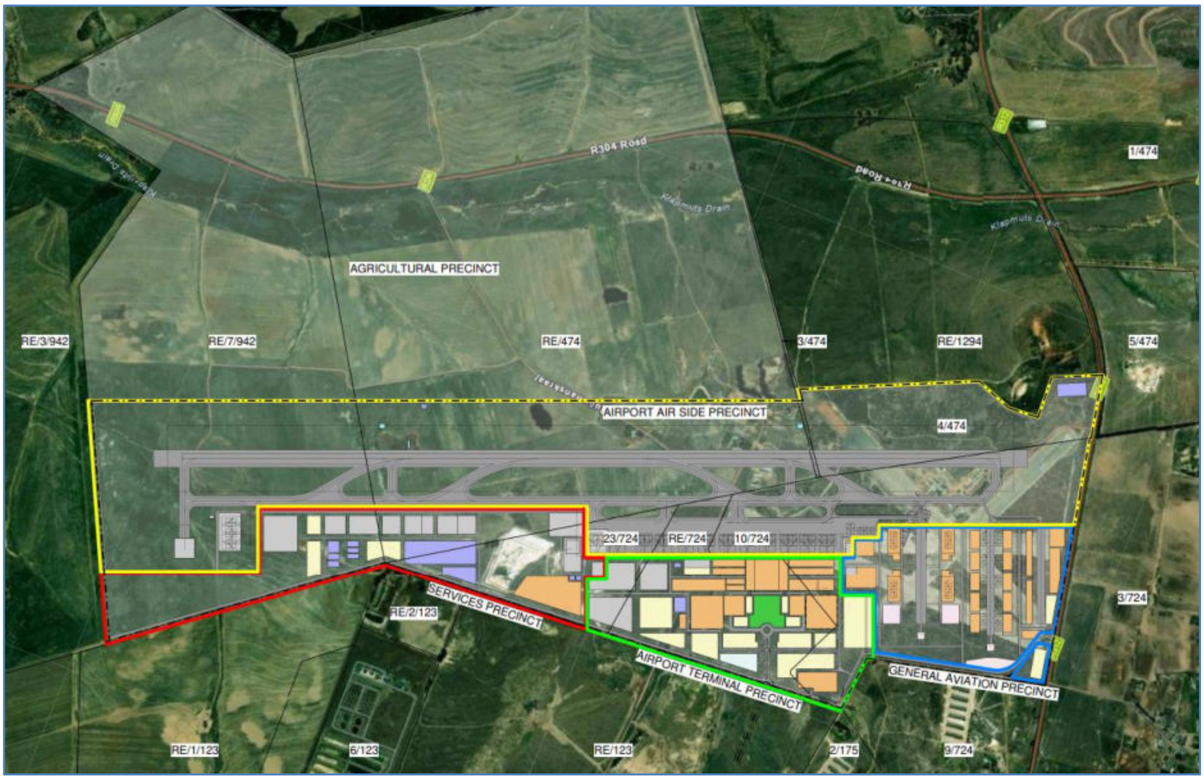


Figure 7: New Preferred Development Option (Phase 2) for the CWA (CWA Ltd, August 2024).

Proposed development of either Alternative 2 or Alternative 3 will have five main precincts (H & A Planning, 2024):

- Agricultural precinct
  - This is the largest precinct and makes up 53% of the site. The precinct will be used for active farming. The available land is large enough to be farmed on its own, but will most likely be rented out to farmers
- Airport airside precinct
  - This is a highly regulated and secured area. Vehicular and pedestrian access will be strictly controlled and all the activity in this precinct relates to aircraft movement and loading/unloading of freight and passengers.
- General aviation precinct
  - The precinct services all non-scheduled aviation including recreational, training, chartered, crop spraying, firefighting and private business. The heliport is also included in this precinct.
- Airport terminal precinct
  - This is the public face of the airport.
- Services precinct
  - This precinct will accommodate the utility services and avionic infrastructure required for the airport. The infrastructure uses include Aircraft Rescue and Fire Fighting (ARFF), Control Tower, Ground Support Equipment (GSE) maintenance, the WWTW, the biogas plant, electrical substations and the fuel farm.

4.5.3.1 RUNWAYS, TAXIWAYS & ASSOCIATED AIRSIDE INFRASTRUCTURE

The aerodrome has been designed to comply with the International Civil Aviation Organization (ICAO) Annex 14 Standards and Recommended Practices (SARPs) for a runway with an Aerodrome Reference Code 4F and Precision Approach CAT II/III procedures. The development options will include the following:

- Primary Runway: 3 500 m Code 4F Runway (45 m wide)
- Parallel Code 4F Taxiway
- Link Taxiways
- Apron Taxiway
- Apron
- Isolation Stand
- Secondary Runway: 700 m Code 1A Cross Runway (18 m wide) (Development Alternative 2 only)
- Code 1 Link Taxiways (Development Alternative 2 only)
- Airside Perimeter/ Equipment Roads
- Airside Perimeter Fence

This is inclusive of drainage, pavement structures, paint markings and earthworks along with considerations aircraft tracking, jetblast impact, hydroseeding requirements.

Roads
Tarred roads will be required on site for use by tenants and the public, including fuel tank trucks. Exact lengths required are still to be determined.

Stormwater line
CWA will be making use of the quarries to the north as a stormwater facility, which will require some reticulation.

Hangars
Prospective tenants who require the safekeeping and storage of aircraft will require a hangar. These hangars will either be in the shape of a T (a "T-hangar"), or in square/rectangular shape with dimensions as required by a prospective tenant. They will be constructed out of mostly light-weight steel where possible.

Aprons
Each hangar will be joined by an apron which is a concrete parking area for planes located directly in front of a hangar.

Commercial/Industrial/Retail facilities
Operators based at Cape Winelands Airport will require facilities to conduct their operations. These facilities will be a mix of commercial office space, industrial warehousing/light-manufacturing, or retail space. These requirements are dependent on each operator's needs and therefore some will be in standalone facilities, and other within the terminal and/or other buildings.

Hotel/Accommodation
Accommodation will be required to house students enrolled in the various flying schools who reside outside of the city/country.

Control Tower
A control tower is to be constructed for use by the Air Traffic Control function. Discussions are currently underway with service providers to perform this role remotely using high-definition cameras, in which case a traditional brick-and-mortar control tower may not be necessary.

Rescue & Firefighting
Facilities are required in order to house the rescue and firefighting function of the airport. These would comprise a secure area for the vehicles, as well as office/crew area for the staff. Water tanks are also required to fill up water trucks if necessary. It is expected that the airport will upgrade to a "Category 4" airport in terms of its rescue & firefighting capability at first, and upgrade as and when needed in line with the size of the aircraft that are operating at CWA.

Terminal
A boutique passenger terminal will be constructed for Phase 1. This will handle the processing, screening, separation and baggage handling of arriving and departing passengers. Included will be space for retail shops and restaurants.

Aviation Fuel Farm
A multi-tank fuel farm will be required to store aviation fuel. These include Jet A-1, Avgas (aviation gasoline), and Mogas (95 unleaded petrol). It is anticipated that the development will require the following storage capacities (Kantey and Templer, 2024):

- Jet A-1 – 10 x 80 m^3 horizontal tanks and 3 x 350 m^3 vertical storage tanks
- Avgas – 2 x 30 m^3 and 1x 9 m^3 double-walled horizontal tanks,

The fuel above will most likely be stored in above-ground containerized tanks. However, mobile bowsers and fuel truck will also be used to provide refuelling capabilities at an aircraft's hangar.

Retail Service Station
A service station has been proposed to supply petrol and diesel from one of the major oil companies. This will include a convenience store, quick service restaurant. It is anticipated that the following storage capacities will be required (Kantey and Templer, 2024):

- 100 m^2 building (small shop, staff room, refuse room, etc.)
- Forecourt with two island structural steel canopies, complete with pump and tank installation, paving, site lighting, spill slabs, pollution collection tanks, compressor, etc.
- 4x 23 m^3 underground storage tanks (USTs)

Outdoor Media
Large signage/billboards are being considered which will be used for commercial advertising purposes.

4.5.4 Development Phases

Several phases of development are planned for the proposed development by the most recent Cape Winelands Airport Project Description (CWA Ltd, 2024). This includes construction prior to the planned opening of the Cape Winelands airport in mid-2027 (Phase 1), and the final phase (Phase 5) being scheduled for 2050.

5 Regional Geology

The Geological Survey of South Africa (now the Council for Geoscience) has mapped the area at 1:250 000 scale (3318, Cape Town). The main geology of the area is listed in **Table 3** and the geological setting is shown in **Map 3**.

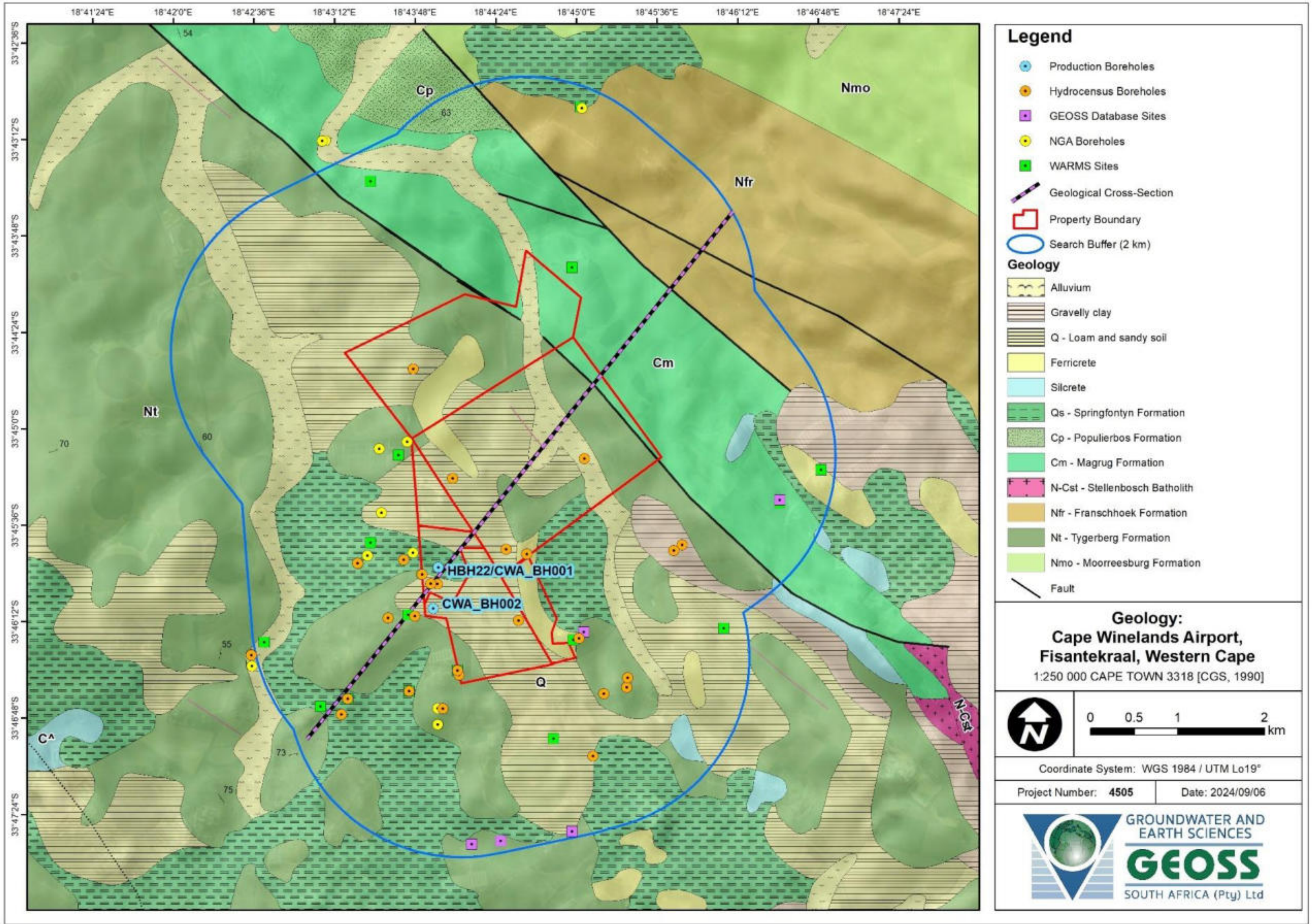
Table 3: Geological formations within the study area

Code	Formation/Pluton	Group/Suite	Description
~	Alluvium	Quaternary	Unconsolidated sand
Qgg	-		Gravelly clay/loam soil
Qg	-		Loam and sandy loam
Qf	-		Limestone and calcrete
Qs	Springfontyn Formation		Light-grey to pale red sandy soil
Cpo	Populierbos Formation	Klipheuwel	Shale, mudstone and sandy shale, mainly reddish
Cm	Magrug Formation		Conglomerate, grit and sandstone, often reddish brown
Nf	Franschhoek Formation	Malmesbury	Grey, feldspathic conglomerate, grit and sandstone, with minor shale
Nt	Tygerberg Formation		Greywacke, phyllite and quartzitic sandstone, interbedded lava and tuff
Nm	Moorreesburg Formation		Greywacke and phyllite with beds and lenses of quartz schist, limestone and grit; quartz-sericite schist with occasional limestone lenses

The geology underneath the proposed Cape Winelands Airport is shale of the Tygerberg Formation (Nt) which is part of the Malmesbury Group, and it is the basement rock of the area. Regionally, the Malmesbury Group is overlain by different Quaternary formations (Qgg, Qg, Qf and Qs).

Based on drilling information in the surrounding area, it has been observed that boreholes in the surrounding area had a general geological log that started with overburden and clay between 0 – 40 m, followed by weathered bedrock between 40 – 60 m), followed by bedrock (shale, sandstone, greywacke, phyllite).

A regional fault structure (the Colenso Fault) is mapped along the northeastern boundary of the Cape Winelands Airport. This fault structure stretches from Langebaan through to just north of Stellenbosch, and is believed to be as wide as ~7 km in places (Kisters et al., 2002). A conceptual geological cross section based on literature is presented in **Figure 8**. Materials that appear to have been derived from the Cape Granite Suite also appear to be present in the area (GEOSS, 2022b; Stapelberg, 2009).



Map 3: Geological setting of the area with the hydrocensus, NGA and WARMS boreholes and cross-section line indicated (3318 – Cape Town).

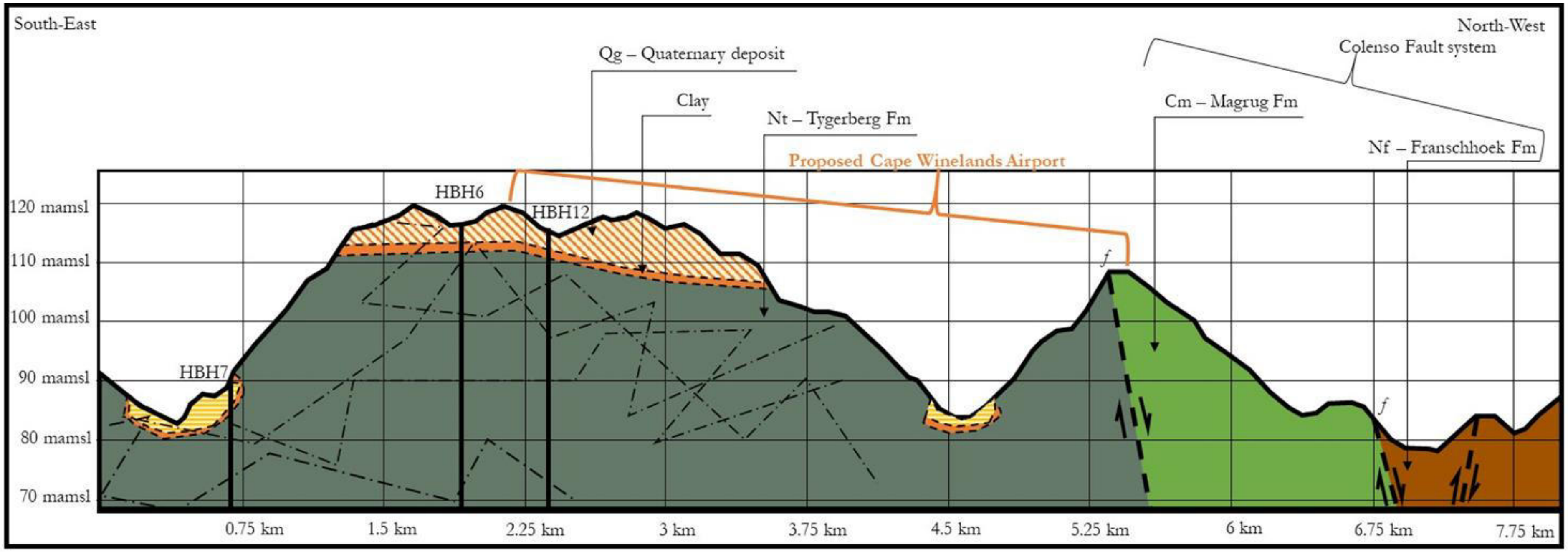


Figure 8: Schematic and conceptual southeast to northwest cross section.

6 Regional Hydrogeology

The aquifer yield and aquifer quality classifications are based on regional datasets, and therefore, only provide an indication of conditions to be expected.

6.1 Aquifer Yield

According to the 1 : 500 000 scale groundwater map of Cape Town (3318), the study area hosts a **fractured aquifer** with an average **borehole yield in the range of 0.5 – 5.0 L/s** (DWAF, 2002) (**Map 4**). A fractured aquifer describes an aquifer where groundwater only occurs in narrow fractures within the bedrock and is most likely associated with the Tygerberg Formation in the area.

6.2 Aquifer Quality

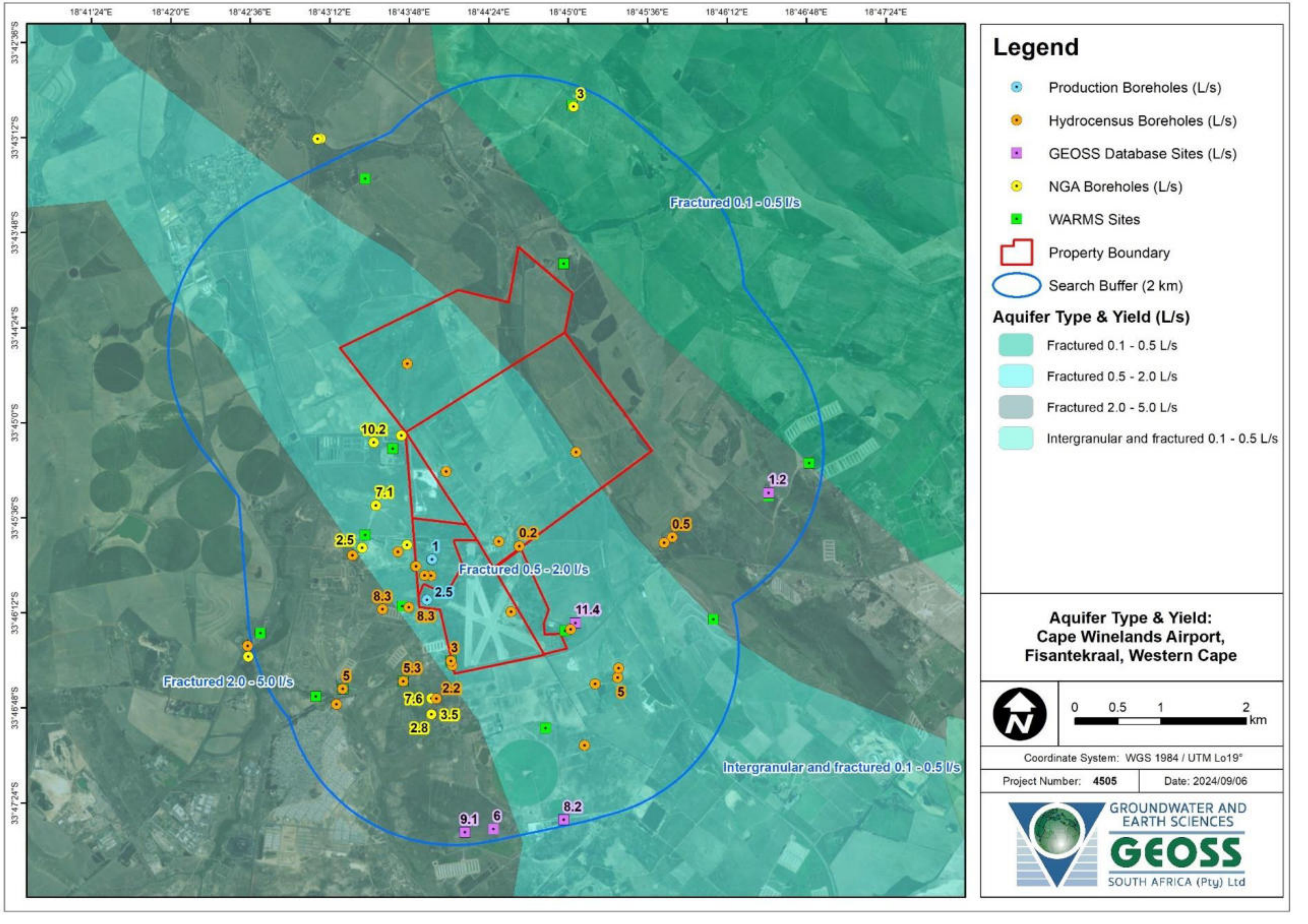
Electrical conductivity (EC) is a measure of the ability of the groundwater to conduct electricity. EC is directly related to the concentration of dissolved ions in the water and this parameter is used as an indication of groundwater quality. The groundwater map indicates that the aquifer has electrical conductivity values in the range of 70 – 1 000 mS/m (**Map 5**) (DWAF, 2002). Better quality water is observed in the north-western area with values ranging between 70 – 300 mS/m. Poorer water quality is observed in the south-eastern area with values ranging between 300 – 1 000 mS/m (Map 6) (DWAF, 2002). In terms of domestic water standards (DWAF, 1998), water quality in the area ranges from **good** (Class I) (70 – 150 mS/m) to **dangerous** (Class IV) (>520 mS/m).

6.3 Aquifer Vulnerability Classification

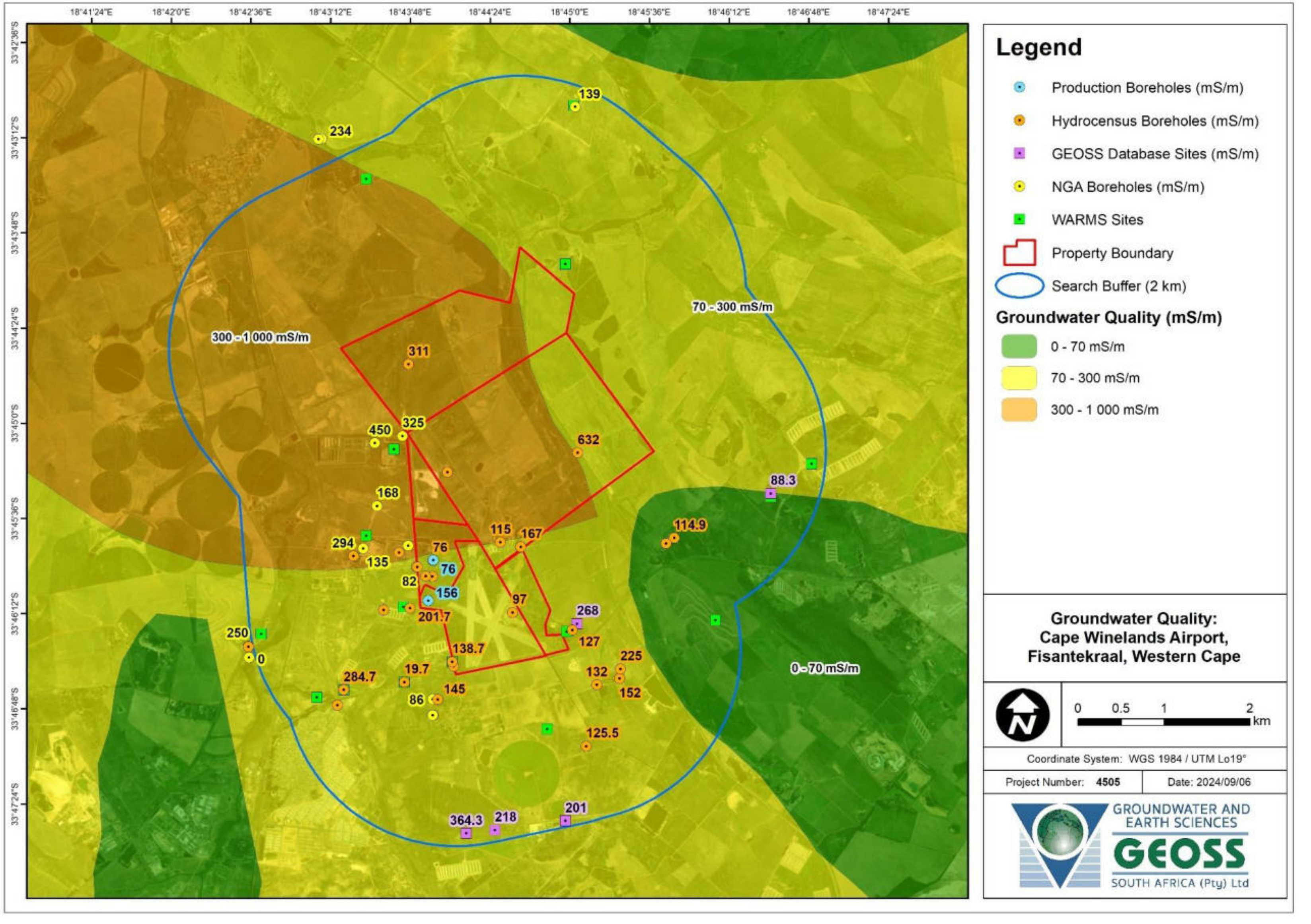
The national scale groundwater vulnerability map, which was developed according to the DRASTIC methodology (Conrad and Munch, 2007), indicates that the study site has a "**low**" to "**medium**" vulnerability to surface-based contaminants (**Map 6**). This vulnerability rating is linked to the host geology. The DRASTIC method considers the following factors:

D	=	depth to groundwater	(5)
R	=	recharge	(4)
A	=	aquifer media	(3)
S	=	soil type	(2)
T	=	topography	(1)
I	=	impact of the vadose zone	(5)
C	=	conductivity (hydraulic)	(3)

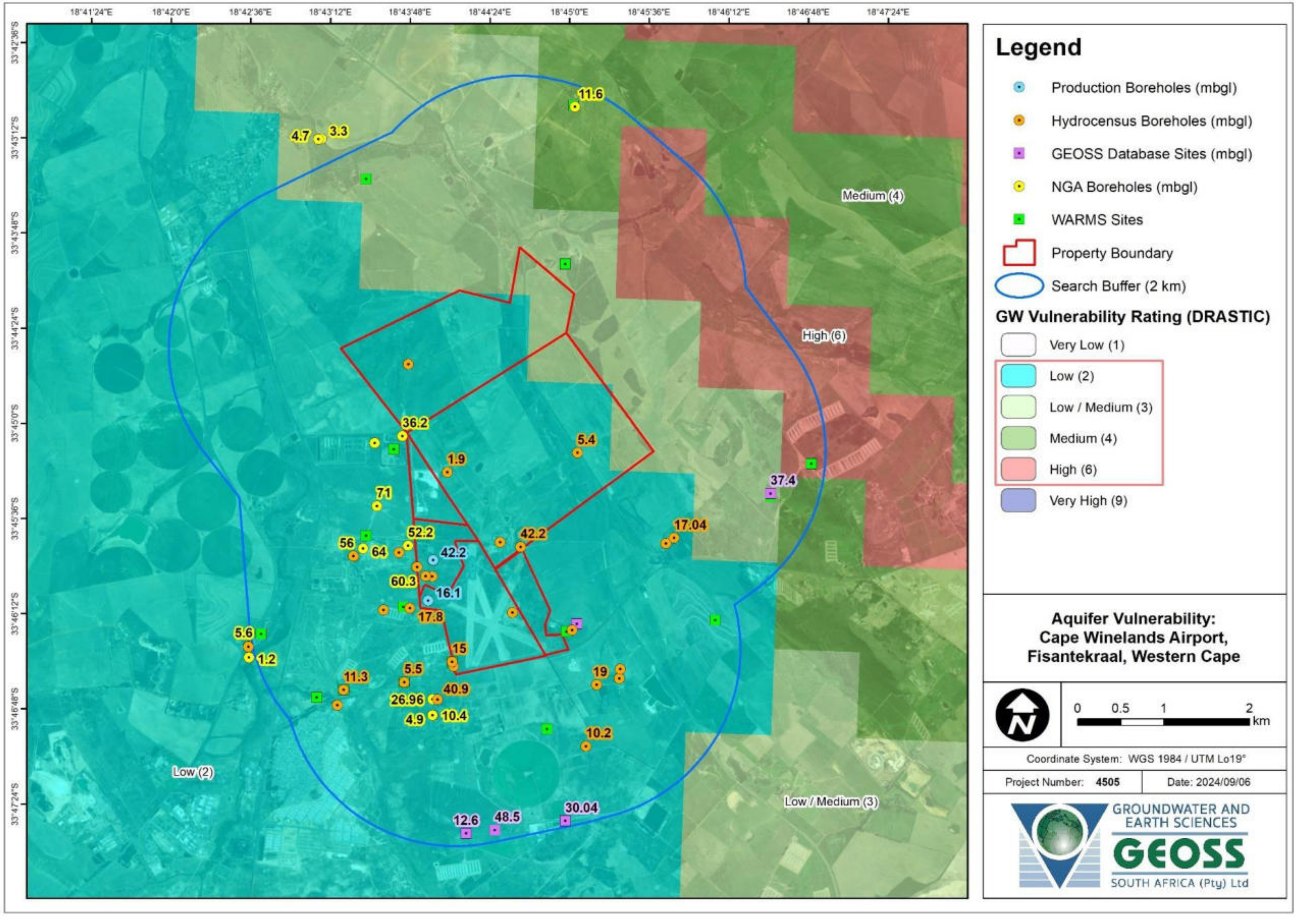
The number indicated in parenthesis after each factor description, is the weighting or relative importance of that factor. The low to medium vulnerability classification indicates that the susceptibility of the aquifer to contamination from anthropogenic activities, is relatively low. This classification is due to the fact that the Malmesbury Group rock weathers to clay. Clays are typically associated with lower permeability, retarding the migration of potential contaminants and offering protection to potentially underlying aquifers. However, it must be noted that the vulnerability does increase to the north-east where the Colenso Fault system is located. This area should be considered as a sensitive area in terms of groundwater.



Map 4: Regional aquifer yield (L/s) (DWAF, 2002) and reported borehole yields.



Map 5: Regional groundwater quality (EC in mS/m) from DWAF (2002) indicating reported EC values.



Map 6: Regional groundwater vulnerability from Conrad and Munch (2007) showing locations and water levels of boreholes

7 Site Specific Information

7.1 Desktop Assessment (Existing Groundwater Information)

To determine whether there are any groundwater users in the area that may be affected by activities on site, a database search was conducted using a 2-km radius around the site. This portion of the study was completed by obtaining groundwater information from existing databases. A search was conducted on a number of databases, namely the National Groundwater Archive (NGA), the Water Use Authorisation and Registration Management System (WARMS) database as well as the internal GEOSS database. These resources provide data on borehole positions, groundwater chemistry and yield, when available. The desktop assessment was initially conducted in January 2022 and updated in subsequent revisions of the hydrogeological scoping report and the draft impact assessment report. This section has been updated again and data available to GEOSS until 6 September 2024 was used. Based on the desktop assessment of the various databases, there are a number of groundwater users in the area surrounding the site, particularly to the southwest and southeast.

7.1.1 National Groundwater Archive (NGA) Database

Assessment of the National Groundwater Archive (NGA) database, which provides data on borehole and wellpoint positions, groundwater level, chemistry and yield, indicated that there are 16 boreholes wellpoint located within a 2-km search area of the site. The NGA sites are indicated on **Map 7** and summarised in **Table 4**.

Table 4: Summary of NGA borehole/wellpoint details.

Site ID	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Water Level (mbgl)	Yield (L/s)	EC (mS/m)	Depth (m)	Lithology
BG00282	-33.76409	18.72275	56.00	-	294	100.00	-
BG00283	-33.76328	18.7239	71.88	2.53	135	93.38	-
BG00284	-33.7588	18.72564	71.00	7.12	168	77.40	-
BG00285	-33.76298	18.72955	52.2	-	-	61.00	-
BG00286	-33.7522	18.72539	41.34	10.17	450	60.46	-
BG00287	-33.75148	18.72887	36.23	-	-	90.00	-
BG00288	-33.76524	18.7306	60.34	-	82	100.00	-
3318DC00102	-33.77912	18.73259	26.96	7.6	86	36.96	-
3318DC00142	-33.78079	18.73259	-	-	-	68.58	Clay
3318DC00143	-33.78079	18.7326	10.36	3.46	-	0-34.14 34.14-96.01	Clay Sandstone
3318DC00144	-33.7808	18.73259	4.88	2.77	-	0-39.32 39.32-78.03	Clay Sandstone
3318DA00364	-33.72022	18.71882	3.33	-	234	60.96	-
3318DA00365	-33.72023	18.71843	4.68	-	-	60.96	-
3318DC00226	-33.77349	18.70946	5.56	-	250	-	-
3318DC00179	-33.77467	18.70954	1.24	-	517	6.50	-
3318DB00056	-33.71690	18.750650	11.6	3.00	139	91.00	-

**Database accessed on 5 September 2024*

The NGA database indicates that the groundwater quality ranges from 82 mS/m to 517 mS/m, which is in line with the regional mapping (DWAF, 2002). The boreholes are generally deep, typically exceeding 60 m. The water levels range from shallow to deep (from 1.24 mbgl to 71 mbgl). The yields that are reported range from 2 L/s to 10 L/s and the lithology is indicated to be clay between 0 - 70 m followed by sandstone. It must be noted that the NGA data is not always accurate, and it is therefore used in conjunction with site data to help conceptualise the hydrogeological setting.

7.1.2 Water Use Authorisation and Registration Management System (WARMS) Database

Assessment of the Water Use Authorisation and Registration Management System (WARMS) Database revealed that there are 16 registered boreholes within 2-km of the study site. Only active and registered sites were included. Water use in the area includes irrigation, livestock watering and urban use. The borehole details are listed in **Table 5** and are presented in **Map 7**.

Table 5: Summary of WARMS borehole details.

WARMS_ID	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Use
22023597	-33.733434	18.749368	Industry (Urban)
22023604	-33.716772	18.750478	Industry (Urban)
22028388	-33.724440	18.724440	Agriculture: Livestock
22028388	-33.761926	18.724300	Agriculture: Irrigation
22040462	-33.770878	18.768118	Agriculture: Livestock
22093789	-33.772070	18.749418	Schedule 1
22140176	-33.772194	18.711083	Agriculture: Irrigation
22153214	-33.769426	18.728956	Agriculture: Livestock
22153214	-33.778090	18.721430	Agriculture: Livestock
22153214	-33.778889	18.718056	Agriculture: Livestock
22154696	-33.757920	18.775100	Agriculture: Livestock
22155944	-33.775183	18.735044	Agriculture: Livestock
22158969	-33.777314	18.729019	Agriculture: Livestock
22164006	-33.754463	18.780229	Agriculture: Livestock
22164685	-33.752858	18.727801	Agriculture: Livestock
22166736	-33.782295	18.746968	Agriculture: Irrigation

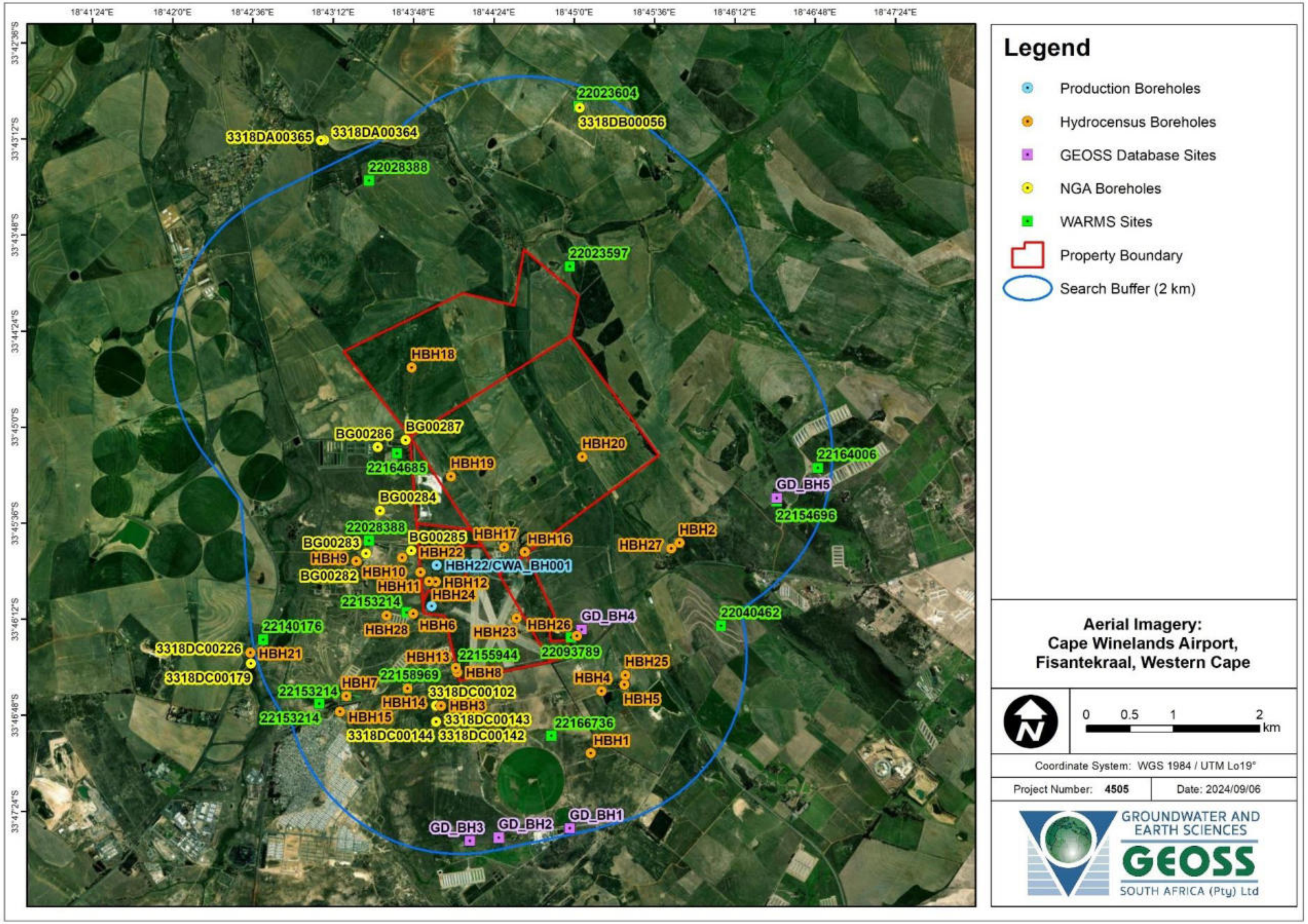
**Database contains data until 2023*

7.1.3 GEOSS Internal Database

A total of five groundwater sites (boreholes) were identified through the GEOSS Internal Database search and the locations of these sites are spatially represented on **Map 7** and summarised in **Table 6**.

Table 6: Summarised details for the GEOSS borehole details.

Site ID	Latitude (DD, WGS84)	Longitude (DD, WGS84)	EC (mS/m)	Yield (L/s)	Water Level (mbgl
GD_BH1	-33.791927	18.749209	201.0	8.2	30.04
GD_BH2	-33.792879	18.740346	218.0	6.0	48.50
GD_BH3	-33.793220	18.736756	364.3	9.1	12.60
GD_BH4	-33.771231	18.750721	268.0	11.4	-
GD_BH5	-33.757592	18.775103	88.3	1.2	37.40



Map 7: Desktop and field hydrocensus groundwater locations within 2-km of the study site.

7.2 Hydrocensus

A site visit was conducted on 26 January 2022 to assess groundwater use and to obtain more data on borehole/wellpoint positions, groundwater chemistry, borehole yield, groundwater level and borehole geology within the study area. The results of the field investigation are presented in **Appendix C** and shown in **Map 7**. Feedback obtained from neighbouring users during the Public Participation Process (PPP) in August 2024, have been incorporated into the hydrocensus.

Based on the NGA, WARMS, GEOSS database and hydrocensus data, it is evident that there are numerous groundwater users in the area surrounding the proposed CWA site. The data obtained from the NGA database and hydrocensus indicate that borehole depth range from 6.5 m to 200 m. The water level ranges from 1.24 mbgl to 71.88 mbgl, however, the water levels that were indicated as deeper than 20 mbgl all originate from the NGA database. Water levels deeper than 20 mbgl do not correspond to the manually measured resting groundwater levels during the hydrocensus which were all less than 20 mbgl. It is, therefore, considered likely that the NGA water levels deeper than 20 mbgl may represent pumping water levels. The groundwater quality ranges from 19.7 mS/m to 632 mS/m, and reported yields range from 0.2 L/s to 10 L/s.

7.3 Groundwater Flow Direction

Groundwater flow generally follows surface topography, flowing from areas of high elevation to areas of lower elevation. In order to evaluate the relationship between groundwater levels and topography, the surface elevations and water table elevations are plotted relative to each other to assess the applicability of an interpolation technique. Where close correlation between surface elevations and water table elevations exist, interpolation techniques are an appropriate method to estimate values for areas with limited data.

Groundwater level data from the field hydrocensus and NGA were used and used to generate a groundwater level contour map to determine groundwater flow direction. Bayesian interpolation was used, making use of surface topography to infer the groundwater level based on the topography where no groundwater level data was available. The correlation between the elevation and the groundwater level is presented in **Figure 9**, and indicates a 94.78% correlation between surface topography and water level elevation. Bayesian interpolation is, therefore, considered an acceptable interpolation technique. **Map 8** shows the general flow direction across the study area. The groundwater locally flows northwest (perpendicular to the contour lines, from higher elevation to lower elevation).

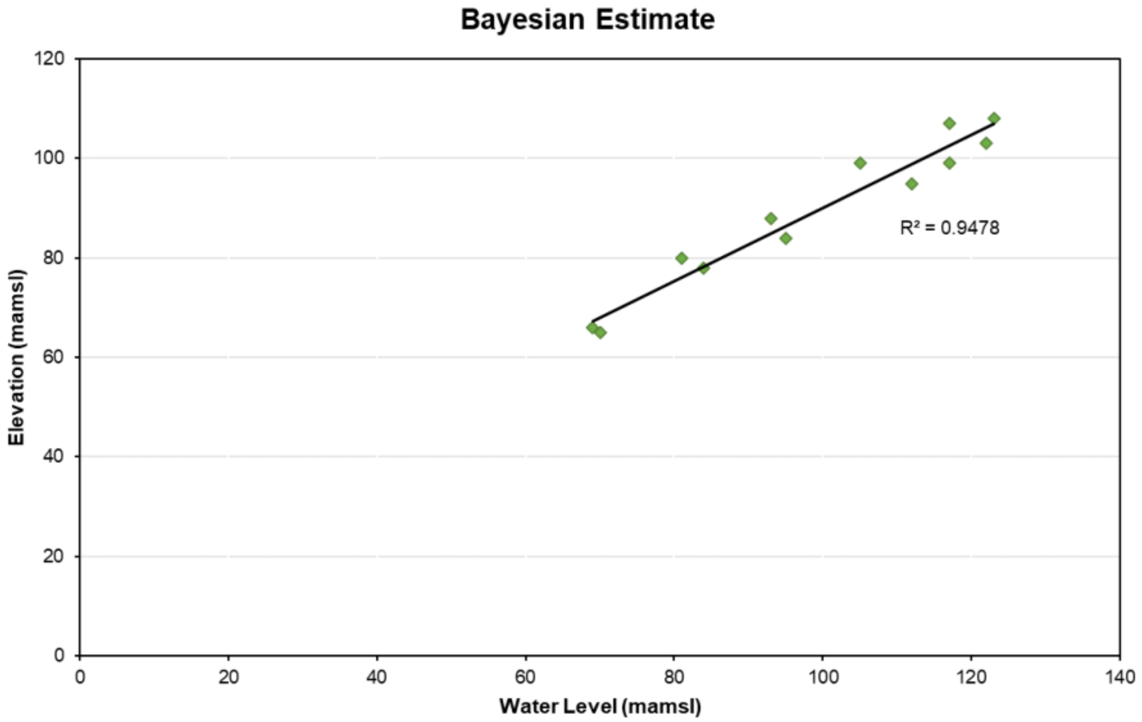
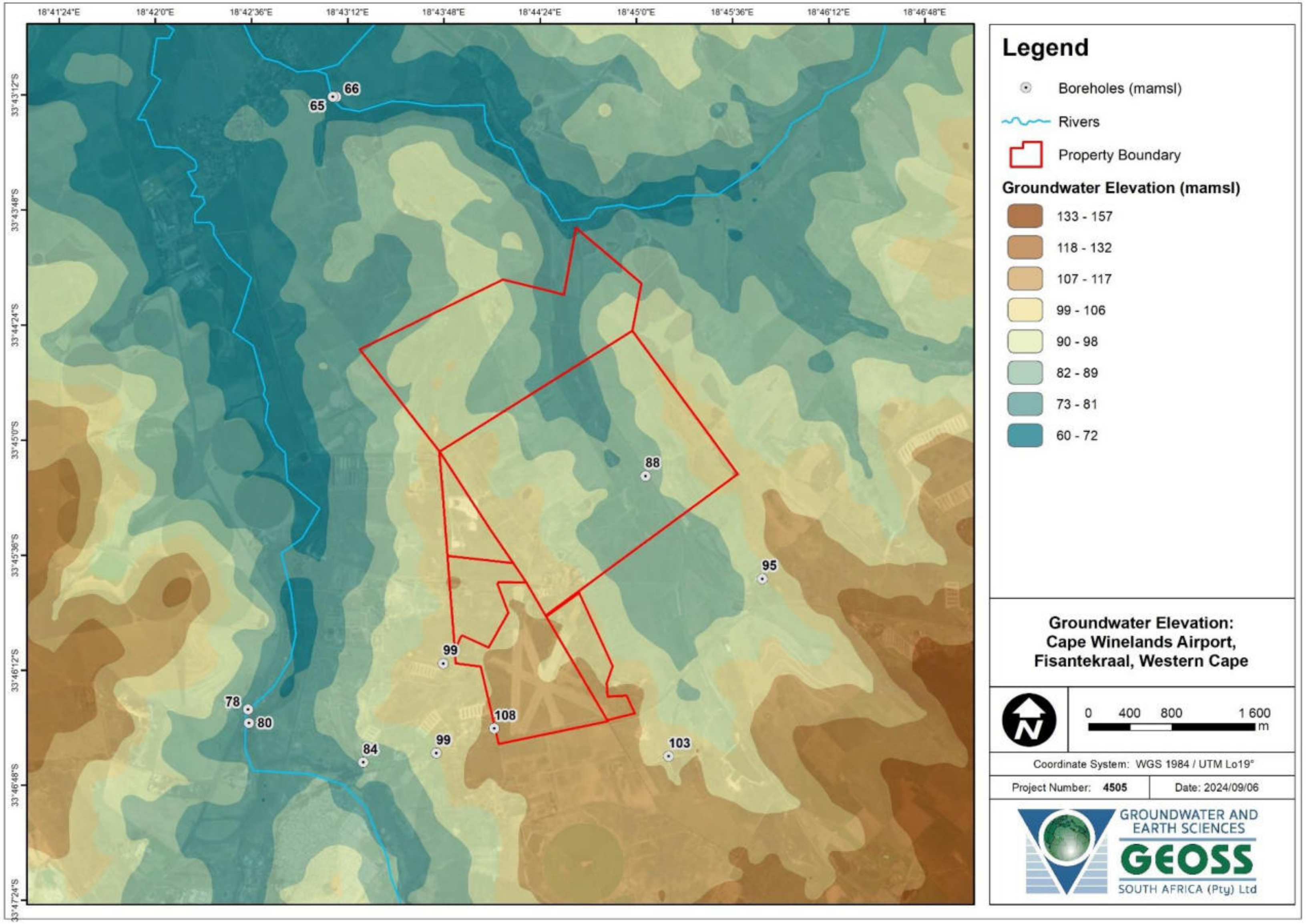


Figure 9: Correlation between surface topography and groundwater elevation for the boreholes proximal to the study site.



Map 8: Interpolated groundwater elevation map for the study area (Bayesian interpolation).

7.4 Water Quality Analysis

A groundwater sample was collected from the quarry during the field visit on 26 January 2022. Additional laboratory results for boreholes CWA_BH001 (CWA_EastBH), CWA_BH002 and HBH23 were provided and all of the laboratory certificates are presented in **Appendix B**. The chemistry data from the samples have been evaluated to give an indication of the groundwater quality that can be expected at the study site. The chemistry results for these sites have been classified according to the SANS241-1: 2015 standards for drinking water (**Table 7**). **Table 9** presents the water chemistry analysis results, colour coded according to the SANS241-1: 2015 drinking water assessment standards.

Table 7: Classification table for the specific limits.

Acute Health	Aesthetic	Chronic Health	Operational	Acceptable

The chemistry results have also been classified according to the DWAF (1998) standards for domestic water. **Table 8** enables an evaluation of the water quality with regards to the various parameters measured (DWAF, 1998). **Table 10** presents the water chemistry analysis results colour coded according to the DWAF domestic water assessment standards.

Table 8: Classification table for the groundwater results (DWAF, 1998).

Class	Water quality	Description
Class 0	Ideal	Suitable for lifetime use.
Class I	Good	Suitable for use, rare instances of negative effects.
Class II	Marginal	Conditionally acceptable. Negative effects may occur.
Class III	Poor	Unsuitable for use without treatment. Chronic effects may occur.
Class IV	Dangerous	Totally unsuitable for use. Acute effects may occur.

From the chemical results presented in **Table 9** and **Table 10**, the groundwater samples are observed to be of marginal quality in terms of dissolved minerals and salts. The quarry has parameters that are elevated including pH, electrical conductivity, turbidity, TDS, sodium, fluoride and chloride. The groundwater samples have parameters that are elevated including electrical conductivity, turbidity, TDS, sodium, manganese, iron and chloride. Both the quarry water (which is likely predominantly groundwater) and groundwater will require treatment if it is planned to be used for potable supply.

Table 9: Groundwater quality analysis classified results according to SANS 241-1:2015.

Analyses	PZ1	PZ2	CWA_ BH001	CWA_ BH002	SANS 241-1:2015
Date sampled	Jan 2022	July 2021	Apr 2022	Nov 2022	
pH (at 25 ºC)	10.2	6.3	7.3	6.8	≥5 - ≤9.7 Operational
Conductivity (mS/m) (at 25 ºC)	165.9	131.0	89.0	155.9	≤170 Aesthetic
Total Dissolved Solids (mg/L)	1124.80	840.00	603.42	1057.00	≤1200 Aesthetic
Turbidity (NTU)	9.91	150.00	18.70	121.00	≤5 Aesthetic ≤1 Operational
Colour (mg/L as Pt)	24.00	<4	<15	<15	≤15 Aesthetic
Sodium (mg/L as Na)	268	185	130	184	≤200 Aesthetic
Potassium (mg/L as K)	2	3	4	4	N/A
Magnesium (mg/L as Mg)	33	20	16	48	N/A
Calcium (mg/L as Ca)	18	14	17	39	N/A
Chloride (mg/L as Cl)	459.58	338.00	207.57	430.19	≤300 Aesthetic
Sulphate (mg/L as SO_4)	29.92	20.90	13.89	38.04	≤250 Aesthetic ≤500 Acute Health
Combined Nitrate & Nitrite (ratio)	<1.05	<0.28	<1.05	<1.05	≤1 Acute Health
Nitrate Nitrogen (mg/L as N)	<1.00	<0.2	<1.00	<1.00	≤11 Acute Health
Nitrite Nitrogen (mg/L as N)	<0.05	<0.08	<0.05	<0.05	≤0.9 Acute Health
Ammonia Nitrogen (mg/L as N)	<0.15	<0.15	<0.15	<0.15	≤1.5 Aesthetic
Total Alkalinity (mg/L as $CaCO_3$)	67.9	86.6	102.1	83.6	N/A
Total Hardness (mg/L as $CaCO_3$)	180.3	118.2	108.1	294.3	N/A
Fluoride (mg/L as F)	0.76	<0.5	0.17	<0.15	≤1.5 Chronic Health
Aluminium (mg/L as Al)	0.199	<0.008	<0.008	0.016	≤0.3 Operational
Total Chromium (mg/L as Cr)	<0.004	<0.004	<0.004	<0.004	≤0.05 Chronic Health
Manganese (mg/L as Mn)	0.015	0.773	0.329	1.272	≤0.1 Aesthetic ≤0.4 Chronic Health
Iron (mg/L as Fe)	0.059	12.93	1.881	7.344	≤0.3 Aesthetic ≤2 Chronic Health
Nickel (mg/L as Ni)	<0.008	<0.008	<0.008	<0.008	≤0.07 Chronic Health
Copper (mg/L as Cu)	0.008	<0.002	0.010	0.010	≤2 Chronic Health
Zinc (mg/L as Zn)	<0.008	0.02	<0.008	<0.008	≤5 Aesthetic
Arsenic (mg/L as As)	<0.010	<0.010	<0.010	<0.010	≤0.01 Chronic Health
Selenium (mg/L as Se)	<0.008	<0.008	<0.008	<0.008	≤0.04 Chronic Health
Cadmium (mg/L as Cd)	0.001	<0.001	0.002	<0.001	≤0.003 Chronic Health
Antimony (mg/L as Sb)	<0.013	<0.013	<0.013	<0.013	≤0.02 Chronic Health
Mercury (mg/L as Hg)	<0.001	<0.001	<0.001	<0.001	≤0.006 Chronic Health
Lead (mg/L as Pb)	<0.008	<0.008	<0.008	<0.008	≤0.01 Chronic Health
Uranium (mg/L as U)	<0.028	<0.028	<0.028	<0.028	≤0.03 Chronic Health
Cyanide (mg/L as CN^-)	<0.01	<0.01	<0.01	<0.01	≤0.2 Acute Health
Total Organic Carbon (mg/L as C)	11.40	6.80	2.46	2.15	N/A
E.coli (cfu/100 mL)	-	<1	nd	nd	Not Det. Acute Health-1
Total Coliform Bacteria (cfu/100 mL)	-	0	nd	nd	Not Det.≤10 Operational
Heterotrophic Plate Count (cfu/mL)	-	<1	69	nd	≤1000 Operational
Charge balance %	1.3	-3.2	-1.1	-1.0	≥-5 - ≤5 Acceptable

Table 10: Classified groundwater sample results according to DWAF (1998).

Analyses:	**Quarry**	**HBH23**	**CWA_ BH001**	**CWA_ BH002**	**DWA (1998) Drinking Water Assessment Guide**				
					Class 0	**Class I**	**Class II**	**Class III**	**Class IV**
pH	10.2	6.3	7.3	6.8	5-9.5	4.5-5 & 9.5-10	4-4.5 & 10-10.5	3-4 & 10.5-11	< 3 & >11
Conductivity (mS/m)	165.9	131.0	89.0	155.9	<70	70-150	150-370	370-520	>520
Turbidity (NTU)	9.91	150.00	18.70	121.00	<0.1	0.1-1	1.0-20	20-50	>50
	mg/L								
Total Dissolved Solids	1124.80	840.00	603.42	1057.00	<450	450-1 000	1 000-2 400	2 400-3 400	>3 400
Sodium (as Na)	268	185	130	184	<100	100-200	200-400	400-1 000	>1 000
Potassium (as K)	2	3	4	4	<25	25-50	50-100	100-500	>500
Magnesium (as Mg)	33	20	16	48	<70	70-100	100-200	200-400	>400
Calcium (as Ca)	18	14	17	39	<80	80-150	150-300	>300	
Chloride (as Cl)	459.58	338.00	207.57	430.19	<100	100-200	200-600	600-1 200	>1 200
Sulphate (as SO_4)	29.92	20.90	13.89	38.04	<200	200-400	400-600	600-1 000	>1 000
Nitrate (as N)	<1.05	<1.05	<1.05	<1.05	<6	6.0-10	10-20	20-40	>40
Fluoride (as F)	0.76	<0.5	0.17	<0.15	<0.7	0.7-1.0	1.0-1.5	1.5-3.5	>3.5
Manganese (as Mn)	0.015	0.773	0.329	1.272	<0.1	0.1-0.4	0.4-4	4-10	>10
Iron (as Fe)	0.059	12.93	1.881	7.344	<0.5	0.5-1.0	1.0-5.0	5-10	>10
Copper (as Cu)	0.008	<0.002	0.010	0.010	<1	1-1.3	1.3-2	2.0-15	>15
Zinc (as Zn)	<0.008	0.02	<0.008	<0.008	<20	>20			
Arsenic (as As)	<0.010	<0.01	<0.010	<0.010	<0.010	0.01-0.05	0.05-0.2	0.2-2.0	>2.0
Cadmium (as Cd)	0.001	<0.001	0.002	<0.001	<0.003	0.003-0.005	0.005-0.020	0.020-0.050	>0.050
Hardness (as $CaCO_3$)	180.300	118.23	108.10	294.300	<200	200-300	300-600	>600	
	counts/100 mL								
Faecal coliforms	-	nd	nd	nd	0	0-1	1.0-10	10-100	>100
Total coliforms	-	nd	nd	nd	0	0-10	10-100	100-1 000	>1 000
Charge Balance %	1.3	-3.2	-1.1	-1.0	≥-5 - ≤5 Acceptable				

7.5 Chemical Diagrams

A number of chemical diagrams have been plotted for the quarry water sample and the groundwater samples and these are useful for chemical characterisation of the water and illustrate the differences in the water types. The chemistry of the samples has been plotted on a trilinear diagram known as a Piper Diagram. This diagram indicates the distribution of cations and anions in separate triangles and then a combination of the chemistry in the central diamond. From **Figure 10** (central diamond), it is evident that both the quarry and the borehole samples are of a similar sodium-chloride hydrofacies type, indicating that the water has likely originated/evolved in a similar geological environment

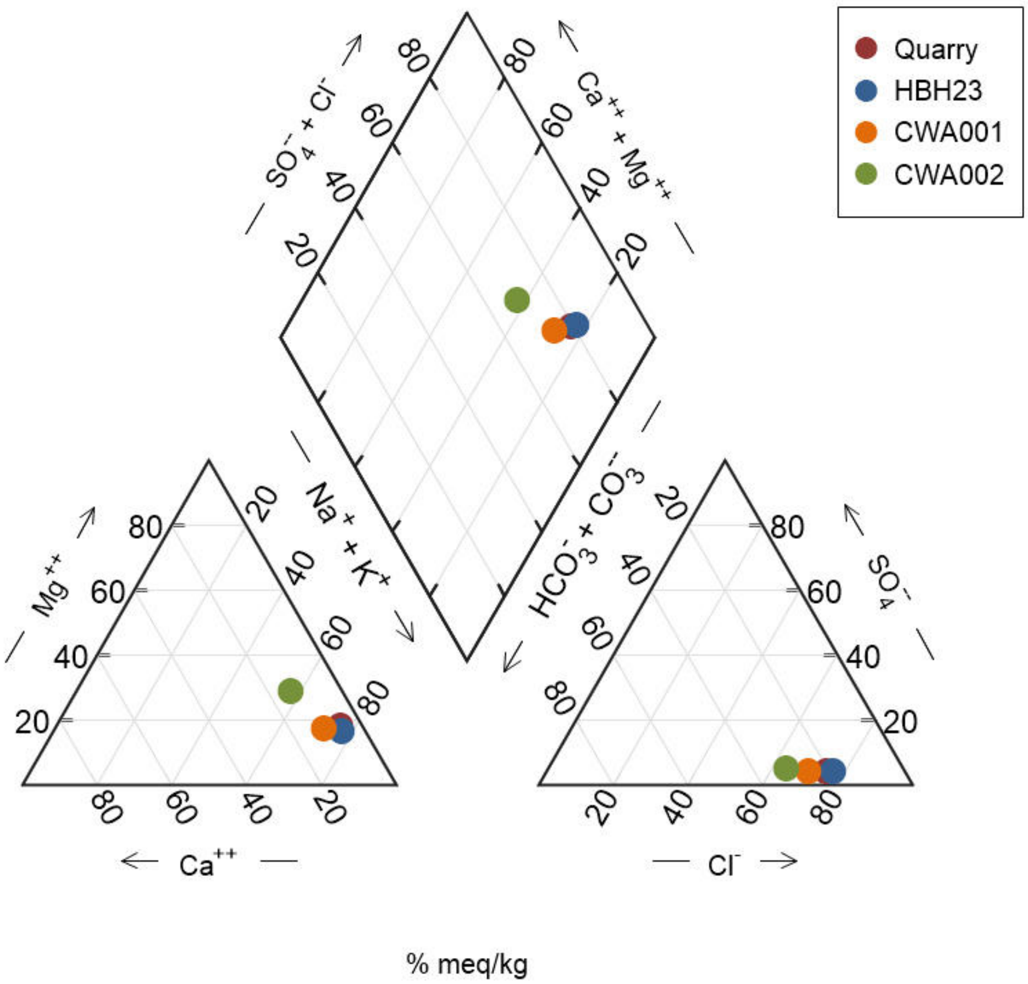


Figure 10: Piper diagram for the collected samples.

The Stiff Diagram is a graphical representation of the relative concentrations of the cations (positive ions) and anions (negative ions). This diagram shows concentrations of cations and anions relative to each other and direct reference can be made to specific salts in the water. The Stiff Diagram for the samples from the boreholes and quarry is shown in **Figure 11**. It is clear that the groundwater and quarry water samples collected is dominated by sodium and chloride. This corresponds to what was observed in the Piper Diagram.

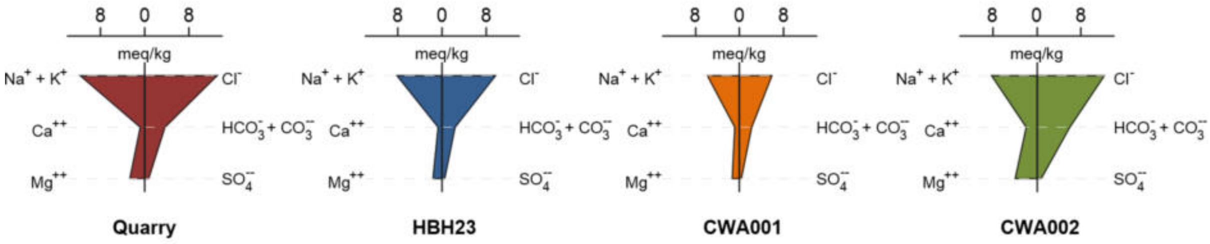


Figure 11: Stiff diagrams for the collected samples.

8 Groundwater Risk Assessment

Due to the minor differences for development alternatives 2 and 3, the difference in impact to groundwater resources will be negligible. Therefore, the impact assessment detailed in the section below applies to both development option 2 and 3. The proposed development will include several facilities all of which are centred around the aerodrome, a summary of the envisaged development includes the following main components relevant to the groundwater impact assessment:

- 3 500 m runway
- 700 m runway
- Taxiways
- Aprons
- Isolated (hard)stands
- Landside Infrastructure
- Bulk Fuel storage (e.g. Petroleum, Jet A1, LPG, AVGAS)
- Stormwater infrastructure
- Solar Photovoltaic facilities
- Biogas digestors for energy generation

For a more detailed overview of the development, the reader is referred to Section 4 of this report or to the project description given in CWA (2021, 2023, 2024) and subsequent revisions.

8.1 Sources

Sources of contamination can be divided into two phases, i.e. those occurring during construction of the development (Construction Phase), and those occurring during the operation of the facility (Operational Phase).

Origins, operations and locations for contamination at civil airport sites around the globe as per Nunes et al. (2011), along with other potential contaminant sources have been summarised in **Table 11**. Where the origin refers to the process of transporting the contaminant to the groundwater, the location indicates the physical place where the contaminants are generated/released; and the operation indicates the activity during which the contaminant is released into the environment. Nunes et al. (2011) compiled information from reports on airports where contamination had taken place. 19 contaminants were assessed and divided into several origins (**Figure 12**). The origins included accidental release (Ac), surface release (S), atmospheric deposition (A), leaks (L), and surface runoff (R). It is clear that surface runoff appears to be the most widespread origin (reported for 17 of the contaminants), followed by surface releases (reported for 15 of the contaminants), and leaks (reported for 14 of the contaminants) (**Figure 12**).

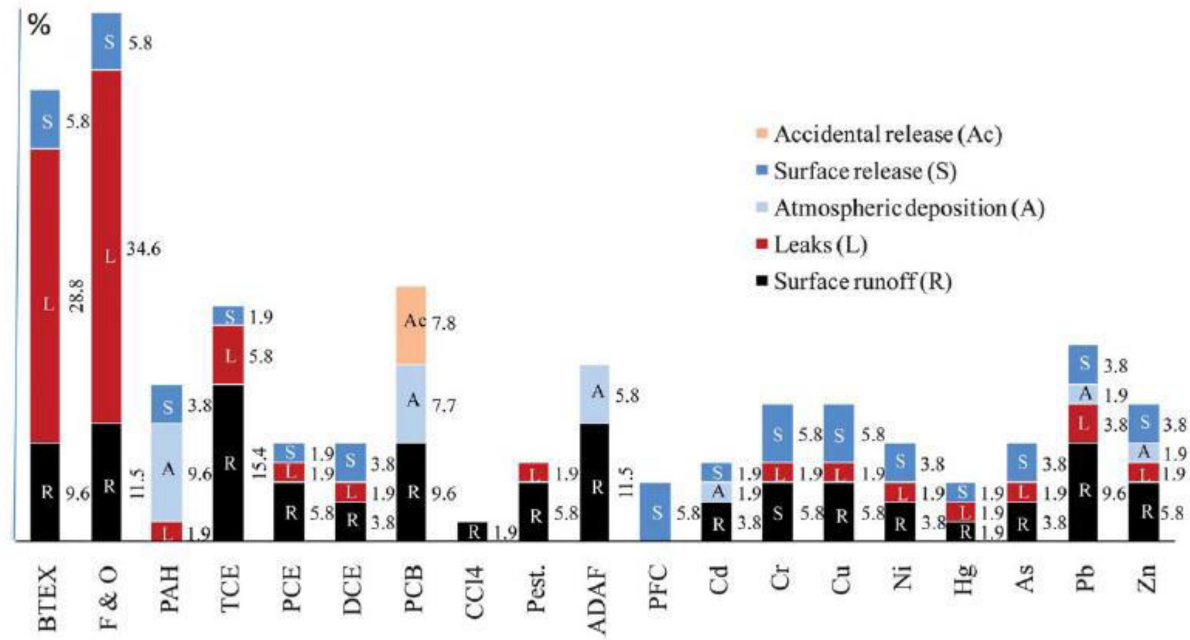


Figure 12: Reported frequency of contaminants for several origins (Nunes et al., 2011). F & O: fuels and Oils; ADAF: anti-icing and de-icing fluids; PFC: perfluorochemicals.

Table 11: Origins, locations, and operations of potential groundwater impact sources at Civil airports (adapted from Nunes, 2011).

Origin	Location	Operations
Surface runoff	Runways, taxiways, aprons, roadways, maintenance areas, vehicle parking areas, hangars, workshops, and other paved areas	Refuelling, handling, parking of vehicles, maintenance of aircraft, vehicles and other equipment, drained by rainwater, pavement cleaning
Leaks from fuel storage and distribution	Fuel Farm	Refuelling on fuel farms and storage of other chemical substances (pesticides, lubricants, solvents, etc.)
Leaks from fuel storage and distribution	AVGAS storage area	Refuelling (hydrant systems) and storage of other chemical substances (solvents, antioxidants, etc.)
Leaks from fuel storage and distribution	Retail services station (petrol station)	Refuelling and storage of other chemical substances (lubricants and solvents)
Leaks from bulk fuel storage	Construction laydown areas, fuel farms, refuelling stations, fuel storage areas	Storage and refuelling on and around construction laydown areas, storage of large amounts of fuel.
Atmospheric deposition	Unpaved areas	Aircraft operations (engine starting, run-ups, testing, ground manoeuvring, take-off, and landing), handling vehicles and equipment, heating systems, and winter operations
Direct release	Unpaved areas, fire-fighting training areas, and storage facilities	Weed control, fire-fighting training, storage/ deposition of substances in unpaved/pervious areas
Accidental contamination (other origins)	Electrical substations, green areas, hangars, workshops, cargo terminal, and storage facilities	Leaks during operation or servicing of electrical substations, spills of pesticides, spills of chemical substances used in cleaning and maintenance of aircraft, handling vehicles and other equipment, spills from cargo

In addition to the potential pollution sources noted above, pollution sources with wate water treatment need to be considered. These potential contamination sources include:

- storage of wastewater before treatment,
- storage of brine from treated potable water,
- storage of chemicals associated with WWTW, and
- irrigation of the landscape with treated wastewater.

The final potential pollution source that needs to be considered is the nearby biodigester. The biodigester in question will use chicken manure as a feedstock and "digestate' from biodigesters can lead to nutrient pollution of surface and groundwater bodies if not properly managed.

8.2 Pathways

Contamination from the sources could potentially infiltrate into the subsurface (soils and groundwater), due to preferential flow paths like the boreholes on site or the edges of buildings and/or conduits constructed for stormwater management and or reticulation of services that extend deeper into the ground. The migration of contaminated water northward/downgradient in the subsurface to groundwater users is unlikely; however, at this stage it is unknown the extent of excavation that will take place. Should substantial deep excavations be required, which for example intersect mostly unweathered, but fractured bedrock potential exists for infiltration of contaminants into the groundwater table.

8.3 Receptors

Receptors within the area include the underlying aquifer and groundwater users, as well as on site workers via through dermal contact with contaminated soils or water. For a risk to groundwater to exist, there must be a source(s), pathway(s) and receptor(s); these are presented in **Figure 13**. All three are present in this case.

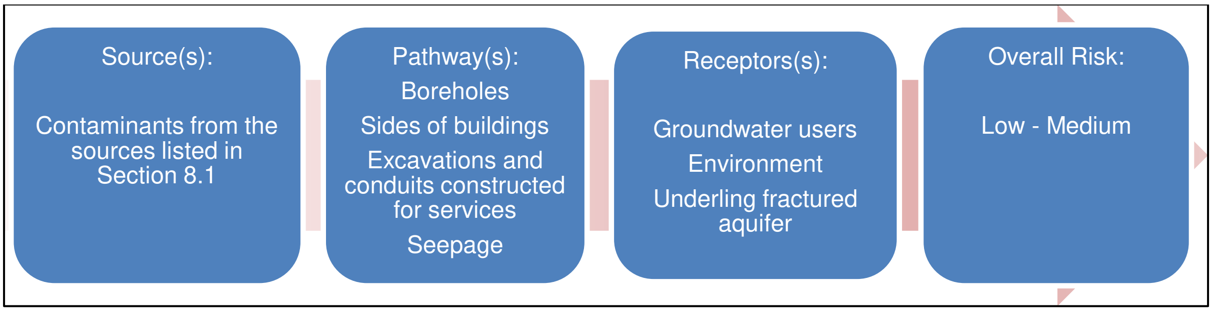


Figure 13: Source, Pathway and Receptor assessment.

8.4 Risk Impact Assessment

There are risks associated with the proposed development at the site. During the construction and operational phase of the proposed development, soil and groundwater contamination could result due to several potential contaminant sources detailed in Section 8.1 . Each source/origin of contamination and impacts associated with groundwater abstraction has been qualitatively assessed during the EIA process and impact tables inclusive of mitigation measures are presented. At present, the projected time for decommissioning of the facility is unknown and therefore, this has not been included in this study.

At present, the final designs of the structures on the site are not available. It is anticipated that some subsurface structures will be required, e.g., for basement parking lots. Since the groundwater in the region is typically well below 30 mbgl, it is anticipated that dewatering will not be required during construction. However, based on the information collected during the preliminary geotechnical assessment there are areas of local perched water tables across the site (GEOSS, 2022b). Such areas may require some dewatering activities during construction. Any revisions to the site development plan (SDP) that are not dealt with appropriately in this document will need to be assessed once the most up-to-date SDP is available.

Each risk is qualitatively assessed based on the existing information. The risk rating has been carried out according to the criteria in **Appendix D**.

8.4.1 Development Alternative 1 (No-go Option)

Development alternative 1 (also referred to as the no-go option) would entail the preservation of the site as is and no further development. Current aviation activity at the airport consists of flight school operations and other unscheduled general aviation (GA) flights. These includes private owner-pilots and limited charter operations in light fixed-wing aircraft, as well as helicopters, gyrocopters and micro flights. Flight activity at the airport currently averages ±100 air traffic movements (ATM; take-offs and landings) per day, varying with weather conditions, seasons and days of the week (NACO, 2023). Consequently, the following risks exist for the existing development:

8.4.1.1 Surface Runoff

Table 12 presents a summary of possible impacts and proposed mitigation measures for surface run-off caused by the development.

8.4.1.2 Leaks from Storage and Distribution

Table 13 presents a summary of possible impacts and proposed mitigation measures for surface leaks for fuel storage and distribution.

8.4.1.3 Atmospheric Deposition

Table 14 presents a summary of possible impacts and proposed mitigation measures for atmospheric deposition which occur as a result of aircraft operations, which includes engine starting, testing, ground manoeuvring, take-off, landing, and run-ups.

8.4.1.4 Direct/Surface Release

Table 15 presents a summary of possible impacts and proposed mitigation measures for surface leaks for direct/surface release. Additional information is presented in Section 8.4.2 below where the risk also exists.

8.4.1.5 Accidental Release

Table 16 presents a summary of possible impacts and proposed mitigation measures for surface leaks for direct/surface release. Additional information is presented in Section 8.4.2 below where the risk also exists.

Table 12: Impact table for contamination of groundwater as a result of surface runoff.

Potential impact on groundwater quality deterioration because of surface runoff.		
Impact	**Description**	
Nature of Impact	Contamination of groundwater and surrounding environment due to contaminated stormwater emanating from the facility infiltrating into the groundwater, leading to a decrease in groundwater quality.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Ensure that the current stormwater management systems are equipped with catch pits to isolate fuel and other contaminants. Properly designed stormwater management systems are required. A stormwater management plan and system should address potential water quality concerns and associated water treatment. The water quality must meet relevant standards prior to discharging into the receiving environment; further the regulations indicated in the Water Act (as well as amendments) will need to be adhered to. An appropriate monitoring system within the stormwater reticulation could be considered, where applicable and possible, e.g. within separation/first flush chambers (for a more detailed description the reader is referred to CEDR, 2016). Petrol interceptors might be considered to mitigate the risks of contaminants draining into the environment.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Low (L)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 13: Impact table for contamination of groundwater as a result of leaks from fuel storage and distribution.

<table>
<tr><th colspan="2">Potential impact on groundwater quality deterioration because of leaks from fuel storage and distribution.</th></tr>
<tr><th>Impact</th><th>Description</th></tr>
<tr><td>Nature of Impact</td><td>Containment, distribution and storage of fuel and other chemical substances (e.g. cleaning agents for apparatus associated with airport equipment used for operation/pesticides for vegetated areas).</td></tr>
<tr><td>Status of Impact</td><td>Negative</td></tr>
<tr><th>Recommended mitigation measures</th><th>Description</th></tr>
<tr><td>Impact avoidance/ Prevention/ Mitigation</td><td>Necessary levels of protection and monitoring will need to be installed on site to reduce the risk of contamination. Here we list some general recommendations for the storage and containment of petrol and diesel. Similar approaches may be required for different types of fuel required at the airport refuelling depot; however, this should be guided by relevant industry practises and international airport development guidelines.

The mitigation measures listed below must be employed to ensure no contamination of the aquifer takes place.

1. Tanks must be double walled / “jacketed” i.e., possessing secondary containment to prevent tank content to release into surrounding soil and groundwater. The underground storage tank must have an internal leak detection monitoring system between the two walls to monitor for product leakage;
2. Fuel lines and sumps must be secondary contained where lines are joined.
3. The filling station must include the following design measures:

• <u>Fuel Containment Area</u>
The containment slab must be graded to drain a catch-pit that is connected to discharge to the stormwater system via an oil separator while the surrounding paved surface areas must be graded to ensure rainwater runoff to the stormwater system. No washing in this area is allowed.

• <u>Forecourt Area</u>
The forecourt area must be provided with its own set of catch pits that is connected to discharge to the sewer via a separate oil separator. Please note that the aforesaid areas (1 & 2 above) cannot be interconnected. The surface area of the forecourt must be graded to the abovementioned catch pits while the surrounding surface area graded to drain rainwater to the stormwater system. Washing of the forecourt surface is allowed in this instance.

Additionally, the following mitigation is required which is associated with petrol filling station Underground Storage Tank (UST) and pipework installations (applicable for the construction and operation phase):</td></tr>
</table>

	National Standards 4. All containment manholes must be regularly inspected as part of the normal management procedures at the service station. 5. The installation of Underground Storage Tanks (UST's) and associated pipework must be implemented in accordance with the relevant South African National Standards (SANS), specifically (not exclusive to) the following standards: **a) SANS 10089-3 (2010) (English): The petroleum industry Part 3: The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations.** **b) SANS 10 400TT (Fire Protection) 53 Sections 1-6 (The application of the National Building Regulations-Installation of Liquid Fuel Dispensing Pumps and Tanks);** **c) SANS 10087-3 (2008) (English): The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L.** 6. The installation of the UST's and associated pipework must comply with the National Building Regulations and Standards Act No. 103 of 1977; 7. The installation must comply with local authority bylaws and all procedures and equipment used must be in accordance with the Occupational Health & Safety Act (No. 85 of 1993); 8. Upon completion of the UST installation, an engineer is to inspect and verify that the tanks and the associated infrastructure have been installed as per the design criteria described in the final BAR and to all required SABS / SANS standards and applicable legislation. A report thereafter, based on the engineer's findings, it to be submitted to the DEA & DP Land Management and Pollution Directorates for inspection and the City of Cape Town Municipality. 9. Any repair work required is to be conducted according to SABS 1535 (Glass-reinforced polyester-coated steel tanks, including jacketed tanks, for the underground storage of hydrocarbons and oxygenated solvents and intended for burial horizontally); **Installation of Underground Storage Tanks** 10. The USTs must be reliable in the event of heavy rains and flooding. UST manholes shall be impermeable and resistant to fuel, they shall consist of a heavy-duty cast-iron cover, which shall prevent damage from surface traffic; 11. Construction of a reinforced concrete slab over the USTs, its thickness and strength are to be determined by a qualified Engineer; 12. The filler point and tank must be fitted with overfill protection. The critical level should be such that a space remains in the tank to accommodate the delivery hose volume (2%). Earthing and snap tight quick coupling is to be provided for loading of materials into tanks to minimise the risk of fires and prevent spillage and loss of materials; and

	13. The USTs are to be fitted with a tank containment sump, fitted on top of the tank and a dispenser containment sump must be provided, fitted underneath the dispenser as containment. A Filler spill containment must also be provided for remote filler containment purposes; 14. The excavation must be protected against the ingress of surface run off water, and is to be kept reasonably free of sub-surface water by pumping out if necessary; **15. The excavation must be lined with a HDPE liner or a suitable layer to prevent infiltration of product to the groundwater should a spill or leak occur (an impermeable liner);** 16. The UST is to be inspected before installation for damage, including factures or damage to coating work. 17. Leak and pressure tests must be conducted on tanks and pipelines to ensure integrity prior to operation and the inspection authority must issue pressure test certificates. 18. The UST must be buried 750mm below finished ground level in accordance with SANS 10089-3; 19. The local Fire Department must be informed two (2) working days before installation commences and to be called for inspection at the following stages: a) Installation of tank on clean sand bed before backfilling b) Witness pressure test (delivery lines 1000kPa, tank 35kPa); and c) Inspection of slab over tank before concreting; **Pipework** 20. Installation of associated pipe work. This shall include the installation of internationally approved non-corrosive pipework systems. All underground piping is to be Petrotechniks UPP Extra piping (nylon lined, 10 bar rated). Nextube Kableflex sleeving (oil industry green with a smooth internal bore) to be used as secondary containment. This is to limit the possibility of pipe failure due to corrosion; this being the most common cause of pipe failure before this system was introduced to South Africa. 21. All pipeline connections are to be housed within impermeable containment chambers. A leak detector on all submersible pumps that automatically checks the integrity of the pipework on the pressure side of the pump must be provided. Pipelines must not retain product after use and no joints are to be made underground. An emergency shut-off valve must be supplied between the supply pipeline and dispenser inlet. All pipes (vent, filler and delivery) are to slope back to the USTs so that fuel does not remain in the pipes; 22. Vent pipes to be fitted with "Fulcrum" vertical vent roses, or an approved equally equivalent market product replacement, that conforms to these standards. Confirmation of filler point and vent position to be made by an approved Engineer for safety distances required; 23. Vent pipes above ground are to be galvanised mild steel and are to be at least 1000mm above the roof height and away from any doors, windows, chimney openings and other sources of ignition; and the tank product lines must be pressure tested prior to commissioning;

	Leak detection and monitoring required 24. It is required to undertake integrity testing on Underground Storage Tanks (UST's) and underground pipe integrity testing. The frequency of integrity testing should be as follows as outlined here. Tank and pipe integrity testing shall be carried out in the following instances: 25. Following installation of a new UST and associated underground pipework or following repair, maintenance or upgrade of an existing UST or underground pipework (or both). Testing shall be carried out prior to burial of the installation; 26. When ownership of the UST and associated underground pipework changes; 27. When leak detection monitoring methods that may be in place, such as Stock Inventory Reconciliation Analysis, Automatic Tank Gauging (with a reconciliation facility) or interstitial vapour or liquid monitoring of double-walled or jacketed steel tanks, indicate the possibility of a leak. In this instance, an investigation into the possible leak, including integrity testing in the final stages of the investigation, shall be used to track the reasons for a failure to reconcile; 28. Where continuous leak detection monitoring, such as Stock Inventory Reconciliation (SIR), is not carried out at a site. In this instance, UST and associated underground pipe integrity testing should be carried out every 2 years. If USTs and underground pipes do not operate with a continuous leak detection system, but do have cathodic protection installed, then this period may be extended to 10-year intervals. 29. USTs are to be fitted with a monitoring tube to allow for the monitoring of leaks through the tank surface; 30. Leak detectors are to be installed to the submersible pumps within UST manholes to ensure that there are no line leaks; 31. A relatively inexpensive soil vapour monitoring installation must be installed which can be monitored on a frequent basis (monthly intervals) using a Photo Ionisation Detector (PID) e.g., Mini RAE 2000. 32. The installation of Soil Vapour Sampling Points will require the placement of a permeable coarse clean sand layer beneath the storage tanks for a vertical depth of approximately 0.5m to 1m in order to locate the vents in the 16 mm diameter monitoring pipe over portion of this depth 33. The Groundwater Monitoring Action Plan must be included as an Annexure to the approved EMP. **34. Observation wells must be installed in the sand fill surrounding the underground storage tanks for regular monitoring purposes** 35. All containment manholes must be regularly inspected as part of the normal management procedures at the service station 36. Continuous electronic monitoring (CEM) of product must be carried out. Should discrepancies occur an alarm will be triggered and site management will review the finding and take appropriate action to rectify the situation as required. **37. Should a leak be found or should the groundwater in the monitoring wells be found to be contaminated with hydrocarbons, a baseline Phase 1 Contamination Assessment should be undertaken and the site remediated in consultation with a contamination remediation consultant and the Authorities.**

<table>
<tr><td></td><td colspan="2">Forecourt Dispensing Area
38. Installation of pump islands in the forecourt area. The pumps are to be fitted with a Spill Containment Chamber;
39. Construction of a concrete bunded reinforced graded slab over the forecourt area, with positive falls towards a centrally located catch-pit/sump. The slabs thickness and strength are to be determined by a qualified Engineer.
The centrally located catch-pit/sump shall drain into a pollution containment chamber i.e., an approved oil/water separator system. Once the wash water has passed through the system, the separated oil must be collected regularly by an approved waste contractor and removed to an approved hazardous waste disposal facility.</td></tr>
<tr><th>Assessment of impact</th><th>Rating before mitigation</th><th>Rating after mitigation</th></tr>
<tr><td>Extent of impact</td><td>Local (L)</td><td>Site Specific (SS)</td></tr>
<tr><td>Duration of impact</td><td>Long term (L)</td><td>Short term (S)</td></tr>
<tr><td>Magnitude of negative impact</td><td>Medium (M)</td><td>Low (L)</td></tr>
<tr><td>Magnitude of positive impact</td><td>Zero (Z)</td><td>Zero (Z)</td></tr>
<tr><td>Intensity of impact</td><td>Destructive – Medium (M)</td><td>Destructive – Low (L)</td></tr>
<tr><td>Probability of occurrence</td><td>Possible (Po)</td><td>Improbable (Im)</td></tr>
<tr><td>Significance</td><td>Medium (M)</td><td>Very Low (VL)</td></tr>
<tr><td>Confidence</td><td>Sure (S)</td><td>Sure (S)</td></tr>
</table>

Table 14: Impact table for contamination of groundwater as a result of atmospheric deposition

Potential impact on groundwater quality deterioration because of atmospheric deposition.		
Impact	**Description**	
Nature of Impact	Aircraft operations (engine starting, run-ups, testing, ground manoeuvring, take-off, and landing), handling vehicles and equipment, and heating and/or cooling systems.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Where vehicles are required for airport operation, make use of electrical vehicles as opposed to conventional combustion engine powered vehicles. Reduce/minimise traffic requirements/ground support vehicles for aircraft operations where possible. Ensure vehicles are well-maintained and always parked on paved surfaces.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Low (L)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Low (L)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Low (L)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 15: Impact table for contamination of groundwater as a result of Direct Release

Potential impact on groundwater quality deterioration because of direct release.		
Impact	**Description**	
Nature of Impact	Direct surface release of contaminants to the soil is that of airport rescue and firefighting (ARFF) training. During such training fires are started using oils, and other fuels (including metal, wood and other raw materials), to allow for emergency training of the fire and rescue staff to take place. Further, other than the fuels used to create fires for simulation purposes, the agents used to extinguish the fires consist primarily of foams with other additives to stabilise, ensure readiness, and allow for longevity of extinguishing agents. These additives contain perfluorochemicals (PFCs) that remain stable for long durations of time in the environment (Cheng et. al., 2009). The practises, protocols and equipment required for the safe and successful emergency operation of the facility will depend on the type of aircraft used at the airport and the scale of the airport.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	For routine burns and training purposes, make use of biodegradable fuels, which once burned minimises the impact on the groundwater. Erect bunds on which training can take place to contain the waste from the fire residue as well as the extinguishing agents. The discharge generated by training exercises should be monitored and analysed for several chemical parameters (to be established once the composition of the extinguishing agents used on site are known) and must be disposed of or stored appropriately in accordance with the National Water Act (DWS, 1998) (and relevant amendments).	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Long term (L)
Magnitude of negative impact	Low (L)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Probable (Pr)	Improbable (Im)
Significance	**Low (L)**	**Low (L)**
Confidence	Sure (S)	Sure (S)

Table 16: Impact table for contamination of groundwater as a result of Accidental Release

Potential impact on groundwater quality deterioration because of Accidental Release.		
Impact	**Description**	
Nature of Impact	The origins of accidental releases of contaminants to the environment are electrical infrastructure (substations) and spillages by chemical storage facilities (Nunes, 2011).	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Ensure that the construction and design of the bunding for storage of chemical substances that are stored on site is appropriate. Ensure that existing electrical infrastructure (where risk of contamination exists, i.e. substations) is located on appropriate bunding. Implement appropriate monitoring infrastructure, e.g. borehole monitoring around the sites where electrical infrastructure and chemicals are stored, to identify leakages and spillages from chemical storage facilities and electrical infrastructure.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Long term (L)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Low (L)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

8.4.2 Development Alternatives 2 and 3 (Further Development)

As the differences between these two development options are minor, the same risks exist for both alternatives and are assessed below.

8.4.2.1 Construction and Development

Table 17 presents a summary of possible impacts and proposed mitigation measures associated with on site development and construction of the proposed airport. Many of the risks related to construction are also applicable during the operational phase of the facility, therefore, the mitigation measures presented here should be kept in mind during operation of the facility. As a simple example, vehicles pose risk of fuel leakage which could potentially contaminate the subsoil and groundwater beneath the site and therefore, vehicles should be well maintained and parked in areas where risk for contamination is minimal, e.g. hard stand areas.

8.4.2.2 Surface Run-off

Table 18 presents a summary of possible impacts and proposed mitigation measures for surface run-off caused by the development.

8.4.2.3 Leaks from Storage and Distribution

Table 19 presents a summary of possible impacts and proposed mitigation measures for surface leaks for fuel storage and distribution.

8.4.2.4 Atmospheric Deposition

Table 20 presents a summary of possible impacts and proposed mitigation measures for atmospheric deposition which occur as a result of aircraft operations, which includes engine starting, testing, ground manoeuvring, take-off, landing, and run-ups.

8.4.2.5 Direct/Surface Release

Table 21 presents a summary of possible impacts and proposed mitigation measures for surface leaks for direct/surface release. Compounds incorporated in extinguishing agents used for extinguishing fires during emergencies have been associated with soil and groundwater contamination at firefighting training facilities, namely at Tyndall AFB and Wurtsmith AFB, both in the USA (Nunes, 2011). Based on discussions with the Airports Company of South Africa, fire and rescue training takes place on a monthly basis, during which live fires are extinguished. Depending on the quality and quantity of the waste generated from these training exercises, a Water Use License (WUL) may be required for storage and/or disposal of such wastes.

8.4.2.6 Accidental Release

Table 22 presents a summary of possible impacts and proposed mitigation measures for surface leaks for accidental release. Based on information compiled by Nunes (2011), the two main causes of accidental release of contaminants into the environment include electrical infrastructure (for example substations), and spills form containers of chemical substances. Capacitors are integral to electrical infrastructure; capacitors and dielectric fluid have been found to constitute the principal sources of polychlorinated biphenyls (PCBs) from electrical infrastructure (Nunes, 2011). Several studies have identified these compounds as being carcinogenic (Nunes, 2011; and references therein).

8.4.2.7 Energy Supply

The Consulting Electrical Engineers Bulk Services Design Report indicates: that CWA ideally intends to act independently of the electrical grid with Eskom (coal-fired) mains source intended and required as a backup source in the event of plant-failure/maintenance operations or unfavourable weather conditions. The Consulting Electrical Engineers Bulk Services Design Report indicates two types of sustainable energy sources considered:

1. Chicken manure/CWA sewerage effluent in bio-digestor plant to run spar-ignition gas-engine generator sets
2. Photo-voltaic power supplies, including optional storage batteries.

The above means of energy generation poses unique risks for groundwater contamination and water availability. **Table 23** highlights the risks identified for the establishment of a bio-digestor plant on the site to generate electricity as well as presents some mitigation measures to reduce the impacts anticipated with such an electricity generation plant. Bio-digestor makes use of chicken manure and waste water harvested in the region to be processed through an anaerobic digestor to convert waste products to biogas and heat which can be used to generate electricity and/or reduce electricity requirements. This process generates digestates, which is a biproduct that can be used to fertilise crops and/or grassed areas on the site or in surrounding areas. Further, potential for contamination of groundwater exists during the operation of the facility where the digestate may leak and be transported to the groundwater.

Some elements contained in the digestate have potential to contaminate groundwater, nevertheless some studies have concluded relatively low potential for groundwater contamination exists for digestate used as fertiliser as compared to inorganic fertilisers (Tshikalange, et al., 2019). Other studies (e.g. Teglia et al., 2011) have indicated that "using organic residues on agricultural land can bring environmental impacts such as groundwater pollution or harmful gaseous emissions". Although not dealt with exhaustively, some of the "parameters presented… are predominantly influenced by the dose used on land and the period of application."

Table 24 indicates the risks associated with a solar photovoltaic facility for the generation of electricity for the proposed development. The main risk associated with the proposed solar voltaic facility is the cleaning of solar panels to ensure optimal energy generation.

Impacts on groundwater associated with construction of the above-mentioned facilities would be similar in nature to those for the entire facility, the reader is referred to Section 8.4.2.1. Any revisions to the site development plan (SDP) that are not dealt with appropriately in this document will need to be assessed once the most up-to-date SDP is available.

8.4.2.8 Groundwater resource depletion as a result of over-abstraction

Over-abstraction of groundwater from a borehole is likely to lead to depletion of the water levels in the area over time. This can cause damage to the aquifer and also damage the groundwater dependant ecosystems in addition to possibly impacting neighbouring groundwater users. Since there is considerable groundwater use in the area it is essential that the borehole is well managed and does not over-abstract to ensure impact on the neighbouring properties does not occur. The borehole has been tested according to SANS 10299_4-2003 and the maximum sustainable yield has been determined to be 104 857 m^3/a. The yield calculated is conservative and if abstraction is kept to the recommended rate, over-abstraction is unlikely to occur. The risk assessment is presented **Table 25**.

Groundwater water level monitoring is recommended monthly to ensure that groundwater abstraction is sustainable. The monitoring will also indicate if the groundwater resource is impacted and if mitigation measures can be instituted before long term impacts occur. Mitigation for over-abstraction would mean a reduction in abstraction.

8.4.2.9 Groundwater quality deterioration as a result of over-abstraction

Over-abstraction of groundwater from a borehole can potentially draw poorer water quality from the nearby environment into the borehole. This is likely to affect the groundwater quality in the area in general and might affect the supply in other boreholes within the same aquifer. As indicated by the regional datasets the groundwater quality is in the range of 70 – 300 m S/m and 300 – 1 000 mS/m further northwest. Thus, this risk is valid and care should be taken to ensure that the proposed production boreholes do not draw poor quality water into the area. If abstraction is kept to the recommended rate, the risk would be low, but quality monitoring should be done to ensure that deterioration in quality does not occur. The risk assessment is presented in **Table 26**.

Groundwater quality monitoring is recommended to ensure that groundwater abstraction is sustainable. The monitoring will also indicate if the groundwater resource is impacted and if mitigation measures can be instituted before long term impacts occur. Mitigation for over-abstraction would be a reduction in abstraction.

8.4.2.10 Storage of wastewater before treatment

Storing wastewater on-site carries significant environmental considerations, particularly concerning groundwater contamination and the resultant decrease of groundwater quality. In areas where groundwater is connected to surface water, this may pose substantial environmental risks to the existing freshwater ecosystems. To mitigate these concerns, it is essential to employ secure storage containers, implement effective bunding measures, and establish spill containment protocols to prevent any leakage from compromising groundwater quality. The risk assessment for the storage of wastewater is presented in **Table 27**.

8.4.2.11 Storage of brine from treated potable water

The storage of brine poses significant environmental risk especially to groundwater contamination and can lead to hypersaline conditions within the aquifer. This is especially significant in instances contaminated aquifers are connected with surface water, as saline water can have extremely adverse impacts on freshwater biota. Effectively sealed containers, appropriate bunding measures, and spill containment measures are required to prevent any leakages from entering the groundwater system. The risk assessment for the storage of brine is presented in **Table 28**.

8.4.2.12 Storage of chemicals associated with WWTW

Storing chemicals for wastewater treatment plants (WWTW) carries substantial environmental implications, particularly in terms of groundwater quality. This concern is heightened when contaminated aquifers interconnect with surface water bodies, as the chemicals associated with WWTW can severely freshwater ecosystems. To address these risks, it is imperative to utilize securely sealed containers, implement suitable bunding measures, and establish spill containment protocols to prevent any leakage from compromising the groundwater system. The risk assessment for the storage of WWTW chemicals is presented in **Table 29**.

8.4.2.13 Irrigation of the landscape with treated wastewater

Over-abstraction of groundwater from a borehole is likely to lead to depletion of the water levels in the area over time. This can cause damage to the aquifer and also damage the groundwater dependant ecosystems in addition to possibly impacting neighbouring groundwater users. Since there is considerable groundwater use in the area it is essential that the borehole is well managed and does not over-abstract to ensure impact on the neighbouring properties does not occur. The borehole has been tested according to SANS 10299_4-2003 and the maximum sustainable yield has been determined to be 104 857 m3/a. The yield calculated is conservative and if abstraction is kept to the recommended rate. over-abstraction is unlikely to occur. The risk assessment is presented in **Table 30.**

Table 17: Impact table for groundwater contamination as a result of construction of the facility.

Potential impact on groundwater quality deterioration because of contamination by construction of the facility.		
Impact	**Description**	
Nature of Impact	Contamination of groundwater and surrounding environment due to the construction processes of the facility such as concrete batching, leading to a decrease in groundwater quality.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Vehicles must be maintained regularly and kept in a good working order, and park on hardstand areas with appropriate drainage and catchment systems, where possible. Dirty water should be captured, to be re-used where possible. No dirty water is allowed to be discharged into the surrounding environment. Fuel spillages are deal with in more detail in subsequent tables, the mitigation measures should also be adopted here. Implement monthly groundwater quality monitoring during construction phase. Drip trays to be used under stationary vehicles and machinery where possible. A dewatering plan to be developed prior to construction (where required). Should this be required, the dewatering plan could be devised by a professional. It is important that if the water is to be released back into the environment, it should be done under the guidance of relevant regulations and supervised/monitored by an appropriately qualified professional.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Site Specific (SS)	Site Specific (SS)
Duration of impact	Short term (S)	Short term (S)
Magnitude of negative impact	Low (L)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Low (L)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Very Low (VL)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 18: Impact table for contamination of groundwater as a result of surface runoff.

Potential impact on groundwater quality deterioration because of surface runoff.		
Impact	**Description**	
Nature of Impact	Contamination of groundwater and surrounding environment due to contaminated stormwater emanating from the facility infiltrating into the groundwater, leading to a decrease in groundwater quality.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Installation of appropriate stormwater systems with catch pits to isolate fuel and other contaminants. Properly designed stormwater management systems and is required. A stormwater management plan and system should address potential water quality concerns and associated water treatment. The water quality must meet relevant standards prior to discharge into the receiving environment; further the regulations indicated in the Water Act (as well as amendments) will need to be adhered to. An appropriate monitoring system within the stormwater reticulation could be considered, where applicable and possible, e.g. within separation/first flush chambers (for a more detailed description the reader is referred to CEDR, 2016). Petrol interceptors might be considered to mitigate the risks of contaminants draining into the environment.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 19: Impact table for contamination of groundwater as a result of leaks from fuel storage and distribution.

Potential impact on groundwater quality deterioration because of leaks from fuel storage and distribution.	
Impact	**Description**
Nature of Impact	Containment, distribution and storage of fuel and other chemical substances (e.g. cleaning agents for apparatus associated with airport equipment used for operation/pesticides for vegetated areas).
Status of Impact	Negative
Recommended mitigation measures	**Description**
Impact avoidance/ Prevention/ Mitigation	Necessary levels of protection and monitoring will need to be installed on site to reduce the risk of contamination. Here we list some general recommendations for the storage and containment of petrol and diesel. Similar approaches may be required for different types of fuel required at the airport refuelling depot; however, this should be guided by relevant industry practises and international airport development guidelines. The mitigation measures listed below must be employed to ensure no contamination of the aquifer takes place. 40. Tanks must be double walled / "jacketed" i.e., possessing secondary containment to prevent tank content to release into surrounding soil and groundwater. The underground storage tank must have an internal leak detection monitoring system between the two walls to monitor for product leakage; 41. Fuel lines and sumps must be secondary contained where lines are joined. 42. The filling station must include the following design measures: • **<u>Fuel Containment Area</u>** The containment slab must be graded to drain a catch-pit that is connected to discharge to the stormwater system via an oil separator while the surrounding paved surface areas must be graded to ensure rainwater runoff to the stormwater system. No washing in this area is allowed. • **<u>Forecourt Area</u>** The forecourt area must be provided with its own set of catch pits that is connected to discharge to the sewer via a separate oil separator. Please note that the aforesaid areas (1 & 2 above) cannot be interconnected. The surface area of the forecourt must be graded to the abovementioned catch pits while the surrounding surface area graded to drain rainwater to the stormwater system. Washing of the forecourt surface is allowed in this instance. Additionally, the following mitigation is required which is associated with petrol filling station Underground Storage Tank (UST) and pipework installations (applicable for the construction and operation phase):

	National Standards 43. All containment manholes must be regularly inspected as part of the normal management procedures at the service station. 44. The installation of Underground Storage Tanks (UST's) and associated pipework must be implemented in accordance with the relevant South African National Standards (SANS), specifically (not exclusive to) the following standards: **d) SANS 10089-3 (2010) (English): The petroleum industry Part 3: The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations.** **e) SANS 10 400TT (Fire Protection) 53 Sections 1-6 (The application of the National Building Regulations-Installation of Liquid Fuel Dispensing Pumps and Tanks);** **f) SANS 10087-3 (2008) (English): The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 500 L.** 45. The installation of the UST's and associated pipework must comply with the National Building Regulations and Standards Act No. 103 of 1977; 46. The installation must comply with local authority bylaws and all procedures and equipment used must be in accordance with the Occupational Health & Safety Act (No. 85 of 1993); 47. Upon completion of the UST installation, an engineer is to inspect and verify that the tanks and the associated infrastructure have been installed as per the design criteria described in the final BAR and to all required SABS / SANS standards and applicable legislation. A report thereafter, based on the engineer's findings, it to be submitted to the DEA & DP Land Management and Pollution Directorates for inspection and the City of Cape Town Municipality. 48. Any repair work required is to be conducted according to SABS 1535 (Glass-reinforced polyester-coated steel tanks, including jacketed tanks, for the underground storage of hydrocarbons and oxygenated solvents and intended for burial horizontally); **Installation of Underground Storage Tanks** 49. The USTs must be reliable in the event of heavy rains and flooding. UST manholes shall be impermeable and resistant to fuel, they shall consist of a heavy-duty cast-iron cover, which shall prevent damage from surface traffic; 50. Construction of a reinforced concrete slab over the USTs, its thickness and strength are to be determined by a qualified Engineer; 51. The filler point and tank must be fitted with overfill protection. The critical level should be such that a space remains in the tank to accommodate the delivery hose volume (2%). Earthing and snap tight quick coupling is

	to be provided for loading of materials into tanks to minimise the risk of fires and prevent spillage and loss of materials; and 52. The USTs are to be fitted with a tank containment sump, fitted on top of the tank and a dispenser containment sump must be provided, fitted underneath the dispenser as containment. A Filler spill containment must also be provided for remote filler containment purposes; 53. The excavation must be protected against the ingress of surface run off water, and is to be kept reasonably free of sub-surface water by pumping out if necessary; **54. The excavation must be lined with a HDPE liner or a suitable layer to prevent infiltration of product to the groundwater should a spill or leak occur (an impermeable liner);** 55. The UST is to be inspected before installation for damage, including factures or damage to coating work. 56. Leak and pressure tests must be conducted on tanks and pipelines to ensure integrity prior to operation and the inspection authority must issue pressure test certificates. 57. The UST must be buried 750mm below finished ground level in accordance with SANS 10089-3; 58. The local Fire Department must be informed two (2) working days before installation commences and to be called for inspection at the following stages: d) Installation of tank on clean sand bed before backfilling e) Witness pressure test (delivery lines 1000kPa, tank 35kPa); and f) Inspection of slab over tank before concreting; **Pipework** 59. Installation of associated pipe work. This shall include the installation of internationally approved non-corrosive pipework systems. All underground piping is to be Petrotechniks UPP Extra piping (nylon lined, 10 bar rated). Nextube Kableflex sleeving (oil industry green with a smooth internal bore) to be used as secondary containment. This is to limit the possibility of pipe failure due to corrosion; this being the most common cause of pipe failure before this system was introduced to South Africa. 60. All pipeline connections are to be housed within impermeable containment chambers. A leak detector on all submersible pumps that automatically checks the integrity of the pipework on the pressure side of the pump must be provided. Pipelines must not retain product after use and no joints are to be made underground. An emergency shut-off valve must be supplied between the supply pipeline and dispenser inlet. All pipes (vent, filler and delivery) are to slope back to the USTs so that fuel does not remain in the pipes; 61. Vent pipes to be fitted with “Fulcrum” vertical vent roses, or an approved equally equivalent market product replacement, that conforms to these standards. Confirmation of filler point and vent position to be made by an approved Engineer for safety distances required; 62. Vent pipes above ground are to be galvanised mild steel and are to be at least 1000mm above the roof height and away from any doors, windows, chimney openings and other sources of ignition; and the tank product lines must be pressure tested prior to commissioning;

	Leak detection and monitoring required 63. It is required to undertake integrity testing on Underground Storage Tanks (UST's) and underground pipe integrity testing. The frequency of integrity testing should be as follows as outlined here. Tank and pipe integrity testing shall be carried out in the following instances: 64. Following installation of a new UST and associated underground pipework or following repair, maintenance or upgrade of an existing UST or underground pipework (or both). Testing shall be carried out prior to burial of the installation; 65. When ownership of the UST and associated underground pipework changes; 66. When leak detection monitoring methods that may be in place, such as Stock Inventory Reconciliation Analysis, Automatic Tank Gauging (with a reconciliation facility) or interstitial vapour or liquid monitoring of double-walled or jacketed steel tanks, indicate the possibility of a leak. In this instance, an investigation into the possible leak, including integrity testing in the final stages of the investigation, shall be used to track the reasons for a failure to reconcile; 67. Where continuous leak detection monitoring, such as Stock Inventory Reconciliation (SIR), is not carried out at a site. In this instance, UST and associated underground pipe integrity testing should be carried out every 2 years. If USTs and underground pipes do not operate with a continuous leak detection system, but do have cathodic protection installed, then this period may be extended to 10-year intervals. 68. USTs are to be fitted with a monitoring tube to allow for the monitoring of leaks through the tank surface; 69. Leak detectors are to be installed to the submersible pumps within UST manholes to ensure that there are no line leaks; 70. A relatively inexpensive soil vapour monitoring installation must be installed which can be monitored on a frequent basis (monthly intervals) using a Photo Ionisation Detector (PID) e.g., Mini RAE 2000. 71. The installation of Soil Vapour Sampling Points will require the placement of a permeable coarse clean sand layer beneath the storage tanks for a vertical depth of approximately 0.5m to 1m in order to locate the vents in the 16 mm diameter monitoring pipe over portion of this depth 72. The Groundwater Monitoring Action Plan must be included as an Annexure to the approved EMP. **73. Observation wells must be installed in the sand fill surrounding the underground storage tanks for regular monitoring purposes** 74. All containment manholes must be regularly inspected as part of the normal management procedures at the service station 75. Continuous electronic monitoring (CEM) of product must be carried out. Should discrepancies occur an alarm will be triggered and site management will review the finding and take appropriate action to rectify the situation as required. **76. Should a leak be found or should the groundwater in the monitoring wells be found to be contaminated with hydrocarbons, a baseline Phase 1 Contamination Assessment should be undertaken and the site remediated in consultation with a contamination remediation consultant and the Authorities.**

	Forecourt Dispensing Area 77. Installation of pump islands in the forecourt area. The pumps are to be fitted with a Spill Containment Chamber; 78. Construction of a concrete bunded reinforced graded slab over the forecourt area, with positive falls towards a centrally located catch-pit/sump. The slabs thickness and strength are to be determined by a qualified Engineer. The centrally located catch-pit/sump shall drain into a pollution containment chamber i.e., an approved oil/water separator system. Once the wash water has passed through the system, the separated oil must be collected regularly by an approved waste contractor and removed to an approved hazardous waste disposal facility.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 20: Impact table for contamination of groundwater as a result of atmospheric deposition.

Potential impact on groundwater quality deterioration because of atmospheric deposition.		
Impact	**Description**	
Nature of Impact	Aircraft operations (engine starting, run-ups, testing, ground manoeuvring, take-off, and landing), handling vehicles and equipment, and heating and/or cooling systems.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Where vehicles are required for airport operation, make use of electrical vehicles as opposed to conventional combustion engine powered vehicles. Reduce/minimise traffic requirements/ground support vehicles for aircraft operations where possible. Ensure vehicles are well-maintained and always parked on paved surfaces.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Low (L)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Low (L)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Low (L)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 21: Impact table for contamination of groundwater as a result of Direct Release.

Potential impact on groundwater quality deterioration because of direct release.		
Impact	**Description**	
Nature of Impact	Direct surface release of contaminants to the soil is that of airport rescue and firefighting (ARFF) training. During such training fires are started using oils, and other fuels (including metal, wood and other raw materials), to allow for emergency training of the fire and rescue staff to take place. Further, other than the fuels used to create fires for simulation purposes, the agents used to extinguish the fires consist primarily of foams with other additives to stabilise, ensure readiness, and allow for longevity of extinguishing agents. These additives contain perfluorochemicals (PFCs) that remain stable for long durations of time in the environment (Cheng et. al., 2009). The practises, protocols and equipment required for the safe and successful emergency operation of the facility will depend on the type of aircraft used at the airport and the scale of the airport.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	For routine burns and training purposes, make use of biodegradable fuels, which once burned minimises the impact on the groundwater. Erect bunds on which training can take place to contain the waste from the fire residue as well as the extinguishing agents. The discharge generated by training exercises will need to be monitored and analysed for several chemical parameters (to be established once the composition of the extinguishing agents used on site are known) and will need to be disposed of or stored appropriately in accordance with the National Water Act (DWS, 1998) (and relevant amendments). It is likely that disposal and/or storage of the waste from training will give rise to the need for a Water Use License (WUL), depending on the waste composition, frequency of training and planned disposal of training residue.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Long term (L)
Magnitude of negative impact	Low (L)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Probable (Pr)	Improbable (Im)
Significance	**Low (L)**	**Low (L)**
Confidence	Sure (S)	Sure (S)

Table 22: Impact table for contamination of groundwater as a result of Accidental Release.

Potential impact on groundwater quality deterioration because of Accidental Release.		
Impact	**Description**	
Nature of Impact	The origins of accidental releases of contaminants to the environment are electrical infrastructure (substations) and spillages by chemical storage facilities (Nunes, 2011).	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Devise and design appropriate bunding for storage of chemical substances that are to be stored on site, as well as erecting the electrical infrastructure (where risk of contamination exists, i.e. substations) on appropriate bunding. Implement appropriate monitoring infrastructure, e.g. borehole monitoring around the sites where electrical infrastructure and chemicals are stored, to identify leakages and spillages from chemical storage facilities and electrical infrastructure.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Long term (L)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Low (L)**
Confidence	Sure (S)	Sure (S)

Table 23: Impact table for contamination of groundwater as a result of bio-digestor facilities for energy generation.

Potential impact on groundwater quality deterioration because of bio-digestor facilities for energy generation.		
Impact	**Description**	
Nature of Impact	Digestate leakage/leaching from facility and potential accumulation of contaminants from application of digestate to land as fertiliser. Leakages of digestate from the facility itself.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Proper management and design of digestate application (i.e. use as fertiliser) to areas on the property and/or surrounding areas. Monitoring of the impacts on the groundwater will need to be implemented should this biproduct of the facility be used in this way. Ensure design of facility is appropriate, e.g. include bunding in high-risk areas or where applicable, instate appropriate monitoring around facility and along relevant points through the system.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Very low (VL)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive – Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very low (VL)**
Confidence	Sure (S)	Sure (S)

Table 24: Impact table for contamination of groundwater as a result of operation of photovoltaic solar facilities.

Potential impact on groundwater quality deterioration because of the operation of photovoltaic solar facilities.		
Impact	**Description**	
Nature of Impact	Use of cleaning agents to ensure maximal power generation from solar panels.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Make use of biodegradable cleaning agents to ensure little to no impact on the quality of the groundwater is experienced.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Low (L)	Very Low (VL)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Low (L)	Destructive – Very Low (VL)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Low (L)**	**Very low (VL)**
Confidence	Sure (S)	Sure (S)

Table 25: Impact table for depletion of the groundwater resource as a result of over-abstraction.

Potential impact due to the depletion of groundwater resources as a result of over-abstraction.		
Impact	**Description**	
Nature of Impact	Over-abstraction from the borehole would drop the regional groundwater level.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Groundwater abstraction volumes must be monitored. Water levels must be monitored and should not drop below the critical water level (refer to yield testing reports). Monitoring information must be assessed regularly (suggested monthly). If the water level in the boreholes drops below the dynamic water level. i.e. 72 mbgl for CWA_BH001. and 40 mbgl for CWA_BH002 abstraction will immediately be reduced by 10%. This would be for normal rainfall events. If a hydrological drought persists for more than two years, the water level can drop to above the critical water level i.e. 85 mgbl for CWA_BH001 and 61 mbgl for CWA_BH002. Monitoring will persist for 30 days. In the event of lowered levels persisting after the initial 10% reduction, further reductions in excess of 10% must be implemented and if the low levels persist for more than 60 days, abstraction must cease until the levels have been recovered. This process will continue until the water level in the borehole is stable. A formal groundwater management plan needs to be designed and implemented.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Definite (D)	Possible (Po)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 26: Impact table for groundwater quality deterioration as a result of over-abstraction.

Potential impact on groundwater quality deterioration as a result of over-abstraction		
Impact	**Description**	
Nature of Impact	Exposure and oxidation of minerals through the lowering of the water table, with potential water quality impacts when water levels recover.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Groundwater abstraction volumes must be monitored. Water levels must be monitored. Monitoring information must be assessed regularly (suggested quarterly). If an increase of 25% in electrical conductivity is observed, abstraction will immediately be reduced by 10%. Monitoring will persist after 30 days if the water quality of the borehole does not recover. In the event of poor quality persisting after the initial 10% reduction, further reductions in excess of 10% must be implemented and if quality continues to deteriorate for more than 60 days, abstraction must cease until the water quality has stabilised.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Improbable (Im)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 27: Impact table for groundwater quality deterioration as a result of waste water storage.

Potential impact on groundwater quality deterioration as a result waste water storage before treatment		
Impact	**Description**	
Nature of Impact	Contamination of groundwater due to the cracking, leaking or overflow of the concrete ponds and/or pipelines within the WWTW and to and from inflow and outflow points, allowing the seepage of contaminants into the groundwater.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Spillages or leakages from the WWTW could contaminate the surrounding non-perennial freshwater systems and groundwater in the area. Therefore, the effluent containment ponds should be appropriately lined to avoid discharge into the subsurface, and potentially groundwater. Solid waste should be stored on concrete bunded or lined surfaces and water drainage from the solid waste should be captured and returned to the WWTW. It is recommended that Groundwater Management Plan be implemented to ensure the groundwater quality is not affected by the operations of the WWTW. Monitoring of the WWTW infrastructure is required to ensure that there is no loss of water in the system; flow meters measuring influent and effluent must be installed, monitored and recorded. Regular internal and external inspections and auditing of the facility must take place to ensure the infrastructure is in good working order.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Site Specific (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 28: Impact table for groundwater quality deterioration as a result of brine storage.

Potential impact on groundwater quality deterioration as a result waste water storage before treatment		
Impact	**Description**	
Nature of Impact	Contamination of groundwater due to the cracking, leaking or overflow of the concrete ponds and/or pipelines containing brine from treated potable water, allowing the seepage of contaminants into the groundwater.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Spillages or leakages from the brine ponds could contaminate the groundwater in the area. Therefore, the brine containment ponds should be appropriately lined with additional bunding structures to avoid discharge into the subsurface, and potentially groundwater. It is recommended that Groundwater Management Plan be implemented to ensure the groundwater quality is not affected by the operations of the brine ponds Regular internal and external inspections and auditing of the facility must take place to ensure the infrastructure is in good working order.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Site Specific (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 29: Impact table for groundwater quality deterioration as a result of chemical storage associated with WWTW.

Potential impact on groundwater quality deterioration as a result waste water storage before treatment		
Impact	**Description**	
Nature of Impact	Contamination of groundwater due to the leaking or spilling of containers storing chemicals associated with the WWTW, allowing the seepage of contaminants into the groundwater.	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Spillages or leakages from the WWTW chemical storage areas could contaminate the groundwater in the area. Therefore, the chemical storage areas should be appropriately lined with additional bunding structures to avoid discharge into the subsurface, and potentially groundwater. It is recommended that Groundwater Management Plan be implemented to ensure the groundwater quality is not affected by the operations of the WWTW. Monitoring of the WWTW infrastructure is required to ensure that there is no loss of water in the system; flow meters measuring influent and effluent must be installed, monitored and recorded. Regular internal and external inspections and auditing of the facility must take place to ensure the infrastructure is in good working order.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Site Specific (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

Table 30: Impact table for groundwater quality deterioration as a result of result of irrigation with the treated sewage effluent.

Potential impact on groundwater quality deterioration as a result waste water storage before treatment		
Impact	**Description**	
Nature of Impact	Contamination of groundwater due to irrigation with poorly treated waste water effluent (TSE)	
Status of Impact	Negative	
Recommended mitigation measures	**Description**	
Impact avoidance/ Prevention/ Mitigation	Contaminated water used to irrigate the demarcated fields could contaminate the groundwater in the area. The WWTW needs to ensure that the water released into the environment is within the limits of the General Authorisation. Monthly monitoring of the quality of the treated effluent must take place to ensure that quality objectives are reached. It is recommended that Groundwater Management Plan be implemented to ensure the groundwater quality is not negatively affected by the irrigation with treated effluent.	
Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local (L)	Site Specific (SS)
Duration of impact	Long term (L)	Short term (S)
Magnitude of negative impact	Medium (M)	Low (L)
Magnitude of positive impact	Zero (Z)	Zero (Z)
Intensity of impact	Destructive – Medium (M)	Destructive –Low (L)
Probability of occurrence	Possible (Po)	Improbable (Im)
Significance	**Medium (M)**	**Very Low (VL)**
Confidence	Sure (S)	Sure (S)

8.5 Cumulative Assessment

During the course of this assessment, it appears that the majority of water users in the area utilise the underlying groundwater resource for agricultural purposes. Further to this, no developments similar to the CWA are present within the region. The developments of interest that were noted include the County Fair chicken farm and the Fisantekraal Wastewater Treatment Works. Each individual impact was assessed with regards to its potential cumulative impact when considered along with the other developments. These are presented in **Table 31**.

Table 31: Cumulative impacts in relation to other regional developments.

Type of cumulative impact	Significance rating before mitigation	Significance rating after mitigation
Construction and Development	Very Low (VL)	Very Low (VL)
Surface Run-off	Medium (M)	Medium (M)
Leaks Storage and Distribution	Medium (M)	Medium (M)
Atmospheric Deposition	Low (L)	Very Low (VL)
Direct/Surface Release	Low (L)	Low (L)
Accidental Release	Medium (M)	Low (L)
Energy Supply	Medium (M)	Very Low (VL)
Groundwater resource depletion as a result of over-abstraction	High (H)	Low (L)
Groundwater quality deterioration as a result of over-abstraction	High (H)	Low (L)
Storage of wastewater before treatment	Medium (M)	Very Low (VL)
Storage of brine from treated potable water	Medium (M)	Very Low (VL)
Storage of chemicals associated with WWTW	Medium (M)	Very Low (VL)
Irrigation of the landscape with treated wastewater	Medium (M)	Very Low (VL)

9 Legislative Requirements

The proposed CWA development is located within quaternary catchment G21E and the groundwater General Authorisation (GA) for this catchment is 150 m^3/ha/a (published on 2 September 2016, in Government Gazette 40243, Government Notice (GN) 538 (i.e., Revision of General authorisation for the taking and storing of water). The general authorisation (GA) limits for each property are presented in **Table 32**.

Table 32: Volume of water that can be used under General Authorisation for each property.

Property	**Remainder of the Joostenberg Vlakte No. 724**	**Portion 10 of the Farm Joostenberg Vlakte No. 724**
Quaternary Catchment	G21E	G21E
Property Size (ha)	42.34	113.96
General Authorization (m^3/ha/a)	150	150
General authorization zone	D	D
General authorization volume (m^3/a)	6 351	17 094
Required abstraction for the property (m^3/a)	31 536	78 840
Total volume applied for (m^3/a)	104 857	
Is General Authorization exceeded?	Yes	Yes

The total volume of groundwater that can be applied for under the general authorisation is 23 445 m^3/a. Considering that the total volume requested is 104 857 m^3/a, a water use license application will be required as per the National Water Act, 1998 (No 36 of 1998). This includes the correct yield testing of production boreholes according to SANS10299.

Mitigation measures associated with the storage and distribution of fuel need to be implemented according to the South African National Standard for each portion of the storage and distribution infrastructure. These standards are detailed within Section 8.4.

9.1 Associated Water Uses

For the purposes of the National Water Act (NWA), water uses across the site include (PHS Consulting, 2024) –

- **(a) taking water from a water resource** - Abstraction of water from two boreholes for potable use onsite and taking from surface water storage for use on site.
- **(b) storing water** – Storage of water in stormwater ponds, reservoirs, weirs and the old quarry.
- **(c) impeding or diverting the flow of water in a watercourse** - Construction within the regulated area of wetlands on site; Any infrastructure/ buildings within the regulated area of or crossing underneath drainage lines / streams / wetlands.
- **(e) engaging in a controlled activity identified as such in section 37(1) or declared under section38 (1)** - Irrigation with water containing waste, i.e., irrigation with treated effluent from

the on-site sewage treatment plant.

- **(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit** - (surplus) treated effluent discharged from the site into the receiving environment when required.
- **(g) disposing of waste in a manner which may detrimentally impact on a water resource** - Storage of domestic and biodegradable industrial wastewater for the purpose of re-use or eventual disposal.
- **(i) altering the bed, banks, course or characteristics of a watercourse** - Construction within the regulated area of wetlands on site; Any infrastructure / buildings within the regulated area of or crossing underneath drainage lines / streams / wetlands.
- **(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people** - Dewatering of areas from time to time for continued operation / safety on site and for the initial construction period.

Consequently, prior to the authorisation of the above water uses, the risk of the development on the groundwater resources in the area have been evaluated.

10 Discussion

A hydrogeological assessment scoping report has been conducted for the proposed Cape Winelands Airport (CWA) to characterise the geohydrological condition and risk of the area proposed for development. This hydrogeological assessment has deemed this development appropriate to proceed on the condition that the potential risks to groundwater resources and receptors that have been identified in the baseline assessment, be qualitatively assessed during the EIA process based on the information available to date. Impact tables for the identified risks are presented in this report and it will be necessary to adopt prevention and mitigation measures against groundwater contamination once the final site development plans and activities are known. The most recent site development plans for proposed development are available in **Appendix A**.

This study and other studies undertaken in the area have found that the site overlies alluvium, colluvium, and weathered bedrock of the Malmesbury Group and Cape Granite Suite (GEOSS, 2022b). The Malmesbury Group provides high yields and is an important source of groundwater for the Cape, and therefore, needs to be protected (Conrad, 2019). A large geological fault (the Colenso Fault) is present along the northeastern boundary of the Cape Winelands Airport. This fault structure stretches from Langebaan through to just north of Stellenbosch and is likely characterised by increased groundwater flow.

The aquifer in the area is classified as a “fractured” aquifer. A fractured aquifer is described as an aquifer where groundwater only occurs in narrow fractures within the bedrock. These aquifers are known to be highly complex and potential contamination in these aquifers is more challenging to manage. The hydrocensus and desktop study showed that there are groundwater users surrounding the CWA. The majority of the groundwater user’s abstract groundwater from the fractured aquifer. The groundwater quality in the area, based on one laboratory sample, hydrocensus data and the NGA data, indicate that the EC ranges from 19.7 mS/m to 632 mS/m, which means the groundwater quality falls within the moderate to poor classification.

The site has a “low” to “low/medium” vulnerability classification, which means that the susceptibility of the aquifer to be contaminated from anthropogenic activities is low - medium. The clay found underlying the site does provide a layer of protection. However, it must be noted that the vulnerability does increase to the northeast where the Colenso Fault system is located. This area should be considered as a sensitive area in terms of groundwater. There are risks associated with the proposed CWA construction activities and the operational activities at the site. Groundwater contamination could potentially result due to dewatering activities, stormwater management, wastewater generated onsite, firefighting activities, aviation fuel farm, bulk fuel storage, and the retail service station. All of these activities present some risk of groundwater contamination.

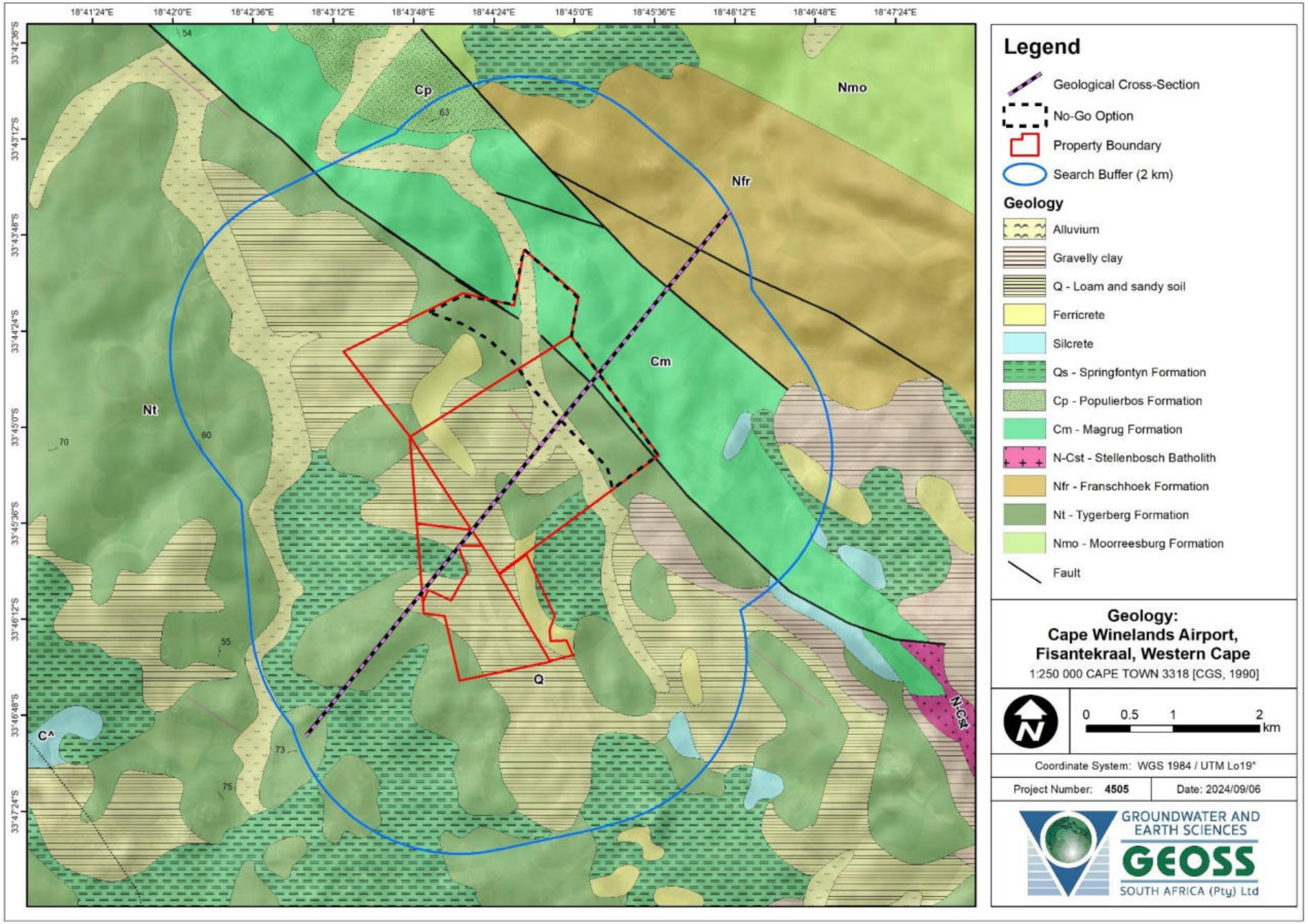
Due to the proximity of the Colenso Fault to the CWA, a no-go area for specific high-risk activities is proposed to the northeastern section of the study area as seen in **Map 9**. The precise location of the Colenso Fault is uncertain and therefore, the no-go area was drawn 500 m from the closest geologically mapped fault. The 1 : 250 000 (Cape Town, 3318) and the 1 : 50 000 (Paarl, 3318DB) geological maps were used and both of these maps delineate the closest fault in the same area. This no-go area does not have to apply to all activities, but only to certain high-risk activities such as the aviation fuel farm, bulk fuel storage, retail service station or other activities that are considered high risk.

Further, although water is present within the quarry, subsequent yield testing of the quarry indicated little to no detectable link to the underlying aquifer. Any contaminants discharged into the quarry would, therefore, degrade the quality of water within the quarry, but will likely not have a large impact on the groundwater quality of the underlying aquifer.

11 Recommendations

The following recommendations are made:

- The site development should only proceed on condition that no contamination of the underlying aquifer takes place. This will require the appropriate protection, mitigation and monitoring measures, including those indicated in this report.
- In situations where it is not possible to avoid pollution because of higher operational priorities for example, the need to protect people, take all reasonably practical steps to mitigate the effects of such pollution.
- A groundwater monitoring network will be required, and will require the following:
    - Regional monitoring boreholes: To monitor the regional groundwater quality, e.g. of the fractured bedrock aquifer. These boreholes should ideally be monitored prior to the commencement of construction to establish baseline conditions.
    - Local monitoring boreholes: These boreholes are required specifically to monitor the groundwater surrounding high-risk facilities (e.g. firefighting training areas, fuel farms, chemical storage facilities etc). The design and position of these boreholes will need to be established once the positions of the high-risk facilities are finalised and the final site development plan is made available. Importantly, any planned development of groundwater production boreholes could be appropriately designed to serve for both groundwater production and monitoring purposes.
- The groundwater impact assessment should be updated if the final site development plan/area changes and once intricate details of the activities for each component of the facilities are known and available.
- It is recommended that all mitigation measures given in this report are to be adhered to in order to minimise the potential impacts of the development on the environment.



Map 9: Geological map indication the cross section, property boundary and the no-go area proposed.

12 Proposed Groundwater Monitoring Plan

It is recommended that a number of groundwater sites should be monitored at the proposed site during the construction and development phases on site. This will allow for monitoring of the groundwater quality and groundwater levels across the site. Monitoring sites need to be strategically placed, typically in the vicinity and downgradient of high risk activities.

Groundwater flow in the area generally mimics the topography, flowing towards topographical lows. It is recommended that a number of local monitoring sites be located across the site to identify any potential impact of the proposed land uses. The additional suggested monitoring sites are presented in **Table 33** and illustrated in **Map 10**.

Table 33: Details for the proposed monitoring sites.

Site_ID	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Location	Depth (mbgl)
CWA_BH001	-33.76452	18.73271	Existing borehole	100.0
CWA_BH002	-33.76876	18.732067	Existing borehole	100.4
MBH1	-33.748832	18.727907	Proximal to the WWTW	Until the clay layer/bedrock is reached
MBH2	-33.751598	18.729944	Proximal to the Biogas plant and fuel farm	Until the clay layer/bedrock is reached
MBH3	-33.753503	18.732373	Proximal to the Biogas plant and fuel farm	Until the clay layer/bedrock is reached
MBH4	-33.755629	18.730166	Proximal to the stormwater retention pond (quarry)	Until the clay layer/bedrock is reached
MBH5	-33.755713	18.736537	Airside activities	Until the clay layer/bedrock is reached
MBH6	-33.760356	18.734556	Airside activities	Until the clay layer/bedrock is reached
MBH7	-33.761442	18.730469	Proximal to the Energy Centre	Until the clay layer/bedrock is reached
MBH8	-33.764807	18.730847	Proximal to the retail service station	Until the clay layer/bedrock is reached
MBH9	-33.769336	18.731523	Boundary of the CWA, to screen potential contaminants upgradient of neighbour	Until the clay layer/bedrock is reached
MBH10	-33.773944	18.735199	Boundary of the CWA, to screen potential contaminants upgradient of neighbour	Until the clay layer/bedrock is reached
MBH11	-33.772721	18.747079	Airside activities	Until the clay layer/bedrock is reached
MBH12	-33.763444	18.742089	Airside activities	Until the clay layer/bedrock is reached

12.1 Construction Specifications

The drilling of boreholes should be supervised by a hydrogeologist and drill samples should be collected every 1 metre and logged. Additional information should also be collected such as the depth of water strikes, associated water strike yields and groundwater quality. This is crucial information for the optimal design of the boreholes. The driller should be supervised to ensure all site requirements are met. A graphical representation of a proposed borehole construction is presented in **Figure 14**; the exact construction will, however, be unique for the borehole.

The boreholes are to be drilled by means of rotary drilling until the clay layer or bedrock is reached. A gravel pack should be installed with an annulus of about 12 mm. The boreholes should be developed with compressed air for at least two hours upon completion along with an airlift test to estimate the yield of the borehole. Each borehole must be protected with a concrete block or a protected manhole if there is traffic in the area. Each borehole also needs a permanent plate glued to the lid containing the details pertaining to the borehole. A bentonite plug of at least 500 mm needs to be installed at the top of the hole to prevent ingress of surface water.

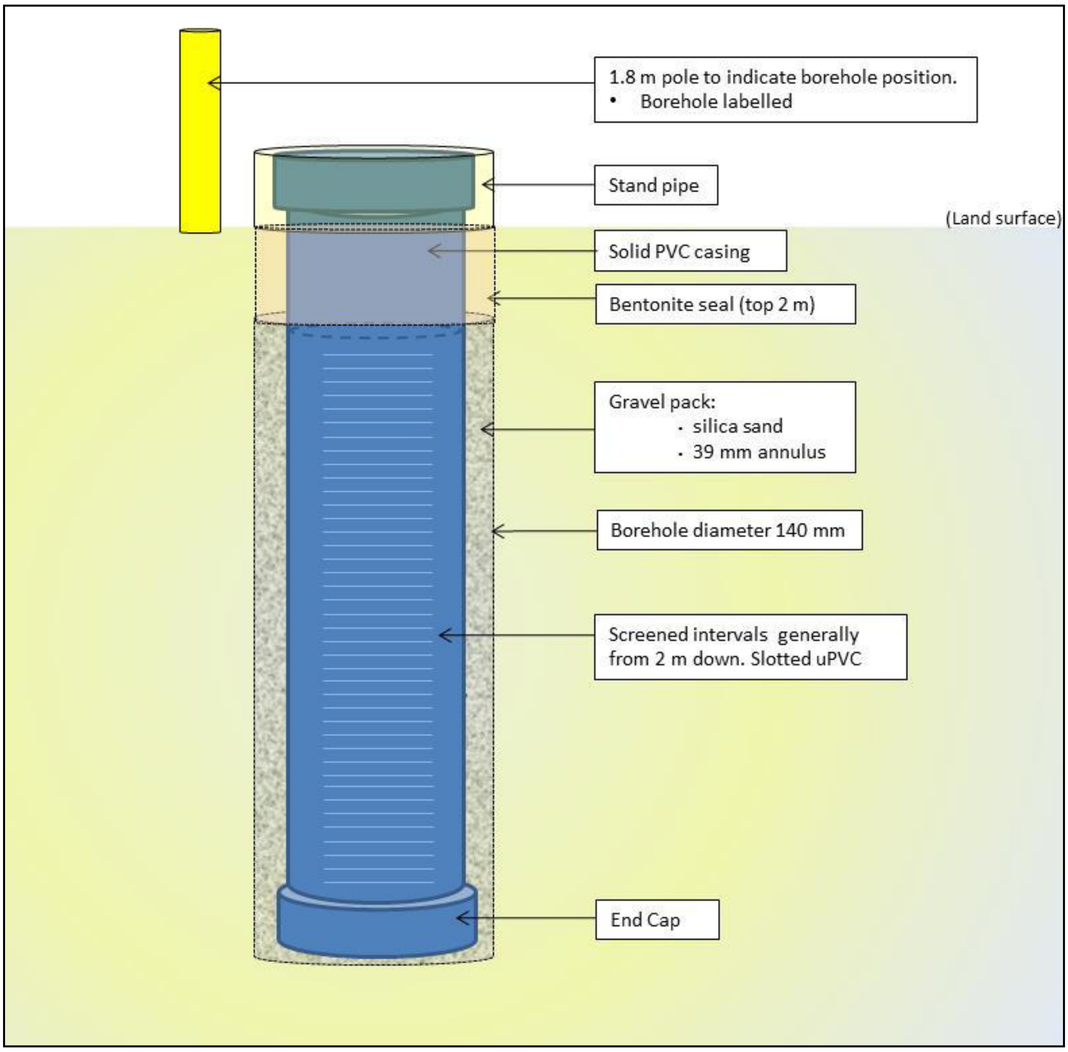


Figure 14: Schematic representation of the proposed general borehole construction.

12.2 Groundwater Level Monitoring

Groundwater level measurements are recommended for the monitoring points at the study site. A dip meter can be used to measure the water level below the top of the borehole collar/casing height (mbch). The height of the collar/casing height must then also be measured (m). The water level (metres below ground level (mbgl)) can then be calculated by subtracting the collar/casing height from the water level (mbch). The value must be recorded along with the date and time of measurement.

12.3 Groundwater Quality Monitoring

It is recommended that the monitoring wells be purged prior to sampling. A low volume sampling pump can be used or the site can be bailed and allowed to recover prior to sample collection. When using a low volume sampling pump, the groundwater should be pumped through a flow-through cell until field chemistry parameters have stabilised.

12.3.1 Sample Collection, Preservation and Submission

Sample bottles must be labelled with the site name, borehole name and date. At the time of sampling, field chemistry parameters must be measured and recorded. These include electrical conductivity (EC), oxidation reduction potential (ORP), pH, temperature and dissolved oxygen (DO). During sampling, disposable nitrile gloves should be worn to minimise the transfer of any potential contaminants. Nitrile gloves should be dedicated to a sampling location and disposed of after use. Samples must be collected in an appropriate sampling container and preserved in the correct manner prior to submission to an accredited laboratory for the analysis parameters. The sample method and preservation must be discussed with the laboratory prior to sampling.

12.4 Monitoring Frequency and Parameter Analysis

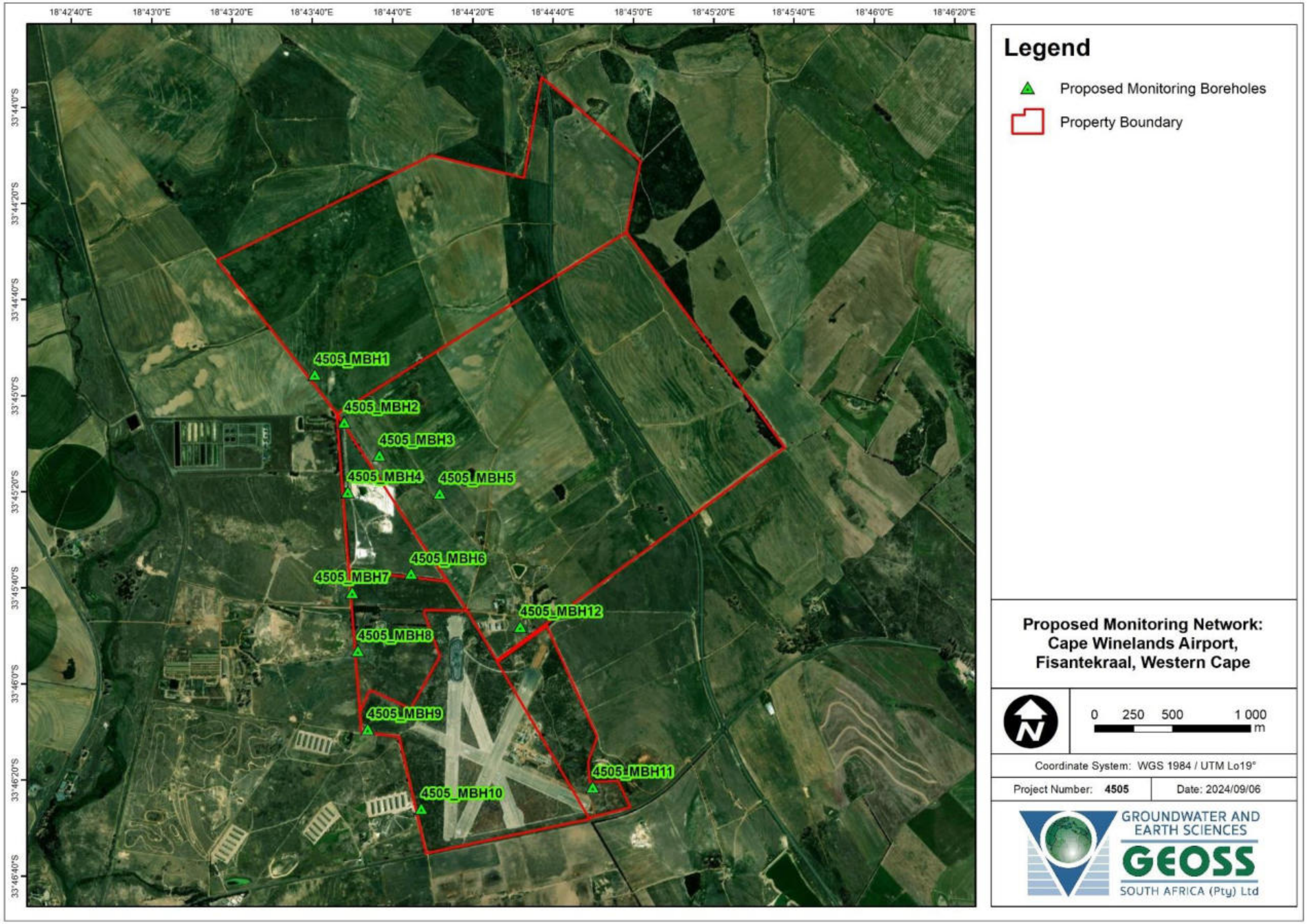
In order to best understand and monitor the site, it is recommended that monthly water level measurements be taken to determine seasonal fluctuation. It is further recommended that the water quality on site is monitored on a quarterly basis for the first year, after which the frequency can be reduced based on the first year's monitoring results.

Groundwater monitoring needs to target the risk of the activity, i.e. organic and microbiological parameters need to be monitored in close proximity to the solid waste storage, WWTW and the biodigestor; BTEX, TPH and GROs need to be monitored in close proximity to fuel storage and dispensing operations, etc. Once the site is developed and the intricate details of the services are made available, a more detailed, standalone monitoring programme report will need to be developed. **Table 34** indicates the potential parameters for ongoing monitoring, this will be revised upon approval and development of the CWA.

Table 34: Proposed groundwater monitoring parameters and their recommended frequency.

Parameter	Frequency*
Groundwater Level	Monthly
pH	Quarterly
Electrical conductivity (EC)	Quarterly
Total Dissolved Solids (TDS)	Quarterly
Inorganic parameters: K, Cl, NO_3, NH_4, P, Na, Ca, HCO_3	Quarterly
Metals: Fe, Mn, Al, Ti, Cr, Cd, Pb, Ni	Quarterly
Total Organic Carbon (TOC)	Quarterly
Biological Oxygen Demand (BOD)	Quarterly
Chemical Oxygen Demand (COD)	Quarterly
Heterotrophic Plate Count	Quarterly
Total Coliforms	Quarterly
E. coli	Quarterly
BTEX	Quarterly
Gasoline Range Organics (GROs)	Quarterly
Total Petroleum Hydrocarbons (TPH)	Quarterly

** Frequency of chemistry sampling may be revised after one year of data has been collected but level monitoring should continue on a monthly basis.*



Map 10: Proposed groundwater monitoring locations across the Cape Winelands Airport development

13 Conclusions

The proposed CWA development poses a risk of contamination to the underlying aquifer. The proximity of the Colenso Fault to the CWA also results in a proposed no-go area for certain activities in the northeastern section of the study area. The aquifer is considered to have a “low” to “medium” vulnerability to contamination as it is overlain by a thick layer of clay. However, there are groundwater users in the area and the construction and operation of the facility should employ relevant mitigation measures so as not to impact on groundwater and therefore it is recommended that a risk assessment and impact tables are developed that include a groundwater monitoring plan for the CWA.

The most crucial findings of this report include the following:

- Groundwater monitoring (chemistry and groundwater levels) is imperative to ensure that any contamination caused as a result of the construction and/or operation of the Cape Winelands Airport is identified so that management any such contamination can take place. Monitoring requirements would need to be revised on an annual basis to ensure that the monitoring is appropriate for the activities taking place at the site. It is highly recommended that monitoring begins prior to the construction period to help establish a sound baseline condition of the groundwater quality and availability at the site. Positions of boreholes should be finalised and/or sited (for the drilling of new boreholes, where required) once the final site development plan is e.g., available and all of the planned activities are approved.
- Incorporation of mitigation measures to limit contamination in the form of bunding at appropriate locations where activities that present a high risk for groundwater contamination are planned to take place, and the use of biodegradable products where possible, should be implemented.
- Based on findings of several yield and quality testing reports, sustainable groundwater abstraction rates have been proposed to supply the development with water. Nevertheless, water level monitoring in the region will be required to ensure these resources are managed sustainably in the long term.
- Several mitigation measures were provided in the report and should be adhere to in order to minimise the effects on of the development on the local and regional groundwater environment.

14 Assumptions and Limitations

The following assumptions and limitations are noted for this study:

- Available data was sourced from the relevant groundwater databases and sources. The aquifer vulnerability, yield and quality data is predominantly accurate, albeit mapped at a regional scale.
- At the time of the report issue, the available site development plans were not yet approved for development, resulting in a generalised recommendation for groundwater monitoring. Once the site is developed and the intricate details of the services are made available, a more detailed, standalone monitoring programme report will need to be developed.
- A further limitation was the temporal nature of the site visit. The field work was undertaken on a single day in January 2022, and does not account for the temporal variability of the water table, i.e. the shallow water table. This is not expected to alter the risk assessment for the site.
- It is possible that there are a greater number of groundwater users in the area than what has been reported in this study as not all groundwater use tends to be registered, particularly when small volumes are used for domestic purposes.
- We have assumed that the available published geological and hydrogeological data on which

our study has been based, is accurate. The interpretation of the analysis results that have been presented here are based on standard rating tables.

- The hydrocensus data and chemistry data in this report is representative of the day and time on which it was collected. Seasonal variation can be expected for the water level and the water quality of the area; however, these variations are typically quite minor and will not change the conclusions in this report.
- During the baseline assessment, a single groundwater sample was collected from the study area which was initially deemed sufficient and for the purpose of this study. Subsequent studies have analysed additional samples in the area and found that groundwater quality generally shows a limited spatial variability.
- The impact assessment has been based on information available at the time of report compilation, and the mitigation measures presented may need to be updated/reassessed once the final development plans are available.

GEOSS has endeavoured to highlight all the risk associated with the planned facilities and activities as far as reasonably possible given the information available and collected to date. Since geological materials are inherently non-homogeneous, there will be deviation from the conditions presented in this report and similar reports compiled for the area by GEOSS.

15 References

Aikman Associates (2020). Proposed Expansion of Cape Winelands Airport: Baseline Study Notification of Intent to Develop Report. HWC Case Number: HWC23101215.

Cape Winelands Aero (2024). Cape Winelands Aero: History. Available at: https://capewinelands.aero/about/ (Accessed on 5 September 2024).

CGS (2012). The 1:50 000 geological map series. Council for Geoscience. Map number: Cape Town 3318.

Cheng J., Vecitis C. D., Park H., Mader B. T. and Hoffmann M. R., (2009). Sonochemical Degradation of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate (PFOA) in Groundwater: Kinetic Effects of Matrix Inorganics. Environ. Sci. Technol., 2009, 44, 445–450.

Conference of European Directors of Roads [CEDR]. (2016). Management of contaminated runoff water: current practice and future research needs. Edited and published by CEDR's Secretariat. ISBN: 979-10-93321-18-9.

Conrad J. and Munch Z., (2007). Groundwater recharge and vulnerability mapping – a national scale approach; GWD Conference Bloemfontein, 8 – 10 October 2007 pp 46 – 56.

Conrad, J., Smit, L., Murray, K., and Van Gend-Muller, J. (2019). The Malmesbury Group - an aquifer of surprising significance. South African Journal of Geology: Vol 112.3, pg.: 331-342. DOI:10.25131/sajg.122.00 28.

CWA Ltd (2021). Cape Winelands Airport Development Project Description.

CWA Ltd (2023a). Cape Winelands Airport Development Project Description.

CWA Ltd (2023b). Runway Alternatives Report – Version 3.

CWA Ltd (2024). Runway Alternatives Report – Version 4.

Department of Water and Sanitation [DWS]. (1998). National Water Act, 1998 (Act no. 36 of 1998): Government Gazette, 19182.

DWAF (2002). The hydrogeological map series of the republic of South Africa. Cape Town, 3318. Scale: 1:500 000.

DWAF, (1998). Minimum Requirements for Water Monitoring at Waste Management Facilities. Second Edition. Department of Water Affairs and Forestry, Pretoria.

GEOSS (2022a). Hydrogeological baseline assessment for the proposed Cape Winelands Airport, Fisantekraal, Western Cape. Report Number: 2022/02-21. GEOSS South Africa (Pty) Ltd. Stellenbosch, South Africa.

GEOSS (2022b). Geotechnical Reconnaissance Investigation for Proposed Cape Winelands Airport, Fisantekraal, Western Cape. Report Number: 2022/02-19. GEOSS South Africa (Pty) Ltd. Stellenbosch, South Africa.

GEOSS (2022c). Borehole Yield and Quality Testing of a Quarry at the Cape Winelands Airport, Fisantekraal, Western Cape. Report Number: 2022/08-23. GEOSS South Africa (Pty) Ltd. Stellenbosch, South Africa.

GEOSS (2022d). Borehole Yield and Quality Testing at Cape Winelands Airport, Fisantekraal, Western Cape. Report Number: 2022/04-12. GEOSS South Africa (Pty) Ltd. Stellenbosch, South Africa.

GEOSS (2022e). Borehole Yield and Quality Testing of CWA_BH002 at Cape Winelands Airport, Fisantekraal, Western Cape. Report Number: 2022/12-08. GEOSS South Africa (Pty) Ltd. Stellenbosch, South Africa.

H & A Planning (2024). Cape Winelands Airport in the Context of Spatial Policies and Land Use Rights.

Kantey and Templer (2024). Masterplan for Aircraft Refuelling Facilities: Cape Winelands Airport: Revision 4. K&T Project Reference: 16736P.

Kisters, A.F.M., Belcher, R.W., Armstrong, R.A., Scheepers, R., Rozendaal, A., and Smith Jordaan, L., (2002). Timing and kinematics of the Colenso Fault: The Early Paleozoic shift from collisional to extensional tectonics in the Pan-African Saldania Belt, South Africa, South African Journal of Geology, 105, pg 257-270.

NACO (2023). Aviation Specialist Studies in support of the Environmental Impact Assessment at Cape Winelands Airport: Baseline Assessment Report and Site Sensitivity Verification.

Nunes, L.M., Zhu, Y.G., Stigter, T. Y., Monteiroa, J. P., and Teixeirad M. R. (2011). Environmental impacts on soil and groundwater at airports: origin, contaminants of concern and environmental risks. The Royal Society of Chemistry: J. Environ. Monit. Vol 13, pg. 3026–3039.

PHS Consulting (2024). Water Use Licence Application Summary Report: Application for a Water Use Licence in terms of Section 21 (a), (b), (c), (e), (f), (g), (i) and (j) on P10/724, RE/724, P23/724, P7/942; RE/474, P3/474 and P4/474 for the Proposed Expansion of the Cape Winelands Airport. DWS REF: WU33620

Schulze, R. E., (2009). SA Atlas of Climatology and Geohydrology; obtained from Western Cape Government Agriculture - http://gis.elsenburg.com/apps/cfm/: Long term median rainfall per month (1950-2000).

South African National Standard [SANS]. (10142-1-2:201X). Draft: South African National Standard: The wiring of premises Part 1-2: Specific requirements for embedded generation installations connected to the low voltage distribution Network in South Africa.

South African National Standard [SANS]. (54470-1:2017). South African National Standard: Fire safety cabinets Part 1: Safety storage cabinets for flammable liquids.

Stapelberg, D. J., (2009). The Engineering Geology of Bellville and Environs Western Cape, South Africa. Council for Geoscience, Pretoria. ISBN: 978-1-920226-19-0.

Teglia, C., Tremier, A., and Martel, J. L. (2011). Characterization of solid digestates: part 1, review of existing indicators to assess solid digestates agricultural use. *Waste and Biomass Valorization*, *2*, 43-58.

Tshikalange B., Bello, Z. A., and Ololade, O. O., (2019). Comparative nutrient leaching capability of cattle dung biogas digestate and inorganic fertilizer under spinach cropping condition. Environmental Science and Pollution Research, available online: https://link.springer.com/article/10.1007/s11356-019-07104-8

United States Department of Agriculture. (2001). Design Guide for Rural Substations. RUS Bulletin 1724E-300 Issued June 2001. Reference: RUS BULLETIN 1724E-300.

Zutari (2024). Cape Winelands Airport: Engineering Services Report. Reference: A89083-CWA-Engineering Services Report.

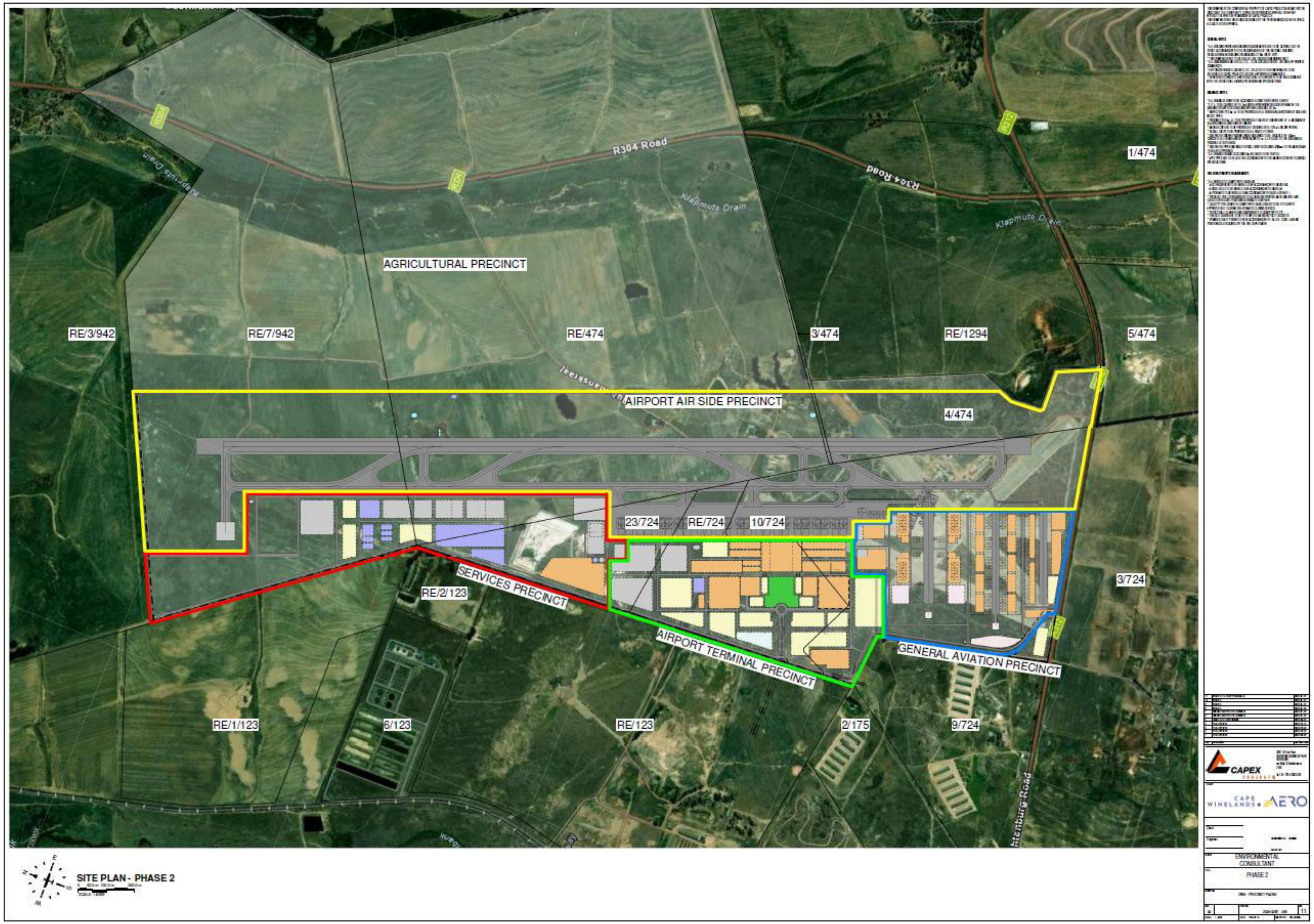
16 Appendix A: Site Development Plans

16.1 Alternative 1: No-go Option

16.2 Alternative 2: Initial Preferred Option (Phase 1 and Phase 2)


LEGEND
Terminal plot + building
Airport facilities/ utilities plot + building
General aviation plot + building
Airside- landside fence incl. gate
Cargo plot + building
Security fence incl. gate
MRO plot + building
Commercial plot + building
01-09-2023 Cadastral Lines Amended
REV DATE DESCRIPTION APPROVED
CAPE WINELANDS AIRPORT LTD
CWA - EIA PLAN
MASTER PLAN
PLANNING ACTIVITY EIA PHASE 2
PHASE: Planning
STATE: FOR INFORMATION
S3
C

16.3 Alternative 3: New Preferred Option



17 Appendix B: Laboratory Analysis Certificates

17.1 Quarry

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-02-01

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
7613
-
0218801079

@VinlabSA

Sample Details									
SampleID					W24787				
Water Type					Drinking Water				
Water Source									
Sample Temperature									
Description					4505PhA_Quarry				
PO Number					4505PhA_Quarry				
Date Received					2022-01-28				
Condition					Good				
Water - Routine									
	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C* (Water)		VIN-05-MW01	0.1%	>= 5 to <= 9.7	10.19				
Conductivity@25C* (Water)	mS/m	VIN-05-MW02	^	<= 170	165.9				
Turbidity (Water)	ntu			<= 5	9.91				
Total dissolved solids (Water)	mg/L			<= 1200	1124.80				
Free Chlorine (Water)	mg/L			<= 5	<0.02				
Ammonia (NH4) as N* (Water)	mg/L	VIN-05-MW08	10%	<= 1.5	<0.15				
Nitrate as N* (Water)	mg/L	VIN-05-MW08	10%	<= 11	<1.00				
Nitrite as N* (Water)	mg/L	VIN-05-MW08	10%	<= 0.9	<0.05				
Chloride (Cl-)* - Water	mg/L	VIN-05-MW08	10%	<= 300	459.58				
Sulphates (SO4)* - Water	mg/L	VIN-05-MW08	10%	<= 500	29.92				
Fluoride (F)* - Water	mg/L	VIN-05-MW08	10%	<= 1.5	0.76				
Alkalinity as CaCO3 (Water)	mg/L				67.90				
Colour (Water)	mg/L Pt-Co			<= 15	24				
Total Organic Carbon (Water)	mg/L			<=10	11.4				
Date Tested					2022-01-28				
Water - Metals									
	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium* (Ca) - Water	mg/L	VIN-05-MW43	14.60%		18				
Magnesium* (Mg) - Water	mg/L	VIN-05-MW43	8.49%		33				

Please click here for SANS241-1:2015 drinking water limits

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd.Opinions and interpretations expressed herein are outside
the scope of SANAS accreditation. Results for methods VIN-05-MW12, 13 and 14, are based on Cq values, a positive result (detected) indicates a Cq value
<35 and a negative result (non-detected) indicates a Cq value of >35.

*Accredited methods. Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; Al=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30°C. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = 1mS/m , >1000mS/m = 9mS/m
^^ - COD, LR = 16mg/L, MR = 48mg/L, HR = 477mg/L

Doc No V31791 VIN 09-01 29-07-2021 1 Visit Vinlab H20

sanas Testing Laboratory T0885

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-02-01

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
7613
-
0218801079

@VinlabSA

Sodium* (Na) - Water	mg/L	VIN-05-MW43	11.45%	<= 200	268				
Potassium* (K) - Water	mg/L	VIN-05-MW43	9.42%		2				
Zinc* (Zn) - Water	mg/L	VIN-05-MW43	19.40%	<= 5	<0.008				
Antimony (Sb) - Water	µg/L			<=13	<13.0				
Arsenic (As) - Water	µg/L			<= 10	<10.0				
Boron (B)* Water	µg/L	VIN-05-MW43	11.79%	<= 2400	<10				
Cadmium (Cd)* Water	µg/L	VIN-05-MW43	12.26%	<= 3	1				
Chromium* (Cr) - Water	µg/L	VIN-05-MW43	13.03%	<= 50	<4				
Copper* (Cu) - Water	µg/L	VIN-05-MW43	11.57%	<= 2000	8				
Iron* (Fe) - Water	µg/L	VIN-05-MW43	12.49%	<= 2000	59				
Lead* (Pb) - Water	µg/L	VIN-05-MW43	16.32%	<= 10	<8				
Manganese* (Mn) - Water	µg/L	VIN-05-MW43	12.44%	<= 400	15				
Nickel* (Ni) - Water	µg/L	VIN-05-MW43	17.38%	<= 70	<8				
Selenium (Se) - Water	µg/L			<= 40	<10.0				
Aluminium* (Al) - Water	µg/L	VIN-05-MW43	13.49%	<= 300	199				
Cyanide (CN) - Water	µg/L			<= 200	<10.0				
Mercury (Hg) - Water	µg/L			<= 6	<1.0				
Barium (Ba)* Water	µg/L	VIN-05-MW43	14.09%	<= 700	13				
Uranium (U) - Water	µg/L			<= 30	<28				
Date Tested					2022-01-31				

Comments

W24787
Ion balance = 2.2%

Adelize Fourie
Laboratory Manager (Waterlab)
VIN-05-
M01,M02,M03,M04,M05,MO8,M10,M28,
M43, MW01, MW02, MW03, MW04,
MW05, MW06, MW07, MW08/9/10

Please click here for SANS241-1:2015 drinking water limits

^ - Conductivity <1000mS/m = 1mS/m , >1000mS/m = 9mS/m
^^ - COD, LR = 16mg/L, MR = 48mg/L, HR = 477mg/L

Doc No V31791 | VIN 09-01 29-07-2021 | 2 | Visit Vinlab H20

sanas Testing Laboratory T0885

17.2 Groundwater

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-12-02

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613
0218801079

@VinlabSA

Sample Details						
SampleID	W33544					
Water Type	Drinking Water					
Water Source	Borehole					
Sample Temperature						
Description	4505_J1_CWA_BH002					
Batch Number						
PO Number	4505_J1_CWA_BH002					
Date Received	2022-11-29					
Condition	Good					

Water - Routine	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C (Water)		VIN-05-MW01	^^^	>= 5 to <= 9.7	6.80				
Conductivity@25C (Water)	mS/m	VIN-05-MW02	^	<= 170	155.9				
Turbidity (Water)*	ntu			<= 5	121.0				
Total dissolved solids (Water)*	mg/L			<= 1200	1057.00				
Free Chlorine (Water)*	mg/L			<= 5	<0.02				
Ammonia (NH4) as N (Water)	mg/L	VIN-05-MW08	2.5%	<= 1.5	<0.15				
Nitrate as N (Water)	mg/L	VIN-05-MW08	10%	<= 11	<1.00				
Nitrite as N (Water)	mg/L	VIN-05-MW08	10%	<= 0.9	<0.05				
Chloride (Cl-) - Water	mg/L	VIN-05-MW08	2.73%	<= 300	430.19				
Sulphates (SO4) - Water	mg/L	VIN-05-MW08	7.56%	<= 500	38.04				
Fluoride (F) - Water	mg/L	VIN-05-MW08	9.74%	<= 1.5	<0.15				
Alkalinity as CaCO3 (Water)*	mg/L				83.60				
Colour (Water)*	mg/L Pt-Co			<= 15	<15				
Total Organic Carbon (Water)*	mg/L			<=10	2.15				
Date Tested					2022-11-29				

Water - Metals	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium (Ca) - Water	mg/L	VIN-05-MW43	14.60%		39				

Please click here for SANS241-1:2015 drinking water limits

*** Not SANAS Accredited. Results marked "Not SANAS Accredited" in this report are not included in the SANAS Scope of Accreditation for Vinlab.**

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

Doc No V39045 | VIN 09-01 10-06-2022 | Page: 1 of 3 | Visit Vinlab H20

sanas Testing Laboratory T0885

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-12-02

vinlabH2O
Your partner in quality water analysis

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613

0218801079

@VinlabSA

Magnesium (Mg) - Water	mg/L	VIN-05-MW43	8.49%		48					
Sodium (Na) - Water	mg/L	VIN-05-MW43	11.45%	<= 200	184					
Potassium (K) - Water	mg/L	VIN-05-MW43	9.42%		4					
Zinc (Zn) - Water	mg/L	VIN-05-MW43	19.40%	<= 5	<0.008					
Antimony (Sb) - Water*	µg/L			<=20	<13.0					
Arsenic (As) - Water*	µg/L			<= 10	<10.0					
Boron (B) Water	µg/L	VIN-05-MW43	11.79%	<= 2400	30					
Cadmium (Cd) Water	µg/L	VIN-05-MW43	12.26%	<= 3	<1					
Chromium (Cr) - Water	µg/L	VIN-05-MW43	13.03%	<= 50	<4					
Copper (Cu) - Water	µg/L	VIN-05-MW43	11.57%	<= 2000	10					
Iron (Fe) - Water	µg/L	VIN-05-MW43	12.49%	<= 2000	7344					
Lead (Pb) - Water	µg/L	VIN-05-MW43	16.32%	<= 10	<8					
Manganese (Mn) - Water	µg/L	VIN-05-MW43	12.44%	<= 400	1272					
Nickel (Ni) - Water	µg/L	VIN-05-MW43	17.38%	<= 70	<8					
Selenium (Se) - Water*	µg/L			<= 40	<10.0					
Aluminium (Al) - Water	µg/L	VIN-05-MW43	13.49%	<= 300	16					
Cyanide (CN) - Water*	µg/L			<= 200	<10.0					
Mercury (Hg) - Water*	µg/L			<= 6	<1.0					
Barium (Ba) Water	µg/L	VIN-05-MW43	14.09%	<= 700	238					
Uranium (U) - Water*	µg/L			<= 30	<28					
Date Tested					2022-11-30					
Water - Micro										
	Unit	Method	Uncertainty	Limits	Results	Results	Results	Results	Results	
Total Coliforms (Water)	cfu/100mL	VIN-05-MW09		<= 10	nd					
E-Coli (Water)	cfu/100mL	VIN-05-MW09		not detected	nd					
Heterotrophic plate count*	cfu/mL			<= 1000	nd					
Date Tested					2022-11-29					

Comments

W33544
Two Samples received,

Ion balance = 1.2%

Please click here for SANS241-1:2015 drinking water limits

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd.Opinions and interpretations expressed herein are outside
the scope of SANAS accreditation. Results for methods VIN-05-MW12, 13 and 14, are based on Cq values, a positive result (detected) indicates a Cq value
<35 and a negative result (non-detected) indicates a Cq value of >35.

*** Not SANAS Accredited. Results marked "Not SANAS Accredited" in this report are not included in the SANAS Scope of Accreditation for Vinlab.**
Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; Al=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30°C. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at botting. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

sanas Testing Laboratory
T0885

Doc No V39045 | VIN 09-01 10-06-2022 | Page: 2 of 3 | Visit Vinlab H20

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-12-02

TEST REPORT

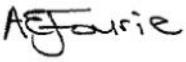
Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613
0218801079

@VinlabSA



Adelize Fourie
Laboratory Manager (Waterlab)
VIN-05-
M01,M02,M03,M04,M05,MO8,M10,M28,
M43, MW01, MW02, MW03, MW04,
MW05, MW06, MW07, MW08/9/10,
MW12, MW13, MW14

Please click here for SANS241-1:2015 drinking water limits

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd.Opinions and interpretations expressed herein are outside
the scope of SANAS accreditation. Results for methods VIN-05-MW12, 13 and 14, are based on Cq values, a positive result (detected) indicates a Cq value
<35 and a negative result (non-detected) indicates a Cq value of >35.

*** Not SANAS Accredited. Results marked "Not SANAS Accredited" in this report are not included in the SANAS Scope of Accreditation for Vinlab.**
Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; Al=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30ºC. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

Doc No
V39045

VIN 09-01 10-06-2022

Page: 3 of 3

Visit Vinlab H20

sanas Testing Laboratory
T0885

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-04-12

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613
0218801079

@VinlabSA

Sample Details					
SampleID	W26855				
Water Type	Drinking Water				
Water Source	Borehole				
Sample Temperature					
Description	4505_D2_CWA_EastBH				
PO Number	4505_D2_CWA_EastBH				
Date Received	2022-04-08				
Condition	Good				

Water - Routine

	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C* (Water)		VIN-05-MW01	0.1%	>= 5 to <= 9.7	7.33				
Conductivity@25C* (Water)	mS/m	VIN-05-MW02	^	<= 170	89				
Turbidity (Water)	ntu			<= 5	18.7				
Total dissolved solids (Water)	mg/L			<= 1200	603.42				
Free Chlorine (Water)	mg/L			<= 5	<0.02				
Ammonia (NH4) as N* (Water)	mg/L	VIN-05-MW08	10%	<= 1.5	<0.15				
Nitrate as N* (Water)	mg/L	VIN-05-MW08	10%	<= 11	<1.00				
Nitrite as N* (Water)	mg/L	VIN-05-MW08	10%	<= 0.9	<0.05				
Chloride (Cl-)* - Water	mg/L	VIN-05-MW08	10%	<= 300	207.57				
Sulphates (SO4)* - Water	mg/L	VIN-05-MW08	10%	<= 500	13.89				
Fluoride (F)* - Water	mg/L	VIN-05-MW08	10%	<= 1.5	0.17				
Alkalinity as CaCO3 (Water)	mg/L				102.10				
Colour (Water)	mg/L Pt-Co			<= 15	<15				
Total Organic Carbon (Water)	mg/L			<=10	2.46				
Date Tested					2022-04-08				

Water - Metals

	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium* (Ca) - Water	mg/L	VIN-05-MW43	14.60%		17				
Magnesium* (Mg) - Water	mg/L	VIN-05-MW43	8.49%		16				

Please click here for SANS241-1:2015 drinking water limits

*Accredited methods. Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; A=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30ºC. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = 1mS/m , >1000mS/m = 9mS/m
^^ - COD, LR = 16mg/L, MR = 48mg/L, HR = 477mg/L

sanas Testing Laboratory T0885

Doc No V33345 VIN 09-01 23-02-2022 1 Visit Vinlab H20

vinlab H2O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-04-12

TEST REPORT

Water

Geoss South Africa (Pty) Ltd
Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613
0218801079

@VinlabSA

Sodium* (Na) - Water	mg/L	VIN-05-MW43	11.45%	<= 200	130				
Potassium* (K) - Water	mg/L	VIN-05-MW43	9.42%		4				
Zinc* (Zn) - Water	mg/L	VIN-05-MW43	19.40%	<= 5	<0.008				
Antimony (Sb) - Water	µg/L			<=20	<13.0				
Arsenic (As) - Water	µg/L			<= 10	<10.0				
Boron (B)* Water	µg/L	VIN-05-MW43	11.79%	<= 2400	29				
Cadmium (Cd)* Water	µg/L	VIN-05-MW43	12.26%	<= 3	2				
Chromium* (Cr) - Water	µg/L	VIN-05-MW43	13.03%	<= 50	<4				
Copper* (Cu) - Water	µg/L	VIN-05-MW43	11.57%	<= 2000	10				
Iron* (Fe) - Water	µg/L	VIN-05-MW43	12.49%	<= 2000	1881				
Lead* (Pb) - Water	µg/L	VIN-05-MW43	16.32%	<= 10	<8				
Manganese* (Mn) - Water	µg/L	VIN-05-MW43	12.44%	<= 400	329				
Nickel* (Ni) - Water	µg/L	VIN-05-MW43	17.38%	<= 70	<8				
Selenium (Se) - Water	µg/L			<= 40	<10.0				
Aluminium* (Al) - Water	µg/L	VIN-05-MW43	13.49%	<= 300	<8				
Cyanide (CN) - Water	µg/L			<= 200	<10.0				
Mercury (Hg) - Water	µg/L			<= 6	<1.0				
Barium (Ba)* Water	µg/L	VIN-05-MW43	14.09%	<= 700	129				
Uranium (U) - Water	µg/L			<= 30	<28				
Date Tested					2022-04-11				

Water - Micro

	Unit	Method	Uncertainty	Limits	Results	Results	Results	Results	Results
Total Coliforms* (Water)	cfu/100mL	VIN-05-MW09		<= 10	nd				
E-Coli* (Water)	cfu/100mL	VIN-05-MW09		not detected	nd				
Heterotrophic plate count	cfu/mL			<= 1000	69				
Date Tested					2022-04-08				

Comments

W26855
Two Samples received,

Ion Balance = 0.7%

Please click here for SANS241-1:2015 drinking water limits

*Accredited methods. Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; A=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30°C. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = 1mS/m , >1000mS/m = 9mS/m
^^ - COD, LR = 16mg/L, MR = 48mg/L, HR = 477mg/L

Doc No V33345 VIN 09-01 23-02-2022 2 Visit Vinlab H20

sanas Testing Laboratory T0885

vinlab H₂O
Your partner in quality water analysis

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2022-04-12

TEST REPORT

Water

@VinlabSA

Geoss South Africa (Pty) Ltd
Attn: - Alison

P.O.Box 12412
Die Boord, Stellenbosch
Die Boord, Stellenbosch
7613
0218801079

AEFourie

Adelize Fourie
Laboratory Manager (Waterlab)
VIN-05-
M01,M02,M03,M04,M05,MO8,M10,M28,
M43, MW01, MW02, MW03, MW04,
MW05, MW06, MW07, MW08/9/10

Please click here for SANS241-1:2015 drinking water limits

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd.Opinions and interpretations expressed herein are outside
the scope of SANAS accreditation. Results for methods VIN-05-MW12, 13 and 14, are based on Cq values, a positive result (detected) indicates a Cq value
<35 and a negative result (non-detected) indicates a Cq value of >35.

*Accredited methods. Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; Al=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30°C. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = 1mS/m , >1000mS/m = 9mS/m
^^ - COD, LR = 16mg/L, MR = 48mg/L, HR = 477mg/L

sanas Testing Laboratory T0885

Doc No V33345 VIN 09-01 23-02-2022 3 Visit Vinlab H20

A. L. ABBOTT & ASSOCIATES (PTY) LTD
Reg. No. 1982/004379/07
Established 1964
THE WATER & WASTE WATER SPECIALISTS

Doc.No. 7.8 # 1 Rev.4

Consulting Analytical & Industrial Chemists
Specialists in Water & Waste Water Treatment
Telephone (021)448 6340/1
After Hours (083-3263887)
e-Mail Address :
info@alabbott.co.za

sanas Testing Laboratory T0276

No. 1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915

Certificate of Analysis

CAPE WINELANDS AIRPORT

ANALYSES

BOREHOLE

DATE SAMPLED : 2021/07/22
DATE RECEIVED : 2021/07/22
DATE ANALYSIS COMMENCED : 2021/07/22

OUR REF. : 2021/07/22/20061
REPORT NO. : 4086

	Sample Number	20061		
Mthd ALA No.	Analyses	Results	SANS 241-1:2015	% Uncertainty of Measurement
97	Colour (mg/l as Pt)	<4	≤15 Aesthetic	22
9	Conductivity (mS/m) (at 25 ºC)	131	≤170 Aesthetic	4.5
7	Total Dissolved Solids (mg/l)	840	≤1200 Aesthetic	-
27	Turbidity (NTU)	150	≤1 Operational : ≤5 Aesthetic	11
19	pH (at 25 ºC)	6.31	≥5 - ≤ 9.7 Operational	1.5
66	Free Chlorine (mg/l)	<0.05	≤5 Chronic Health	-
N/A	Monochloramine (mg/l)	<0.05	≤3 Chronic Health	-
Calc	Nitrate Nitrogen (mg/l as N)	<0.20	≤11 Acute Health	3.4
5	Nitrite Nitrogen (mg/l as N)	<0.08	≤0.9 Acute Health	3.8
4B	Nitrate & Nitrite Nitrogen (mg/l as N)	<0.20	≤12 Acute Health	10.2
N/A	Combined Nitrate plus Nitrite (mg/l as N)	0.10	≤1.0	-
102	Sulphate (mg/l as SO4)	20.9	≤250 Aesthetic ≤500 Acute Health	8.3
98	Fluoride (mg/l as F)	<0.50	≤1.5 Chronic Health	4.4
3	Ammonia Nitrogen (mg/l as N)	<0.15	≤1.5 Aesthetic	3.8
96	Chloride (mg/l as Cl)	338	≤300 Aesthetic	10
92a	Sodium (mg/l as Na)	185	≤200 Aesthetic	5.1
92a	Zinc (mg/l as Zn)	0.02	≤5 Aesthetic	5.4
92a	Antimony (µg/l as Sb)	<20	≤20 Chronic Health	5.2
92a	Arsenic (µg/l as As)	<10	≤10 Chronic Health	10.9
92a	Barium (µg/l as Ba)	202	≤700 Chronic Health	5.2
47	Boron (mg/l as B)	<0.10	≤2.4 Chronic Health	-

Sampler : CUSTOMER

This report relates only to the samples tested and is issued subject to the company's standard terms and conditions of business.

Page 1of 4

A. L. ABBOTT & ASSOCIATES (PTY) LTD
Reg. No. 1982/004379/07
Established 1964
THE WATER & WASTE WATER SPECIALISTS

Doc.No. 7.8 # 1 Rev.4

Consulting Analytical & Industrial Chemists
Specialists in Water & Waste Water Treatment
Telephone (021)448 6340/1
After Hours (083-3263887)
e-Mail Address :
info@alabbott.co.za

sanas Testing Laboratory
T0276

No. 1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915

Certificate of Analysis

CAPE WINELANDS AIRPORT
ANALYSES
BOREHOLE

DATE SAMPLED : 2021/07/22
DATE RECEIVED : 2021/07/22
DATE ANALYSIS COMMENCED : 2021/07/22

OUR REF. : 2021/07/22/20061
REPORT NO . : 4086

	Sample Number	20061		
Mthd ALA No.	**Analyses**	**Results**	**SANS 241-1:2015**	**% Uncertainty of Measurement**
92a	Cadmium (µg/l as Cd)	<1	≤3 Chronic Health	4.2
92a	Total Chromium (µg/l as Cr)	<20	≤50 Chronic Health	4.9
92a	Copper (µg/l as Cu)	<20	≤2000 Chronic Health	5.3
51	Cyanide (µg/l as CN-)	<20	≤200 Acute Health	-
92a	Iron (µg/l as Fe)	12930	≤300 Aesthetic ≤2000 Chronic Health	4.9
92a	Lead (µg/l as Pb)	<10	≤10 Chronic Health	4.9
92a	Manganese (µg/l as Mn)	773	≤100 Aesthetic ≤400 Chronic Health	5.6
92a	Mercury (µg/l as Hg)	<5	≤6 Chronic Health	-
92a	Nickel (µg/l as Ni)	<20	≤70 Chronic Health	5.5
92a	Selenium (µg/l as Se)	<10	≤40 Chronic Health	5.5
92	Uranium (µg/l as U)	<15	≤30 Chronic Health	-
92a	Aluminium (µg/l as Al)	<40	≤300 Operational	4.9
105	Total Organic Carbon (mg/l as C)	6.8	≤10 Chronic Health	0.07
N/A	Trihalomethane (Chloroform) (µg/l)	<10.0	≤300 Chronic Health	-
N/A	Trihalomethane (Bromoform) (µg/l)	<10.0	≤100 Chronic Health	-
N/A	Trihalomethane (Dibromochloromethane) (µg/l)	<10.0	≤100 Chronic Health	-
N/A	Trihalomethane (Bromodichloromethane) (µg/l)	<10.0	≤60 Chronic Health	-
N/A	Combined Trihalomethanes (µg/l)	0.40	≤1.0	-
N/A	Total Microcystin (µg/l)	<0.15	≤1	-
45	Phenols (mg/l)	<0.01	≤0.01 Aesthetic	-
84	E.coli (count per 100 ml)	<1	Not Detected	0.11

Sampler : CUSTOMER

This report relates only to the samples tested and is issued subject to the company's standard terms and conditions of business.

Page 2of 4

A. L. ABBOTT & ASSOCIATES (PTY) LTD
Reg. No. 1982/004379/07
Established 1964
THE WATER & WASTE WATER SPECIALISTS
Doc.No. 7.8 # 1 Rev.4

Consulting Analytical & Industrial Chemists
Specialists in Water & Waste Water Treatment
Telephone (021)448 6340/1
After Hours (083-3263887)
e-Mail Address :
info@alabbott.co.za

sanas Testing Laboratory
T0276

No. 1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915

Certificate of Analysis

CAPE WINELANDS AIRPORT

ANALYSES

BOREHOLE

DATE SAMPLED : 2021/07/22
DATE RECEIVED : 2021/07/22
DATE ANALYSIS COMMENCED : 2021/07/22

OUR REF. : 2021/07/22/20061
REPORT NO . : 4086

	Sample Number	20061		
Mthd ALA No.	**Analyses**	**Results**	**SANS 241-1:2015**	**% Uncertainty of Measurement**
85	Total Coliform Bacteria (count per 100 ml)	<1	≤10 Operational	0.21
88	Heterotrophic Plate Count (count per ml)	<1	≤1000 Operational	0.15
N/A	Somatic Coliphages (count per 10 ml)	<1	Not Detected Operational	-
N/A	Protozoan Parasites (Giardia Species) (count per 10 litres)	To Follow	Not Detected Acute Health	-
N/A	Protozoan Parasites (Cryptosporidium Species) (count per 10 litres)	To Follow	Not Detected Acute Health	-
92a	Calcium (mg/l as Ca)	14.0	N/A	5.6
92a	Magnesium (mg/l as Mg)	20.3	N/A	5.1
92a	Potassium (mg/l as K)	2.7	N/A	4.5
94	Total Alkalinity (mg/l as CaCO3)	86.6	N/A	4
Calc	Langelier Saturation Index (at 25 °C)	-2.1	N/A	-

Sampler : CUSTOMER

This report relates only to the samples tested and is issued subject to the company's standard terms and conditions of business.

Page 3of 4

A. L. ABBOTT & ASSOCIATES (PTY) LTD
Reg. No. 1982/004379/07
Established 1964
THE WATER & WASTE WATER SPECIALISTS

Doc.No. 7.8 # 1 Rev.4

Consulting Analytical & Industrial Chemists
Specialists in Water & Waste Water Treatment
Telephone (021)448 6340/1
After Hours (083-3263887)
e-Mail Address :
info@alabbott.co.za

sanas Testing Laboratory
T0276

No. 1, Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK, CAPE
7915

Certificate of Analysis

CAPE WINELANDS AIRPORT

ANALYSES

BOREHOLE

DATE SAMPLED :	**2021/07/22**
DATE RECEIVED :	**2021/07/22**
DATE ANALYSIS COMMENCED :	**2021/07/22**

OUR REF. : **2021/07/22/20061**
REPORT NO. : **4086**

Notes:
1. Test marked with an asterisk (*) on attached Appendix 1 (Doc. 7.8#3) are SANAS Accredited and are included in the SANAS Schedule of Accreditation for this laboratory.
2. Schedule of Accreditation excludes sampling. Where applicable pH and Free & Total Chlorine Residual results are supplied by the sampling officer and will be indicated on the Certificate of Analysis. This is marked as "Field".
3. Sampling plans are as requested by the customer. Sampling is done according to A.L. Abbott and Associates (Pty) Ltd sampling procedures which are available on request.
4. Uncertainty of Measurement and Method Description will be provided upon request.
5. Results are reported at the 95% Confidence Interval with a Coverage Factor K = 2.
6. The laboratory does not normally issue any statement of conformity, unless by prior arrangement.
   Decision Rule: Results reflecting on the Certificate of Analysis are actual results as obtained at the time of testing and do not include any uncertainty consideration.
7. The quality and integrity of samples submitted has a direct correlation on the results reported. Results reflected on this report therefore relate only to the sample as received.
8. In the absence of customer specified limits, SANS 241-1:2015 or General Limits will appear, as applicable.
9. This report may not be reproduced, except in full, without the prior written approval of the laboratory.
10. Opinions and interpretations are not included in the Certificate of Analysis.

José Luis da Silva
Digitally signed by José Luis da Silva
Date: 2021.08.02 14:13:49 +02'00'

J.L. DA SILVA (Cert.Sci.Nat.)
TECHNICAL MANAGER
02 August 2021

TO: CAPE WINELANDS AIRPORT
Attention: Chris Giannopoulos<chris@capewinelands.aero

Sampler : CUSTOMER

This report relates only to the samples tested and is issued subject to the company's standard terms and conditions of business.

Page 4of 4

18 Appendix C: Hydrocensus Database

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH1	19	10.15	-	EC: 125.5 mS/m	BH collapsed.	
HBH2	103	17.04	0.54	EC: 114.9 mS/m	Used in the nursery.	
HBH3	83.2	40.87	2.2	EC: 145 mS/m TDS: 710 mg/L pH: 6.2	Used for livestock.	
HBH4	-	19	-	EC: 132 mS/m TDS: 650 mg/L pH: 6.7	Livestock watering, BH in use.	

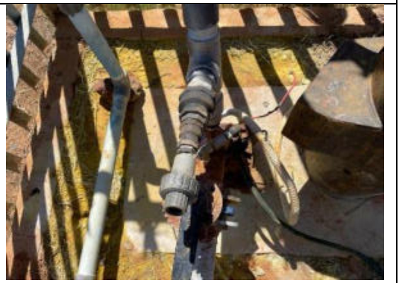
ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH5	-	-	5	EC: 152 mS/m TDS: 750 mg/L pH: 6.7	Domestic use and garden irrigation. Borehole overgrown.	
HBH6	102	17.8	8.3	EC: 201.7 mS/m TDS: 1210 mg/L pH: 7.1	County Fair production borehole. 2024 comment on behalf of CF indicates that the borehole is now dry and no longer in use.	
HBH7	90	11.27	5	EC: 284.7 mS/m TDS: 1708 mg/L pH: 7.9	County Fair production borehole	
HBH8	-	-	-		County Fair borehole. BH welded shut. Not in use. 2024 comment on behalf of CF indicates that the borehole is now dry.	

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH9	-	-	-		Borehole used for household supply.	
HBH10	-	-	-		Tanks concentrated with red staining, likely groundwater use.	
HBH11	-	-	-		Could not gain permission to access borehole.	
HBH12	-	-	-		Could not gain access to borehole.	

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH13	200	15	3	EC: 138.7 mS/m TDS: 832 mg/L pH: 7.5	County Fair production borehole.	
HBH14	156	5.5	5.3	EC: 19.7 mS/m TDS: 118 mg/L pH: 8.7	County Fair production borehole.	
HBH15	-	-	-		Used for garden irrigation, iron staining on walls.	No photo taken
HBH16	30	42.2	0.2	EC: 167 mS/m TDS: 830 mg/L pH: 6.4	Livestock and domestic use.	

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH17	60	-	-	EC: 115 mS/m TDS: 570 mg/L pH: 6.3	Lots of iron. Livestock and domestic use.	
HBH18	25	-	-	EC: 311 mS/m TDS: 1580 mg/L pH: 6.2	Used for livestock.	
HBH19	15	1.9	-		Not in use.	
HBH20	-	5.4	-	EC: 632 mS/m TDS: 1820 mg/L pH: 7.0	Used for livestock.	

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH21	-	-	-		Domestic use and livestock.	
HBH22	-	-	-	EC: 76 mS/m TDS: 370 mg/L pH: 7.2	Low iron, good quality water. Previous owner has used this water as drinking water in their house. Later renamed to CWA_BH001 (/CWA_EastBH).	
HBH23	-	-	-	EC: 97 mS/m TDS: 480 mg/L pH: 6.7	Airport borehole. Yellow colour in water.	
HBH24	-	-	-		Could not gain access to borehole.	

ID	Depth (m)	Water Level (mbgl)	Yield (L/s)	Field Chemistry	Comment	Photo
HBH25	-	-	-	EC: 225 mS/m TDS: 1120 mg/L pH: 6.5	Not in use.	
HBH26	-	-	-	EC: 127 mS/m TDS: 630 mg/L pH: 6.8	Used for livestock.	
HBH27	-	-	-		Not in use.	
HBH28	102	-	8.3	-	County Fair borehole. Borehole is in use. BH not visited in the field, details provided by County Fair.	No photo taken

19 Appendix D: Risk Assessment Procedure

These criteria are drawn from the EIA Regulations published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989) and include:

- **Nature of the impact:**
  - This is an appraisal of the type of effect the construction, operation, and maintenance of a development would have on the affected environment. This description should include what is to be affected and how.
- **Extent of the impact:**
  - The specialist should describe whether the impact will be local (extending only as far as the development site area) or limited to the site and its immediate surroundings; or will have an impact on the region; or will have an impact on a national scale or across international borders.
- **Duration of the impact:**
  - The specialist should indicate whether the lifespan of the impact would be short term (0-5 years), medium term (5-15 years), long term (16-30 years) or permanent.
- **Intensity:**
  - The specialist should establish whether the impact is destructive or benign and should be qualified as low, medium, or high. The specialist study must attempt to quantify the magnitude of the impacts and outline the rationale used.
- **Probability of occurrence:**
  - The specialist should describe the probability of the impact actually occurring and should be described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

The impacts should also be assessed in terms of the following aspects:

- **Legal requirements:**
  - The specialist should identify and list the relevant South African legislation and permit requirements pertaining to the development proposals. He / she should provide reference to the procedures required to obtain permits and describe whether the development proposals contravene the applicable legislation.
- **Status of the impact:**
  - The specialist should determine whether the impacts are negative, positive, or neutral (“cost –benefit” analysis). The impacts are to be assessed in terms of their effect on the project and the environment. For example, an impact that is positive for the proposed development may be negative for the environment. It is important that this distinction is made in the analysis.
- **Cumulative impact:**
  - Consideration must be given to the extent of any cumulative impact that may occur due to the proposed development. Such impacts must be evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium, or high impact.
- **Degree of confidence in predictions:**
  - The specialist should state what degree of confidence (low, medium, or high) exists in the predictions based on the available information and level of knowledge and expertise.

Based on a synthesis of the information contained in the above-described procedure, the specialist is required to assess the potential impacts in terms of the following significance criteria:

- No significance: the impacts do not influence the proposed development and/or environment in any way.
- Low significance: the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.
- Moderate significance: the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.
- High significance: the impacts will have the "no-go" implication on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated.

The EIA process is based on assessment of future impacts and consequences, therefor there is still possibility of uncertainties and unknown areas even though the scientific basis of the specialist studies is sound. Where unknowns and uncertainties exist, it should be indicated, and a conservative approach should be followed when assessing and determining the level of significance.

Table 35: Criteria for evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
EXTENT or Spatial influence of impact	**Regional (R)**	Beyond 5km of the proposed development
	Local (L)	Within 5 km of the proposed development
	Site specific (SS)	On site or within 100 m of the site boundary.
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	**High (H)**	Bio-physical and/ or social functions and/ or processes are *severely* altered.
	Medium (M)	Bio-physical and/ or social functions and/ or processes are *notably* altered.
	Low(L)	Bio-physical and/ or social functions and/ or processes are *slightly* altered.
	Very Low (VL)	Bio-physical and/ or social functions and/ or processes are *negligibly* altered
	Zero (Z)	Bio-physical and/ or social functions and/ or processes remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**High (H)**	Bio-physical and/ or social functions and/ or processes are *vastly* enhanced.
	Medium (M)	Bio-physical and/ or social functions and/ or processes are *notably* enhanced.
	Low(L)	Bio-physical and/ or social functions and/ or processes are *slightly* enhanced.
	Very Low (VL)	Bio-physical and/ or social functions and/ or processes are *negligibly* enhanced.
	Zero (Z)	Bio-physical and/ or social functions and/ or processes remain *unaltered.*

Table 29 (Continued)

CRITERIA	CATEGORY	DESCRIPTION
DURATION of impact	**Short Term (S)**	0-5 years (after construction).
	Medium Term (M)	5-15 years (after construction).
	Long Term (L)	More than 15 years (after construction).
PROBABILITY of occurrence	**Definite (D)**	>95% chance of the potential impact occurring.
	Probable (Pr)	20% - 95% chance of the potential impact occurring.
	Possible (Po)	5% - 20% chance of the potential impact occurring.
	Improbable (Im)	<5% chance of the potential impact occurring.
CONFIDENCE levels	**Certain (C)**	More than adequate amount of information and understanding of the bio-physical and/ or social functions and/ or processes that may potentially influence the impact.
	Sure (S)	Reasonable amount of information and understanding of the biophysical and/ or social functions and/ or processes that may potentially influence the impact.
	Unsure (U)	Limited amount of information and understanding of the bio-physical and/ or social function.

Table 36: Definition of significance ratings

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High (H)	• High magnitude with a regional extent and long-term duration • High magnitude with either a regional extent and medium-term duration or a local extent and long-term duration • Medium magnitude with a regional extent and long-term duration.
Medium (M)	• High magnitude with a local extent and medium-term duration • High magnitude with a regional extent and short-term duration or a site-specific extent and long-term duration • High magnitude with either a local extent and short-term duration or a site-specific extent and medium-term duration • Medium magnitude with any combination of extent and duration except site specific and short term or regional and long term • Low magnitude with a regional extent and long-term duration.
Low (L)	• High magnitude with a site-specific extent and short-term duration. • Medium magnitude with a site-specific extent and short-term duration. • Low magnitude with any combination of extent and duration except site specific and short term. • Very low magnitude with a regional extent and long-term duration.
Very low (VL)	• Low magnitude with a site-specific extent and short-term duration. • Very low magnitude with any combination of extent and duration except regional and long term.
Neutral (N)	• Zero magnitude with any combination of extent and duration.

(last page)