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Thirsti Bottling Plant
Water Use Licence Application Technical Report

Version - Final

3 June 2026

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EXECUTIVE SUMMARY

Introduction

The Thirsti Bottling Plant (Thirsti), operated by Normandien Farms (Pty) Ltd, is located in northern KwaZulu-Natal within the V31F quaternary catchment, which forms part of the Northern Drakensberg Strategic Water Source Area (SWSA). This region is nationally recognised as one of South Africa's most important water-producing landscapes, providing water security to downstream communities, agriculture, and industry.

Since its establishment in 2015, the Thirsti facility has expanded from a modest bottling operation into a key regional employer and national brand. To ensure legal compliance and operational sustainability, the plant now seeks a Water Use Licence (WUL) under the National Water Act, 1998 (Act No. 36 of 1998) (NWA) for its groundwater abstraction, sanitation systems, and infrastructure located within regulated areas.

Water Uses Applied For

The following water uses in terms of Section 21 of the NWA are triggered by the Thirsti operations:

- Section 21(a): Abstraction of groundwater from eight production boreholes, with an estimated volume of 281 371 cubic metres (m^3) per annum.
- Section 21(c) and (i): The location of boreholes and plant infrastructure within 500 m of wetlands and watercourses, potentially altering the hydrological and ecological functioning of these systems.
- Section 21(g): Operation of a 68.16 m^3 septic tank and French drain system, which, if poorly managed, could result in contamination of groundwater and downstream wetlands.

These water uses underpin both the continued operation of the plant and its ability to expand production in line with market demand.

Environmental Baseline and Sensitivities

The Bottling Plant is situated in Quaternary Catchment V31F in the Pongola-Mtamvuma Water Management Area (WMA). SWSAs supply a disproportionate share of South Africa's usable water, and any abstraction or land use activity in these areas must be carefully managed to protect downstream water security for communities, agriculture, and industry.

Groundwater Environment

Hydrogeological investigations confirm that the site draws water from a confined fractured aquifer system, which is relatively resilient to short-term drawdown impacts. The radius of

influence of individual boreholes ranges between 69 metres (m) and 496 m, depending on pumping rates and aquifer transmissivity. Recharge modelling indicates that the current level of abstraction falls into category A (small-scale) relative to available recharge, suggesting that abstraction is within sustainable limits at a sub-catchment scale.

Although the confined aquifer reduces direct connectivity with surface wetlands, there remains a risk of cumulative pressure when combined with other catchment scale water uses, such as plantation forestry and agricultural irrigation (e.g., pecan nut orchards). Proper monitoring of abstraction volumes and groundwater levels is therefore critical.

Surface Water and Wetlands

Surface water assessments identified several freshwater ecosystem types within 500 m of the site, including:

- Channelled Valley Bottom (CVB) wetlands, directly influenced by stormwater discharges and septic tank overflow risks.
- Unchannelled Valley Bottom (UVB) wetlands, which play a key role in attenuating flows and supporting biodiversity.
- Hillslope Seep (HSS) wetlands, sensitive to changes in shallow groundwater and stormwater inputs.

Several of these wetlands are listed as Critically Endangered ecosystems in terms of the national biodiversity framework. Their conservation is essential for maintaining local ecological integrity, particularly as they provide flow regulation, water purification, and habitat functions.

Ecological Integrity

The Present Ecological State (PES) of the wetlands is currently assessed as moderately to largely modified (category C–D), reflecting historical land use, existing stormwater discharges, and surrounding forestry. Their Ecological Importance and Sensitivity (EIS) rating is medium to high, due to the presence of rare ecosystem types, their role in flow regulation, and their contribution to downstream biodiversity.

This means that while the systems have already experienced some degradation, they remain important for catchment scale water balance and ecological functioning, and further disturbance must be carefully avoided or minimised.

Catchment Context and Cumulative Pressures

Beyond site-level sensitivities, the plant's location in a SWSA creates a broader layer of responsibility. Activities such as commercial pine plantations, which are licenced as streamflow reduction activities, and expanding agriculture already reduce natural baseflows

and recharge. When considered together, these cumulative pressures mean that even a relatively small-scale abstraction such as Thirsti must be managed within a catchment-wide sustainability framework.

Key Sensitivities

From this baseline, the following sensitivities are identified as requiring priority management:

- Groundwater dependence: Reliance on a confined aquifer with finite recharge, requiring careful monitoring.
- Proximity to wetlands: Presence of CVB, UVB, and HSS wetlands, including Critically Endangered ecosystem types.
- Pollution risks: Septic tank overflow, stormwater discharges, and potential hydrocarbon or chemical spills.
- Strategic location: Operation within an SWSA, where national water security priorities demand heightened compliance.

Key Impacts / Risks Identified

The impact / risk assessments conducted for this application identify a number of key risks associated with the Thirsti's activities. These risks are linked to both the biophysical environment (groundwater, surface water, wetlands, soils) and the broader catchment context.

- Groundwater Risks:
    - Over-abstraction: Although the aquifer is confined, over-pumping could result in localised drawdown and reduced contributions to baseflow, especially under drought conditions. Long-term over-abstraction may reduce water availability for neighbouring users or sensitive ecosystems.
    - Cumulative stress: Catchment-level pressures from plantation forestry (streamflow reduction activity) and irrigated agriculture could compound abstraction impacts, leading to a broader lowering of groundwater levels.
    - Contamination pathways: Poorly managed sanitation systems (septic tank and French drain) present a risk of nutrients, pathogens (*E. coli*), and organic matter entering fractured dolerite zones, potentially contaminating boreholes if not properly cased and sealed.
- Surface Water Risks:
    - Stormwater runoff: Uncontrolled stormwater can increase erosion,

sedimentation, and turbidity in nearby streams and wetlands, reducing water quality and affecting aquatic habitats.

- Pollutant transport: Runoff may carry hydrocarbons, detergents, and plastics from operational areas into surface water systems, leading to both chemical and physical pollution.
- Flow regime alteration: Impermeable surfaces and stormwater diversion structures can reduce natural infiltration and interflow contributions to wetlands, altering hydrological balance.

- Wetland Risks:
  - Hydrological modification: Boreholes and infrastructure located within 500 m of wetlands (CVB, UVB, HSS) increase the risk of altering flow regimes. Even small-scale disruptions could affect wetlands classified as Critically Endangered ecosystems, which are already under stress from land use change.
  - Habitat degradation: Nutrient and pathogen inputs from septic tank overflow could trigger eutrophication, vegetation shifts, and loss of habitat quality.
  - Reduced ecological functioning: Stormwater and sediment inflows may compromise wetland services such as water purification, baseflow support, and biodiversity provision.
- Sanitation and Effluent Risks:
  - System overflow: The septic tank has been observed to overflow, raising the risk of direct contamination of surface water and wetlands[1].
  - Operational failure: Blockages or inadequate desludging could lead to uncontrolled discharges.
  - Pathogen risk: Elevated *E. coli* levels from inadequate treatment would directly threaten downstream water quality and human health.
- Catchment-Level Risks:
  - Streamflow reduction activities: Dense pine plantations reduce infiltration and increase evaporation, contributing to diminished low flows and altered seasonal runoff.
  - Agricultural abstraction: Pecan nut irrigation contributes to cumulative

[1] During the original assessment, the septic tank was found to be overflowing, which impacted the receiving environment (i.e. water quality component). The specialist has since been informed that the septic tank has been upgraded and is no longer leaking. As a result, the impact on water quality is no longer considered a concern.

reductions in baseflow and winter runoff.

- Strategic Water Source Area context: Because the site falls within the Northern Drakensberg SWSA, localised impacts could have disproportionate significance for downstream water supply security.

- Socio-Economic Risks:
  - Reputation and compliance risk: Failure to adequately manage water impacts could affect Thirsti's licence to operate, damage its brand as a responsible water steward, and undermine community trust.
  - Livelihood dependency: With approximately 350 direct employees and many indirect beneficiaries, disruption of operations due to water non-compliance could have severe socio-economic consequences in a rural economy with limited alternatives.

Mitigation and Management Framework

Thirsti operates in a sensitive water environment, and potential risks to groundwater, surface water, wetlands, and surrounding communities have been identified. To address these, a Mitigation and Management Framework has been developed. The framework sets out practical measures to prevent or reduce impacts, supported by monitoring and regular maintenance, ensuring compliance with the NWA and long-term sustainability of operations.

- Groundwater Management:
  - Staggered Pumping: Rotate abstraction between boreholes to reduce concentrated drawdown around individual sites and allow aquifer recovery.
  - Flow Measurement: Install flow metres and dipper tubes on each borehole to accurately monitor abstraction volumes and water level responses.
  - Sustainable Yield Monitoring: Conduct quarterly monitoring of groundwater levels and chemistry, ensuring abstraction remains within authorised volumes and sustainable limits.
  - Borehole Integrity: Properly case and seal boreholes, especially through fractured dolerite zones, to prevent vertical contaminant migration from sanitation systems.
  - Adaptive Management: If monitoring detects significant declines in groundwater levels, reduce abstraction immediately and re-assess pumping schedules.

- Surface Water Management:
    - Stormwater Infrastructure: Maintain and enhance stormwater diversion structures to capture and release runoff gradually.
    - Erosion and Sediment Control: Install sediment traps, check dams, and energy dissipation structures at stormwater discharge points; design these using natural materials where possible.
    - Routine Maintenance: Conduct regular inspections and clearing of culverts, drains, and stormwater structures to ensure they function effectively.
    - Vegetation Rehabilitation: Restore riparian zones with indigenous plant species to stabilise banks, reduce erosion, and enhance infiltration.
- Wetland Protection:
    - Buffer Zones: Establish and maintain vegetated buffer zones (using indigenous species) between operational areas and CVB, UVB, and HSS wetlands.
    - Hydrological Safeguards: Avoid additional infrastructure placement within 500 m of wetlands; implement design “with nature” principles for any unavoidable interventions.
    - Invasive alien plant (IAP) Control: Remove alien invasive species within 20 m of rivers, recharge areas, and wetlands to restore natural hydrology and reduce evapotranspiration losses.
    - Ecological Monitoring: Apply PES and EIS tools periodically to track wetland health and integrity.
- Sanitation and Effluent Management:
    - Septic System Upgrade: Expand septic tank capacity to prevent overflow and install manholes for rapid access during maintenance.
    - Routine Desludging: Implement a strict desludging schedule with contractor certification and proper disposal at licenced facilities.
    - Overflow Contingency: Place sandbags or absorbent barriers downstream of septic infrastructure in the event of overflow or failure, directing effluent into soil for infiltration rather than wetlands.
    - Water Quality Monitoring: Conduct bi-annual monitoring of nearby surface water (wet and dry seasons) for parameters including pH, Electrical Conductivity, Dissolved Oxygen, Total Dissolved Solids, ammonia, nitrate,

phosphate, and *E. coli*.

- Hydrocarbon and Chemical Management:
    - Fuel and Oil Control: Require drip trays under all parked vehicles and hydraulic equipment.
    - Spill Response: Provide and maintain hydrocarbon spill kits onsite, with trained staff for immediate deployment.
    - Coal and Ash Management: Store coal in runoff-controlled areas; dispose ash only at compliant landfill sites; cover stockpiles with protective materials to prevent leachate and windblown dust.
    - Laundry Wastewater: Pre-treat wastewater to remove microfibres and detergents prior to discharge; monitor effluent quality to confirm compliance.
- Catchment-Level Management:
    - Integrated Approach: Recognise cumulative pressures from forestry and agriculture; engage with catchment forums to ensure coordinated water stewardship.
    - Streamflow Reduction Management: Ensure plantations are licenced; avoid new plantings in groundwater recharge zones or near wetlands; phase out invasive alien vegetation.
    - Piezometer Installation: Monitor groundwater–surface water interaction around plantation and irrigation areas to detect reductions in baseflow.
- Socio-Economic and Compliance Management:
    - B-BBEE Procurement: Continue to strengthen local enterprise participation and ensure preferential procurement policies are maintained.
    - Community Engagement: Maintain regular communication with affected communities and stakeholders; transparently share monitoring results.
    - Emergency Preparedness: Maintain capacity to provide emergency water supplies to local communities in times of crisis, reinforcing social licence to operate.
    - Training and Awareness: Provide staff training on water stewardship, pollution prevention, and spill response.

Conclusion

Thirsti is both a strategic socio-economic asset and a sensitive water user due to its location within a SWSA. The evidence provided in this report demonstrates that groundwater abstraction and associated infrastructure can be managed sustainably, with minimal impact on wetlands and watercourses, provided the proposed mitigation and monitoring measures are implemented.

The project delivers significant economic and social benefits through employment, procurement, and community support, while aligning with national water and environmental policy objectives. On this basis, it is concluded that the granting of a WUL for Thirsti is justified, subject to strict compliance with the proposed management conditions.

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LIST OF ABBREVIATIONS

Abbreviation	Description
B-BBEE	Broad-Based Black Economic Empowerment
BH	Borehole
BHN	Basic Human Needs
CAPA	Corrective and Preventive Action
CAPEX	Capital Expenditure
CIP	Clean-in-Place
CMS	Catchment Management Strategy
CO_2	Carbon Dioxide
CVB	Channelled Valley Bottom
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
EIS	Ecological Importance and Sensitivity
ELWU	Existing Lawful Water Use
FSSC	Food Safety System Certification
FSMS	Food Safety Management System
GA	General Authorisation
GCS	GCS Environment South Africa (Pty) Ltd
GMU	Groundwater Management Unit
GN	Government Notice
GN R	Government Notice Regulation
GMP	Good Manufacturing Practice
GRU	Groundwater Resource Unit
HACCP	Hazard Analysis and Critical Control Points
HGM	Hydro-Geomorphic
HSS	Hillslope Seep
HST	Hydrological Soil Types
I&AP	Interested and Affected Parties
IAP	Invasive Alien Plants
IHI	Index of Habitat Integrity
ISO	International Organization for Standardization
IUA	Integrated Unit of Analysis
IWRM	Integrated Water Resource Management
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
NCR	Non-Conformance Report
NFEPA	National Freshwater Ecosystem Priority Areas
NGA	National Groundwater Archive
NGO	Non-Governmental Organisation
NIWIS	National Integrated Water Information System
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
PET	Polyethylene Terephthalate
PPP	Public Participation Process
PRP	Prerequisite Programme
QA	Quality Assurance
QA/QC	Quality Assurance / Quality Control
QC	Quality Control
RQO	Resource Quality Objective
SANBI	South African National Biodiversity Institute
SANBWA	South African National Bottled Water Association
SCM	Site Conceptual Model
SLA	Service Level Agreement
SWSA	Strategic Water Source Area
TDS	Total Dissolved Solids
UVB	Unchannelled Valley Bottom
WARMS	Water Authorisation and Registration Management System

Abbreviation	Description
WMA	Water Management Area
WUL	Water Use Licence
WULA	Water Use Licence Application

UNITS OF MEASUREMENT

Unit	Description
%	Percentage
°C	Degrees Celsius
ha	Hectares
km	Kilometres
km²	Square kilometres
l	Litres
l/s	Litres per second
m	Metres
m²	Square metres
m³	Cubic metres
m³/a	Cubic metres per annum
m³/day	Cubic metres per day
mamsl	Metres above mean sea level
mbgl	Metres below ground level
mg/l	Milligrams per litre
ml	Millilitres
mm	Millimetres
mm/a	Millimetres per annum
MPa	Megapascals
Mm³/a	Million cubic metres per annum

CHEMICAL ELEMENTS

Abbreviation	Description
EC	Electrical Conductivity
DO	Dissolved Oxygen
E. coli	Escherichia coli
NH_3	Ammonia
NO_3^-	Nitrate
O_3	Ozone
pH	Potential Hydrogen
PO_4^{3-}	Phosphate
TDS	Total Dissolved Solids

1 INTRODUCTION

1.1 Activity Background

Normandien Farms (Pty) Ltd (Normandien) owns and operates the Thirsti Bottling Plant (Thirsti), located on farms Buffelshoek 15469 and Woodburn 15470, approximately 28 kilometres (km) southwest of Newcastle and 6 km northwest of the settlement of Normandien in the province of KwaZulu-Natal (Figure 1-1). Production commenced in 2015 with the bottling of natural and sparkling spring water, later expanding to include fruit-flavoured products. Due to growth in consumer demand and production capacity, Thirsti proposes to expand operations, requiring increased abstraction of water from on site boreholes.

The abstraction of water from boreholes, the presence of infrastructure within 500 metres (m) of wetlands, and the operation of an existing septic tank and French drain trigger water uses under Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Normandien has therefore appointed GCS Environment South Africa (Pty) Ltd (GCS) to prepare this Technical Report in support of the Water Use Licence Application (WULA). The WULA is being undertaken under Department of Water and Sanitation (DWS) reference number WU41899.

1.2 History of the Project

This note aims to explain the lengthy licensing process undertaken by Thirsti in respect of its Normandien facility (commenced in 2019) and the overlap between the application made in 2019 (the original WULA application) and the application currently before DWS for decision making (the re-application)

1.2.1 The Original Application (2019 – 2022)

Thirsti appointed GCS in 2019 to undertake a WULA process in support of the continued operation and future expansion of the facility (the original application).

The licensing process for the original application was initiated while groundwater abstraction at the Thirsti Bottling Plant was being undertaken under General Authorisation (GA) reference 27/2/1/V31F/1 and before the expansion of the facility and the introduction of additional production capacity.

The WULA process for the original application commenced with a pre-application meeting held with the DWS on 24 March 2020. Thereafter, specialist investigations, technical assessments and stakeholder engagement processes were undertaken to support the application.

The initial Public Participation Process (PPP) for the original application commenced on 19 March 2021 and included the placement of site notices, distribution of Background Information Documents (BIDs) to Interested and Affected Parties (I&APs), adjacent landowners and relevant authorities, and publication of notices in the Newcastle Advertiser. Additional public participation activities were undertaken on 4 June 2021, including the placement of multilingual site notices

in English, Afrikaans and isiZulu, and publication of multilingual advertisements in English and isiZulu. A public review period was undertaken between 19 March 2021 and 17 May 2021, followed by a public meeting held on 23 June 2021.

The original application included groundwater abstraction from ten boreholes together with water uses associated with infrastructure located within the regulated area of watercourses. As part of the review process, DWS undertook a site inspection on 12 May 2022 to review the proposed water uses and associated infrastructure. During the site inspection, DWS identified additional water uses associated with the septic tank and French drain system that required inclusion in the application. The application subsequently progressed through the electronic Water Use Licence Application and Authorisation System (e-WULAAS), with DWS requesting additional supporting information, including septic tank design details and updated wetland-related assessments.

While the original application was progressing, the Thirsti Bottling Plant continued to operate and the licensing process advanced through specialist investigations, public participation, DWS review, site inspections and the submission of additional technical information. Although the COVID-19 pandemic and associated restrictions contributed to delays during 2020 and 2021, the original application process continued to progress, with updated technical information being compiled and submitted to DWS as required.

During the review and refinement of the project, the proposed abstraction infrastructure was reduced by Thirsti from ten boreholes to eight operational boreholes, reflecting the boreholes currently utilised to supply the Thirsti Bottling Plant. The original WULA progressed substantially through the licensing process, including specialist investigations, public participation, DWS review processes and a site inspection. DWS subsequently advised that outdated e-WULAAS applications must be replaced with newly submitted applications in accordance with current administrative requirements.

1.2.2 The Re-application (2023 – 2026)

Consequently, the application currently before the DWS for decision making (the re-application) constitutes a re-application of the WULA process and incorporates updated project information, revised specialist studies, refined abstraction requirements, additional technical assessments, and the outcomes of regulatory engagement undertaken since the original submission ie: additional information requested by the DWS.

The re-application therefore builds upon the extensive technical investigations, stakeholder engagement processes and regulatory review undertaken since the initiation of the WULA process in 2019 and represents the continuation of a long-standing licensing process rather than a completely new water use application.

1.3 Regional Setting and Location of Activity

Thirsti is situated on the farm Buffelshoek 15469 and Woodburn 15470 in the province of KwaZulu-Natal. The site lies approximately 28 km southwest of Newcastle and 6 km northwest of the settlement of Normandien. Access to the property is via the P39-1 provincial road leading from Newcastle. Thirsti is located in the Newcastle Local Municipality which falls under the jurisdiction of the Amajuba District Municipality.

1.3.1 Property Description

Thirsti covers an area of approximately 2 413.92 hectares (ha) and is located on farms Buffelshoek 15469 and Woodburn 15470. The property details are provided in Table 1-1, and the property map is shown in Figure 1-2.

Table 1-1: Property Details of the Farms

Farm Name	Portion	Landowner	Title Deed
Buffelshoek Farm	Erf 15469	Normandien Farms (Pty) Ltd	000011131/2002
Woodburn Farm	15470 Ptn 1	Normandien Farms (Pty) Ltd	000015271/2016
Woodburn Farm	15470 RE	Normandien Farms (Pty) Ltd	000015271/2016

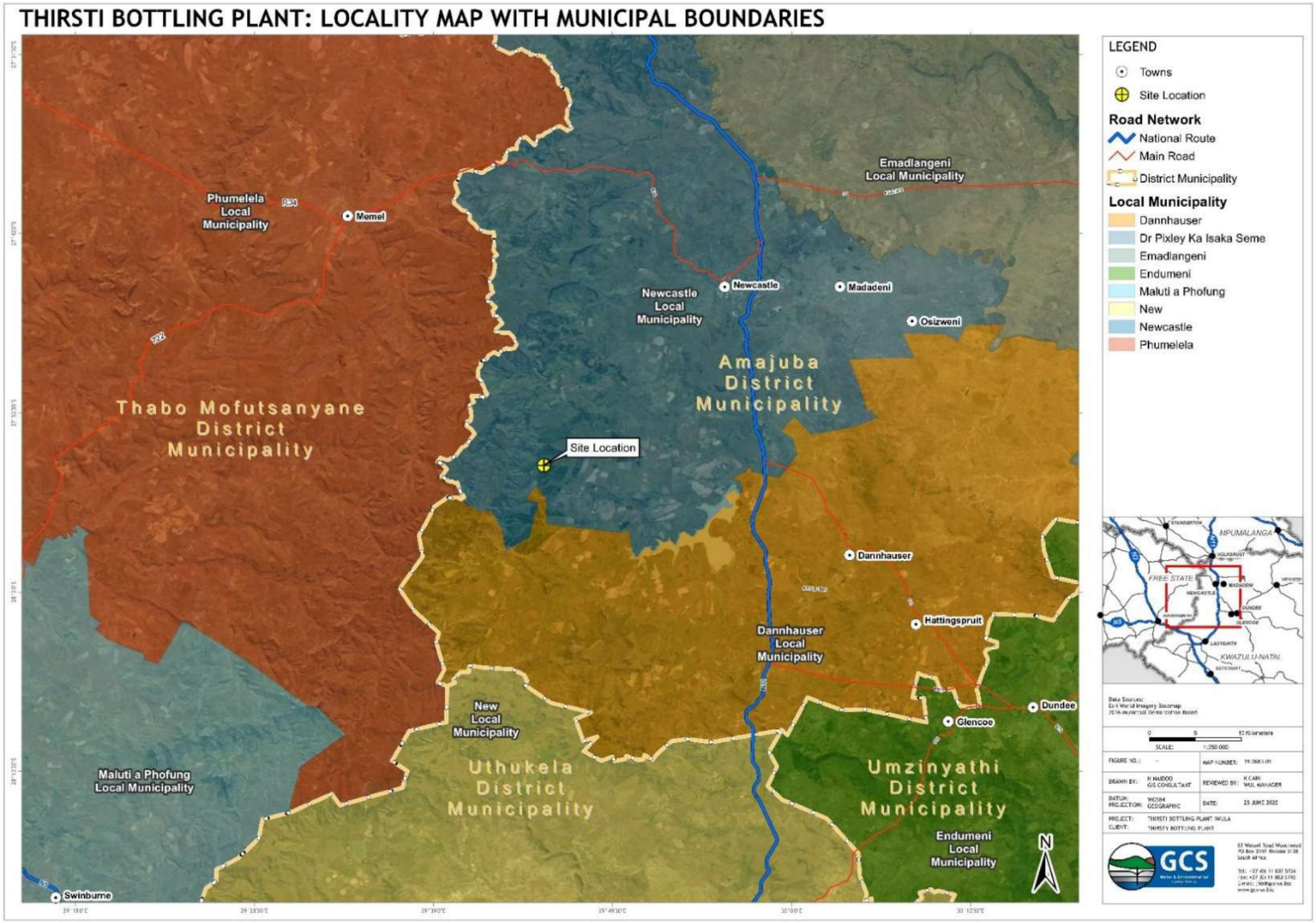


Figure 1-1: Regional Locality of the Thirsti Bottling Plant

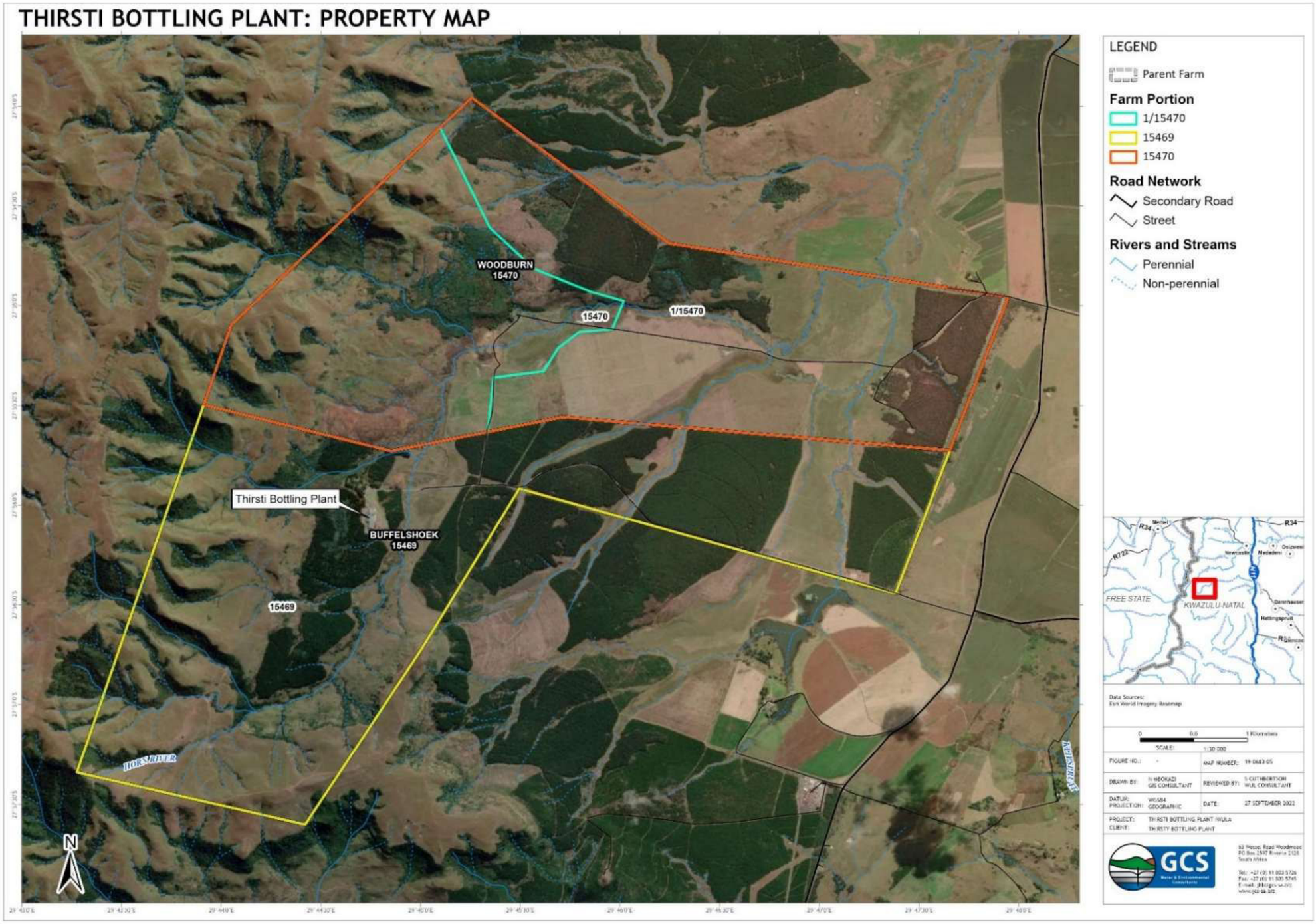


Figure 1-2: Properties that form the Thirsti Bottling Plant

1.4 Purpose of this Report

A Water Use Licence (WUL) Technical Report is prepared to support an application under the NWA. Its purpose is to demonstrate that proposed water uses are lawful, sustainable, and well-managed. The report outlines the current condition of surface and groundwater resources, assesses potential impacts, and applies risk tools to identify and mitigate threats to water quality and quantity. It also shows alignment with national and catchment strategies while addressing socio-economic benefits. Ultimately, the report provides the DWS with the technical evidence needed to make an informed licensing decision.

1.5 Contact Details

The contact details of the Applicant, Normandien, and the appointed water use consultant, GCS, are provided in Table 1-2 and Table 1-3 respectively.

Table 1-2: Applicant Details

Company Name	Normandien Farms (Pty) Ltd
Telephone Number	033 251 0977
Contact Person	Robin Hoatson
Contact Person Mobile Number	087 803 0417
Email Address	rob@thirsti.co.za
Postal Address	PO Box 13559, Cascades, 3202
Physical Address	Cnr Umlaas & Richmond Road, Thornville, 3760

Table 1-3: Water Use Licence Consultant

Company Name	GCS Environment South Africa (Pty) Ltd
Telephone Number	011 803 5726
Contact Person	Paula Tolksdorff
Email Address	paulat@gcs-sa.biz
Postal Address	PO Box 2597, Rivonia,2128
Physical Address	63 Wessel Road, Rivonia, 2128

The Curriculum Vitae and Qualifications of the Environmental Assessment Practitioner is attached to APPENDIX A.

2 CONCEPTUALISATION OF ACTIVITY

2.1 Description of Activity

The Thirsti Bottling Plant sources groundwater from boreholes on the property and transfers it to the treatment facility, where it undergoes multi-stage preparation. The process includes sand and activated carbon filtration, microfiltration, ultraviolet sterilisation, and ozonation, all supported by a Clean-in-Place system to maintain hygiene and operational efficiency. This ensures the water retains its natural mineral balance while meeting potable water and food safety standards.

Packaging is prepared on site. Polyethylene Terephthalate (PET) preforms are blow-moulded into bottles of various sizes using high-pressure compressed air, while closures, labels, shrink-wrap,

and trays are staged and fed into the filling lines.

The plant operates three main production lines:

- Three still water lines: Bottles are rinsed, filled under hygienic conditions, capped, labelled, coded, and shrink-wrapped.
- Two flavoured water lines: Syrups and concentrates are blended with base water under controlled ratios and inline quality checks before bottling and canning.
- One sparkling water line: Carbon Dioxide (CO_2) is injected under pressure, with isobaric filling technology used to retain carbonation before capping and packaging.

Supporting utilities include compressed air for bottle blowing and rinsing, chillers for process cooling, boilers for steam and hot water, and process water systems for rinsing and Clean-in-Place (CIP) cycles. These utilities are closely monitored to ensure safe and efficient operation.

Once packaged, products are shrink-wrapped into multipacks, palletised, and stored in temperature-stable warehouses before national distribution.

Waste is managed through controlled disposal and recycling systems. Wastewater from CIP and cleaning cycles, rejected packaging and bottles, and CO_2 or boiler emissions are treated or disposed of in accordance with environmental requirements.

For further information refer to Section 2.3.

2.2 Extent of Activity

The Thirsti covers an operational footprint of approximately 1.86 ha within a total project area of 2 413.92 ha.

2.3 Key Activity Related Processes and Products

2.3.1 Water Preparation

The primary raw material for the Thirsti Bottling Plant is groundwater. Abstraction is undertaken via a network of boreholes on the property, with conveyance pipelines directing water to the treatment facility. The water preparation system is designed to preserve the natural mineral composition of the spring water while ensuring that it meets the required food safety and potable water standards.

The treatment train comprises several sequential stages:

- Sand Filtration: The raw water first passes through sand filters, which remove suspended solids and larger particulate matter. This ensures that downstream processes are not compromised by clogging or excessive turbidity.
- Microfiltration: The water is then subjected to fine membrane microfiltration, which removes small, suspended solids and reduces microbial load without altering the mineral

balance of the water.

- Ozonation: Ozone (O_3) is used for the treatment of rinse water, which provides a residual disinfection effect, further stabilises the product, and ensures compliance with shelf-life requirements.

All filtration and sterilisation units are linked to a CIP system, which enables automated cleaning and sterilisation of equipment using caustic and sanitising solutions, followed by rinsing with process water. This ensures continuous hygienic operation and reduces downtime for manual cleaning.

2.3.2 Packaging Preparation

Packaging preparation is undertaken on site to improve efficiency and reduce reliance on external suppliers.

- Bottle Manufacture: PET preforms are delivered to the facility and stored in controlled conditions. Preforms are heated and blown into bottles using stretch-blow moulding machines that rely on high-pressure compressed air. This allows for rapid production of bottles of varying sizes (e.g., 330 millilitres (ml), 500 ml, 750 ml,1 litres (l), 1.5 l, 2 l, 5 l formats and canning).
- Closures and Ancillaries: Plastic caps, can lids, labels, shrink-wrap, and carton trays are supplied separately and staged for each filling line. Automated sorting and feeding systems ensure caps and labels are consistently aligned with production throughput.

2.3.3 Production Lines

The Thirsti plant is designed with multiple filling lines to accommodate different product streams, ensuring operational flexibility and product diversification.

2.3.3.1 Still Water Lines

For still water, blown bottles are first rinsed with ozonated rinse water or filtered compressed air to remove any foreign particles. They are then filled with natural spring water under hygienic, low-turbulence conditions to minimise aeration and contamination risk. Filled bottles are capped, labelled, and date-coded before being shrink-wrapped into multipacks and stacked onto pallets for storage.

2.3.3.2 Flavoured Water Line

The flavoured water line incorporates a syrup mixing and dosing system. Concentrates are blended with filtered water in carefully controlled ratios to produce consistent flavour profiles. Inline quality checks verify concentration and pH levels before the product is released for filling. Bottles and cans follow the same rinse–fill–cap–label–packaging sequence as still water, with additional focus on ensuring no flavour carry-over between production batches.

2.3.3.3 Sparkling Water Line

The sparkling water line incorporates a carbonation system where food-grade CO_2 is injected into the water under controlled pressure. To prevent CO_2 loss during filling, isobaric filling technology is used, maintaining pressure stability within the filling tanks and bottles. Once filled, bottles are capped immediately to preserve carbonation levels. This line is also capable of producing carbonated flavoured variants.

2.3.4 Utilities

The plant relies on a range of utility systems to maintain efficient and safe operations:

- Compressed Air Systems: Supply high-pressure air for bottle blowing and filtered sterile air for bottle rinsing.
- Chiller Units: Provide cooling for both the production environment and process water loops, particularly for carbonation processes which require temperature control.
- Boilers: Supply steam and hot water for cleaning, sterilisation, and other thermal process requirements.
- Process Water Systems: Provide treated water for bottle rinsing, CIP cycles, and other ancillary uses.

These utilities are integrated with monitoring systems to ensure reliability, energy efficiency, and compliance with occupational health and safety requirements.

2.3.5 Finished Product Storage and Distribution

Once packaged, finished products are grouped into multipacks and shrink-wrapped, then palletised for handling. Pallets are stored in a warehouse facility under clean, temperature-stable conditions to protect product quality prior to distribution. Distribution occurs via a national logistics network, ensuring delivery to wholesalers, retailers, and direct customers across South Africa.

The Thirsti process is depicted in Figure 2-1, Figure 2-2, Figure 2-3 and Figure 2-4.

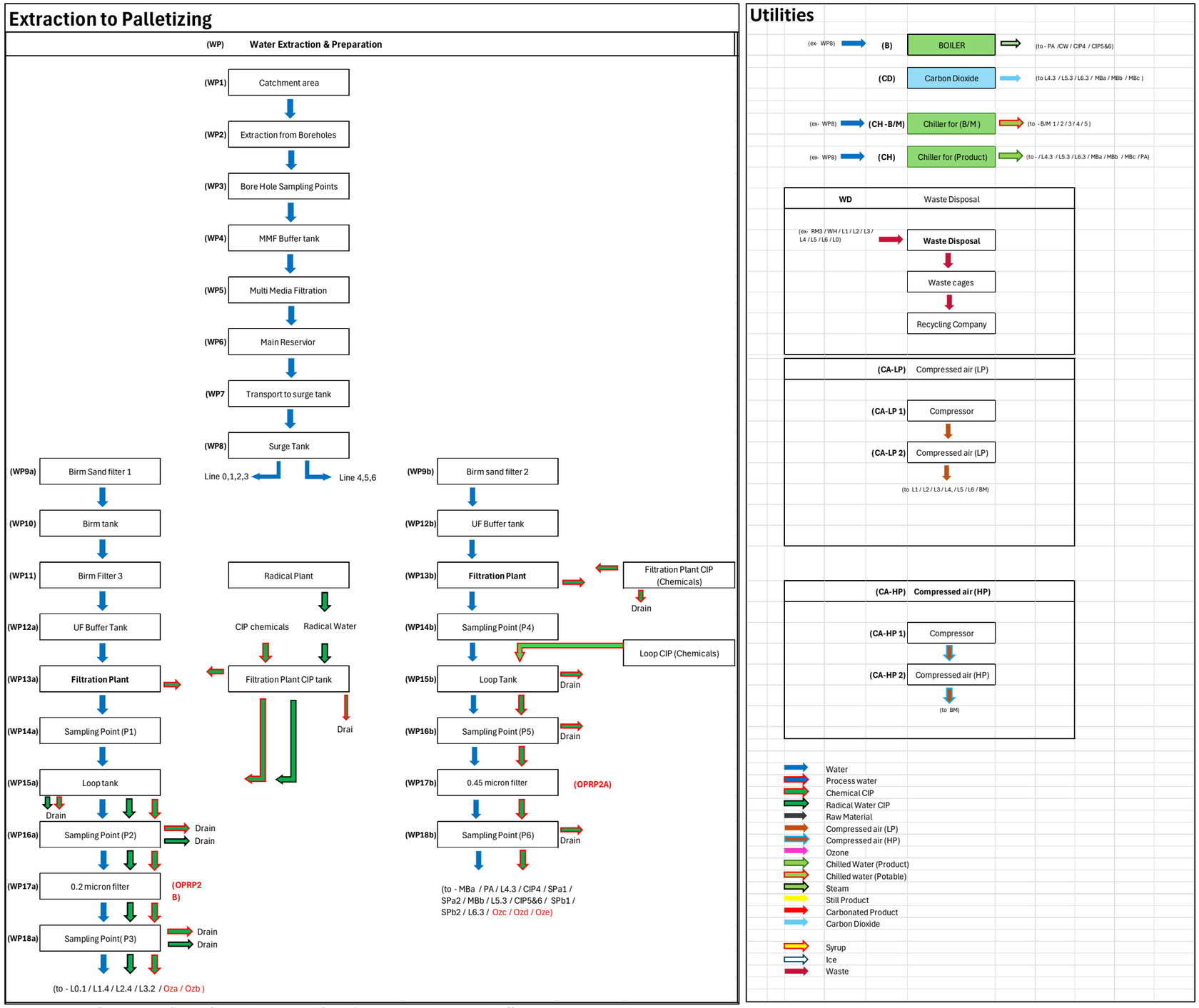


Figure 2-1: Thirsti Bottling Plant - Process Flow from Extraction to Palletising (Part 1)

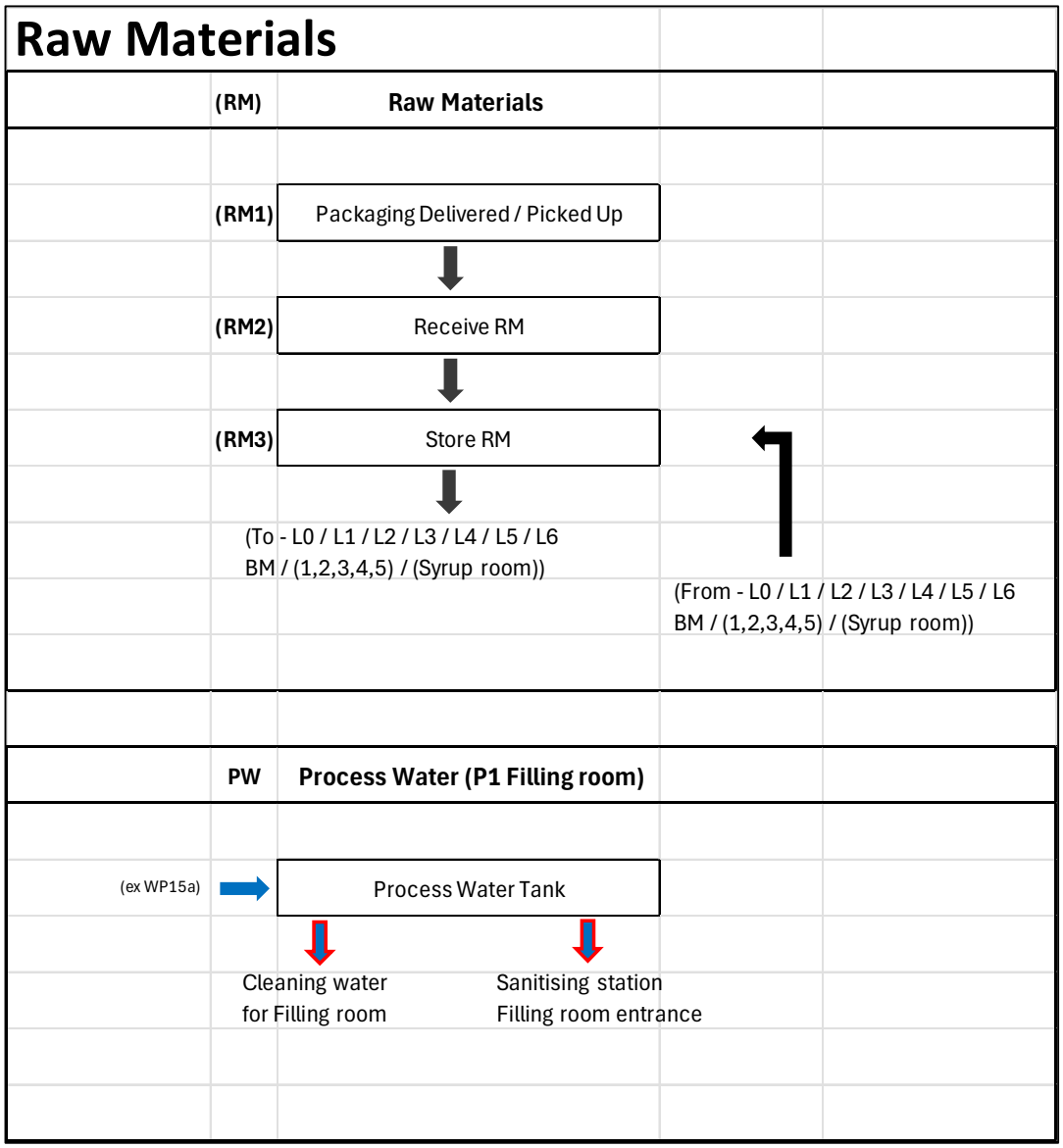
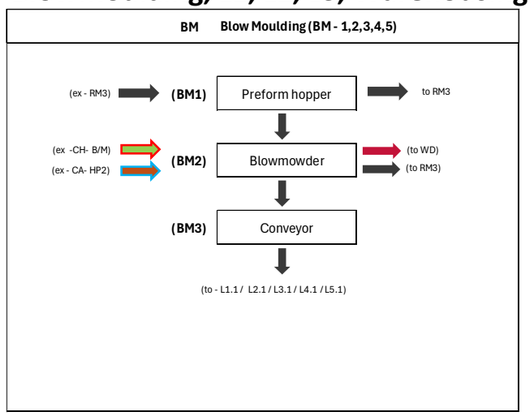
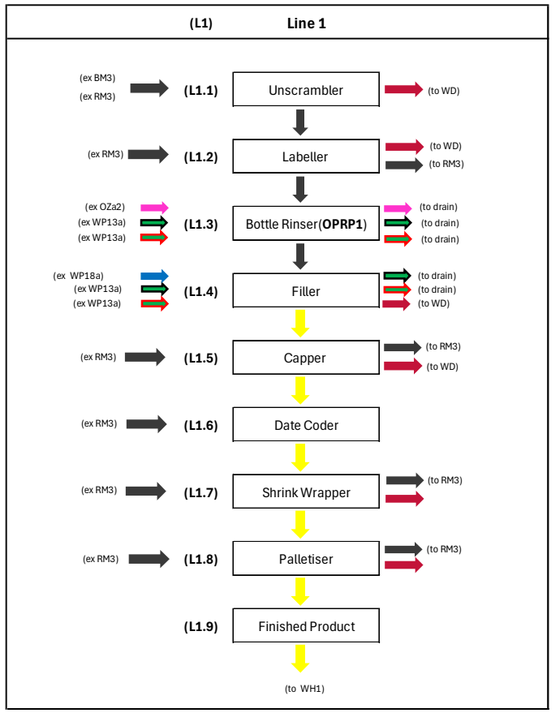
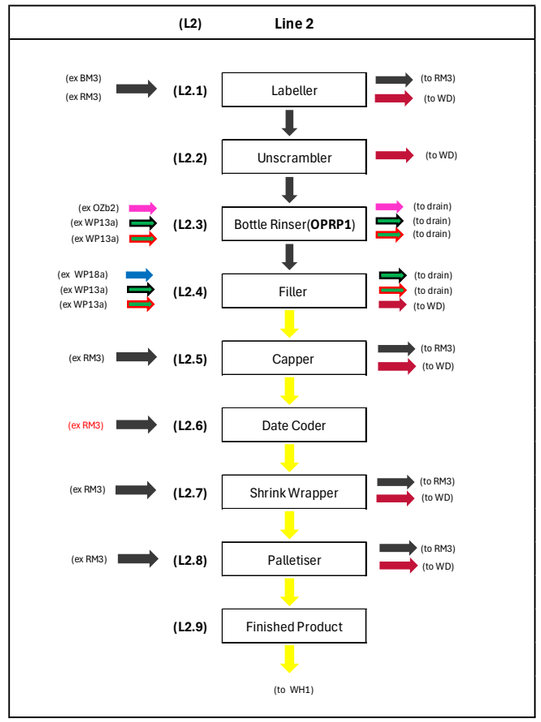


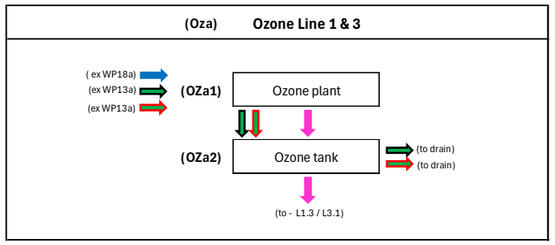
Figure 2-2: Thirsti Bottling Plant - Process Flow from Extraction to Palletising (Part 2)

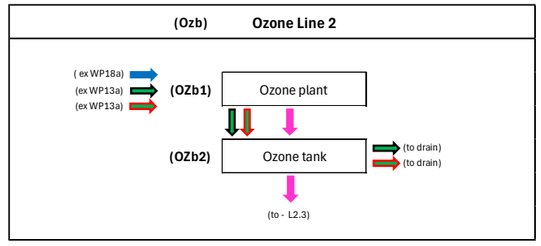
Blowmoulding, L1, L2, L3, Warehousing











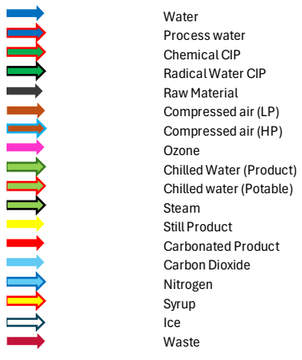


Figure 2-3: Thirsti Bottling Plant: Process Flow from Extraction to Palletising (Part 3)

L4, L5, L6

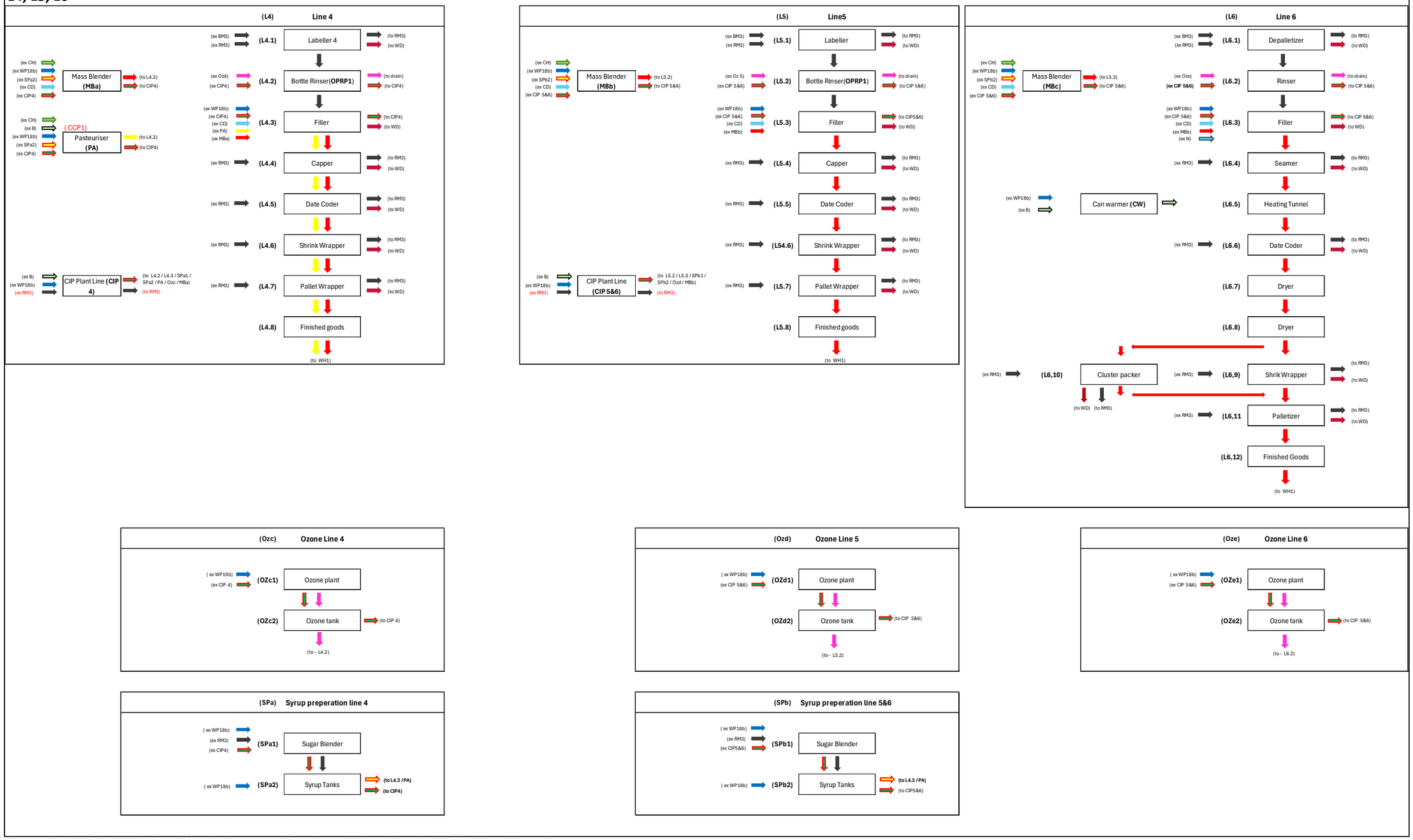


Figure 2-4: Thirsti Bottling Plant - Process Flow from Extraction to Palletising (Part 4)

2.3.6 Waste Streams and Management

The Thirsti plant generates several waste streams:

- Wastewater: Produced during CIP cycles, rinsing, and equipment cleaning. This wastewater is collected and disposed of in a controlled manner to prevent contamination of surface or groundwater resources.
- Solid Waste: Includes rejected bottles, damaged packaging, and off-spec product. Solid waste is either recycled where possible (e.g., PET) or disposed of at licenced waste facilities.
- Gas Emissions: Include CO_2 used in carbonation and emissions from boiler operations. These are managed in accordance with air quality regulations.

2.3.6.1 Waste Service Level Agreement

Thirsti maintains a Service Level Agreement (SLA) with Iron Man Recycling (Pty) Ltd (Iron Man) for the provision of waste management services at its Normandien facility in KwaZulu-Natal. The agreement, which came into effect on 7 April 2025, clearly outlines the obligations and deliverables of both parties. Under the SLA, Iron Man has an onsite bales machine to compress the waste bottles and cans, which are collected by a truck three times a week.

All waste removed from the facility is weighed, and the corresponding weight records are provided to Thirsti to support internal monitoring, reporting, and compliance requirements. Furthermore, Iron Man is responsible for ensuring that all recyclable materials are separated and channelled into appropriate recycling streams, contributing to the conversion of waste into new products and supporting Thirsti's sustainability objectives. l.

2.3.7 Septic Tank and French Drain

The sewage treatment system (Figure 2-5) for the Thirsti has been designed to handle wastewater through a combined septic tank and French drain process. Wastewater from the plant is first conveyed via the sewer main pipeline, which includes access manholes for maintenance and monitoring. The flow is directed into a new septic tank, which has been constructed with a reinforced concrete foundation and brick masonry walls to ensure structural stability and watertight performance. The tank is divided into three chambers, allowing solids to settle progressively as the wastewater moves through each section. Access covers have been installed above each chamber to facilitate inspection and desludging when required.

From the final chamber of the septic tank, effluent is discharged through an outlet pipe into a French drain system designed to provide natural filtration and soil absorption. The French drain consists of a subsurface trench filled with stone aggregate and lined with geotextile fabric, enabling percolation of treated effluent into the surrounding soil. The trench is backfilled with earth material, restoring surface stability while allowing infiltration to occur below ground. This

combined process ensures that wastewater is treated in stages: solids are retained and broken down within the septic tank, while liquid effluent undergoes final polishing in the French drain before being safely absorbed into the environment.

The system has been engineered with reinforced concrete slabs for durability, double-seal manhole covers for secure access, and adequate reinforcement steel to meet structural requirements. Construction specifications ensure a minimum concrete strength of 25 MPa at 28 days, proper curing, and sufficient cover over steel reinforcement for long-term performance. Overall, the process provides a sustainable, low-maintenance solution for sewage management at the Thirsti Bottling Plant, aligning operational efficiency with environmental compliance.

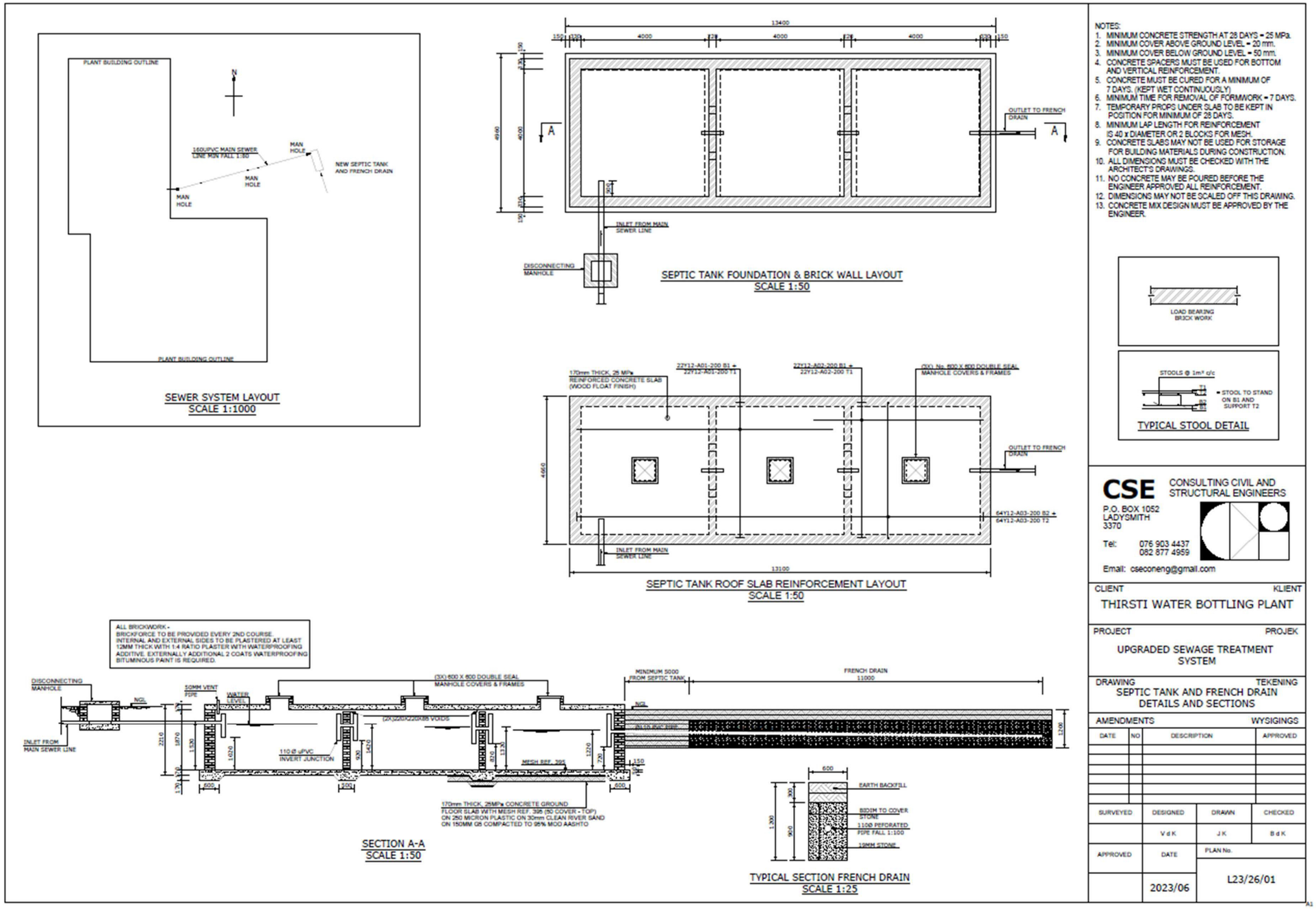


Figure 2-5: Septic Tank and French Drain System

2.4 Activity Life Description

Production at the Thirsti Bottling Plant commenced in 2015 with the bottling of natural and sparkling spring water, later expanding to include fruit-flavoured products. Due to growth in consumer demand and production capacity, Thirsti proposes to expand operations. At this stage, no operational end date has been determined; the facility is intended to operate on an ongoing basis subject to market demand.

2.5 Key Water Uses

The key water uses at Thirsti include Section 21(a), (c), (g) and (i) water uses in terms of NWA. Table 2-1 below outlines the Section 21 water uses identified and their applicability to the Thirsti.

Table 2-1: Section 21 Water Uses to be included in the Water Use Licence Application

Water Use	Description
Section 21 (a) Taking water from a water resource.	Groundwater is abstracted from boreholes on the property for use in the production of bottled water.
Section 21 (c) and (i): Altering beds, Banks and flow of a watercourse.	Several boreholes and associated infrastructure are located within 500 m of natural watercourses and wetlands, potentially affecting these aquatic systems.
Section 21(g): Disposing of waste or water containing waste in a manner which may be detrimentally impact a water resource.	A septic tank and associated French drain system are in operation at the Bottling Plant, with potential to impact groundwater if not properly managed.

2.6 Organisational Structure of Activity

Normandien bears ultimate responsibility for the implementation of the Water Management Plan and for ensuring compliance with all conditions set out in the WUL. Within this framework, Thirsti Bottling Plant has established a clear operational management structure to ensure accountability, efficiency, and effective communication across all functional areas. The structure is summarised below.

- Managing Director:
    - Provides overall leadership, strategic direction, and oversight of the company's operations and performance.
- General Management:
    - Oversees all divisions of the company to ensure that business objectives, operational efficiency, and regulatory compliance are achieved.
- Plant Operations:
    - Plant Manager oversees production, maintenance, and warehousing functions, ensuring smooth operational performance and product quality.
    - Production: Senior Production Manager supported by Production Managers, Supervisors, Operators, and Packers responsible for daily manufacturing activities

and adherence to food safety standards.

- Maintenance: Maintenance Manager supported by Artisans and Apprentices ensures plant equipment reliability, preventive maintenance, and compliance with safety standards.
- Warehousing and Logistics: Head of Logistics and Warehouse Manager oversee inbound and outbound logistics, supported by Warehouse Controllers, Reach Truck and Forklift Operators, and Packers.

- Quality Assurance and Food Safety:
  - Head Quality Manager
    - Leads site quality strategy to ensure full compliance with food safety, water standards, and regulatory requirements.
    - Oversees Quality Assurance and Quality Control (QA/QC) processes across bottling, packaging, and warehouse operations to guarantee product safety and consistency.
    - Drives continuous improvement by reducing defects, managing non-conformances, and strengthening Good Manufacturing Practice (GMP), hygiene and process controls.
    - Manages supplier quality, raw material compliance, and strengthens a robust quality culture across all departments.
  - Quality Assurance Manager
    - Responsible for all food safety aspects of the Food Safety Management System (FSMS), ensuring legal and customer requirements are fully met.
    - Ensures all employees, contractors and temporary staff are inducted and competent in FSMS requirements.
    - Manages staff improvement suggestions and communicates FSMS performance through briefings, training, reports, etc.
    - Coordinates corrective action system and prepares for management review using data on Non-Conformance Reports (NCRs), supplier performance, and customer feedback.
    - Develops emergency preparedness & response plans for food safety risks.
    - Coordinates internal and external auditing programmes.
    - Maintains and controls FSMS documentation, updates and distribution.

- Manages pest control programme, laboratory oversight, and participates in mock recall procedures.

- Food Safety Officer
  - Implements and monitors Prerequisite Programmes (PRPs) and GMP.
  - Conducts inspections of production areas, equipment, and finished products to ensure compliance.
  - Investigates food safety incidents and manages Corrective and Preventive Action (CAPA).
  - Maintains accurate food safety documentation and supports audit readiness.
  - Provides food safety training and creates awareness across Production and QA/QC teams.
- QA Technician
  - Conducts inspections, tests, and monitoring on production lines and in laboratory environments.
  - Performs basic physical, chemical, and microbiological tests.
  - Maintains accurate record keeping, identifies non-conformances, and ensures GMP compliance.
  - Supports QA and QC teams to maintain safe, compliant, and efficient production operations.
- Quality Control Manager
  - Leads and manages the QC team, ensuring training, competency, and strong quality culture.
  - Oversees raw material, in-process and finished product testing.
  - Manages product non-conformances and CAPA.
  - Ensures compliance with GMP, HACCP, ISO and regulatory standards.
  - Maintains QC documentation, reporting and trend analysis.
  - Drives continuous improvement and collaborates with Production, R&D and Procurement.
- Quality Controller Supervisor
  - Supervises QC Technicians and ensures accuracy of inspections and

testing.

- Monitors in-process and finished product quality, identifying deviations.
- Assists in CAPA execution and improves quality performance.
- Ensures compliance with GMP, HACCP, ISO and internal procedures.
- Supports continuous improvement initiatives and teamwork across departments.

- Quality Controllers
  - Collect samples from production, tanks and boreholes.
  - Conduct environmental monitoring in cleanroom areas.
  - Perform ozone testing, CO_2 sampling and swabbing activities on cleanroom equipment and filler nozzles.
  - Record temperature, pH and verify measurement equipment.
  - Manage start-up checklists, CCP monitoring, and participate in emergency/first-aid duties.
  - Check retention samples weekly and autoclave laboratory waste.
  - Assist with lab stock take, mock recall, and accurate laboratory data recording/filing.
- Microbiologist
  - Performs microbiological testing for raw materials, in-process and finished products.
  - Conducts environmental monitoring to prevent contamination.
  - Supports R&D with shelf-life studies and microbial risk assessments.
  - Ensures compliance with GMP, HACCP, ISO and regulatory standards.
  - Maintains precise microbiology records and issues technical reports.
  - Provides microbiological guidance and training to QC and production teams.

- Administration and Finance:
  - Senior Financial Manager oversees budgeting, cost management, and financial reporting.
  - Administrative and Support Staff: Includes Receptionist, Training Officer, and Human Resources support ensuring administrative, record keeping, and training

compliance.

- Cleaning and Hygiene:
    - Cleaners under QA supervision ensure sanitation, hygiene, and compliance with food safety protocols across all operational areas.

2.7 Business and Corporate Policies

This section summarises the relevant policies guiding operations at the Thirsti plant. The information has been sourced from the Food Safety Management System, Document No. POL-02 (Thirsti, 2016), attached in APPENDIX F. These policies outline the company's commitment to maintaining high standards of quality, safety and regulatory compliance.

2.7.1 Hygiene Policy

It is the policy of Thirsti to practice good hygiene management in order to ensure good quality and safe product through all the stages of receiving, storing, processing, packaging and dispatching.

Regular checks are conducted in the plant to ensure hygiene standards are being met. A master cleaning schedule is maintained and only South African Bureau of Standards approved cleaning chemicals will be used. Staff is trained on the effective use of the chemicals and basic hygiene rules.

It is the responsibility of management, employees and visitors to observe the policies and follow procedures laid down in order to prevent contamination of the packaging and finished products while in the plant as well as in transit to the plant and customers. The following is undertaken:

- Eating or drinking is not permitted in any processing area, toilets or changing rooms. The canteen is the only area available for this purpose and provided dustbins must be used for refuse.
- Smoking is not allowed within the facility and is to be kept confined to designated areas outside the facility.
- Spitting is not allowed anywhere on the premises, especially in areas where products are handled.
- Overalls worn in the production areas are changed daily.
- Suitable footwear must be worn in product handling areas, i.e. no open shoes or slop-slops.
- Protective clothing including microbiology laboratory may not be worn outside the production area or taken off the premises for any reason.
- All staff that handles final products will ensure that their personal hygiene includes a

daily bath, shower or wash.

- For safety, no loose clothing will be worn near moving machinery. This includes scarves, towels and blankets.
- Jewellery must not be worn by employees in food handling areas. Religious, ethnic, medical and cultural imperatives that pose a risk to food safety must be controlled by measures to minimise contamination.
- Nail polish and any nail art must not be used on fingernails, and fingernails must be kept short and clean. Artificial fingernails must not be worn.
- Artificial eyelashes must not be worn. Hair nets and beards mask must be worn when entering the factory.
- Civilian clothing must be neat and clean, and ironed on a regular basis.
- Hands and forearms must be washed with warm water and anti-bacterial soap and dried with paper towel:
    - after visiting the toilet
    - after blowing the nose
    - after smoking and/or eating
    - after handling any soiled object.
- Hand washbasins are only available for the cleaning of hands and are not to be used for the cleaning of equipment or utensils.
- Any skin infections, irritations, illness or disease that could influence product safety must be reported to the First Aider when arriving at work.
- Any cuts, scratches, open wounds or abrasions must be covered with a plaster, bandage and glove, which will be issued by the first aider.
- Any loss of plasters and spillage of blood near to product and equipment must be immediately reported to the Supervisor.
- Gloves will only be issued in circumstances where hands need to be protected against physical or chemical injuries. They may also be worn to cover plasters and bandages where necessary. Visitors and finance will be allowed to wear gloves and shall be recorded on glove issue register.
- Before coughing or sneezing turn away from products and turn head into shoulder when working in the production area.

2.7.2 Food Safety Policy

It is the primary concern of Thirsti, to provide safe and high-quality products that meet and succeed customer and consumer expectations. The following quality and food safety principles are the foundation of Thirsti Water's commitment to quality and food safety:

- At the very minimum we will comply with all relevant legislation and approved codes of practice.
- Meet mutually agreed customer requirements related to quality and food safety.
- Manufacture and deliver products that meet the highest quality and food safety standards, assuring product and process integrity.
- Ensure a sustainable quality and food safety culture through communication and developing employees' competencies and technical skills.
- Include quality and food safety strategies in the annual business planning process to ensure that food safety and quality remains an integral part of operations.
- Management ensures that the appropriate resources, including human and financial resources, are committed towards implementing this policy across all our operations and communicating the policies, behaviours and standards to all employees.
- Set clear measurable food safety and quality objectives and targets against which performance will be measured.
- Establish, implement and maintain effective arrangements for communicating with suppliers and contractors, customers and statutory and regulatory authorities.
- Maintain a food safety and quality management system conforming to FSSC 22000.
- Validate the effectiveness of the quality and food safety management systems through internal and external audit processes.
- Regularly measure compliance with these behaviours and implement performance objectives to help assure our clients and consumers that we are providing products that are safe while meeting their quality expectations. at Thirsti.
- Review the food safety quality policy annually to ensure that it continues to reflect the aims and aspirations of Thirsti.

3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

3.1 Summary of All Water Uses

Normandien was issued with a GA (27/2/1/V31F/1) on 17 June 2015 in terms of Section 39 of the NWA. Details of the authorised water uses are provided in Table 3-1.

Table 3-1: Normandien Water Uses (GA No. 27/2/1/V31F/1)

Water Use	Description of Water Use	Volume Licenced	Farm Portion
Section 21 (a)			
Borehole	Abstraction of groundwater through a borehole for industry (bottling).	36 000 m^3/a	Portion 0 Buffelshoek Farm 15469T

As part of the expansion of operations for Thirsti, additional water uses have been identified that require authorisation in terms of Section 21 of the NWA. The expansion triggers the following key water uses (Table 3-2) in terms of Section 21 of the NWA:

Table 3-2: Water Uses being Applied For

Water Uses – Thirsti Bottling Plan						
Section 21(a)						
Water Use No.	**Water Use Description**	**Site Name**	**Coordinates**		**Property**	**Volume (m³/a)**
			Latitude	**Longitude**		
1	Groundwater abstraction for operational use	BH3	27°56'41.41"S	29°44'41.61"E	Farm Buffelshoek No. 15469	30 660 m³/a (84 m³/day)
2	Groundwater abstraction for operational use	BH4	27°55'26.62"S	29°45'21.85"E	Portion 1 of Farm Woodburn 15470	23 652 m³/a (64.8 m³/day)
3	Groundwater abstraction for operational use	BH6	27°55'24.10"S	29°45'11.30"E	Remainder of Farm Woodburn 15470	15 768 m³/a (43.2 m³/day)
4	Groundwater abstraction for operational use	BH7	27°55'37.92"S	29°45'6.98"E	Remainder of Farm Woodburn 15470	23 652 m³/a (64.8 m³/day)
5	Groundwater abstraction for operational use	BH8	27°55'7.68"S	29°45'25.74"E	Remainder of Farm Woodburn 15470	29 959 m³/a (82 m³/day)
6	Groundwater abstraction for operational use	BH11	27° 56' 31.9632" S	29° 44' 37.3632" E	Farm Buffelshoek No. 15469	39 420 m³/a (108 m³/day)
7	Groundwater abstraction for operational use	BH12	27° 55'54.714"S	29° 44'55.5324"E	Farm Buffelshoek No. 15469	39 420 m³/a (108 m³/day)
8	Groundwater abstraction for operational use	BH13	27° 55' 43.77" S	29° 44' 57.4404" E	Farm Buffelshoek No. 15469	78 840 m³/a (216 m³/day)
Section 21 (c) and (i)						
Water Use No.	**Water Use Description**	**Activity Name**	**Coordinates**		**Property**	**Volume (m³/a)**
			Latitude	**Longitude**		
1	Groundwater abstraction for operational use	BH3	27°56'41.41"S	29°44'41.61"E	Farm Buffelshoek No. 15469	30 660 m³/a (84 m³/day)
2	Groundwater abstraction for operational use	BH4	27°55'26.62"S	29°45'21.85"E	Portion 1 of Farm Woodburn 15470	23 652 m³/a (64.8 m³/day)
3	Groundwater abstraction for operational use	BH6	27°55'24.10"S	29°45'11.30"E	Remainder of Farm Woodburn 15470	15 768 m³/a (43.2 m³/day)
4	Groundwater abstraction for operational use	BH7	27°55'37.92"S	29°45'6.98"E	Remainder of Farm Woodburn 15470	23 652 m³/a (64.8 m³/day)
5	Groundwater abstraction for operational use	BH8	27°55'7.68"S	29°45'25.74"E	Remainder of Farm Woodburn 15470	29 959 m³/a (82 m³/day)
6	Groundwater abstraction for operational use	BH11	27° 56' 31.9632" S	29° 44' 37.3632" E	Farm Buffelshoek No. 15469	39 420 m³/a (108 m³/day)

Water Uses - Thirsti Bottling Plan						
7	Groundwater abstraction for operational use	BH12	27° 55'54.714"S	29° 44'55.5324"E	Farm Buffelshoek No. 15469	39 420 m^3/a (108 m^3/day)
8	Groundwater abstraction for operational use	BH13	27° 55' 43.77" S	29° 44' 57.4404" E	Farm Buffelshoek No. 15469	78 840 m^3/a (216 m^3/day)
Section 21(g)						
Water Use No.	**Water Use Description**	**Site Name**	**Coordinates**		**Property**	**Volume (m^3)**
			Latitude	**Longitude**		
9	Septic tank and French drain	Plant	27°56'03.2"S	29°44'49.9"E	Farm Buffelshoek No. 15469	68.16 m^3

3.2 Existing Lawful Water Uses

Existing Lawful Water Use (ELWU) is defined in Section 32 of the NWA as any water use which has taken place at any time during a period of two years immediately before the date of commencement of the NWA or which has been declared an ELWU under Section 33 and which was authorised by or under any law which was in force immediately before the date of commencement of the NWA.

Normandien holds a GA (No. 27/2/1/V31F/1), issued on 17 June 2015. The authorisation, granted by DWS in terms of the NWA, permits the abstraction of groundwater from a borehole. Details of the authorised water uses are provided in Table 3-3.

Table 3-3: Normandien Water Uses (GA No. 27/2/1/V31F/1)

Water Use	Description of Water Use	Volume Licenced	Farm Portion
Section 21 (a)			
Borehole	Abstraction of groundwater through a borehole for industry (bottling).	36 000 m^3/a	Portion 0 Buffelshoek Farm 15469T

3.3 Relevant Exemptions

No exemptions are applicable to this application.

3.4 Generally Authorised Water Uses

Normandien holds a GA (No. 27/2/1/V31F/1), issued on 17 June 2015. The authorisation, granted by the DWS in terms of the NWA, permits the abstraction of groundwater from a borehole at a volume of 36 000 m^3/a.

3.5 New Water Uses to be Licenced

The water uses triggered for Thirsti require authorisation in terms of Section 21 (a), (c), (g) and (i) of the NWA. The following water uses have been identified for authorisation:

- Section 21(a) – Taking water from a water resource:
    - Abstraction of water from eight boreholes. The total abstraction from the eight boreholes is 281 371 m^3/a.
- Section 21(c) and (i) – Impeding or diverting the flow of water in a watercourse and altering the beds, banks, course or characteristics of a water course:
    - Infrastructure/boreholes within 500 m of a wetland.
- Section 21(g) - Disposing of waste in a manner which may detrimentally impact on a water resource:
    - An existing septic tank with a capacity of 68.16 m^3 and French drain.

3.6 Other Authorisations

No other environmental authorisations are currently held by Normandien apart from those specified within this application.

4 PRESENT ENVIRONMENTAL BASELINE

4.1 Climate

This information is sourced from the Hydrological Assessment compiled by GCS (GCS, 2025a).

4.1.1 Rainfall

Daily rainfall for Thirsti was also provided by Thirsti for the recent years (Jan 2021 to Feb 2025), at a daily timestep. This data was aggregated to monthly averages to maintain consistency with the catchment rainfall, generating a record of 50 months (or 1 520 days). Rainfall peaks have been increasing in the recent years during the summer months, as shown by the trendline's positive slope (Figure 4-1).

Rainfall from the catchment underestimates site-specific rainfall during the wet months (September to May) but overestimates site-specific rainfall during the drier months. This input data uncertainty can lead to inaccurate site conceptual hydrological cycle estimates, affecting evapotranspiration, infiltration, baseflow, and runoff rates etc. As the design of rainfall is based on these regionalised estimates, peak flow underestimates can lead to inadequate flood and stormwater impact estimations. Therefore, the use of the upper design rainfall limit is well suited to better accommodate the underestimates in regional rainfall, given that the design rainfall is the best available dataset.

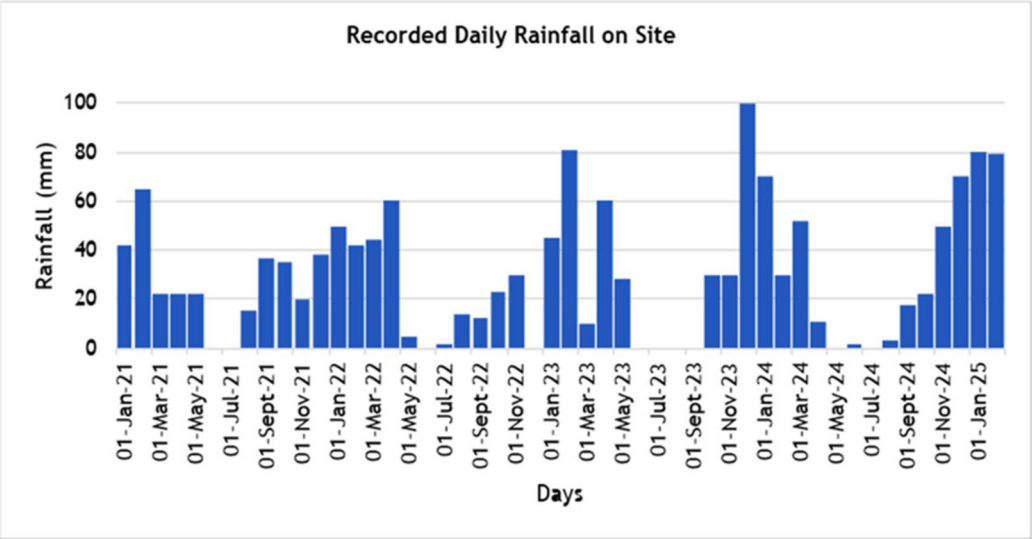


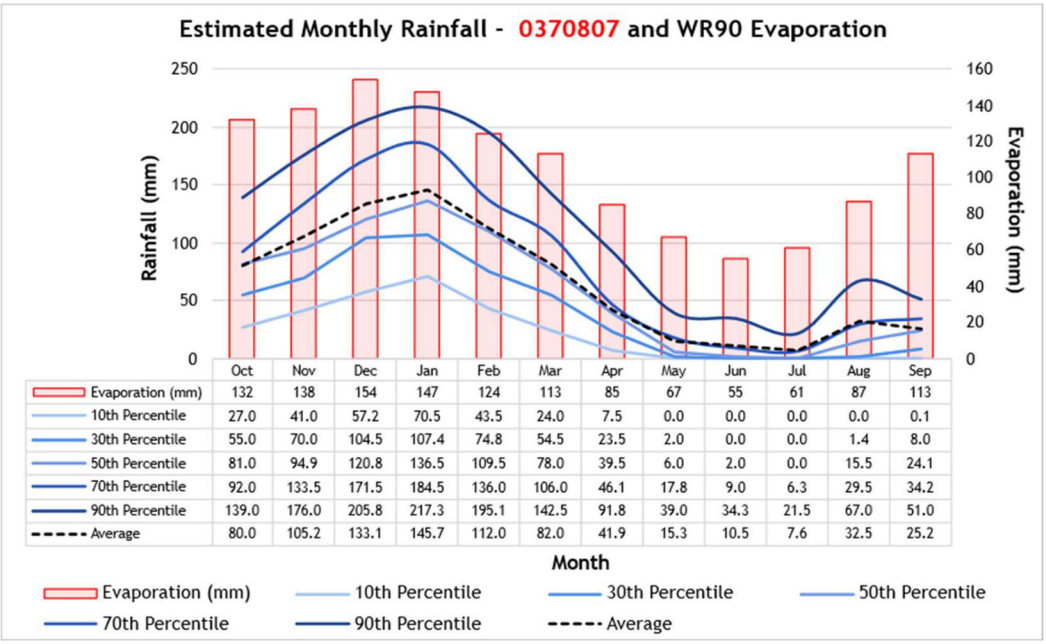
Figure 4-1: Daily rainfall recorded at Thirsti site

4.1.2 Evaporation

As can be seen in Figure 4-2, rainfall percentiles (10th, 30th, 50th, 70th, 90th) are plotted alongside average values, while evaporation is shown with red bars. Rainfall from this station is likely to follow the historic trends shown in Figure 4-2, such that 80% of Mean Annual Precipitation (MAP)

may fall in the ranges of 271 millimetres per annum (mm/a) and 1 308 mm/a. Peak rainfall is expected in the late summer months, and peak evaporative losses are expected in December (Figure 4-2).

Evaporation data for Thirsti were extracted from the WR90 database. Thirsti falls within evaporation zone 12A. The MAP clearly exceeds the Mean Annual Evaporation (MAE) (Figure 4-2), supporting the earlier statement that the project area experiences a sub-humid climate.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation (mm)	132	138	154	147	124	113	85	67	55	61	87	113
10th Percentile	27.0	41.0	57.2	70.5	43.5	24.0	7.5	0.0	0.0	0.0	0.0	0.1
30th Percentile	55.0	70.0	104.5	107.4	74.8	54.5	23.5	2.0	0.0	0.0	1.4	8.0
50th Percentile	81.0	94.9	120.8	136.5	109.5	78.0	39.5	6.0	2.0	0.0	15.5	24.1
70th Percentile	92.0	133.5	171.5	184.5	136.0	106.0	46.1	17.8	9.0	6.3	29.5	34.2
90th Percentile	139.0	176.0	205.8	217.3	195.1	142.5	91.8	39.0	34.3	21.5	67.0	51.0
Average	80.0	105.2	133.1	145.7	112.0	82.0	41.9	15.3	10.5	7.6	32.5	25.2

Figure 4-2: Estimated historic rainfall for station 0370507_W (Oct 1968 to Oct 2004) and mean annual evapotranspiration (WR90) for the project area (GCS, 2025a)

4.2 Surface Water

This information is sourced from the Hydrological Assessment compiled by GCS (GCS, 2025a).

4.2.1 Sub-catchments / Hydrological Response Units

Four hydrological response units (HRU) with an extent range of 1.628 to 7.074 km^2 were identified based on a 30 m digital elevation model. These sub-catchments are elongated in shape (Figure 4-3) and are well-drained with an average slope ranging between 5 % and 18 % (Table 4-1 and Figure 4-4).

The delineated sub-catchments are drained by tributaries of the Horne River that lies about 200 m away from Thirsti. The HRUs are characterised by perennial and non-perennial drainage lines. The Horne River feeds the Ngagane River off the N11, both which form part of the Thukela River System. Several small farm dams (mainly off channel) can be seen in the quaternary catchment. Within the Normandien, surface water is stored in the Kingston-Rooi Dam that is 6 m in height. Low flows are maintained through a Siphon spillway type. The dam was first registered in 1983

with a 300 000 cubic metre (m^3) capacity. The dam is an embarkment-type and is currently used for pecan nut irrigation.

4.2.2 Land Cover and Slope

Based on the reclassified 2022 national land cover map Figure 4-3 (DFFE, 2022), Thirsti sub-catchments are mainly covered by grasslands and some woody vegetation. A 30 m digital terrain model (DTM) was used to determine the slope rise (%) for each HRU (Figure 4-4). The slope rise is one of the key parameters in flood line modelling. Meanwhile, the vegetation and land cover observed on site were essential for estimating the Manning's coefficients (n-values).

The land cover maps, previous reports and field observations confirm three wetlands within the Normandien, two valley bottom wetlands and hillslope seep wetland type (Figure 4-6). The Normandien hosts a pine plantation, and according to Le Maitre *et al.*(2020) the V31F quaternary losses approximately 1-5 % of annual streamflow due to dense afforestation stands. This makes afforestation potentially the most significant impact that currently affects the status of freshwater systems in the area, followed by the effects of wetland grazing and trampling by cattle.

Table 4-1: Thirsti Sub-catchment Characteristics (GCS, 2025a)

Sub-catchment		HRU01	HRU02	HRU03	HRU04	HRU05
Area (km²)		3.915	1.628	3.387	4.391	7.074
Longest drainage line (km)		2.151	0.918	1.713	1.482	2.519
Average slope (%)		5.02	9.60	18.05	16.14	13.19
Slope (%)	<3	48.19	16.11	1.91	5.91	6.29
	3-10	39.07	48.12	10.43	30.56	34.08
	10-30	11.67	35.18	77.82	54.23	55.29
	>30	1.07	0.59	9.84	9.29	4.34
Land cover (%)	Thick bush & plantation	40.97	21.10	38.76	45.67	38.41
	Light bush & farmlands	36.57	8.75	0.00	0.38	1.86
	Grasslands	20.79	68.34	60.97	53.40	59.70
	No Vegetation	1.67	1.81	0.27	0.55	0.04

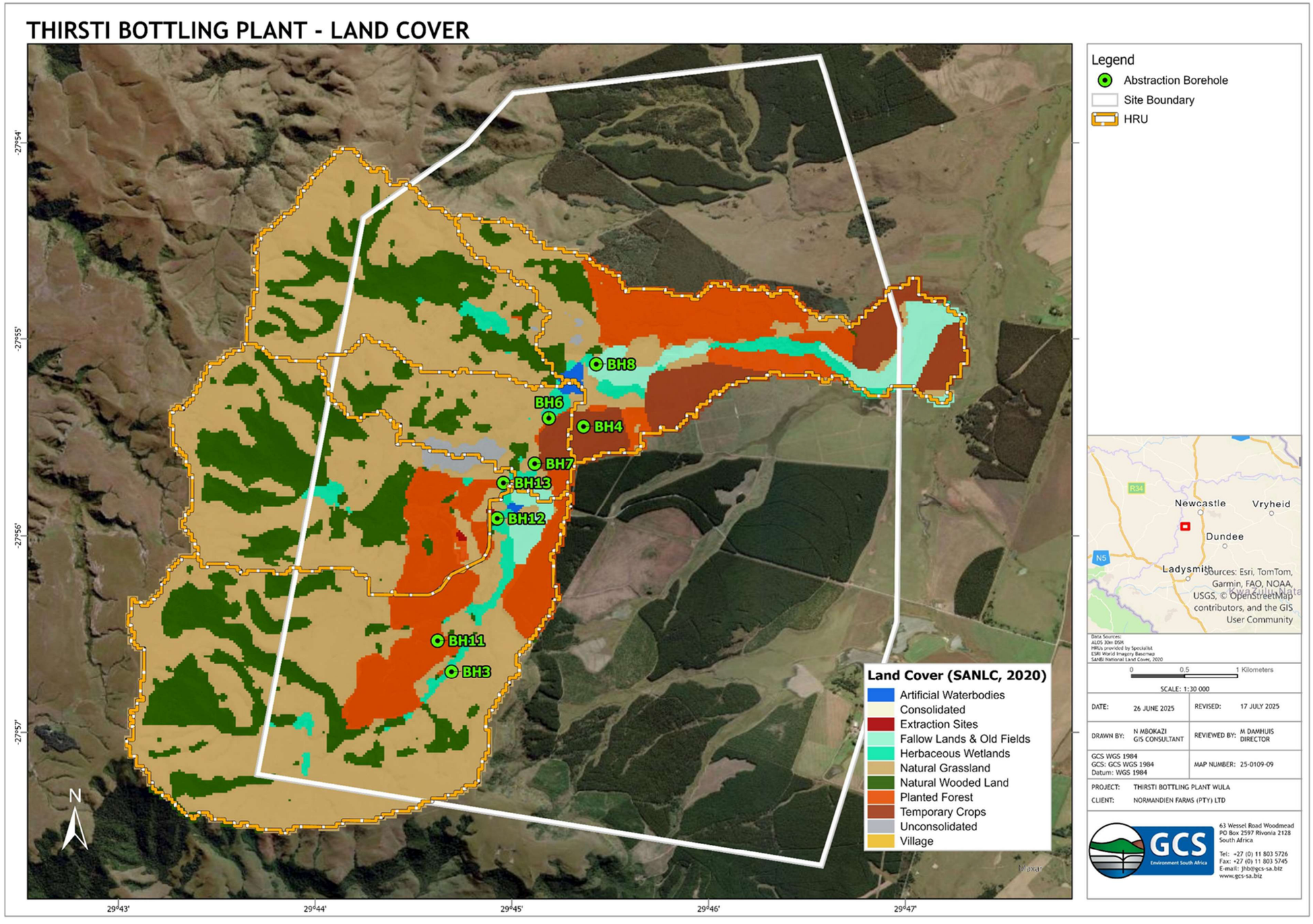


Figure 4-3: Sub-catchments and land cover types (GCS, 2025a)

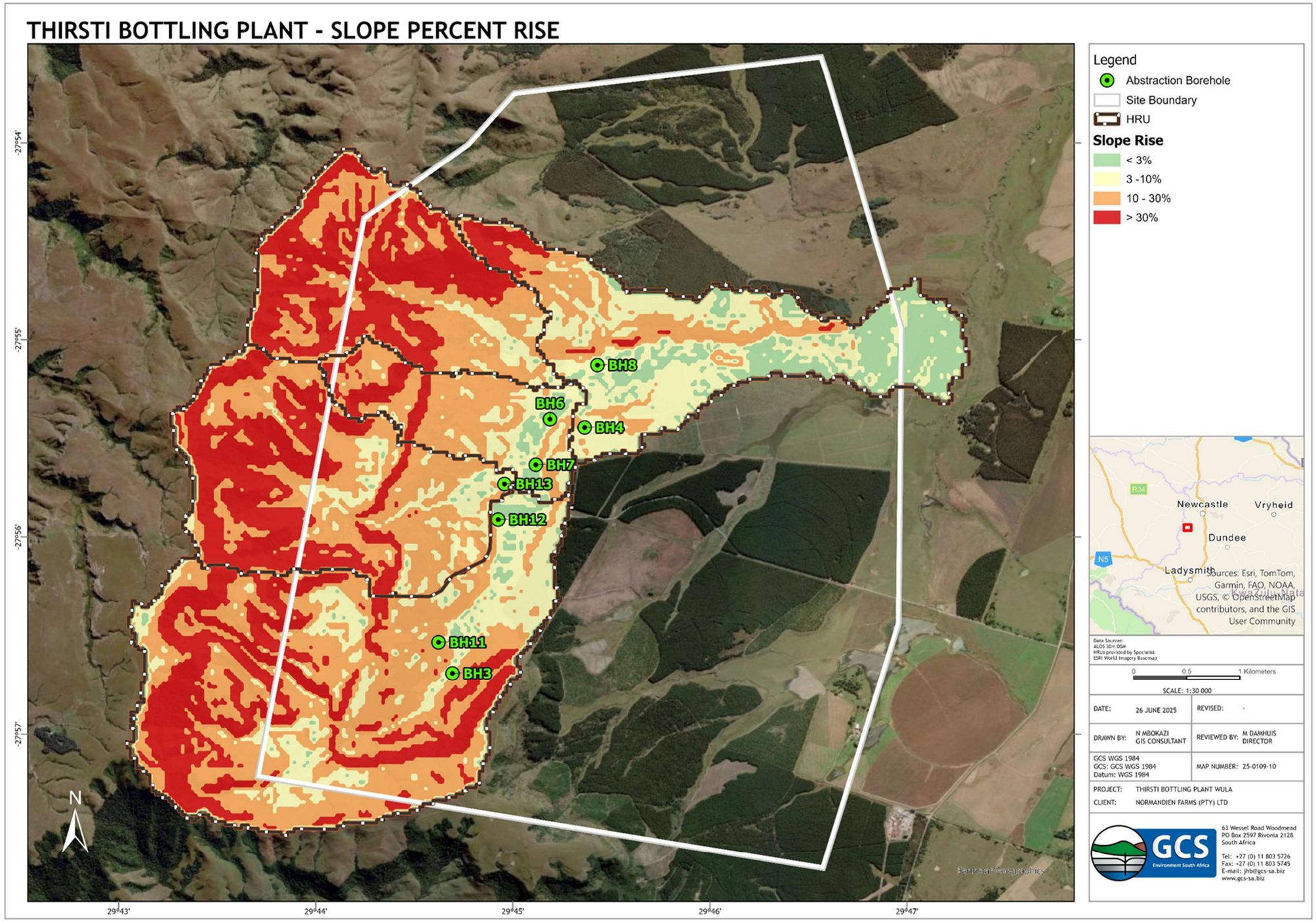


Figure 4-4: Sub-catchments and slope rise percentage (GCS, 2025a)

4.2.3 Water Management Area

The Bottling Plant is situated in Quaternary Catchment V31F in the Pongola-Mtamvuma Water Management Area (WMA) (DWS, 2022). Thirsti sits at elevations between 1 050 to 1 450 metres above mean sea level (mamsl), with an average slope gain of 7 percent (%) from the south-west to north-east direction.

4.2.4 Surface Water Hydrology

The study area falls within the uplands of the V31F catchment (Figure 4-5). Thirsti is located within the Northern Drakensburg Strategic Water Source Area (SWSA) (Le Maitre *et al.*, 2017). SWSAs are high yielding arears (n= 21, MAR ≥135 mm/a) that account for 50 % of all annual runoff in South Africa, although they occupy less than 10 % of the country's landmass).

The Northern Drakensburg SWSA spans 10 302 square kilometres (km^2), covering KwaZulu-Natal and parts of Lesotho, which makes it a transboundary SWSA. This SWSA contributes 4.94 % (or 2 376 cubic metres per annum (m^3/a) per ha) to the national streamflow budget. The viability of this SWSA is threatened by land degradation due to overgrazing and invasive alien plants (IAP), which point to the need for protecting and restoring headwater catchments.

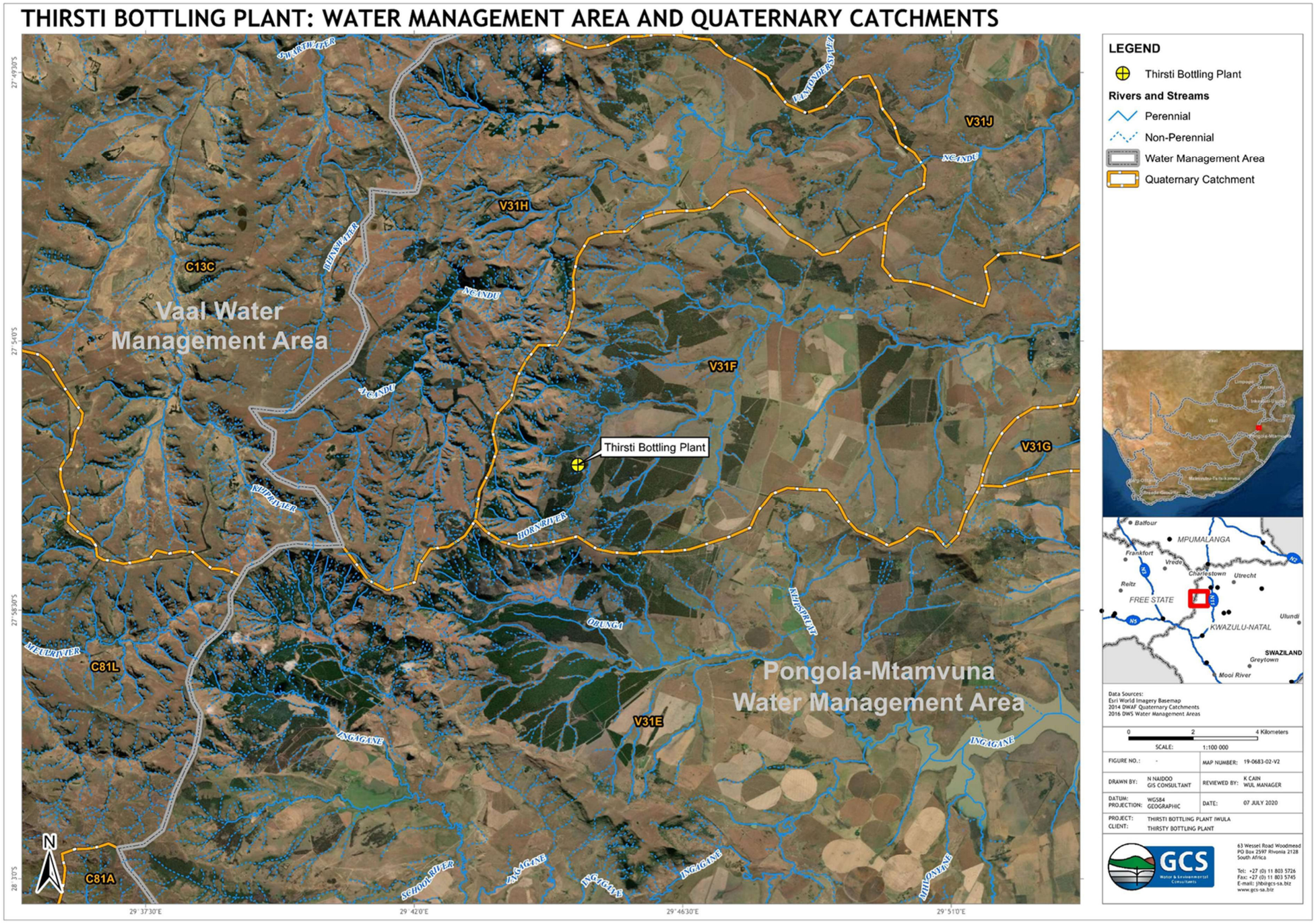
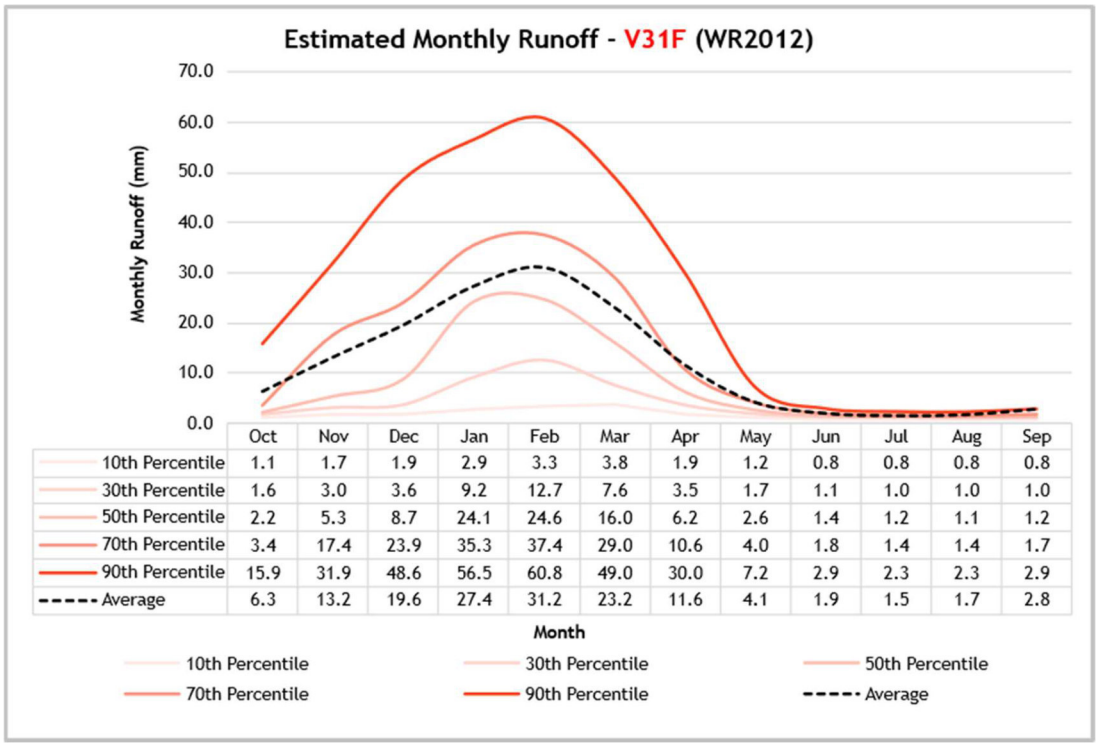


Figure 4-5: Water Management Area and catchments in which Thirsti is located (GCS, 2025a)

4.2.5 Mean Annual Runoff

Natural runoff from the V31F quaternary catchment is shown in Figure 4-6. Streamflow percentiles (10th, 30th, 50th, 70th, 90th, in millimetres (mm)) are plotted alongside average values. These runoff estimates are outdated as they cover the period 1920 to 2009 and may not capture recent climate change events; however, they are the best available dataset for South Africa (WR2012) (Bailey, A.K. and Pitman, W.V., 2016).

Runoff for the V31F quaternary catchment is estimated at 144.5 mm/a [or 22.49 million cubic metres (Mm^3/a)]. This is equal to approximately 23% of the MAP. Runoff in this area exhibits high seasonality and inter-annual variability, with high summer flows (Figure 4-6), following a similar pattern to the estimated rainfall.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	1.1	1.7	1.9	2.9	3.3	3.8	1.9	1.2	0.8	0.8	0.8	0.8
30th Percentile	1.6	3.0	3.6	9.2	12.7	7.6	3.5	1.7	1.1	1.0	1.0	1.0
50th Percentile	2.2	5.3	8.7	24.1	24.6	16.0	6.2	2.6	1.4	1.2	1.1	1.2
70th Percentile	3.4	17.4	23.9	35.3	37.4	29.0	10.6	4.0	1.8	1.4	1.4	1.7
90th Percentile	15.9	31.9	48.6	56.5	60.8	49.0	30.0	7.2	2.9	2.3	2.3	2.9
Average	6.3	13.2	19.6	27.4	31.2	23.2	11.6	4.1	1.9	1.5	1.7	2.8

Figure 4-6: Simulated runoff for quaternary V31F for the period 1920 -2009 (Bailey, A.K. and Pitman, W.V., 2016)

4.2.6 Resources Class and River Health Receiving Water Quality Objectives and Reserve

The recommended water resource class for the Ngagane River (draining Quaternaries V31E-K) is Class 3, and the ecological category to be maintained is Class C (Government Notice (GN) 46032). The environmental flow requirements from quaternary V31F is 336.65 % of MAR or 160.12 m^3/a. The primary water user within quaternary V31F is afforestation, which is classified as a streamflow-reducing activity.

4.2.7 Surface Water User Survey

According to the Water Allocation Registration Management System (WARMS, 2024), there are two active WARMS water uses within a 2.5 km radius and within the sub-catchments. One of the users is a surface water user, and one is a groundwater user. The information is summarised in Table 4-2.

Table 4-2: Summary of WARMS Users Identified in the Study Area (WARMS, 2024)

ID	Latitude	Longitude	User	Resource Type	Resource Name	Register Status	Lawfulness Finding	Registered Volume (m^3/a)
21019345	-27.94350	29.73475	Company	Borehole	Horn River Catchment	Active	Lawfulness still to be determined	3 600
21019345	-27.93156	29.74983	Company	River/stream	Horn River	Active	Lawful	300 000

The Hydrogeological Investigation (GCS, 2025b) has recommended an annual abstraction rate from eight boreholes on site of 618 579 m^3/a which will be applied to Thirsti conceptual hydrological model.

4.3 Sensitive Areas Survey- Wetlands

This section provides an overview of the watercourses on site compiled by (Groundtruth, 2025). The full report is attached in APPENDIX D.

4.3.1 Wetland Classification

To allow for the differentiation between wetland systems and the prioritisation of systems either for conservation or management purposes, the wetlands were classified in accordance with the South African National Biodiversity Institute's (SANBI) wetland classification system (Table 4-3). However, for the purpose of assessing each hydrogeomorphic (HGM) unit, was used to classify the wetland systems as particular HGM units rather than Level 4 of the SANBI system. The HGM unit types defined by (Kotze D. M., 2007) differ with the river classification being excluded and flat wetlands being grouped with the depression wetlands. The HGM units identified within the study site are classified as channelled and hillslope seep linked to a stream channel.

Table 4-3: A Description of the on site Wetland Based on the SANBI Classification (Groundtruth, 2025) (Groundtruth, 2025)

System (Level 1)	Bioregion (Level 2)	Landscape Unit (Level 3)	Hydrogeomorphic (HGM) Unit (Level 4)	Description of HGM Units
Inland systems	Sub-Escarpment Grassland, Gs3 and Sub-Escarpment	Valley Floor landscape unit	Channelled Valley Bottom (CVB)	Valley bottom areas with a clearly defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterised by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks

System (Level 1)	Bioregion (Level 2)	Landscape Unit (Level 3)	Hydrogeomorphic (HGM) Unit (Level 4)	Description of HGM Units
				overspill) and from adjacent slopes.
	Sub-Escarpment Grassland, Gs4	Hillslope landscape unit	Hillslope seep (HSS)	A wetland area located on gently to steeply sloping land and dominated by colluvial (i.e., gravity-driven), unidirectional movement of water and material downslope. Seeps are often located on the side slopes of a valley, but they do not typically extend onto a valley floor.

As described above, two unchannelled valley bottom (UVB) and two hillslope seepage (HSS) wetlands were identified within the study site that are hydrologically linked to the proposed development.

4.3.2 National Wetland Mapping (National Wetland Map 5) and the Threat Status of Wetlands

Mapping of all wetlands within South Africa has been an ongoing exercise for many years, as data has been collated and improved upon over time. SANBI has recently released the latest National Wetland Map 5 (Figure 4-7) in an attempt to improve the wetland inventory available to users at a national level. This layer includes inland wetlands and estuaries and has been determined through extensive consultation with many other datasets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018.

The development sites have been contextualised within the broader landscape two distinct wetland types have been classified within the DWS 500 m regulated area, namely (shown as UVB on the map) and seeps (shown as seep on the map). A third type was identified outside of the 500 m buffer, which is a CVB. For the identified wetland vegetation group, the ecosystem threat status for the wetland types is Critically Endangered. This is mostly related to the minimal protection this vegetation group receives and the level of transformation that has occurred. Deterioration in condition of the remaining healthy examples of these ecosystem types must be avoided, and the remaining healthy examples should be the focus of urgent conservation action.

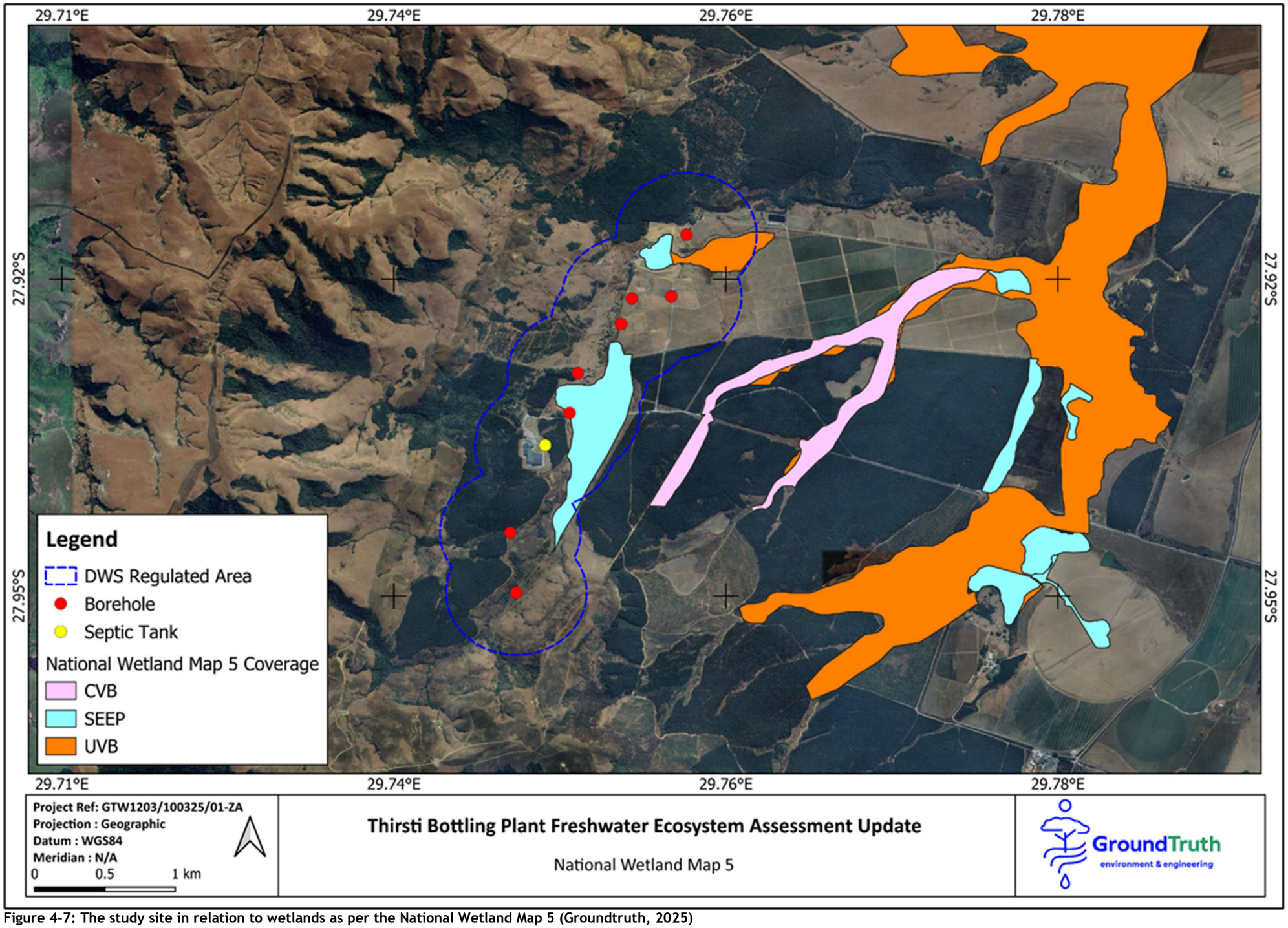


Figure 4-7: The study site in relation to wetlands as per the National Wetland Map 5 (Groundtruth, 2025)

4.4 Groundwater

This information is sourced from the Thirsti Bottling Plant Hydrogeological Assessment Report compiled by GCS (GCS, 2025b).

4.4.1 Geology

According to the 1:250 000 geological map (2728 Frankfort), the site is underlain by sediments of the Karoo Supergroup, specifically the Karoo Sequence. The dominant unit is the Normandien Formation (Pne), which is characterised by olive-green and grey mudstone with subordinate sandstone. This formation overlies the Volksrust Formation (Pvo), comprising bluish-grey to dark-grey mudstone and shale. In the western section of the site, younger dolerite intrusions occur in the form of large sheets and long dykes, although these do not extend to the eastern side of the site. In the northeastern section, alluvium deposits are present closer to the drainage lines. Borehole log data (GCS, 2019) confirms that the lithostratigraphy of the site generally consists of black shales, grey sandstone, and dolerite, which aligns with the mapped geological units.

4.4.2 Aquifer Characterisation

According to the 1:500 000 hydrogeology map (2725 Kroonstad), the site is located on an intergranular and fractured aquifer type. Baran (2003) classifies the groundwater yield potential of the Volksrust Formation as low. This assessment is based on empirical data indicating that approximately 40 % of boreholes yield between 0.5 litres per second (l/s) and 2 l/s, while a further 30% yield less than 0.5 l/s.

These values are consistent with the current abstraction rates reported verbally by Thirsti (Levin, 2016). Only 2.9% of boreholes in the formation are documented to yield more than 5 l/s. Baran (2003) further notes that the shales of the Volksrust Formation are effectively impermeable and are considered to contribute to artesian conditions in the underlying fractured pre-Karoo Formations.

The lithology of the Beaufort Group (Estcourt and Normandien Formations) has little effect on the borehole yield and aquifer classification (Baran, 2003). In essence, almost the entire Group, irrespective of lithology and presence or absence of dolerite, is low yielding. The median borehole yield range in this Group falls in the range of less than 0.5 l/s. No evidence of an existing deeper aquifer within the Beaufort Aquifer has been found.

4.4.3 Depth to Groundwater

Groundwater level data obtained from the National Groundwater Archive (NGA) for boreholes within a 5 km radius of the site indicate groundwater levels ranging from 2.19 mbgl to 20 mbgl, with an average groundwater level of 8.795 mbgl. In comparison, the abstraction boreholes located on site have groundwater levels ranging from 3.70 mbgl to 11.1 mbgl. Additionally, the hydrocensus conducted on site indicated that groundwater levels of boreholes surrounding the site ranged from 4.41 mbgl to 17.84 mbgl.

Figure 4-8 plots the relationship between elevation and groundwater levels for all boreholes identified on site. The data indicates a strong relationship between groundwater and topography elevation (R=99.75 %), suggesting that the groundwater table closely follows the regional topographic elevation. Such a relationship typically indicates that the aquifer system is semi-unconfined. (Freeze and Cherry, 1979)

The Co-Kriging interpolation approach was applied to the water level data to conceptualise the groundwater elevation and flow direction. The results are presented in Figure 4-9 and indicate that the groundwater flow direction mimics the surface water conditions at the site, which is predominantly flowing from west to east towards the Horn River.

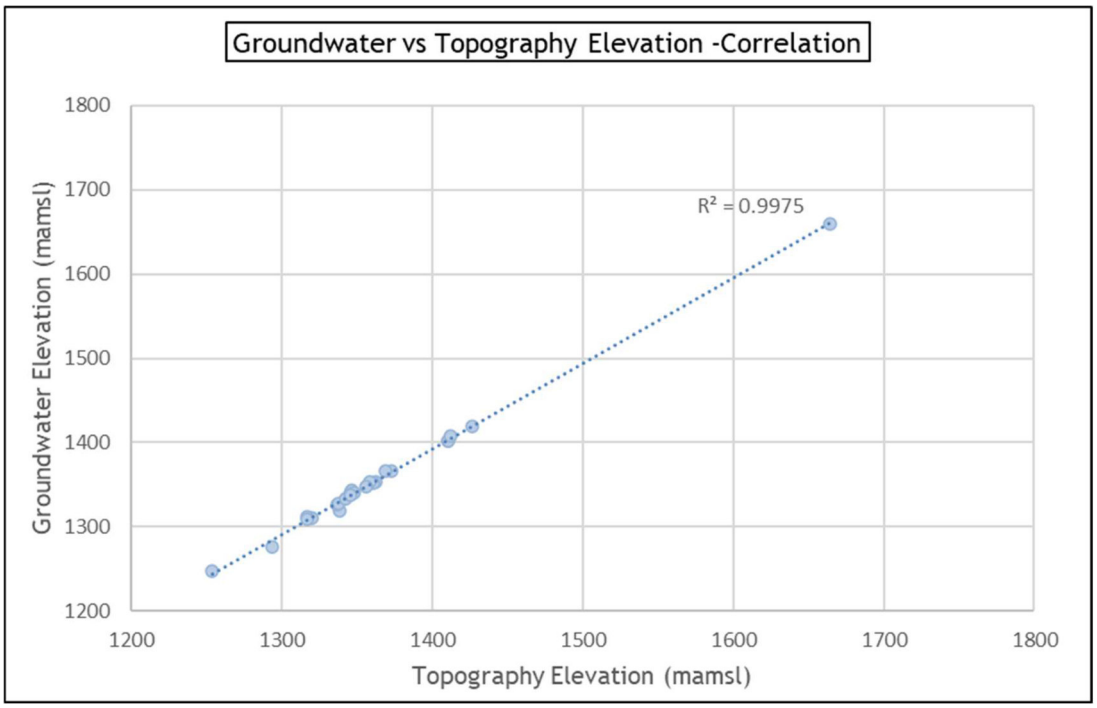


Figure 4-8: Groundwater elevation and topography elevation correlation (GCS, 2025b)

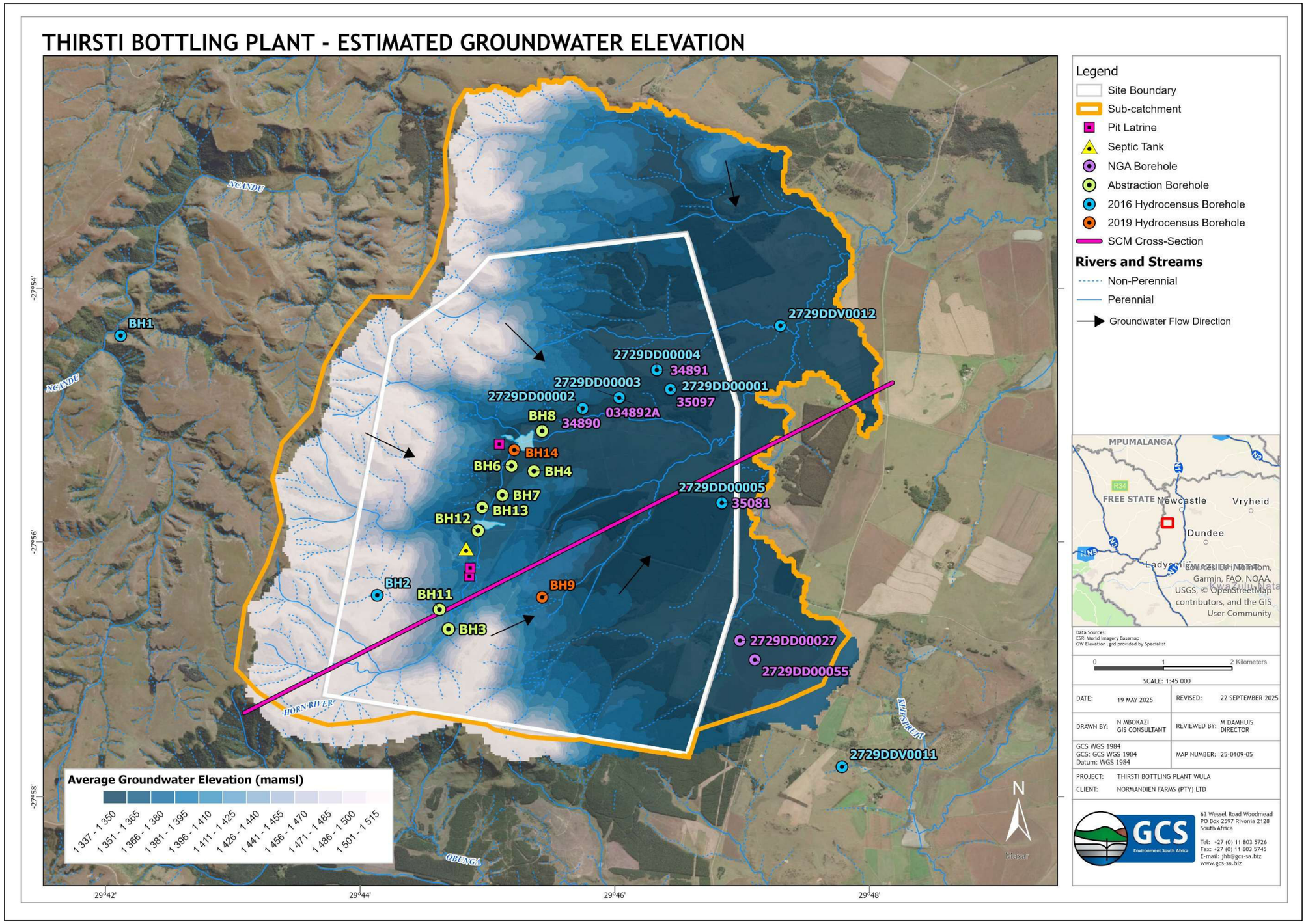


Figure 4-9: Estimated groundwater elevation and flow direction for the site (GCS, 2025b)

4.4.4 Groundwater Quantity

An Intermediate Groundwater Reserve Determination (IGRD) was conducted for the site. The IGRD aims to quantify the vulnerability of the Groundwater Reserve as a result of groundwater abstraction activities.

It is necessary, from a groundwater point of view, to quantify the groundwater quantity and likely future impacts on quantity. Moreover, the groundwater balance gives an estimate of how much groundwater can safely be abstracted from the aquifer.

The data used for the IGRD calculation was derived from a report compiled by DWS in 2024, titled "Proposed reserve determination of water resources for the Pongola-Mtamvuna Water Management Area Catchment". IGRD was conducted in terms of Section 16(3) of the NWA (DWS, 2024).

The IGRD for Quaternary Catchment V31F is summarised in Table 4-4 below. The Groundwater Reserve consists of the volume of groundwater required to satisfy the Basic Human Needs (BHN) and to meet the Ecological Water Requirements (EWR) through groundwater contribution to baseflow (GWBF).

Table 4-4: Summarised Intermediate Groundwater Reserve Determination for the Quaternary Catchment V31F (DWS, 2024)

Parameter	V31F
Quaternary Catchment	V31F
Area (km^2)	155.0
Recharge (m^3/a)	8 590 000
Population (Water Services 2011)	7 771
Basic Human Needs (m^3/a)	70 910
Groundwater contribution to Baseflow (m^3/a)	210 000
Total Reserve (m^3/a)	280 910
Groundwater Use (WARMS, 2025) (m^3/a)	165 389
Allocable Groundwater Total (m^3/a)	8 143 701

4.4.4.1 Sub-Catchment Delineation

Sub-catchment was delineated using Global Mapper. A 30 m ALOS DTM was used as input, and a 1:2500 drainage stream count was applied to define the sub-catchment boundary.

The sub-catchment describes the drainage from the site as well as the drainage of the Horn River and further describes the groundwater sphere of influence. The sub-catchment has an estimated surface area of 55.54 km^2.

The Groundwater Reserve determination calculation, scale of abstraction, and Stress Index will focus on the delineated sub-catchment. Table 4-5 presents a summary of the hydrogeological information for the delineated sub-catchment.

Table 4-5: Delineated sub-catchment information summary (GCS, 2025b)

Description	Delineated Sub-Catchment	
Surface Area	55.54	[km^2]
Recharge	3 077 991	[m^3/a]
Population	2 785	people
Basic Human Needs	25 409	[m^3/a]
Baseflow	75 248	[m^3/a]
Groundwater Use	59 263	[m^3/a]
Reserve	100 657	[m^3/a]

4.4.4.2 Groundwater Recharge

The effective groundwater recharge from precipitation is the portion of precipitation that reaches the groundwater table. The remainder of the precipitation comprises surface water runoff, evapotranspiration, and soil moisture. The effective recharge is dependent on the geology, soils, surface runoff, and stream morphology, but most importantly for the study area, the effective storage.

Based on values sourced from the IGRD for the Pongola-Mtamvuna WMA Catchment (DWS, 2024), a recharge of 3 077 991 m^3/a is estimated for the delineated sub-catchment (Table 4-6).

Table 4-6: Delineated sub-catchment recharge summary (GCS, 2025b)

Description	Delineated Sub-Catchment	
Total Recharge	18 684 000	[m^3/a]
Delineated Catchment Area	56 312 000	[m^2]
Delineated Catchment Recharge	3 077 991	[m^3/a]

4.4.4.3 Existing Groundwater Abstraction

The latest available groundwater abstraction information obtained from the National Integrated Water Information System (NIWIS) database indicates the existing groundwater usage within Quaternary Catchment V31F is in the order of 165 389 m^3/a (NIWIS, 2025) This equates to a calculated 59 263 m^3/a of the existing groundwater usage within the delineated sub-catchment.

4.4.4.4 Basic Human Needs

According to the Government Gazette no 46798 of 26 August 2022, the BHN reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, food preparation, and personal hygiene. Basic Human need is set by the Water Services Act, 1997 (No. 108 of 1997) at 25 l per person per day. The reserve is calculated by multiplying the number of people living within the confines of a source unit by 25 l/d. The estimated BHN for Quaternary Catchment V31F is 70 910 m^3/a (refer to Table 4-4), which equates to 75 248 m^3/a for the delineated sub-catchment.

4.4.4.5 Groundwater Contribution to Baseflow

Baseflow is the low flow in a river during dry or fair-weather conditions, but not necessarily all

contributed by groundwater; baseflow includes contributions from delayed interflow and groundwater discharge. Because of the contribution of groundwater to surface water flow in certain circumstances, the volume of groundwater that could be abstracted without impacting the ability of the groundwater to sustain or contribute to the surface water reserve has to be considered.

The baseflow of groundwater into surface water bodies in Quaternary Catchment V31F is 210 000 m^3/a (DWS, 2024). The groundwater contribution to the baseflow of the delineated sub-catchment is described below and summarised in Table 4-7.

$$\mathbf{Baseflow}_{Catchment\ Area} = \mathbf{Baseflow}_{\text{GRU } Area} \mathbf{\ x\ Area}_{Catchment}$$

Where:

- $Baseflow_{GRU\ Area}$ = value for baseflow in Quaternary Catchment V31F (DWS, 2024) [m/a].
- $Area_{Catchment\ Area}$ - Delineated catchment area [m^2].

Table 4-7: Delineated sub-catchment groundwater contribution to baseflow summary (GCS, 2025b)

Description	Delineated Sub-Catchment	
Baseflow for Quaternary Catchment	210 000	[m^3/a]
Delineated Catchment Area	55 540 000	[m^2]
Delineated Catchment Areas Baseflow	75 248	[m^3/a]

4.4.4.6 Proposed Groundwater Usage

Based on flow characteristics calculations, the recommended sustainable abstraction rate of the eight (8) abstraction boreholes for a 12-hour pumping schedule, the total recommended groundwater abstraction volume from boreholes is 618 579 m^3/a.

4.4.4.7 Groundwater Balance

The groundwater balance and the reserve determination on a sub-catchment scale are presented in Table 4-8 and summarised below:

- $GW_{available}$ = (Re) - (EU + BHN + BF + PU)

Where:

- $Gw_{available}$ = Available GW for use.
- Re = Effective recharge to the aquifer.
- BF = Baseflow to surface water streams.
- EU = Existing GW abstraction/use (identified on sub-catchment, excluding Applicant).
- BHN = Basic Human Needs.

- PU = Proposed Use.

The following applies to the water balance conducted:

- For this reserve determination, values from the Quaternary Catchment V31F Groundwater Reserve were downscaled to an area of 55.54 km^2 related to the delineated sub-catchment.
- The Groundwater Reserve already includes the BHN and EWR (GWBF) components.

Table 4-8: Sub-catchment groundwater balance and reserve determination summary (GCS, 2025b)

Description	Delineated Sub-Catchment	
Recharge to the Aquifer (Sub-Catchment)	3 077 991	[m^3/a]
Groundwater Reserve	100 657	[m^3/a]
Total Available Groundwater	2 977 334	[m^3/a]
Existing Groundwater Use (WARMS, 2025)	59 263	[m^3/a]
Remaining Available Groundwater	2 918 072	[m^3/a]
Recommended Abstraction	618 579	[m^3/a]
Surplus Groundwater Available	2 299 493	[m^3/a]

Based on the groundwater balance calculated for the delineated sub-catchment (Table 4-8) 2 918 072 m^3/a of groundwater is available for abstraction. Furthermore, a surplus of 2 299 493 m^3/a of groundwater will be available within the delineated sub-catchment after the proposed abstraction of 618 579 m^3/a.

4.4.5 Hydrocensus

The borehole information obtained from the NGA database on 13 May 2025 for the site area indicates there are seven boreholes situated within a 5 km radius of the site (NGA, 2025). In 2019, GCS conducted a hydrocensus on site and identified two of these, namely BH9 and BH14.

Levin (2016) also conducted a hydrocensus to identify groundwater users in the vicinity of the site. Twelve (12) boreholes were identified in the 2016 hydrocensus.

Based on the data obtained from the hydrocensus conducted for the site, it is noted that none of the boreholes identified during the hydrocensus were located upstream.

Table 4-9 lists the groundwater users and boreholes identified on site, and their locations are shown in Figure 4-10.

Table 4-9: Summary of Desktop Boreholes Identified in the Site Area (GCS, 2025b)

Borehole ID	Latitude	Longitude	Coordinate GPS Accuracy	Elevation (mamsl)	Water Level (mbgl)	Depth (m)
NGA 2025						
2729DD00055	-27.9488	29.78498	-	1340	20	18
2729DD00027	-27.9463	29.78303	-	1320	-	65

Borehole ID	Latitude	Longitude	Coordinate GPS Accuracy	Elevation (mamsl)	Water Level (mbgl)	Depth (m)
35081	-27.9283	29.78067	-	1300	5.35	61
34890	-27.9159	29.76246	-	1340	-	-
034892A	-27.9145	29.76724	-	1340	-	-
35097	-27.9134	29.77395	100	1340	3.91	15
34891	-27.9108	29.77216	-	1340	5.92	61
GCS 2019						
BH9	-27.9406	29.75715	-	-	6.84	
BH14	-27.9213	29.7535	-	-	9.34	100
Dr Levin 2016						
2729DD00001	-27.91331594	29.77395	-	-	-	15
2729DD00002	-27.91583577	29.76245	-	-	-	29
2729DD00003	-27.91442586	29.76724	-	-	-	-
2729DD00004	-27.91078609	29.77216	-	-	-	61
2729DD00005	-27.92822051	29.78067	-	-	-	61
2729DDV0011	-27.96277779	29.79639	-	-	9.57	80
2729DDV0012	-27.90499987	29.78833	-	-	17.84	80
2829BA00027	-28.04210803	29.66359	-	-	-	45
2829BAV0007	-28.02738894	29.67918	-	-	9.8	60
2829BBV0005	-28.02877917	29.81859	-	-	6.9	100
BH1	-27.9063	29.70198	-	-	4.41	-
BH2	-27.93903	29.73557	-	-	-	-

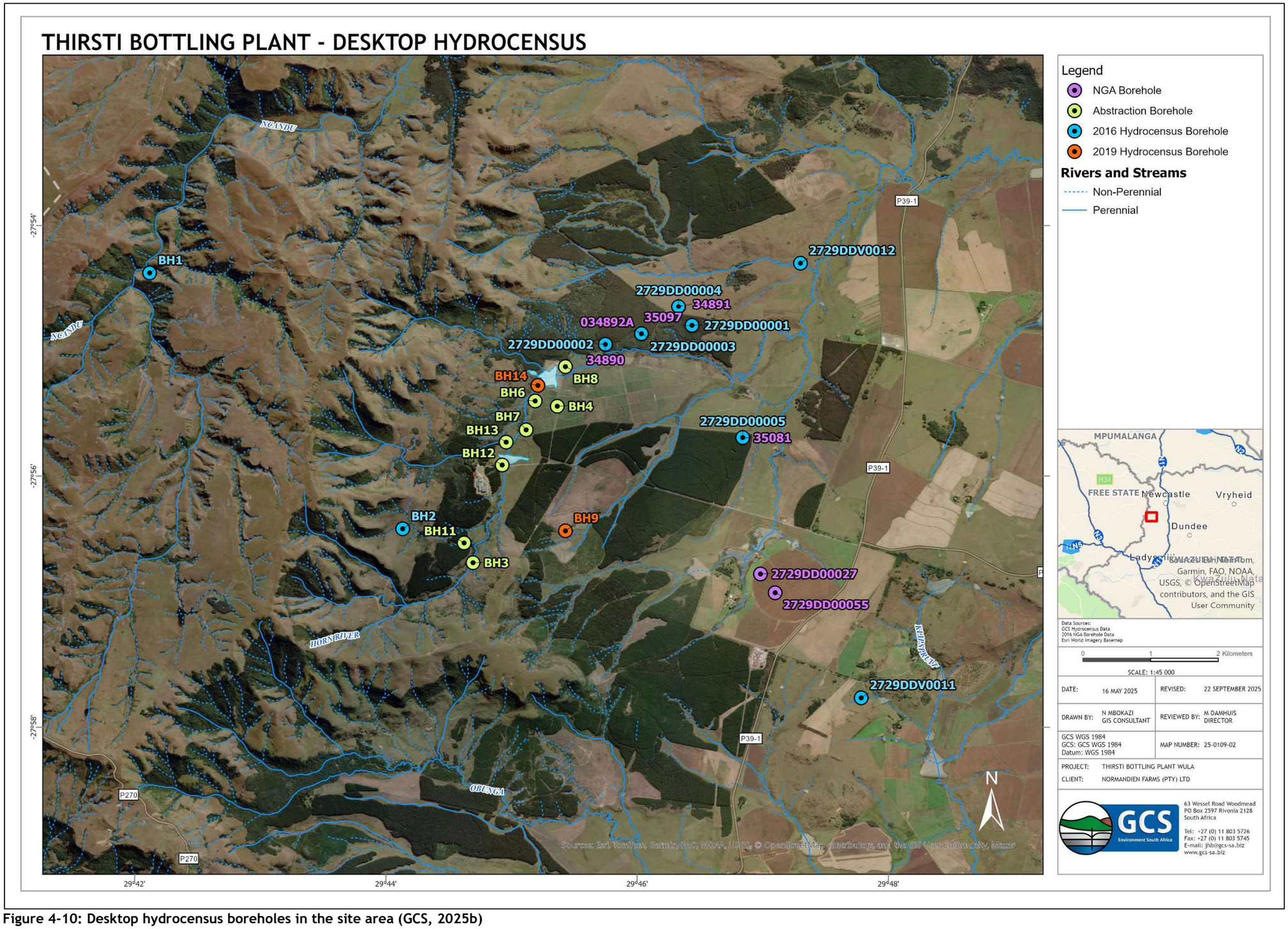


Figure 4-10: Desktop hydrocensus boreholes in the site area (GCS, 2025b)

4.5 Socio-economic Environment

The Newcastle Local Municipality is situated in the northern part of KwaZulu-Natal, South Africa. It serves as a significant economic and administrative hub for the region. The municipality is part of the Amajuba District Municipality and encompasses an area of 1 855 km². Newcastle is the third-largest city in KwaZulu-Natal and is strategically located at the intersection of major national roads, including the N11 and R34, facilitating trade and connectivity.

4.5.1 Population Characteristics

According to Census 2022, Newcastle Local Municipality (Statistics South Africa, 2022) has a total population of 507 710 people, showing significant growth from 363 236 recorded in 2011. This reflects an average annual growth rate of approximately 3.3 % over the 11-year period. The municipal area covers approximately 1 856 km², resulting in a population density of around 273.6 persons per km² (City population: Population of Newcastle Municipality, 2024).

The age distribution within the municipality indicates that 27.8% of the population is younger than 15 years, 66.3 % falls within the economically active age group of 15–64 years, and 5.9 % is aged 65 years and older. The dependency ratio is estimated at 50.8 dependents per 100 working-age persons, implying a moderately youthful but increasingly mature population structure (Wazimap, 2024).

Gender distribution reflects a sex ratio of 92.1 males per 100 females, meaning females represent approximately 52.1 % of the total population (Wazimap, 2024).

4.5.2 Economic Activities

Newcastle serves as a major economic hub in the northern region of KwaZulu-Natal, underpinned by manufacturing, mining, agriculture, and trade sectors. The municipality's economy is historically rooted in steel production, textiles, and chemical industries, with ongoing diversification into retail, services, and logistics.

The town's strategic location along the N11 and rail corridors positions it as a key service and industrial centre linking KwaZulu-Natal, Mpumalanga, and Gauteng. Although recent industrial restructuring has led to some employment fluctuations, Newcastle remains one of the stronger industrial economies in the Amajuba District (Statistics South Africa, 2022).

4.5.3 Access to Services

Access to basic services in the Newcastle Local Municipality has improved over recent years, although significant backlogs remain, particularly in peri-urban and informal settlement areas. Approximately 58.2 % of households have piped water inside their dwellings, and 75.6 % of households have access to flush toilets connected to sewerage. Access to electricity is widespread, with 96.6 % of households using electricity for lighting. Refuse removal services are provided to 73.2 % of households on a weekly basis, although some communities still lack reliable

waste collection. These statistics highlight both progress and ongoing challenges in ensuring equitable access to essential services (Statistics South Africa, 2022) and (City population: Population of Newcastle Municipality, 2024).

4.5.4 Education

Education levels in Newcastle show a positive trend. Census 2022 data indicate that 76. 3% of individuals aged 20 years and older have completed at least Grade 9, while 48.2% have attained Grade 12 (matric) or higher (Wazimap, 2024).

The municipality hosts a range of primary, secondary, and tertiary educational facilities, including technical and vocational institutions that support local industrial and commercial skills development. These educational resources contribute to the area's potential for long-term economic growth and labour stability.

4.5.5 Employment

The Newcastle Local Municipality faces significant challenges in its labour market, with an unemployment rate of 37.4 %. Youth unemployment is particularly high, with 49.0 % of individuals aged 15 to 34 unable to secure employment. Income distribution within the municipality shows that 10.9 % of local workers earn a low income, while 24.2 % of workers earn a high income, highlighting disparities in earnings and economic opportunity across the area (Statistics South Africa, 2022) and (Wazimap, 2024). The recent closure of ArcelorMittal in Newcastle is expected to further exacerbate unemployment levels and economic vulnerability in the region. In this context, the role of Normandien as a major employer becomes increasingly crucial in supporting livelihoods and contributing to local economic stability.

5 SPECIALIST STUDY FINDINGS

This section provides the field findings of specialist assessments following the desktop analyses undertaken to describe the receiving environment, as detailed Section 4.

5.1 Surface Water

Information in the section below was taken from the Hydrological Assessment (GCS, 2025a) attached as APPENDIX B.

5.1.1 Flood Line Delineation

Estimated flood lines for the 500 m regulated zone around Thirsti are shown in Figure 5-1. From the flood line study, the following observations can be made:

- The water bottling facility is situated outside of the modelled flood lines.
- The existing boreholes (BH-6, 7, 8, 11, 13, and 14) are likely situated within the flood lines; and
- The dirt access road from the main road to the plant crosses over a flood line and could

potentially become inundated.

The presence of borehole infrastructure inside the 1:100-year flood line poses damage risk to the infrastructure and may alter the natural flood regime. During flood events, piping infrastructure above-ground leading out of the boreholes could be struck and damaged or severed by debris in the flood waters. The pipe damage or pumps malfunction could result in operational disruption. The surface around the casing could erode (depending on the construction and whether there is a concrete pad around the boreholes). The casing itself could be scoured or eroded (again, depending on the boreholes' construction).

Limitations

The identified flood impacts may differ from those presented, and more accurate estimates could be better articulated by a dynamic flood model and the availability of finer-resolution elevation data. Some of the key limitations are stated below:

- The flood study conducted here is a deterministic analysis, with rainfall as a key input. A steady-state model produces worst-case conditions but overlooks the changes in antecedent soil moisture and storage within the system.
- The design rainfall itself is based on regionalised estimates from surrounding rainfall stations. The regional rainfall underestimates wet season magnitudes, implying that the flow magnitudes from the flood return periods could be more than those in shown in Table 5-1. Table 5-1 shows a summary of the calculated flood peak flows. The Modified Index Flood Method (MIP)I and Standard Design Flood (SDF) methods produced slightly higher flood peaks than the Rational Method. To balance the strengths and weaknesses of the various methods, an aggregate estimate (geometric mean) of all three will be used and applied to the HEC-RAS model.
- Topography is one of the primary factors of runoff. For flood line modelling, this is represented by the elevation model, and its reliability is limited by the quality of the available DTM. The 30 m resolution dataset used here inevitably produces irregular flood lines that require manual adjustment to follow the natural drainage lines. This was done to improve the flood line display.

Although hydraulic structures are present on site, these were not included in the flood line assessment, owing to the coarse resolution elevation data used.

Table 5-1: Summary of design peak flows for the delineated hydrological response units (HRU) in (m^3/s) (GCS, 2025a)

Catchments		HRU01	HRU02	HRU03	HRU04	HRU05
Method	Return period	Peak flows (m^3/s)				
Rational Method (RM3)	1:20-year	6	7	8	3	4
	1:50-year	9	11	11	5	6

Catchments		HRU01	HRU02	HRU03	HRU04	HRU05
	1:100-year	13	14	15	6	8
Standard Design Flood (SDF)	1:20-year	13	30	33	13	16
	1:50-year	22	43	48	19	23
	1:100-year	32	55	61	24	29
Modified Index Flood Method (MIPI)	1:20-year	35	46	53	24	32
	1:50-year	46	60	69	31	42
	1:100-year	54	70	81	36	49
Cumulative (Geomean)	**1:20-year**	**14**	**21**	**24**	**69**	**82**
	1:50-year	**21**	**30**	**33**	**99**	**117**
	1:100-year	**28**	**38**	**42**	**126**	**148**

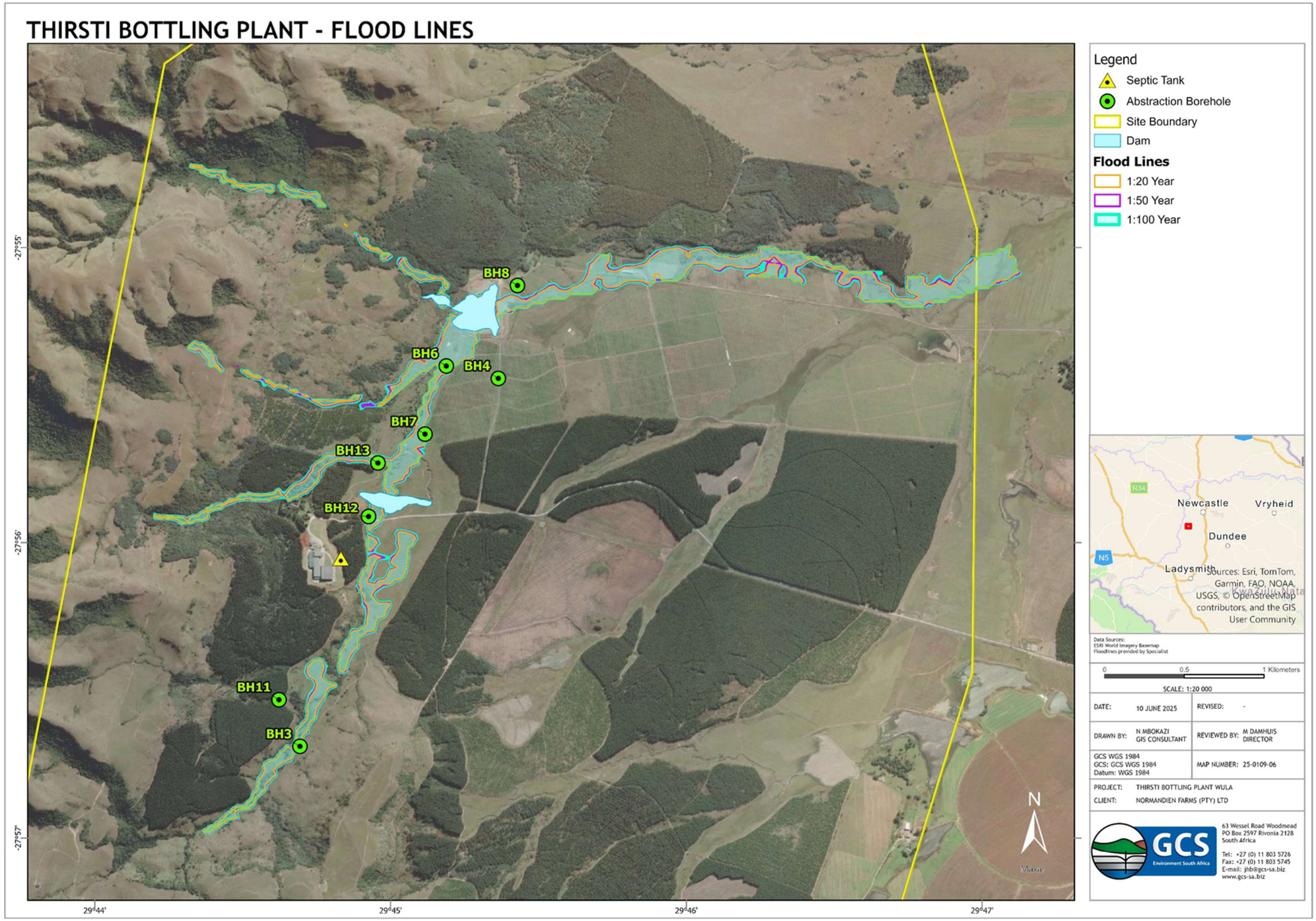


Figure 5-1: Simulated 1:20, 1:50 and 1:100-year flood inundation zones for the Buffelshoek 15469 and Woodburn 15470 properties (GCS, 2025a)

5.1.2 Stormwater

5.1.2.1 Existing Stormwater Infrastructure and Measure

Based on Thirsti visit observations, Sustainable Urban Drainage Systems (SUDS) have been considered for stormwater management at Thirsti. To mimic natural systems, the SUDS principles aim to use cost-effective solutions with low environmental impact to manage stormwater runoff. This involves collecting, storing and cleaning the water before gradually releasing it back into the environment, such as into existing watercourses.

- The current stormwater system on site manages runoff from various sources, like pine plantations upstream, through a surface water diversion berm.
- Rainwater from the Thirsti laydown area, which sits on an elevated bed, plant wash-water, laundry water and spills from storage tanks are routed through an underground drainage system to a pond located at the lowest elevation point just outside Thirsti.
- Rainwaters captured by the walkways, driveways, the parking lot and the smaller buildings flow overland.
- The sewer system discharges to a septic tank (90 m^3), urban areas and plant wash-water.

5.1.2.2 Rational Method Runoff Estimation and Design Rainfall Depths

The Rational Method is a widely used hydrological technique for estimating peak runoff rates from small catchments, particularly in urban and semi-urban environments. The method is expressed by the formula:

$$Q = C \times I \times A$$

Where:

Q is the peak runoff (m^3/s),

C is the runoff coefficient (dimensionless), representing the proportion of rainfall that becomes runoff,

I is the rainfall intensity (mm/hr) and

A is the catchment area (ha or km^2).

This method assumes that peak runoff occurs when the entire catchment contributes simultaneously, typically when the rainfall duration equals the time of concentration. While the Rational Method provides a simple and practical tool for estimating design flows, its validity is generally limited to small catchments (typically less than 200 hectares) where stormwater infrastructure is designed for short-duration, high-intensity events. It is less accurate in large or highly complex catchments where flow routing, storage and spatial rainfall variability become significant.

To derive the rainfall intensity (I), 24-hour rainfall depths from design storm events (e.g., 1:20, 1:50 and 1:100-year recurrence intervals) are often used in conjunction with intensity-duration-

frequency curves. These 24-hour depths offer a consistent and conservative basis for estimating potential peak runoff, especially in ungauged or poorly monitored areas and align with regulatory and engineering design standards.

The following table summarises the 24-hour design rainfall depths extracted from the Design Rainfall Estimation Software and utilised for Thirsti in the runoff calculation process using the Rational Method.

Table 5-2:Summary of Design Rainfall Depths (GCS, 2025a)

Area	24 hour rainfall depths (mm)		
	1:20	1:50	1:100
Thirsti Bottling Plant	181.6	214.2	241.0

5.1.2.3 Stormwater Characterisation

Thirsti is situated in the upper reaches of the Horn River in a valley on the western banks of a tributary of the Horn River. The valley walls are situated west of Thirsti, sloping downwards towards the tributary in an eastern direction. The upstream runoff will therefore be in a general west to east direction across Thirsti.

5.1.2.3.1 Stormwater Catchment Delineation

Stormwater catchments for Thirsti are indicated in Figure 5-2. Fifteen (15) stormwater sub-catchments characterise the runoff generated upstream from and on Thirsti. The clean upstream catchments (C1-2) comprise plantations. The on site dirty water catchments are mostly built-up with pavements, the plant and roads. Vegetation and lawns are maintained on and around Thirsti.

5.1.2.3.2 Flow Directions in Stormwater Catchments

- C1-2
  - Upstream catchments from Thirsti, mostly vegetated with plantations.
  - C1 and C2 will see stormwater flowing in an eastern direction towards Thirsti.
  - Water from these catchments is captured by a diversion channel that runs for several metres in a northern direction.
- C3-4
  - This catchment characterises runoff from lawns situated between the plantation catchments and Thirsti.
  - Runoff generated in this catchment will flow eastwards towards an existing stormwater channel located between the lawns and the plant, which flows south towards the underground drainage system.
- C8
  - This catchment characterises runoff generated north of the plant and the access gate.

- Runoff generated in this catchment will flow northeast to an existing stormwater/wash-water infiltration pond located between the plant and the downstream plantations.

- C5-7 and C9-12
  - These catchments characterise the runoff generated on the plant footprint.
  - C6 represents runoff generated on the roof of the plant.
  - C5, C7, C9 and C11 characterise runoff generated around Thirsti on the pavements, roads and parking lots.
  - C10 and C12 characterise runoff that will be generated on the lawns either side of the road in C11.

- C13-15
  - These catchments characterise runoff generated on the side slopes of the raised platform on which the facility is located.

5.1.2.4 Stormwater Flows and Volumes

Peak flows for each catchment were determined using the Rational Method and are summarised in Table 5-3.

Table 5-3: Stormwater Catchment Peak Flows (GCS, 2025a)

Name	Area (km^2)	Manning's Coefficient	24-hour Rainfall Depth (mm)			Peak Runoff (m^3/s)		
			1:20	1:50	1:100	Q_{20}	Q_{50}	Q_{100}
C1	0.112	0.12	181.6	214.2	241	0.678	0.800	0.900
C2	0.015	0.12	181.6	214.2	241	0.092	0.109	0.122
C3	0.003	0.035	181.6	214.2	241	0.005	0.006	0.007
C4	0.002	0.035	181.6	214.2	241	0.004	0.005	0.006
C5	0.004	0.025	181.6	214.2	241	0.004	0.005	0.006
C6	0.015	0.024	181.6	214.2	241	0.018	0.022	0.025
C7	0.003	0.025	181.6	214.2	241	0.004	0.005	0.005
C8	0.009	0.025	181.6	214.2	241	0.011	0.013	0.014
C9	0.003	0.025	181.6	214.2	241	0.004	0.005	0.006
C10	0.002	0.035	181.6	214.2	241	0.004	0.005	0.006
C11	0.002	0.025	181.6	214.2	241	0.004	0.005	0.006
C12	0.001	0.035	181.6	214.2	241	0.004	0.005	0.006
C13	0.017	0.035	181.6	214.2	241	0.004	0.005	0.006
C14	0.005	0.035	181.6	214.2	241	0.004	0.005	0.006
C15	0.002	0.035	181.6	214.2	241	0.004	0.005	0.006

5.1.3 Stormwater Systems Analysis and Placement Recommendations

The following is recommended in addition to the existing stormwater measures (Figure 5-3):

- The current above-ground stormwater channels have been hydraulically analysed and it is concluded that the systems are appropriately sized to contain a 1:100-year storm event based on the design rainfall depths identified in this section. The stormwater surface within these channels can be viewed in Appendix B of the Hydrological Assessment (GCS, 2025a).
- Two additional downstream channels are recommended as indicated in Figure 5-3 and their dimensions are illustrated in Appendix B of the Hydrological Assessment (GCS, 2025a).
    - The first is a concrete channel downstream of the road section east of the plant. The channel must be flush with the road and enter the underground system via a drain in the same manner as the concrete channel west of the plant. This channel will have runoff routed to the infiltration pond.
    - The second is an earth trench north of Thirsti and east of the access road near the entrance to the plant to capture runoff from C8. This channel will capture sediment-laden runoff and route it to the infiltration pond.
- Sediment trap or capture measures are recommended within all channels on site, as sediment was noted during Thirsti visit.
    - Check dam sediment traps in the form of sandbags or rock strips that can be placed inside the channels. This will lower the velocity of runoff and filter out sediment to a certain degree.
- For the stormwater and wash-water outlets, the following mitigation measures are recommended to curb erosion and remove unwanted matter from the outflows:
    - Litter such as plastic bottle caps, hair nets, etc, were noted at the discharge points. This should be prevented. Dewatering socks can be placed around the outlet of the pipes to capture litter, debris and sediment that may be in the runoff and wash-water. This will also aid in dispersing the water exiting the outlet pipes to reduce erosion on the slopes of the platform.
    - Stiff grass barriers can be placed upstream of the infiltration pond near the inlet to filter the incoming water.
    - For the erosion channels forming downstream of the outlet pipes, it is recommended to rehabilitate these artificial drainage lines with rocky reinforcement. This will include the placement of rocks along the erosion channel called riprap to protect against further degradation. The outlets of these artificial drainage lines created by the outlet pipes should end in a small reno mattress to disperse the water and encourage overland flow and velocity reduction.

- It is imperative to conduct regular maintenance and inspections on all stormwater infrastructure to ensure that debris does not cause obstructions or contribute to material being transported by runoff. The plant and its associated paved and unpaved surfaces should be kept free of litter and other unwanted materials that could enter the stormwater system and impact the surrounding environment.

It is imperative to conduct regular maintenance and inspections on all stormwater infrastructure to ensure that debris does not cause obstructions or contribute to material being transported by runoff. The plant and its associated paved and unpaved surfaces should be kept free of litter and other unwanted materials that could enter the stormwater system and impact the surrounding environment.

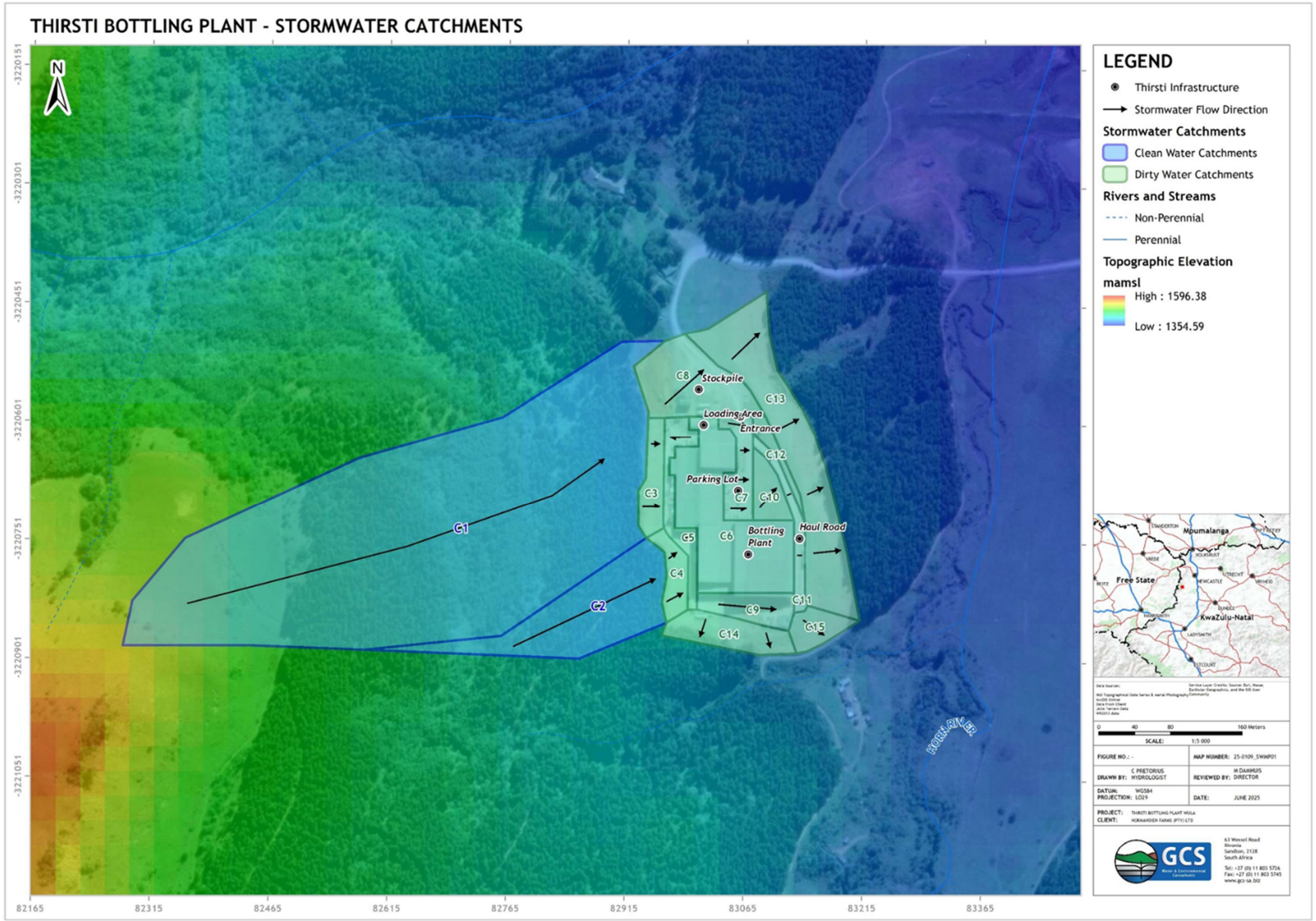


Figure 5-2: Delineated Stormwater Sub-catchments for the Thirsti Bottling Plant (GCS, 2025a)

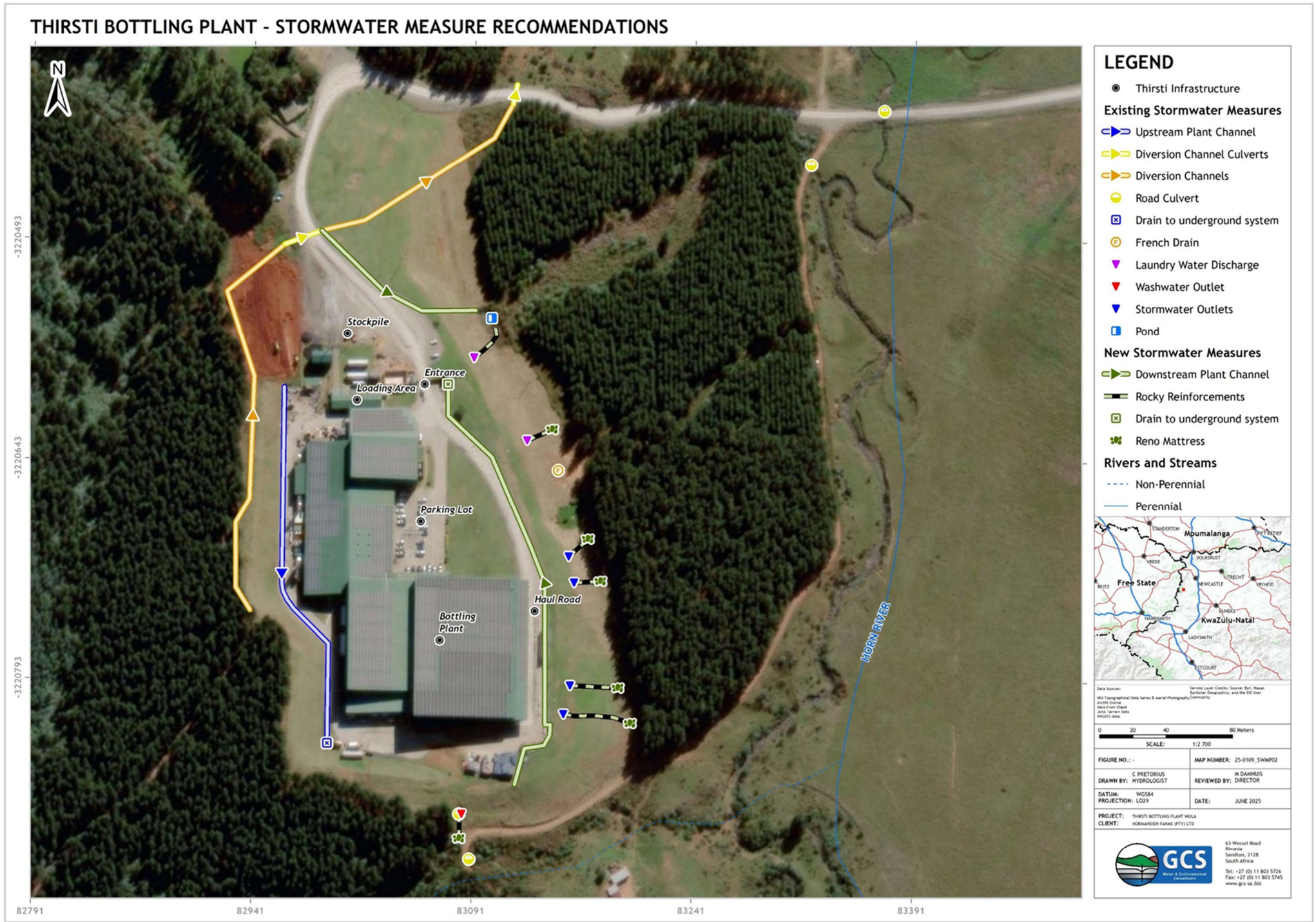


Figure 5-3: Existing and Proposed Stormwater Infrastructure for the Thirsti Bottling Plant (GCS, 2025a)

5.2 Groundwater

Information in the section below was taken from the Geohydrology Assessment Report (GCS, 2025b) attached as APPENDIX C.

5.2.1 Potential Pollution Source Identification

Based on the GCS field investigation conducted between 14 and 18 June 2021 to identify potential on site pollution sources that could impact groundwater quantity and quality, the effluent travel time from the septic system and pit latrines to BH8 was calculated (refer to Table 5-4).

Table 5-4: Impact Assessment for the Point Source Contamination at the Site (GCS, 2025b)

Factor	Jurassic Dolerite	Volksrust Formation
Septic Tank and French Drain		
Travel Time	~38.63 years	~215.44 years
Permeability	Low to Moderate (fracture-dependent)	Very Low
Impact of Contaminant Migration	Low-negative	Low- negative
Pit Latrines		
Travel Time	~58.19 years	~324.93 years
Permeability	Low to Moderate (fracture-dependent)	Very Low
Impact of Contaminant Migration	Low-negative	Low-negative
Laydown Area		
Travel Time	~34 years	~194.27years
Permeability	Low to Moderate (fracture-dependent)	Very Low
Impact of Contaminant Migration	Low-negative	Low-negative
Plantations		
Travel Time	~31.93 years	~178.71 years
Permeability	Low to Moderate (fracture-dependent)	Very Low
Impact of Contaminant Migration	Low-negative	Low-negative

Dolerite generally has low permeability; however, the presence of fractures and joints can significantly enhance groundwater flow. A contaminant travel time of range between 30 to 58 years indicates low impact.

According to the 2728 Frankfort geological map Volksrust Formation consists predominantly of shale and mudstone, which typically has very low permeability. A travel time of range between 178 to 325 years suggests a neutral impact of contaminant migration under natural conditions. The Volksrust Formation provides a natural barrier to groundwater contamination.

The significance of point source contamination impact on the groundwater at the site is considered low, as the boreholes on site are located within a confined aquifer system, which serves as a natural geological barrier to surface-level contaminants.

5.2.2 Groundwater Model

A Site Conceptual Model (SCM) was developed by combining all relevant hydrogeological and geological information of the site to provide an understanding of the site composition and

governing processes within it.

The site is situated in Quaternary Catchment V31F of the Pongola-Mtamvuna WMA (DWS, 2016). Elevations across the site range from 1 050 mamsl to 1 450 mamsl.

The site falls within rainfall zone V3B, which receives a MAP of 791 mm/a. The site falls within evaporation zone 21A, of which MAE is 1 276 mm/a. The MAE far exceeds the MAP for the site, indicating that evaporative losses are likely to surpass the amount of rainfall received annually. As a result, the site experiences a net water deficit.

Groundwater levels measured within the site region varied between 3.70 mbgl to 20 mbgl, showing a strong correlation between groundwater and topographic elevation, suggesting that the groundwater table closely follows the regional topographic elevation. The at the site groundwater flow from west to east.

The site is underlain by geological formations of the Karoo Supergroup, primarily consisting of mudstones and sandstones of the Normandien and Volksrust Formations. Dolerite intrusions are present in the western section of the site. Alluvial deposits are also present on the northeastern side of the site. However, the abstraction boreholes are drilled into both the Jurassic Dolerite and the Volksrust Formation. The formations have transmissivity values, ranging from 7.71 m^2/day to 34.35 m^2/day for the dolerite, and 1.83 m^2/day to 2.43 m^2/day for the Volksrust Formation.

Hydrogeologically, the site is located on an intergranular and fractured aquifer type with a borehole yield of 0.5 l/s to 2 l/s

Several point contamination sources have been identified on such as:

- Oil spillage from truck operations.
- Pit latrines.
- A septic tank and French drain.

The site is characterised by pecan nut and pine tree plantations, which impact groundwater both quantitatively and qualitatively. These deep-rooted species have high water uptake and contribute to reduced groundwater recharge through evapotranspiration, while also potentially affecting groundwater quality through nutrient leaching and agrochemical runoff. The nearby wetland system acts as a receptor, relying on consistent groundwater inputs to maintain its hydrological and ecological functions. Changes in groundwater quantity or quality from the plantations may therefore compromise the health and function of the wetland ecosystem

Based on values sourced from the IGRD for the Pongola-Mtamvuna WMA Catchment (DWS, 2024), an estimated recharge of 3 077 991 m^3/a has been calculated for the delineated sub-catchment. The groundwater baseflow into surface water bodies within the sub-catchment is estimated at

75 248 m³/a.

Based on the flow characteristics calculations, the recommended groundwater abstraction volume is 618 579 m³/a. Groundwater balance calculations indicate that approximately 2 918 072 m³/a of groundwater is available for abstraction at the sub-catchment scale. After accounting for the recommended abstraction volume, a surplus of 2 299 493 m³/a remains available within the delineated sub-catchment, indicating that the recommended abstraction is well within sustainable limits. The SCM is shown in Figure 5-4.

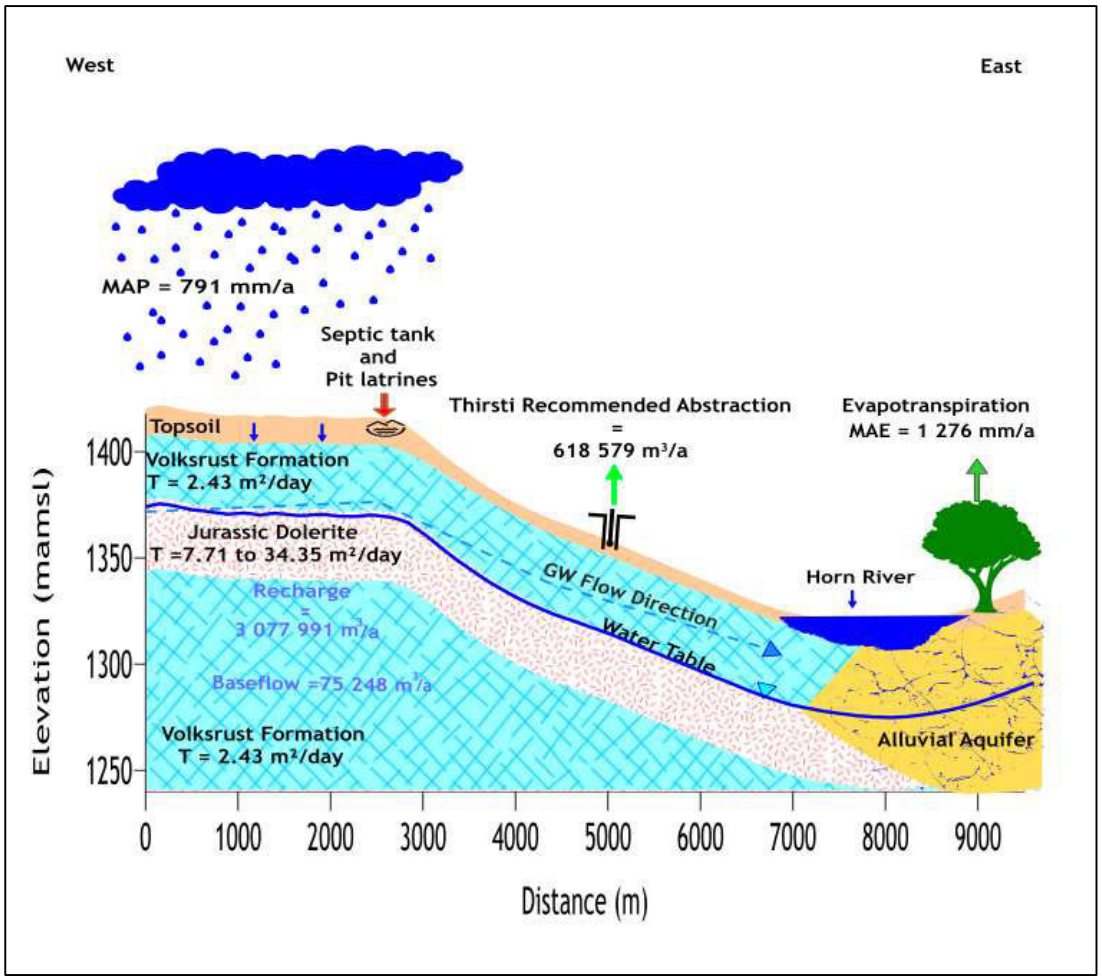


Figure 5-4: Site Conceptual Model (GCS, 2025b)

5.3 Wetlands

This section provides an overview of the watercourses on site compiled by (Groundtruth, 2025). The full report is attached in APPENDIX D.

5.3.1 Freshwater Ecosystem Delineation and Verification

The delineation and verification of the freshwater ecosystems that are hydrologically linked to

the boreholes and the septic tank included three riparian streams (Riparian 1, 2 and 3), two CVB wetlands (CVB 1 and 2) and two seeps (seep 1 and 2) (Figure 5-6). Several hydrologically isolated inflowing watercourses and one seep were identified within the 500 m DWS radius.

5.3.1.1 Riparian 1

Riparian 1, associated with borehole (BH) 13, is a riparian B channel approximately 250 m in length that decants into the lower CVB wetland (CVB 1). The channel is heavily eroded in places, with steep, incised banks (Figure 5-5). Much of the channel's banks and adjacent catchment is invaded by IAPs, notably *Solanum mauritianum* (bugweed) and *Acacia mearnsii* (black wattle). Cattle grazing was also observed along the channel margins. Semi-natural grasslands, pine plantations, IAP infestations and patches of natural mistbelt forest characterise the upstream catchment. An overview of the on site freshwater ecosystem is shown in Figure 5-6.



Figure 5-5: Photographs showing a portion of the channel where the banks have been heavily incised and the dense infestations of alien vegetation (Groundtruth, 2025)

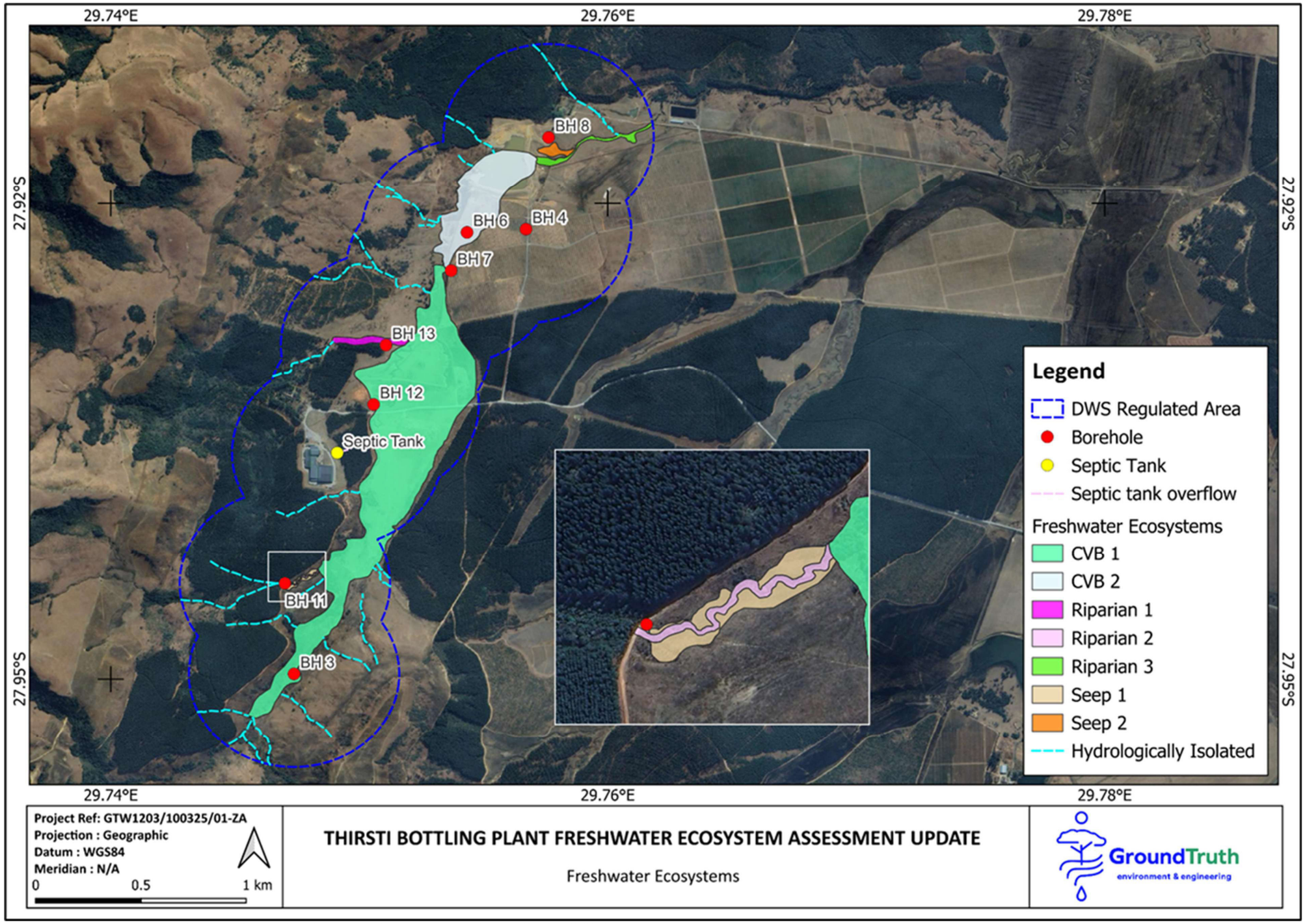


Figure 5-6: An overview of the on site freshwater ecosystem overview (Groundtruth, 2025)

5.3.1.2 Riparian 2

Riparian 2 (Figure 5-7), which is associated with BH 11 and is a riparian B channel and is characterised by a relatively steep incised channel that emerges from under a service road, where it discharges roughly 250 m downstream into the channel associated with CVB 1. The channel is less steep than the densely vegetated portions upstream of the road, however it is heavily eroded. Parts of the banks in the upper portions of the system appear to have recently collapsed and parts of the road have eroded to expose the culvert outlet. A second headcut was noted immediately south of the channel, which was also relatively deep (>1 m in depth). IAPs were again noted along the channel margins, which included *Xanthium strumarium* (cocklebur), *Verbena bonariensis* (tall verbena), *Rubus sp*. (bramble), *Acacia mearnsii* (black wattle) and *Solanum mauritianum* (bugweed), while some of the native plants observed included *Leucosidea sericea* (ouhout), *Sporobolous africanus* (rat's tail grass) and *Paspallum urvillei* (vasey grass), amongst others.



Figure 5-7: Images showing the pipe out of which Riparian 2 emerges and the heavily incised and eroded characteristics of the channel (Groundtruth, 2025)

5.3.1.3 Riparian 3

Riparian 3 occurs below the large water supply dam associated with CVB 2 and is a riparian C channel. It receives water from the dam's baseflow outlet pipe, which discharges onto the bedrock within the channel (Figure 5-8). The upper portions of the channel were observed to be heavily eroded and infested with *Populus sp*. (poplar), *Melia azedarach* (Syringa) and *A. mearnsii*. The current spillway from the dam is directing flows along the northern banks of the

system. The channel associated with the spillway is approximately 670 m in length and has been directed through a large seepage system before decanting into the riparian system. Historical images on Google Earth depict riparian vegetation all along the channel, however this was cleared around 2018, which coincides with the time that the southern spillway (which has since been decommissioned) was created. The channel flows out under a road to the east.



Figure 5-8: A photograph showing the general channel characteristics at the location of the baseflow discharge point (Groundtruth, 2025)

5.3.1.4 Channelled Valley Bottom Wetland 1 (CVB 1)

CVB 1 (Figure 5-9) is the southernmost and largest of the two CVB wetlands, with a total area of approximately 54.28 ha. It receives inflow from several channels originating in the steep, mountainous catchment to the southwest and west, while smaller channels also enter the system from the eastern hills. The catchment is largely characterised by grasslands, patches of IAPs, pine plantations and pockets of mist belt forest that tend to occur on the south-facing slopes. A small patch of pecan nut farming borders the system to the northeast.

CVB 1 was observed to have a largely incised channel running along the length of the valley bottom. The incision, particularly in the upper portions of the system, is likely a result of the wetland's relatively steep longitudinal slope of 3.80%, which, given its size, makes the system susceptible to erosion. Although the incision has lowered the water table, lateral inputs still appear to contribute to flow within the wetland. This is evident in the central valley bottom area, where seasonal soils appeared light brown to yellow-grey (10YR 4/2) with extensive mottling and a relatively high clay content. In contrast, non-wetland areas exhibited darker brown soils (10YR 4/4) with lower clay content.

The central valley bottom is currently utilised by local farmers for cattle grazing. Downstream of the road crossing, the channel discharges into a dam. East of the dam, the spillway has become heavily eroded and now appears to function as the primary channel. Water was noted to be flowing out of an area to the west of the dam wall, which is thought to be associated with the old channel. The dam wall is heavily invaded by IAPs including *Persicara sp*. (knotweed), A. *mearnsii* and *S. mauritianum* and an area to the west of the dam has been

substantially modified through the movement of soil and the creation of an earthen platform.

IAPs were observed throughout the system, particularly along the upper channel and the western slopes of the central wetland area. A relatively deep excavated trench (> 50 cm) was noted in the upper portions, running perpendicular to the valley floor. This appears to be associated with a pipeline from borehole 3 (BH 3) to Thirsti. The channel shows signs of erosion due to animal trampling. This area is considered to pose a significant risk to wildlife.

Vegetation within the system included grasses such as *Sporobolus spp., Cymbopogon sp., P. urvillei* and *Melinis repens* (Natal red top), among others. Along the riparian areas and wetland margins, species such as *Searsia dentata* (nana-berry), *Podocarpus latifolius* (real yellowwood), *Cliffortia linearifolia* (River Rice-bush) and *Helichrysum aureonitens* (imphepho) were observed and others.



Figure 5-9: Images showing the eroded channel in the upper portions of the system, the deep excavated trench that appears to be associated with the pipeline running from BH 3 to the Bottling Plant and the old channel behind the dam where water was noted (Groundtruth, 2025)

5.3.1.5 Channelled Valley Bottom Wetland 2 (CVB 2)

CVB 2 (Figure 5-10) is a smaller (12.86 ha) system that occurs immediately downstream of CVB 1. With a slope of 2.10%, it is less steep than CVB 1, however it is still considered moderately vulnerable to erosion. It shares much of the same catchment characteristics as CVB 1, which falls within its catchment. Much of its eastern slope has been converted to pecan nut orchards, which are irrigated. The channel is well incised and heavily infested with *A. mearnsii*. Much of the western boundary upslope of the wetland has dense *A. mearnsii* infestations. Like CVB 1, it is believed that lateral seep inputs contribute to maintaining hydrophytic conditions in parts of the valley bottom area. In contrast, areas immediately adjacent to the channel were not characterised by hydromorphic soils (soil colours ranged from 10YR 3/4 to 10YR 4/4), likely due to the significant incision depth (approximately 3 m) from the valley floor to the channel bed. Much of the valley bottom area has been transformed due to a combination of hay production and cattle grazing. At the base of the system is a large water supply dam at the bottom of the system, which is likely being used for agricultural purposes. *S. africanus* and *P. urvillei* were recorded in parts of the system.







Figure 5-10: Photographs showing the incised channel where a road passes through it, the flat valley bottom area utilised for hay production and the pecan nut trees along the eastern bank and the large water supply dam downstream with a dense infestation of wattle in the catchment (Groundtruth, 2025)

5.3.1.6 Seep 1

Seep 1 is a small seep that flanks Riparian 2 on both the northwestern and southeastern sides, wherein it laterally drains (0.38 ha). Its catchment is comprised of both grassland and natural mistbelt forests, however its immediate upstream area is dominated by pine plantations. Small areas of erosion were noted, which are associated with the eroding Riparian 2 channel, however much of the system was intact.

5.3.1.7 Seep 2

Seep 2 occurs immediately downstream of CVB 2. It has a total size of 0.67 ha and is considered heavily modified due to the water supply dam wall and spillway that passes directly through the system. Soil samples revealed a heavily disturbed system, with hard imported material being found throughout much of the soil profile. The northeastern portions of the system had some V. *bonariensis, Cymbopogon sp*. and *P. urvillei*, amongst other grasses, while the southwestern portion of the system had short, mowed grass. The area below the spillway was observed to be heavily eroded, with a broad headcut present, which has left various pipes exposed as a result. *A. mearnsii* was also observed to be establishing along the edges of the spillway.





Figure 5-11: Photographs showing the vegetation characteristics of the northeastern portion of the seep, the short mowed grass on the southwestern side of the seep and the heavily eroded area associated with the spillway (Groundtruth, 2025)

5.3.2 Assessment of Wetland Functioning

The assessments of the HGM units were derived by evaluating the level of ecosystem functioning and ecological integrity/condition of the identified hydrologically linked wetlands for the pre-borehole and septic tank (hereafter pre-borehole) and post-borehole and septic tank (hereafter post-borehole) scenarios as outlined in the following sections.

5.3.2.1 Wetland Ecosystem Functioning

The general features of the HGM units were assessed in terms of their ecosystem functioning at a landscape level for the pre-borehole and post-borehole scenarios using a Level 2 WET-EcoServices assessment (Table 5-5 and Table 5-6). The score for each ecosystem service represents the likely extent to which that benefit is being supplied by the wetlands, based on the supply and demand scores, rated from 0-4, which informs the overall importance score, based on the following categories as presented within (Kotze, Macfarlane, & Collins, 2021):

- 0-0.79 Very Low.
- 0.8-1.29 Low.
- 1.3-1.69 Moderately Low.
- 1.7-2.29 Moderate.
- 2.3-2.69 Moderately High.
- 2.7-319 High.
- 3.2-4.0 Very High.

5.3.2.1.1 Channelled Valley Bottom 1

The values recorded for the regulating and supporting ecosystem services in CVB 1 for both the pre- and post-borehole scenarios ranged from Very Low to Moderate. Overall, the wetland delivers a relatively low level of ecosystem service benefits, largely due to limited demand for many of these services within the rural and sparsely populated catchment. For example, although the supply of streamflow regulation is High, the associated demand is Low, resulting in a Moderate importance score. Most other regulating services, including flood attenuation, erosion control and nutrient and toxicant assimilation, were rated Very Low in importance due to both low supply and demand. The low erosion control rating is related to the presence of erosion features throughout the assessment unit, particularly within channel and the excavated trench near BH 3 and poor vegetation cover in some areas.

The biodiversity maintenance and carbon storage services remained of Very Low and Low importance, respectively, in both scenarios. This is despite relatively high demand scores, as the area is identified as an important bird area and it falls upstream of an NFEPA area.

Provisioning services showed a variable range of importance. The supply of water for human use and food for livestock was High, which is due to the dam and perennial flow, as well as the grazable plant species within the valley bottom area. However, demand for these services was negligible, resulting in only Moderately Low importance scores. Other provisioning services, such as cultivated foods and harvestable resources, were rated Very Low in importance due to a lack of current use in the surrounding area.

Cultural services were consistently rated Very Low in both scenarios. This is due to the limited recreational, educational, or spiritual use of the wetland, compounded by its rural setting and private landownership.

5.3.2.1.2 Channelled Valley Bottom 2

No changes were noted under pre- and post-borehole scenarios. The regulating and supporting ecosystem services in CVB 2 ranged from Very Low to Moderate in both the pre- and post-borehole scenarios. Overall, the wetland provides a relatively low level of ecosystem service benefits, mainly due to limited demand in the rural setting. While streamflow regulation showed relatively high supply, most other services, including flood attenuation, erosion control and nutrient assimilation, were rated Very Low due to low supply and demand. The low erosion control rating is associated with the relatively steep slope that characterises the system, deep channel incision and dense wattle infestation along the channel, which reduce soil and vegetation stability.

Biodiversity maintenance and carbon storage remained of Very Low importance despite a high demand for it, which is due to degradation to the system from channel incision, IAPs and land use impacts such as grazing and hay production. This is despite relatively high demand scores, as the area is identified as an important bird area and it falls upstream of an NFEPA area.

Provisioning services showed greater variability. Food for livestock scored High supply, which

is due to the presence of palatable grass species observed (and indication of grazing due to the presence of cattle manure) and hay production, though importance remained Low due to limited current demand.

Water for human use was rated Moderate, linked to the downstream dam, while cultivated foods were of Low importance. Other provisioning services had Very Low importance. Cultural services were rated Very Low, with this being attributed to the fact that area is rural and private and due to the absence of recreational or spiritual use.

5.3.2.1.3 Seep 1

Again, no changes were registered under pre- and post-borehole scenarios. The ecosystem services delivered by seep 1 are generally limited, reflecting its small size and the low demand for most services. Regulating and supporting services ranged from Very Low to Moderate. While the supply of streamflow regulation and nutrient assimilation was relatively high, their overall importance was Moderately Low to Moderate due to limited downstream demand. Sediment trapping also scored Moderate in importance, which due to the relatively intact vegetation and low levels of disturbance within the seep itself.

Erosion control was rated Very Low in importance, despite the ability of the wetland to supply these services, which is likely due to presence of minor erosion features associated with the adjacent Riparian 2 channel. Biodiversity maintenance and carbon storage were rated as Moderately Low and Very Low in importance respectively, despite relatively high demand scores due to area being identified as an important bird area and occurring upstream of an NFEPA area.

Provisioning and cultural services were consistently rated Very Low, except for food for livestock, which showed high supply but low demand, resulting in a Moderately Low importance score. No use of the system for water supply, harvestable resources, or cultivation was observed.

5.3.2.1.4 Seep 2

Both pre- and post- borehole scenarios registered no change. The values recorded for the regulating and supporting ecosystem services in seep 2 ranged from Very Low to Low. Overall, the wetland delivers a low level of ecosystem service benefits, primarily due to its small size and the fact that the system has been heavily modified by the water supply dam wall and spillway. These disturbances have resulted in a degraded soil profile and a large headcut through the centre of the system, limiting its capacity to provide services such as erosion control, sediment trapping and nutrient assimilation.

The supply of streamflow regulation is Moderate, but due to low demand, it holds a Very Low importance score. Similarly, services related to phosphate, nitrate and toxicant assimilation were rated Very Low in importance, reflecting both low demand and the wetland's compromised condition. Slightly higher importance scores were recorded for carbon storage and cultivated foods, possibly due to residual vegetation and adjacent agricultural use.

Provisioning and cultural services were consistently rated Very Low, indicating minimal use of the site for water abstraction, grazing, recreational, or cultural purposes.

5.3.2.2 Ecological Importance and Sensitivity

According to the DWA (2013), the current Ecological Importance and Sensitivity (EIS) categories for the six systems are derived from the EIS score for all the assessed freshwater ecosystems. Of the systems linked to the boreholes, CVB 1 is a C category for the pre-borehole and post-borehole scenarios, while CVB 2 and the two seeps are D (Table 5-5). The EIS score for the two CVB system was predominantly derived from the protection status afforded to the wetland due to it being on private property, as well as its size. While CVB 2 has scored similar scores, but scored a lower category, its smaller size was enough to see it drop from a C to a D. The EIS category for the seeps was largely derived from the fact that they are on the same private property, which affords them protection status, however seep 1's score is also partially derived from its hydro-functional importance as the score is highly linked to these systems' ability to provide regulating and support ecosystem services.

Table 5-5: Ecological Importance and Sensitivity Score for the wetland systems for the pre- and post- borehole (BH) scenario15 for CVB 1, CVB 2, Seep 1 and Seep 2 (Groundtruth, 2025)

Ecological Importance and Sensity Categories	CVB 1		CVB2		Seep 1		Seep 2	
	Pre-BH	Post-BH	Pre-BH	Post-BH	Pre-BH	Post-BH	Pre-BH	Post-BH
Ecological Importance and Sensitivity	2.0	2.0	2.0	2.0	1.6	1.6	1.4	1.4
Hydro-functional Importance	0.4	0.4	0.4	0.4	1.2	1.2	0.2	0.2
Direct Human Benefits	0.4	0.4	0.6	0.6	0.4	0.4	0.2	0.2
Overall Importance and Sensitivity Score	2.0	2.0	2.0	2.0	1.6	1.6	1.4	1.4
Overall Importance and Sensitivity Category	**C**	**C**	**D**	**D**	**D**	**D**	**D**	**D**

5.3.2.3 Wetland Ecological Condition

The ecological integrity or Present Ecological State (PES) of the CVB and seepage wetlands were assessed for the hydrology, geomorphology, water quality and vegetation components comprising wetland health for the pre- and post-borehole scenarios (Table 5-6).

Table 5-6: Summary of the Overall Ecological Integrity of the Wetlands for the Pre-Borehole Scenarios (Groundtruth, 2025)

		Hydrology	Geomorphology	Water Quality	Vegetation	Overall Score
CVB1	Impact Score	4.5	2.9	0.8	5.1	2.5
	PES Category	D	C	C	D	C
CVB2	Impact Score	7.5	4.7	1.1	7.6	6.0
	PES Category	**E**	**D**	**C**	**E**	**E**
Seep 1	Impact Score	3.1	2.6	0.7	4.3	2.7
	PES Category	**C**	**C**	**A**	**D**	**C**
Seep 2	Impact Score	10.0	7.3	1.1	8.1	7.7
	PES Category	**F**	**E**	**B**	**F**	**F**

5.3.2.3.1 Pre-borehole Scenario

Assessment of Impacts on Hydrology

The impact scores recorded for the hydrological component of the CVBs and seepage wetlands ranged from 3.1 to 10, indicating a broad range of impacts to hydrology across the wetlands. CVB 1 scored an overall score of D, CVB 2 scored an overall E, while seep 1 scored a C and a seep 2 a F. The modifications to the wetland's Present Hydrological State are primarily linked to the following factors:

- The heavy erosion that characterises both the channels in CVB 1 and CVB 2 contributes to the lowering of the wetlands' hydrology scores. This incision has likely contributed to a lowered table, while the depth of the channel has also led to a reduction in flood flows reaching the adjacent valley bottom. The historical drains and deep excavated trench within CVB 1 further compound these issues. While lateral flows from seeps or shallow subsurface flows still enter the system and contribute towards maintaining its wetness, the incision offsets these contributions.
- The dams within both CVB 1 and CVB 2 have further contributed to the lowering of hydrology scores by altering the natural flow regimes within the systems. In CVB 1, the large erosion gully associated with the dam's spillway has further affected water retention times, contributing to faster drainage and reduced saturation in that portion of the wetland.

In seep 2, the hydrological score is significantly impacted by the dam spillway. The associated infilling of more than 50% of the wetland has significantly altered natural flow patterns.

Across all these systems and their catchments, plantations, irrigation from pecan nut trees and invasive alien vegetation have altered the natural hydrological regime. In particular, the presence of pine plantations on slopes and dense infestations of invasive species such as wattle have likely increased water uptake and reduced baseflow contributions to the wetlands.

Assessment of Impacts on Geomorphology

The impact scores recorded for the geomorphological component of the CVB and seep wetlands ranged from 2.6 to 7.3, indicating varying levels of alteration to geomorphic processes across the wetlands. CVB 1 was assigned a Present Geomorphology State category of C, CVB 2 a D, while seep 1 was rated C and seep 2 and E. The modifications to the wetlands' present geomorphic condition are primarily linked to the following factors:

The dams in CVB 1, CVB 2 and Seep 2 have contributed to infilled areas that have buried portions of the wetlands, with more than half of seep 2 comprising of fill material. Furthermore, dams act as sediment sinks, which have fundamentally changed the natural level of sediment flux through the wetland.

The large erosion gully to the east of the dam in CVB 1, associated with the spillway, has

significantly altered the natural sedimentation processes within the system. This effect is likely exacerbated by the deep incised channels, which facilitate rapid transport of sediments downstream, thereby depriving critical areas along the valley bottom of sediment deposition.

Assessment o Impacts on Water Quality

The impact scores recorded for the water quality component of the CVB and seep wetlands were relatively low across all systems, ranging from 0.7 to 1.1. This corresponds to Present Water Quality State categories of A or B, suggesting that water quality impacts are currently limited. CVB 1 and seep 1 were rated A, while CVB 2 and Seep 2 were rated B. The limited level of degradation to water quality can be attributed to the following factors:

- Catchment land uses have partially contributed to a lowering of the water quality scores across all the systems, which include plantations and IAPs, however these impacts are minimal.
- CVB 2 has seen a further reduction in water quality due to the pecan nut farming in the catchment as well as within a small portion of the wetland, while seep 2 has been impacted by infilling and the eroded areas within the system.

Assessment of Impacts on Vegetation

The impact scores recorded for the vegetation component of the CVB and seep wetlands ranged from 4.3 to 8.1, indicating moderate to severe levels of degradation across the sites. CVB 1and seep 1 were assigned a Present Vegetation State category of D, CVB 2 an E and seep 2 scored an F. The following factors were considered to contribute to the current state of vegetation across these wetlands:

- IAPs within the CVB wetlands have impacted the native vegetation of the systems. In addition, the areas are used for grazing and are thought to be semi-natural rather than natural due to this historical and ongoing land use.
- In seep 2, much of the natural vegetation has been removed or altered due to infilling associated with the dam spillway. The remaining vegetation is fragmented, with grasses in certain portion of the system being kept artificially short.
- Hay production in CVB 2 has resulted in near-complete transformation of the vegetation composition in these areas.
- The deep and permanent flooding associated with the dams in both CVB 1 and CVB 2 has limited the ability of wetland vegetation to establish in affected areas. Zones that might previously have supported hydrophytic vegetation are now submerged or disturbed, contributing to the overall vegetation degradation.
- Channel incision in parts of CVB 1 and CVB 2 has resulted in a lowering of the local water table and a disconnection from regular overbank flooding. This hydrological alteration can lead to shifts in vegetation composition, with species better adapted

to drier conditions replacing native wetland species.

- Moderately degraded areas associated with seep 1 and the eroding adjacent riparian channel have also contributed to a lower vegetation score. While indigenous vegetation remains, bare areas were evident.

5.3.2.3.2 Post-borehole Scenario

Table 5-7: Summary of the Overall Ecological Integrity of the Wetlands for the Post-borehole Scenarios (Groundtruth, 2025)

		Hydrology	Geomorphology	Water Quality	Vegetation	Overall Score
CVB1	Impact Score	4.5	2.9	0.8	5.1	2.5
	PES Category	**D**	**C**	**C**	**D**	**C**
CVB2	Impact Score	7.5	4.7	1.1	7.6	6.0
	PES Category	**E**	**D**	**C**	**E**	**E**
Seep 1	Impact Score	3.1	2.6	0.7	4.3	2.7
	PES Category	**C**	**C**	**A**	**D**	**C**
Seep 2	Impact Score	10.0	7.3	1.1	8.1	7.7
	PES Category	**F**	**E**	**B**	**F**	**F**

The PES scores of the CVB and seep wetlands assessed for the hydrology, geomorphology, water quality and vegetation components comprising wetland health under the post-borehole scenario are presented in Table 5-7. Summary of the overall ecological integrity of the wetlands for the post-borehole scenarios. The only change in this scenario is the decline in the PES categories for the water quality component, which is attributed to the presence of a leaking septic tank[2] located upstream of the wetland systems.

The leaking septic tank is situated within the catchment of CVB 1 and CVB 2 and is likely contributing to elevated nutrient and organic loads, resulting in a decrease in water quality scores for CVB 1 and CVB 2. These impacts are likely to be transported downstream via overland or shallow subsurface flow, particularly during rainfall events. The extent of change is limited to water quality, with no changes to hydrology, geomorphology, or vegetation in this scenario. It is important to note that impacts to water quality are considered transient, as appropriate mitigation measures help to ensure that any leaks are infrequent and limited in extent.

5.3.3 Index of Habitat Integrity

The Index of habitat integrity (IHI) assessment result summaries of the riparian B and C channels that will be impacted by the boreholes are presented in Table 5-8, with a discussion on the impacts to both the instream and riparian habitats to follow. IHI assessment summary of ecological categories for the identified riparian ecosystems.

[2] During the original assessment, the septic tank was found to be overflowing, which impacted the receiving environment (i.e. water quality component). The specialist has since been informed that the septic tank has been upgraded and is no longer leaking. As a result, the impact on water quality is no longer considered a concern.

Table 5-8: IHI Assessment Summary of Ecological Categories for the Identified Riparian Ecosystems (Groundtruth, 2025)

Watercourse	Instream Habitat		Riparian Habitat	
	Score	Class	Score	Class
Riparian 1	98	A	86	B
Riparian 2	97	A	87	B
Riparian 3	98	B	68	C

Instream impacts across the systems were minimal, with condition scores ranging from natural (A) to good (B). The primary contributor to instream alteration was the dam affecting Riparian 3, which has regulated natural flow regimes and led to unnatural morphological changes within the channel. Invasive alien vegetation was also noted to negatively affect instream habitats across all systems.

Riparian habitat condition for Riparian 1 and 2 was rated as good (B), with relatively minor disturbances. Riparian 3 is considered to be in fair condition (C) and is considered to be slightly more modified. All riparian zones have been negatively affected by IAPs and plantations within their immediate catchments. These disturbances have reduced the natural buffering capacity of the riparian zones and contributed to reduced water availability and quality. While bank erosion and channel modification were noted across all three systems, Riparian 1 and 3 were particularly affected by severe bank erosion, as observed during the field assessment. Furthermore, the dam has altered the riparian habitat in Riparian 3 by regulating flow patterns and disrupting natural flood pulses that typically sustain riparian vegetation and sediment dynamics, while the culvert that channels water into the Riparian 2 has also contributed towards some minor disruption of natural flows through the system.

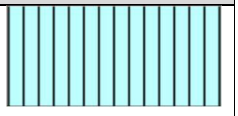
5.4 Hydropedology

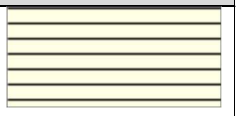
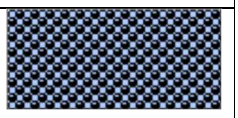
This information is sourced from the Hydropedology Assessment for the Thirsti Bottling Plant Report compiled by GCS (GCS, 2021).

5.4.1 Hydrological Soil Types

In the determination of Hydrological Soil Types (HST), soils were divided into classes based on their expected hydrological responses (Van Tol, 2013)). Hydrological processes were perceived from traceable signatures in the soil matrix resulting from the soil's ability to transmit, store and react with water (Le Roux, P, 2011). The HST descriptions and representative symbols are presented in Table 5-9, below. HSTs identified in the project area is shown in Figure 5-12.

Table 5-9: Hydrological Soil Types (GCS, 2021)

Hydrological soil type	Description	Symbol
Recharge	The soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.	

Hydrological soil type	Description	Symbol
Interflow (A/B)	The soils have a textural discontinuity which facilitates the buildup of water in the topsoil, the water that sits on the upper layer then flows laterally into the stream on the A/B horizon interface. The flow path is predominantly downslope in a lateral direction.	
Interflow (Soil/Bedrock) Or Interflow (A/ Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.	
Responsive (Shallow)	The soils are shallow, and they are over a relatively less permeable weathered rock or bedrock. They have limited storage capacity which results in the generation of overland flow after rainfall events.	
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.	

5.4.2 Hillslopes and Hillslope Hydrology

Hillslopes and preferential soil flow paths were evaluated based on a 30 m Advanced Land Observation Satellite digital terrain model (DTM) (JAXA, 2021) and can be seen in Figure 5-12. The hillslopes generally feed into responsive or interflow soil types or streams/rivers. The Thirsti Bottling Plant is situated in a micro catchment draining towards the northeast but is situated in a large catchment predominantly feeding into the wetland system associated with the Horn River. Based on the soil data for the project area, one hillslope (from crest to valley) is sufficient to describe the hillslope hydrological processes. However, a 2nd hillslope is presented for the micro catchment associated with the Bottling Plant, to illustrate hydropedological processes.

5.4.3 Conceptual Hydrological Flow Processes

The hydrological processes associated with the land types and associated soils in the project area are discussed concerning the numbered arrows in Figure 5-13, below:

- Soils associated with hilltops and crests (headwaters of the catchment) in the study area are highly likely to act as shallow responsive soils (shallow A horizon underlain by intact and relatively impermeable bedrock). These soils would act as interflow soil/bedrock soil types.
    - In interflow (A/B) soils the flow path is predominantly downslope in a lateral direction. If interflow (A/B) soils occur upstream of responsive (shallow or wet) HSTs, overland flow at the soil interface may occur (this will depend on the soil characteristics and clay content).
    - Minor deep secondary flow towards the saturated zone is expected.

- The portion of the hillslope which characterises the midslope to footslope position is characterised by freely drained deep recharge soils of the Clovelly and Hutton soil groups.
    - Shallow vertical and lateral recharge to sub-soils and lateral discharge towards responsive and interflow soil types are expected.
    - Deep percolation into the sub-soils / hard rock and subsequent aquifers towards the lower topography areas is expected. This deep percolation water contributes to surface water streams as groundwater baseflow.
- The area associated with the Horn River flood plain (also identified as a CVB wetland) is associated with hydrogeomorphic soil types (such as the Katspruit soil form encountered) and will primarily be responsive (saturated).
    - In responsive soils, the buildup of water is expected in the B and upper A horizons after rain and overland discharge and minor lateral seepage are expected (due to saturation excess). Secondary vertical seepage to deeper soil zones from the saturated B horizon is expected.
    - The release of water from the gleyic horizons will be somewhat slow and can still contribute to vertical and lateral water movement during dry periods.

Due to the likely presence of interconnected fractures within the bedrock, deep lateral movement of water is anticipated from high to low topography areas. However, this will depend on the degree of fracturing and interconnectivity between the vadose and saturated zones.

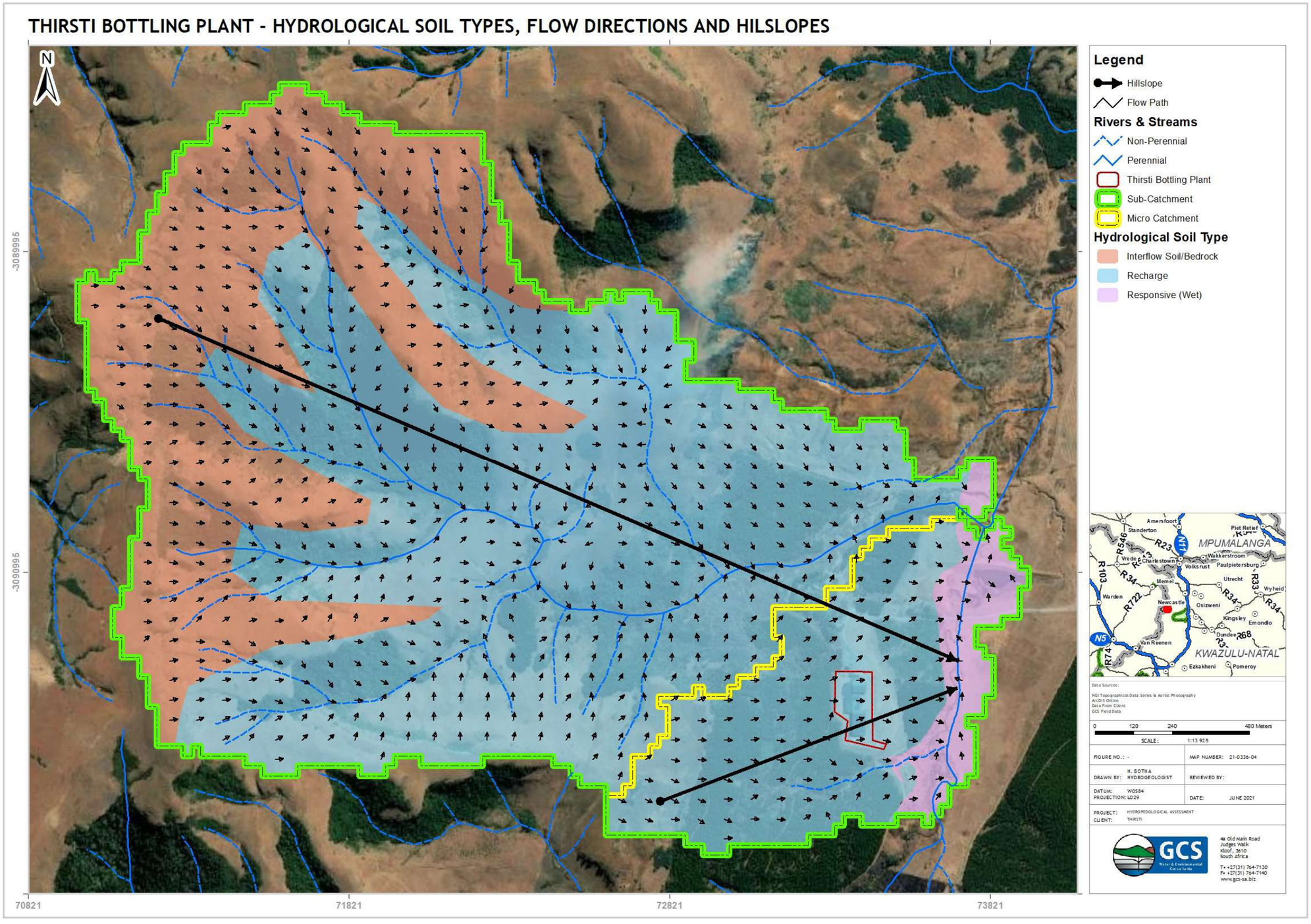


Figure 5-12: Flow Directions and Hydrological Soil Types (GCS, 2021)

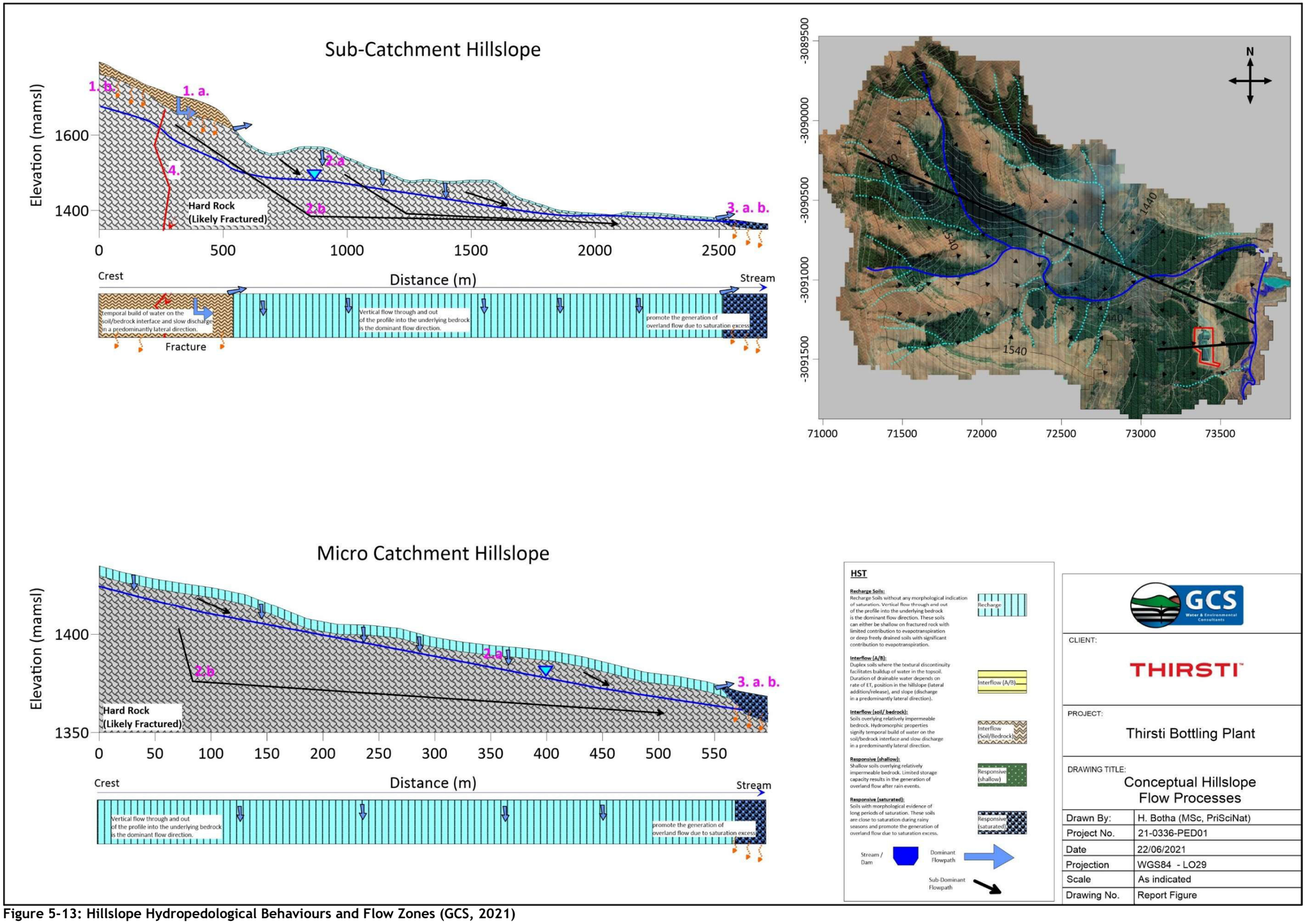


Figure 5-13: Hillslope Hydropedological Behaviours and Flow Zones (GCS, 2021)

6 IMPACT / RISK ASSESSMENT

6.1 Impact / Risk Assessment Methodology

Possible impacts are identified through comments from I&APs, specialist reports, and from water use consultants experience. The assessment process followed a structured approach comprising four key activities:

- Identification and assessment of potential impacts likely to result from the project activities.
- Prediction of the nature, magnitude, extent, and duration of these impacts, with specific focus on those that may be significant.
- Identification of appropriate mitigation measures to reduce, avoid, or manage the severity or significance of the potential impacts.
- Evaluation of residual impacts to determine the significance of the impact after implementation of mitigation measures.

The assessment of significance was guided by a set of criteria, including:

- Cumulative impacts in the broader environmental and social context.
- Nature of the impact, i.e., whether it is positive, negative, direct, or indirect.
- Extent of the impact, ranging from localised to regional or national scale.
- Probability of occurrence of the impact.
- Reversibility of the impact, i.e., whether it can be restored to pre-impact conditions.
- Irreplaceability of affected resources, considering whether resources lost can be substituted or recovered.
- Potential for mitigation, i.e., the extent to which the impact can be avoided, minimised, or offset.

The evaluation of significance followed a consequence–probability approach:

$$\textit{Consequence} = (\textit{Duration} + \textit{Extent} + \textit{Irreplaceability of resource}) \times \textit{Severity}$$

The overall significance of an impact was then determined using the formula:

$$\textit{Significance} = \textit{Consequence} \times \textit{Probability}$$

A summary of the criteria used to assess the significance of impacts is provided in Table 6-1, with detailed explanations presented in Table 6-2.

Table 6-1: Proposed Criteria and Rating Scales to be used in the Assessment of the Potential Impacts

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	

Criteria	Rating Scales	Notes
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0 - 6 months.
	Short-term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months - 5 years.
	Long-term (4)	The duration of the activity associated with the impact will last more than 5 years.
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50% likely that an impact will occur.
	Probable (1)	It is between 50 and 70% certain that the impact will occur.
	Definite (2)	It is more than 75% certain that the impact will occur or the impact will occur.
Significance	Very high – negative (-49 to -66)	A function of Consequence and Probability.
	High – negative (-37 to -48)	
	Moderate – negative (-25 to -36)	

Criteria	Rating Scales	Notes
	Low – negative (-13 to -24)	
	Neutral - Very Low (0 to -12)	
	Low positive (0 to 12)	
	Moderate–positive (13 to 24)	
	High–positive (37 to 48)	
	Very high – positive (49 to 66)	

Table 6-2: Explanation of Assessment Criteria

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact of change on the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), site (limited to the site), and regional (limited to the immediate surroundings and closest towns to the site). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid "double counting," specialists have been requested to indicate spatial significance under "intensity" or "impact on irreplaceable resources" but not under "extent" as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced should it be impacted. A resource could be replaced by natural processes (e.g., by natural colonisation from surrounding areas), through artificial means (e.g., by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those who are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable, e.g., red data species that are restricted to a particular site or habitat to a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the impact (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed

Criteria	Explanation
	development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision making.
Degree of confidence in predictions	Specialists and the environmental team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact based on the available information and their level of knowledge and expertise. The degree of confidence is not considered in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

6.2 Impact / Risk Assessment Outcomes

6.2.1 Impacts on Surface Water

Information in the section below was taken from the Hydrological Assessment (GCS, 2025a) attached as APPENDIX B. The impact/risk assessment ratings are listed in Table 6-5.

Four sources of surface water impacts were identified:

- Earthen dam within a wetland exclusion zone.
- Built-up areas.
- Stormwater release points.
- Plant wash-water outlets.
- Dense pine stands (streamflow-reducing activity).

Changes in interflow contributions from the vadose zone and subsequent shallow water table:

- Pumping from boreholes.
- This impact is negligible as borehole drilling and test records show that Thirsti abstracts from deep the fractured Karoo aquifer.

Modifications in baseflow contributions because of abstraction from deep groundwater aquifer storages. These effects of this activity have no mitigation as abstraction is expected to continue. However, it is recommended that water abstraction be kept at sustainable levels and that losses from pipe leaks, as well as storage tanks, be minimised.

6.2.1.1 Cumulative Impacts

As abstraction of groundwater for bottling and domestic use on site, as well as the associated pecan nut orchards, pine plantations (streamflow-reducing activity), and livestock watering are all expected to take place in the same property, cumulative hydrological impacts can be expected. These impacts are related to baseflow contributions to surface water availability, and no mitigation can measure can be suffused as abstraction is likely to continue in the long-term. However, clearing less-economically viable woody species on the 1:100-year flood line to augment runoff is recommended.

6.2.2 Impacts on Groundwater

Information in the section below was taken from the Geohydrology Assessment Report (GCS, 2025b) attached as APPENDIX C. The impact/risk assessment ratings are listed in Table 6-5.

According to GCS (2019), the site is characterised by various pecan nut and pine tree plantations, which pose a quantitative and qualitative impact on the groundwater abstracted at the site. Pecan nut and pine plantations could reduce groundwater recharge due to the trees' ability to hamper rainfall ingress and take water from shallow groundwater zones, which may lower the water table. For example, the plantations' canopies can intercept rainfall, reducing infiltration to the aquifer. According to GCS (2019), the boreholes at the Thirsti are considered to be vulnerable to the activities listed above, of which plantation farming seems to be the dominant impact.

6.2.2.1 Dewatering Impact as a Result of Groundwater Abstraction Activities

Thirsti abstracts groundwater from eight boreholes spread across the site. From available data, the following is noted:

- Groundwater is obtained from the confined fractured aquifer network, as all boreholes target the deep aquifer zone and dolerite contacts (GCS, 2019);
- The confined aquifer system is under pressure;
- Borehole depths range from 50 to 100 mbgl; and
- Groundwater levels range from 2 to 9 mbgl and mimic the topography.

However, given the confined nature of the aquifer and the depth at which groundwater is abstracted, the potential impact on surrounding surface water features and on other groundwater users, particularly those using shallower unconfined aquifers, is considered to be low. The artesian pressure conditions further reduce the likelihood of vertical leakage or drawdown affecting nearby users relying on different aquifer units.

However, it is recommended that the periodic hydrochemical assessment and groundwater level monitoring be maintained to ensure early detection of any changes that could influence neighbouring groundwater users. Where feasible, an updated groundwater model and cumulative impact assessment should be developed to further support sustainable groundwater management.

6.2.2.2 Impacts on the Groundwater Reserve

The potential radius of influence of pumping for the abstraction boreholes was determined by applying the Cooper-Jacob equation (1):

$$\boldsymbol{Radius\ of\ Influence}\ (r_e) = \mathbf{1.5}\sqrt{\frac{Tt}{S}} \qquad \textbf{Equation 1}$$

Where:

T = aquifer transmissivity (m^2/day).

t = exploitation time/pumping time (days).

S = aquifer storativity.

Based on available hydrogeological data (Levin, 2016) (GCS, 2019), the radius of influence around the boreholes (known as the cone of depression) is estimated to range between 69.21 m and 496.36 m (refer to Table 6-3 and Figure 6-1).

The expected impact from groundwater abstraction is confined mainly to the fractured aquifer system, which is deep underground. This is because water being abstracted is from the confined aquifer; any drawdown in the upper weathered zone (which typically supports baseflow to nearby streams and wetlands) is expected to be minimal to none.

Groundwater abstraction from the confined aquifer system is not anticipated to result in significant impacts on surface water features, such as streams or wetlands, due to the hydraulic separation between the confined and unconfined aquifers.

However, pumping all eight abstraction boreholes simultaneously may significantly increase the cumulative radius of influence, potentially leading to aquifer drawdown, interference between boreholes, and reduced yields, especially in areas with lower transmissivity, like in BH3 and BH8. This could negatively impact nearby groundwater users and connected surface water bodies, such as the Horn River.

Therefore, to mitigate this, the following is recommended;

- Staggered pumping operations- Implement staggered pumping schedules to reduce cumulative drawdown and avoid interference between boreholes.
- Groundwater level monitoring.
- Hydraulic Modelling- Conduct groundwater modelling to simulate the combined effects of all boreholes under the recommended pumping rate. This can help identify safe operational thresholds.

The significance of the potential impact of staggered pumping operations from the eight abstraction boreholes on surrounding groundwater users is assessed as neutral to very low, provided that mitigation measures are effectively implemented (refer to Table 6-5).

Table 6-3: Radius of Influence for Abstraction Boreholes on Site (GCS, 2025b)

Parameters	BH3	BH4	BH6	BH7	BH8	BH11	BH12	BH13
T (m^2/day)	4	31	18.5	18.5	2.4	7	12	5
t (days) 12-Hour Pumping Schedule	182.5	182.5	182.5	182.5	182.5	182.5	182.5	182.5

Parameters	BH3	BH4	BH6	BH7	BH8	BH11	BH12	BH13
s	0.19	0.5	0.8	0.5	0.01	0.6	0.02	0.01
Tt	730	5657.50	3376.25	3376.25	438.00	1277.50	2190.00	912.50
Tt/s	3842.11	11315	4220.31	6752.50	43800	2129.17	109500	91250
Square Root (Tt) m	61.98	106.37	64.96	82.17	209.28	46.14	330.91	302.08
Radius of Influence (m)	92.98	159.56	97.45	123.26	313.93	69.21	496.36	453.11

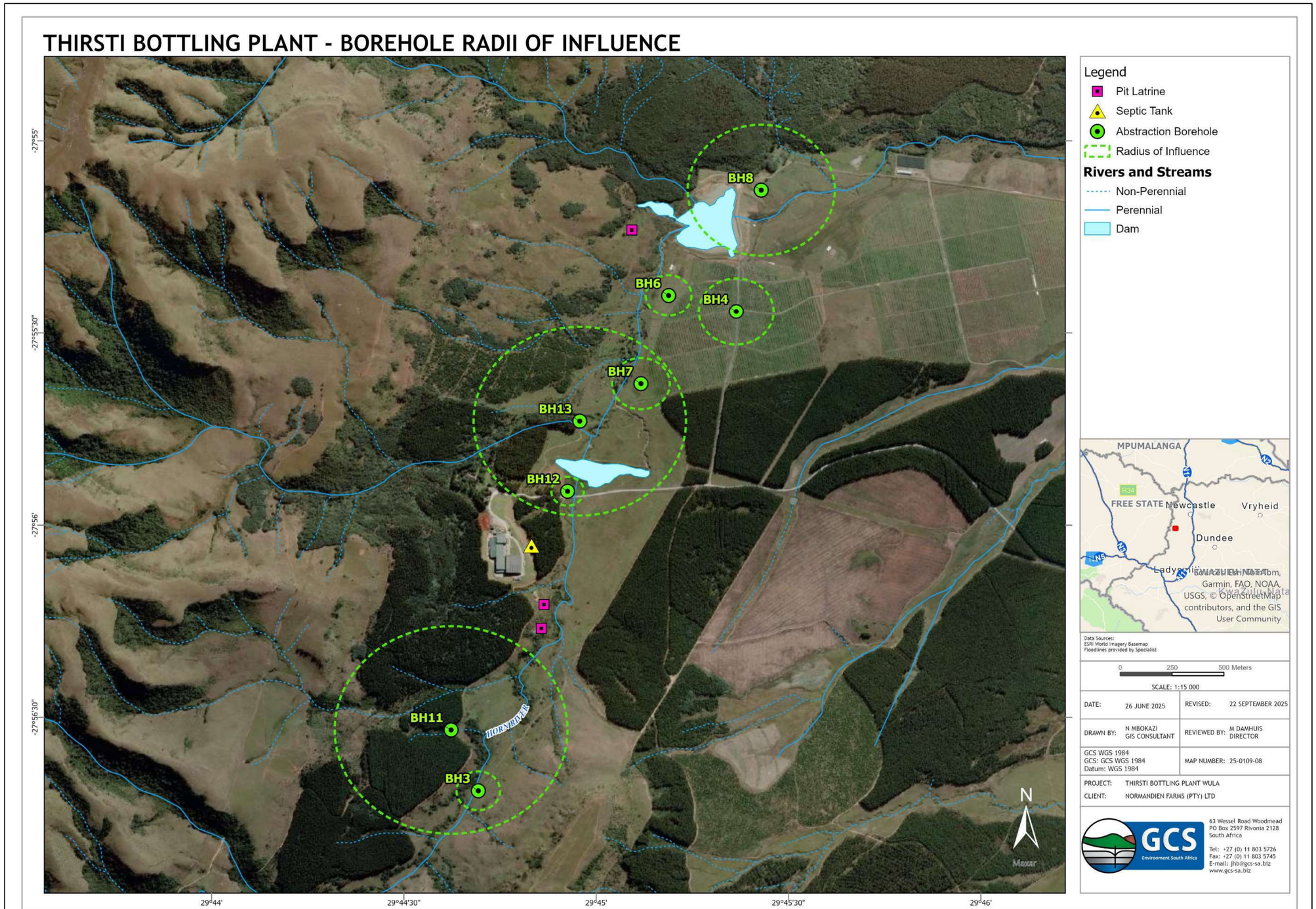


Figure 6-1: Radius of influence for abstraction boreholes on site (GCS, 2025b)

6.2.2.3 Scale of Abstraction

Based on the DWS "Requirements for WULA: Groundwater Abstraction [S21(a)]", the licence application must be evaluated in terms of three possible categories. Categories A, B, and C each have an applicable list of information requirements for the licence application, as should be provided by the Applicant to the DWS:

- Category A – Small-scale abstractions (<60% recharge on the property).
- Category B – Medium scale abstractions (60-100% recharge on the property).
- Category C – Large-scale abstractions (>100% of recharge on the property).

The scale of abstraction is described below.

$$ABS_{scale} = (BHN + ABS_{existing} + ABS_{Proposed} + Baseflow_{GRDM})/Re_{Catchment\ Area} \times 100$$

Where:

- BHN = Basic Human Need.
- $ABS_{existing}$ = Existing abstraction within the delineated area.
- $ABS_{Proposed}$ = Proposed abstraction within the delineated area.
- $Baseflow_{GRDM}$ = Groundwater contribution to baseflow within the delineated area.
- $Re_{Catchment\ Area}$ = Recharge over the delineated catchment area.

With reference to the DWS scale of abstraction categories, the scale of abstraction after the proposed abstraction from the groundwater unit, relative to recharge, across the delineated sub-catchment area is classified as category A "Small-Scale" abstraction.

6.2.2.4 Stress Index

The status of a groundwater resource unit can be assessed in terms of sustainable use, observed ecological impacts, or water stress. As no ecological reserve is available for the affected catchment, the impact of the proposed abstraction on the ecological reserve cannot be determined.

The concept of stressed water resources is addressed by the NWA but is not defined. Part 8 of the Act gives some guidance by providing the following qualitative examples of 'water stress':

- Where water demands are approaching or exceeding the available supply;
- Where water quality problems are imminent or already exist; or
- Where water resource quality is under threat.

To provide a quantitative means of defining stress, a groundwater Stress Index was developed by dividing the volume of groundwater abstracted from a groundwater unit by the estimated

recharge to that unit (Parsons & Wentzel, 2007).

The Stress Index for an assessment area is defined as follows:

Stress Index = Groundwater Abstraction/ (Recharge – Baseflow)

=59 263 +618 579 / (3 077 991 – 75 248)

= 0.23

The Stress Index and classes described in Table 6-4 is a guide for determining the level of stress of a groundwater resource unit, based on abstraction, baseflow, and recharge.

Table 6-4: Guide for Determining the Level of Stress of a Groundwater Resource Unit (GCS, 2025b)

Present Status Category	Description	Stress Index
A	Unstressed or low level of stress	**<0.05**
B		**0.05 - 0.2**
C	Moderate levels of stress	**0.2 - 0.5**
D		**0.5 - 0.75**
E	Highly Stressed	**0.75 - 0.95**
F	Critically stressed	**>0.95**

Based on the guide for determining the level of stress of the groundwater resource unit, the abstraction of 677 842 m^3/a across the delineated sub-catchment area is classified as Status Category C (0.2 – 0.5). The aquifer unit thus has a moderate level of stress.[3]

6.2.3 Impacts on Wetlands

Information in the section below was taken from the Freshwater Ecosystem Assessment compiled by (Groundtruth, 2025), as attached in APPENDIX D. For details on the impact / risk ratings please refer to the DWS RAM noted in Section 6.4.

Based on the reports by Levin (2016) and GCS, the boreholes are drawing from confined aquifers deep below the surface of the wetlands, with the borehole depths range between 50 – 100 m. Given this, the impacts to the wetlands from an abstraction point of view is negligible.

Given that the boreholes and the septic tank are already installed, the following impact is anticipated:

- Pollution from discharges – there is a potential for the water quality[4] to be negatively affected in downstream areas if the septic tank or hydrocarbons from the boreholes leak. These impacts could, over time, result in eutrophic conditions, altering aquatic flora and fauna dynamics and may even impact downstream users of the water resources.

[3] The Stress Index recalculated using the proposed abstraction volume of 281,371 m^3/a rather than the sustainable abstraction volume of 618,579 m^3/a, results in a Stress Index of 0.11 which falls within the low-stress (Status A) category defined by Parsons and Wentzel (2007).

[4] Septic tank has been upgraded and is no longer leaking. As a result, the impact on water quality is no longer considered a concern.

6.2.4 Impacts on Socio-Economic Setting

The impact/risk assessment ratings are listed in Table 6-5.

6.2.4.1 Economic Impact

The Thirsti Bottling Plant plays a vital role in the local and regional economy, particularly given its location in a rural area of KwaZulu-Natal where employment opportunities are limited. The continued authorisation of groundwater use is essential to ensure the uninterrupted operation and growth of the plant.

Currently approximately 350 people are employed across the operations, with job creation spanning administrative, technical, sales, and logistics functions. In addition to direct employment, the plant stimulates indirect employment opportunities through engagement with manufacturers, marketing agencies, and maintenance service providers throughout KwaZulu-Natal and South Africa more broadly.

The economic benefits of authorising the water use include:

- Sustained employment, both direct (e.g. drivers, sales teams, plant operators) and indirect (e.g. service providers, suppliers, distribution networks);
- Support for local enterprises and contractors, many of which are empowered through B-BBEE-compliant procurement practices;
- Contribution to local economic development, through the circulation of income within the rural economy and increased business activity;
- Resilience and long-term viability of operations, particularly important in the context of climate change and increasing water scarcity.

By ensuring reliable access to groundwater, the licence will enable Normandien to continue contributing meaningfully to inclusive economic growth, rural development, and local livelihoods.

6.2.4.2 Social Impact

The benefits of Thirsti Bottling Plant's water use extend beyond economic development to encompass significant social impacts, particularly through community upliftment and emergency relief initiatives.

- Youth Development: Through initiatives such as the Sports for Lives programme, Normandien supports school-based sporting activities across South Africa. These interventions promote physical wellness, academic motivation, and the holistic development of youth, fostering long-term societal benefits.
- Community Resilience and Humanitarian Support: During the devastating fires in Knysna, Normandien responded swiftly by donating over 31,500 litres of water to affected communities. Partnering with Gift of the Givers and Shoprite Checkers, the water was

distributed to thousands in need, providing critical relief in a time of severe disruption and water shortages.

These programmes highlight Normandien's role as a responsible corporate citizen committed to building resilient communities, supporting vulnerable populations, and improving access to essential services.

6.3 Impact / Risk Assessment Matrix

The impact/risk assessment details are listed in Table 6-5.

Table 6-5: Potential Impacts in the Operational Phase and Proposed Mitigation Measures

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation						
			Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance		Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance
Surface Water																	
Primary Surface Water Receivers: - Perennial stream; Channelled valley bottom wetland	Impeding or diverting water flow in a water course and alteration of bank characteristics.	An earthen dam within 500 m of a valley bottom wetland	3	3	4	1	24	2	High – negative (-37 to -48) -48	• No mitigation possible. • The earth dam intended for pecan nut irrigation was constructed over 5 years ago and may not be economically feasible for the owner to remove. • Minimum flows are maintained by an outlet control point for downstream ecosystems.	3	3	4	1	24	2	High – negative (-37 to -48) -48
	Presence of impermeable structures may increase overland flow and soil detachment.	Built-up areas/ Bottling Plant Facility	2	1	4	1	12	2	Moderate – negative (-25 to -36) -24	• Thirsti already has stormwater conveyance structures to ensure that rainfall is captured and slowly released to the environment. • Install erosion control systems along storm flow release points.	2	1	4	1	12	2	Moderate – negative (-25 to -36) -24
	Soil cover loss and sedimentation of waterways by ongoing stormwater release from plant Poor quality overland runoff, plastic pollution and uncontrolled erosion from the channel.	Stormwater release points Plant wash-water outlets	2	1	4	1	12	2	Moderate – negative (-25 to -36) -24	• Ensure that sediment barriers are in place immediately at the end of stormwater release points, to prevent sediment runoff and erosion. • Design energy dissipation structures using naturally occurring materials. • Regular maintenance and monitoring. • Restore vegetation where possible.	2	1	4	1	12	2	Moderate – negative (-25 to -36) -24
	Disproportionally high evaporation rates, delays in flow attenuation, reductions in low flow volumes, can be expected because of dense pine stands.	Pine plantation	3	2	4	1	21	2	High – negative (-37 to -48) -42	• No mitigation possible, pine stands are expected to remain until their harvest date. • Ensure compliance with streamflow-reducing activity licence requirements.	3	2	4	1	21	2	High – negative (-37 to -48) -42
Interflow contributions from vadose zone and subsequent shallow water table	Leakages from pipeline, post-earthwork activities; and constant flow from stormwater control pipes. This may cause sedimentation on the watercourse, leading to increased flood impacts.	Pipeline areas, culverts, and dirt access roads, which were backfilled with collapsible soils; or stormwater control outlets; and water leakages which may cause soil subsidence	2	1	4	1	12	1	Neutral - Very Low (0 to -12) -12	• Visual assessment for signs of erosion or contamination. Undertake regular clearing of debris and sediment buildup on culverts and waterways.	2	1	4	1	12	**1**	Neutral - Very Low (0 to -12) -12
	Spillage of effluent from the septic tank may contaminate the nearby water resources.	On site effluent disposal	2	2	4	1	14	2	Moderate – negative (-25 to -36) -28	• As part of this WUL application, Thirsti is planning to instal a manhole to enable quicker maintenance works on the septic tank. • Regular maintenance to clear blockage. • Routine bacteriological analysis on surface water. • Regular removal of sludge built-up. • Policy improvements on site (e.g., ban wearing of head nets and rubber gloves outside the plant and introduce penalties to offenders). • The septic tank has been upgraded..	2	2	4	1	14	**1**	Low – negative (-13 to -24) -14
	Hydrocarbon may from coal and ash stockpiles, leading to contamination of the nearby water resources.	Coal boiler	3	2	3	1	18	2	Moderate – negative (-25 to -36) -36	• Dispose ash stockpiles only on landfill sites that meet the minimum structural standards. • Store unused coal on runoff-controlled zones. Cover any stockpiles with appropriate materials.	3	2	3	1	18	**0**	Neutral - Very Low (0 to -12) 0
	Oil and fuel spills and leakages at vehicle park areas, and in the project areas, may cause	Vehicle parking areas and driveway	2	1	1	1	6	1	Neutral - Very Low (0 to -12)	• Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. • Place oil drip trays under parked construction vehicles	2	1	1	1	6	**0**	Neutral - Very Low (0 to -12)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation						
			Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance		Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance
	poor quality seepage and runoff.								-6	and hydraulic equipment at Thirsti. Have hydrocarbon spill kits on site.							0
	Microfibres and chemicals in laundry wastewater may directly contaminate subsurface water resources and degrade water quality.	Pond	2	2	3	1	12	2	Low – negative (-13 to -24) -24	• Laundry wastewater must be treated before release to the environment. Ensure routine water quality monitoring.	2	2	3	1	12	**0**	Neutral - Very Low (0 to -12) 0
	Impermeable areas decrease rainfall infiltration into recharge soils and thus reduce interflow to downstream wetland areas.	Built-up areas	1	1	5	1	7	1	Neutral - Very Low (0 to -12) -7	• No mitigation required. Thirsti already has storm water diversion structures to ensure that rainfall is captured and slowly released to the environment.	1	1	5	1	7	**1**	Neutral - Very Low (0 to -12) -7
	Dewatering perched groundwater near wetlands and river systems may impact natural soil flow processes.	Pumping from boreholes	1	1	2	1	4	0	Neutral - Very low (0 to -12) 0	• No mitigation required. • However, records of Thirsti boreholes suggest that groundwater is drawn from a confined aquifer network. Thus, impact on the soil-water flow process is negligible.	1	1	2	1	4	**0**	Neutral - Very low (0 to -12) 0
	Reduced vertical recharge, and interflow into and out of less mature plantation areas.	Pine plantation zones	1	1	5	0	6	2	Neutral - Very low (0 to -12) -12	• No mitigation is possible. • Reducing plantation areas is the only way to reduce impact. However, may not be economically feasible for the landowner.	1	1	5	0	6	**2**	Neutral - Very low (0 to -12) -12
Baseflow contributions from deep aquifer storage	Ongoing abstraction for industrial use combined with a streamflow-reducing activity (pine plantation) will lead to decrease in groundwater contribution to baseflow, possibly leading to wetland modification.	Abstracting groundwater from the seven abstraction boreholes	1	1	4	1	6	**2**	Neutral - Very Low (0 to -12) -12	• No mitigation possible. • Groundwater abstraction from the confined aquifer system is likely to continue. • However, abstracting beyond acceptable limits should be avoided. • Follow the water management protocol and avoid unnecessary water losses.	1	1	4	1	6	**2**	Neutral - Very Low (0 to -12) -12
	Reductions in winter runoff because of water use impact from pecan nut and pine plantations.	Pecan nut and pine plantations on site	1	2	4	1	7	**2**	Low – negative (-13 to -24) -14	• Avoid establishing plantations in groundwater recharge zones or close to watercourses and wetlands. • Clear invasive alien plants within 20 m of river lines, within groundwater recharge zones or within the 1-100-year flood line and floodplains. • Install piezometers to help monitor groundwater levels around plantation areas.	1	2	4	1	7	**1**	Neutral - Very Low (0 to -12) -7
Groundwater																	
Site Aquifer	The potential radius of influence of pumping for eight abstraction boreholes ranges from 69.21 m and 496.36 m.	Dewatering. Abstracting groundwater from the eight) abstraction boreholes.	4	2	2	1	-14	2	Moderate – negative (-25 to -36) -28	• Staggered pumping operations and groundwater level monitoring.	4	2	1	0	-6	1	Neutral – Very Low (0 to -12-) -6
Regional Aquifer	With reference to the DWS scale of abstraction categories, the scale of abstraction after the proposed abstraction from the groundwater unit, relative to recharge, across the delineated sub-catchment area is classified as category A “Small-Scale” abstraction.	Abstracting groundwater from the eight abstraction boreholes.	4	4	1	1	-9	1	Neutral – Very Low (0 to -12) -9	• Abstract only the recommended volume. • Install a flow metre and dipper tube on the borehole, undertake to monitor abstractions and water level response, and reduce abstraction if the groundwater supply shows a significant decrease.	4	4	1	0	-8	0	Neutral – Very Low 0 to -12) -0

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation						
			Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance		Duration	Extent	Severity	Potential for Impact on Irreplaceable Resources	Consequence	Probability	Significance
Local Aquifer	The presence of a septic system and pit latrines on site.	Point Source Contamination On site.	4	3	3	1	-24	1	Low-negative (-13 to -24) -24	• Ensure all abstraction boreholes are properly cased and sealed, especially through fractured zones in the dolerite, to prevent vertical migration of contaminants. • Implement a quarterly monitoring programme to track changes in water levels and quality. • Regularly inspect and maintain on site sanitation systems to prevent leakage into the subsurface.	4	3	1	0	-7	0	Neutral - Very Low (0 to -12) -0
Local Aquifer	Pecan nut and pine plantations on site.	Pecan nut and pine plantations on site impact the groundwater quality.	4	3	3	1	-24	1	Low-negative (-13 to -24) -24	• Avoid establishing plantations in groundwater recharge zones. • Monitor groundwater quality regularly.	4	3	1	0	-7	0	Neutral - Very Low (0 to -12) -0
Local Aquifer	Vehicle Park area and driveway.	Oil and fuel spills and leakages at vehicle park areas and at the site may cause poor quality seepage and runoff.	4	3	3	1	-24	1	Low-negative (-13 to -24) -24	• Ensure all abstraction boreholes are properly cased and sealed, especially through fractured zones in the dolerite, to prevent vertical migration of contaminants. • Implement a quarterly monitoring programme to track changes in water levels and quality. • Regularly inspect and maintain on site sanitation systems to prevent leakage into the subsurface.	4	3	1	0	-7	0	Neutral - Very Low (0 to -12) -0
Socio-Economic																	
Economic Setting	Continued abstraction and use of groundwater for Thirsti Bottling Plant operations.	Thirsti Bottling Plant.	4	3	3	0	21	2	High-positive (37 to 48) + 42	• Maintain B-BBEE compliant procurement to strengthen local enterprises.	4	3	3	0	21	2	High-positive (37 to 48) + 42
Social Setting	Operation of the Thirsti Bottling Plant and its community outreach programmes.	Thirsti Bottling Plant.	4	5	2	0	16	2	Moderate-positive (13 to 24) +18	• Sustain and expand community development initiatives such as Sports for Lives, promoting youth wellness and development. • Maintain and strengthen partnerships with humanitarian organisations (e.g. Gift of the Givers, Shoprite Checkers) to provide emergency relief when required. • Ensure ongoing communication with local communities to identify needs and provide targeted support. • Position Thirsti as a responsible corporate citizen by aligning upliftment projects with local and regional development goals.							Moderate-positive (13 to 24) +18

6.4 Department of Water and Sanitation Risk Assessment Matrix

This section provides the risk matrix compiled by (Groundtruth, 2025), as attached in APPENDIX D.

Application of the risk matrix, as described in Government Notice (GN) 4167 of 2023, which takes into account the mitigation measures that will be adopted by the project, highlighted that the potentially affected watercourses within Thirsti are at Low Risks of negative impacts on system functioning and integrity (Table 6-6).

While the boreholes present a potential risk of hydrocarbon contamination to groundwater, this risk is considered to be low, as the borehole infrastructure is housed within sealed and enclosed pump houses that minimise the likelihood of leaks or spills reaching the subsurface. Proper containment and infrastructure design significantly reduce the potential for contamination. However, it is important that infrastructure is regularly inspected and maintained as needed to prevent any potential for contamination.

The overflow of the septic tank observed on site has been addressed through corrective actions. The following continued regular maintenance and proper management of the facility will help protect nearby water resources:

- Strong messages to staff and guests of Thirsti should include the appropriate use of septic tanks and French drains.
- The system should be inspected for sludge buildup in the main tank chamber, and the inflow and outflow pipes should be checked for any blockages. This will not only reduce the risk of failure but will also ensure that the septic tanks are operating optimally to reduce their overall operational-related risks to the downstream watercourses.
- An appropriate buffer zone should be maintained between the septic tank and the downstream freshwater ecosystem (CVB 1). This buffer should be vegetated with indigenous plant species, which can assist in intercepting and slowing down overland flow, thereby enhancing infiltration and reducing the direct transport of nutrients, pathogens, and other pollutants into the wetland. The vegetation within the buffer zone also contributes to phytoremediation, where plants take up and metabolise certain contaminants, further improving water quality before it reaches sensitive aquatic habitats.
- In the event of a system failure, sandbags should be strategically placed immediately downstream of the septic tank to divert any overflow and promote infiltration into the surrounding soil. This measure will help reduce the likelihood of overland flow reaching nearby freshwater ecosystems.
- Bi-annual water quality monitoring of CVB 1 and CVB 2 should be undertaken by an

independent specialist using a simple in-situ water quality test to determine temperature, electrical conductivity, dissolved oxygen, pH, and salinity. In addition, it is recommended that individual ammonia, total nitrate, total phosphate, and *E. coli* water quality tests are taken. These tests should be undertaken twice a year (one test in the dry season and one in the wet season) to ensure that the septic tank systems are not having an overall cumulative impact on the resource quality of the CVB 1 and CVB 2. This monitoring should occur for at least three years from the date of authorisation.

Table 6-6: Wetland Risk Assessment Activities, Impacts and Risk ratings for the Operation Phase (Groundtruth, 2025)

Phase	Activity	Impact	Potentially Affected Watercourses		Overall Intensity (max = 10)	Spatial Scale (max = 5)	Duration (max = 5)	Likelihood (Probability) of Impact	Significance (max = 100)	Risk Rating
			Name/s	Ecological Importance						
OPERATIONAL (mitigated)	Operations of septic tank	Overflowing septic tank upstream of Channelled Valley Bottom (CVB)1 and CVB2 due to improper management.	CVB 1	Moderate	8.0	3.0	1.0	80.0%	28.8	L
			CVB 2	Moderate	6.0	2.0	1.0	80.0%	21.6	L
	Operations of boreholes tank	Potential hydrocarbon contamination of wetlands through fuel leaks from borehole pumps.	CVB 1	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			CVB 2	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Seep 1	Low/ Very Low	2.0	1.0	1.0	20.0%	1.6	L
			Seep 2	Low/ Very Low	2.0	1.0	1.0	20.0%	1.6	L
			Riparian 1	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Riparian 2	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Riparian 3	Moderate	2.0	3.0	1.0	20.0%	3.6	L

6.5 Assessment of Level and Confidence of Information

All information contained in this Technical Report was sourced from the specialist studies conducted for the project area. The specialists appointed to undertake the various investigations are considered to be competent in their particular fields. In light of the above, the level of confidence with regards to the information and reports used to compile this document is high.

7 WATER MANAGEMENT PLAN

7.1 Organisational Structure

Normandien bears ultimate responsibility for the implementation of the Water Management Plan and for ensuring compliance with all conditions set out in the WUL. Within this framework, Thirsti Bottling Plant has established a clear operational management structure to ensure accountability, efficiency, and effective communication across all functional areas. The structure is shown in Section 2.6.

7.2 Resources and Competence

Normandien ensures that individuals appointed to key roles hold the appropriate qualifications, professional registrations, and relevant experience required to fulfil their responsibilities effectively. The company is committed to maintaining a skilled and competent workforce by providing ongoing training and development opportunities tailored to the needs of each role. Training covers both regulatory requirements and site-specific procedures to ensure compliance, operational efficiency, and continuous improvement in environmental and water management practices. Competence is reviewed regularly to confirm that employees remain suitably equipped to perform their duties to the required standard.

7.3 Education and Training

Normandien provides structured education and training programmes to ensure that all employees understand their roles and responsibilities within the organisation. Training is tailored to the requirements of each position and includes induction for new staff, refresher courses, and specialised training where necessary. Core topics typically cover compliance with legal and regulatory requirements, workplace health and safety, and site-specific operational procedures. Training records are maintained, and effectiveness is periodically evaluated to ensure that knowledge is applied effectively in daily operations.

7.4 Internal and External Communication

At Thirsti Bottling Plant, internal communication is critical to ensure that all employees are informed, aligned, and able to act on environmental and compliance matters. This is done through regular toolbox talks, posted notices at key operational areas, email bulletins, and structured meetings. These channels are used to share updates on licence conditions, monitoring results,

non-conformances, corrective actions, procedural changes, incident reports, and internal audit findings. A feedback mechanism is built into communications to allow employees to raise concerns, ask questions, or suggest improvements.

Externally, Thirsti maintains structured communication with stakeholders such as the DWS, municipalities, community groups, and other interested parties. Reports of compliance, incident notifications, and formal submissions are sent to DWS in accordance with licence requirements. Stakeholder engagement may take the form of written correspondence, presentations, meetings, newsletters, or reports.

7.5 Awareness Raising

Thirsti Bottling Plant actively promotes awareness among employees to ensure that environmental responsibilities are clearly understood at all levels of the organisation. Awareness raising initiatives are designed to highlight the importance of compliance with licence conditions, protection of water resources, and the broader environmental impacts of operations. These initiatives are delivered through toolbox talks, posters displayed in key operational areas, email updates, and periodic staff briefings. Awareness campaigns also emphasise individual roles in preventing pollution, maintaining safe and efficient practices, and reporting potential risks or incidents.

7.6 Water Balance

The water balance for the Thirsti Bottling Plant is provided in Table 7-1 (GCS, 2025a). The following observations are made:

- In the year ending December 2024, Thirsti abstracted 249 015 m^3 for industrial and domestic use, compared to the application volume of 281 376 m^3.
- All rainfall water captured on the Thirsti laydown area (~27 528.2 m^3/a) is released back to the environment.
- As expected, groundwater abstraction was found to be the primary source of water supply for industrial use.
- Based on the provided data and information, 159 724 m^3 was used for bottling and domestic use, with bottling accounting for 64.2% of water requirements in 2024.
- A total proportion of 36.8% was discharged as plant wash-water.
- 420 m^3/a (or 410 000 l) is intended for fire emergency storage.
- The water balance is acceptable as it falls within the specified threshold of 10% accuracy.
- The positive balance suggests that some water is in the storage units and is not emptied in reality.

Table 7-1: Water Balance Results - Annual (average) (GCS, 2025a)

Facility Name	Water Circuit/Stream	Quantity (m^3/a) - IN	Water Circuit/Stream	Quantity (m^3/a) - OUT	Balance
Factory laydown area	From: Rainfall	27 528.2	To: Runoff	16 517	
			To: Evapotranspiration	8 881	
			To: Infiltration	2 130	
	Total	**27 528**	**Total**	**27 528**	**0**
Groundwater Use	From: Boreholes	249 015	**To: Reservoir**	**249 015**	
		249 015		**249 015**	**0**
Bottling Process	From: Reservoir	249 015	To: Production	157 268	
			To: Green Tank	3 000	
			To: Ultrafiltration	2 490	
			To: Treatment	86 257	
	Total	**249 015**	**Total**	**249 015**	**0**
Domestic water circuit	From: Green Tank	3 000	To: Domestic Areas	2 360	
			To: Laundry	168	
			To: Fire emergency storage	420	
			To: Spill & leaks	53	
	Total	**3 000**	**Total**	**3 000**	**0**
Waste water circuit	From: Domestic Areas	1 038	To: Septic Tank	1 038	
	From: Laundry	168	To: Laundry wastewater	74	
	From Rainfall	226	To: Evaporation	320	
	Total	**1 432**	**Total**	**1 432**	**0**
Ember = Assumed RED = Estimated BLUE = Available Data	*Total IN*	529 990	*Total Out*	529 990	0
Percent Error					*0.00%*

7.7 Water Use and Environmental Management Plan

The operation of the Thirsti Bottling Plant has the potential to impact both surface and groundwater resources, as well as the surrounding socio-economic and social environment. To ensure compliance with the NWA, and to promote sustainable operations, a comprehensive management plan has been developed. This plan identifies potential impacts, the activities that may give rise to them, and the recommended mitigation measures to avoid, minimise, or manage risks. The management plan integrates surface water, groundwater, ecological, socio-economic, and community aspects into a single framework, thereby ensuring that water use remains within authorised limits and supports both environmental integrity and social well-being.

The table below outlines the Thirsti Water Use and Environmental Management Plan, providing a consolidated overview of potential impacts and the corresponding measures required to mitigate or manage these impacts.

Table 7-2: Water Use and Environmental Management Plan

Environmental Component	Activity Causing Impact	Detailed Management and Mitigation Measures	Rationale / Expected Outcome
Groundwater	Abstraction from eight production boreholes (281 371 m^3/a)	• Staggered pumping schedules – rotate abstraction between boreholes to reduce localised cone of depression and allow aquifer recovery. • Install flow metres and dipper tubes at each borehole to track abstraction rates and aquifer response in real time. • Quarterly groundwater level and chemistry monitoring (major ions, nitrates, ammonia, *E. coli*). • Borehole casing & sealing through fractured dolerite zones to prevent vertical contaminant migration from septic/French drain. • Adaptive abstraction controls – if levels drop below threshold (linked to Resource Quality Objectives), reduce pumping volumes immediately.	Prevents long-term aquifer depletion, protects baseflow contributions to wetlands, and safeguards drinking water quality for downstream users.
Surface Water (streams and stormwater)	Runoff from impermeable surfaces; stormwater releases; erosion from channels	• Maintain and expand stormwater diversion systems to ensure gradual release. • Install sediment traps and check dams at all stormwater outfalls. • Design energy dissipation structures (gabions, rock mattresses, natural fibre mats) at discharge points. • Routine maintenance and inspections of culverts, drains, berms after rainfall events. • Riparian rehabilitation with indigenous species to stabilise soils and improve infiltration. • Litter and plastic traps at stormwater channels to prevent downstream contamination.	Reduces erosion, sedimentation, turbidity, and pollution of nearby valley bottom wetlands; maintains ecological functioning of aquatic ecosystems.
Wetlands (CVB, UVB, HSS – Critically Endangered types)	Boreholes/infrastructure within 500 m; altered hydrology; sediment inflows	• Establish buffer zones (≥30 m, vegetated with indigenous grasses/shrubs) around wetlands. • No new hard infrastructure permitted within 500 m unless unavoidable; if unavoidable, apply “design with nature” (low impact designs, permeable surfaces). • Invasive alien plant removal (wattle, pine,	Protects Critically Endangered ecosystems, maintains flow regulation, water purification, and biodiversity support functions.

Environmental Component	Activity Causing Impact	Detailed Management and Mitigation Measures	Rationale / Expected Outcome
		gum) within 20 m of wetlands/rivers. • Hydrological safeguards – avoid diverting natural seepage or interflow pathways. • Ecological monitoring – repeat Present Ecological State and Ecological Importance and Sensitivity assessments every 2 years.	
Sanitation and Effluent (Septic tank and French drain)	Overflow, blockages, inadequate desludging, pathogen release (*E. coli*, nutrients)	• Routine desludging by licenced contractors; maintain disposal certificates. • Overflow contingency measures – sandbag berms/absorbent pads downstream to prevent raw effluent entering wetlands. • Install manholes for emergency access to clear blockages quickly. • Bi-annual surface water quality monitoring upstream and downstream for pH, electrical conductivity, dissolved oxygen, total dissolved solids, ammonia, nitrate, phosphate, and *E. coli*. • Staff hygiene policies (e.g., prohibit taking Personal Protective Equipment outside plant, penalties for non-compliance).	Prevents groundwater/surface water contamination, controls bacterial and nutrient pollution, protects downstream users from health risks.
Hydrocarbons and Chemicals	Fuel and oil leaks from vehicles; coal and ash stockpiles; laundry wastewater	• Coal/ash stockpile management – cover stockpiles, store in runoff-controlled zones, dispose ash only at compliant landfill sites. • Drip trays under vehicles and hydraulic equipment to capture oil/fuel leaks. • Hydrocarbon spill kits onsite; staff trained for immediate response. • Laundry wastewater treatment – install pre-treatment to remove microfibres, detergents, discharge only after meeting compliance limits. • Routine monitoring of soils at vehicle yards and storage areas for hydrocarbon contamination.	Prevents chemical and hydrocarbon contamination of soils, groundwater, and wetlands; ensures compliance with National Water Act, 1998 (Act No. 36 of 1998) (NWA) water quality standards.
Catchment-Level (Strategic Water Source Area	Forestry plantations (streamflow reduction), irrigation (pecans), cumulative abstraction	• Ensure pine plantations licenced as Streamflow Reduction Activities. • Avoid new plantation establishment in	Ensures local water use remains aligned with Strategic Water Source Area protection, mitigates cumulative catchment pressures.

Environmental Component	Activity Causing Impact	Detailed Management and Mitigation Measures	Rationale / Expected Outcome
pressures)		recharge areas. • Progressive removal of invasive alien vegetation to restore natural hydrology. • Install piezometers to monitor groundwater-surface water interaction and impacts of forestry/agriculture. • Engage in catchment forums (Catchment Management Agencies, local water user associations) for coordinated management.	
Socio-Economic and Compliance	Reputational risk; dependency on Water Use Licence; community reliance on plant	• Strengthen B-BBEE procurement and local enterprise participation to maintain social licence. • Transparent engagement with stakeholders – share monitoring reports, hold regular information sessions. • Emergency preparedness – keep capacity to provide potable water to nearby communities in case of water crises. • Staff training programmes – water stewardship, pollution prevention, spill response, hygiene. • Auditing and reporting – internal audits quarterly; external compliance audits annually; report findings to Department of Water and Sanitation.	Maintains compliance with NWA licence conditions, builds community trust, secures long-term licence to operate.

7.8 Monitoring and Control

7.8.1 Surface Water Monitoring

From the hydrology assessment undertaken (GCS, 2025a), it is anticipated that the water courses downstream of the Bottling Plant (including the septic tank) and those around the borehole points are the receptors of any potential pollution from the activity (i.e., overland runoff, seepage, interflow, stormwater discharge, etc.). It is recommended that long-term monitoring focus on these areas and entail visual inspections on a monthly to quarterly basis during the operational phase.

The stormwater release points around the Thirsti laydown areas, the pond, the septic tank, and the roadway culverts are the proposed observation and monitoring points. It is proposed that monitoring be conducted as specified in Table 7-3 for the duration of the activity taking place. Stormwater monitoring is recommended to be done at the end of a storm event. If concerns are noted, then monitoring must be conducted more frequently until the issues are resolved. The need for further monitoring of Thirsti can be evaluated by the local environmental authorities or DWS representatives. Monitoring responsibility will fall with Thirsti.

Table 7-3: Proposed Surface Water Monitoring Points, Frequencies, and Sample Analyses (GCS, 2025a)

Site	Frequency	Type	Field Measurements	Laboratory Analyses / Action
Stormwater Monitoring points	Twice per rainy season, once within the first significant rainfall event (>10mm/d) and following a significant rainfall event near the end of the season (March/April). During the storm event or once the storm has subsided. Avoid sampling stagnant water.	Field assessment and laboratory (if required)	pH Electrical conductivity (EC) Total Dissolved Solids (TDS) Sediment load	If field measurements indicate a contaminant trend, such as visual pollution of water, it is recommended that a sample be submitted for analytical testing. The following should typically be screened: • pH, Conductivity, TDS, and total suspended solids (TSS). • Biological oxygen demand (BOD). • Sulphate and Nitrate.
Surface water monitoring	Bi-annually for the duration of operations.	Field assessment and laboratory	pH EC TDS Sediment load	If field measurements indicate a contaminant trend, it is advised that a sample be submitted for analytical testing. The following should typically be screened: • pH, Conductivity, TDS, and TSS.

Site	Frequency	Type	Field Measurements	Laboratory Analyses / Action
				• BOD. • Calcium, Magnesium, Sodium, Potassium, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Iron, Manganese, Fluoride, Aluminium, Total Alkalinity, Ammonia, Ammonium. • Total coliforms, *E. Coli*, Faecal coliforms.
Hydraulic monitoring	Monthly visual inspection of stormwater systems.	Field visual assessment	Flow (if possible)	Clear systems of noted debris to ensure the free flow of water during storm events.

7.8.2 Groundwater Monitoring

The following monitoring is proposed (GCS, 2025b) to monitor the overall environmental impact associated with the activities at the site and to serve as an early detection system for potential problems:

- Annual groundwater quality monitoring, where a sample is taken from the groundwater abstraction borehole. The aim is to determine if there is any degradation of the water that is being used for domestic purposes and to detect issues before they arise. Sample analyses should be as follows (taken in 1 x 1-litre plastic and 1 x 250 ml sterile containers):
    - pH in water at 25°C.
    - Electrical conductivity in mS/m @ 25°C.
    - Total Dissolved Solids.
    - Bicarbonate Alkalinity as $CaCO_3$.
    - Bicarbonate as $CaCO_3$.
    - Total Alkalinity as $CaCO_3$.
    - Calcium.
    - Magnesium.
    - Potassium.
    - Sodium.
    - Chloride.

- Fluoride.
- Nitrate.
- Ammonium.
- Sulphate.
- Aluminium.
- Iron.
- Manganese.
- Microbes (*E. coli*, faecal coliforms, total coliforms).

- Weekly groundwater level monitoring:
  - It is recommended that water levels be measured weekly to maintain a record of borehole performance and impact on the groundwater resource.
  - Water level readings can be taken by a handheld water level dip metre or through the installation of an automated water level logger. Water level loggers are installed just above the pump depth and monitor the level of water in the borehole. The data from the logger should be downloaded at least on a monthly basis or connect directly to a telemetry system to allow for real time monitoring.
  - This data, along with a manual water level measurement, allows for the compilation of monitoring graphs which should be analysed by a qualified Hydrogeologist to ensure long-term sustainable use from the borehole.
- Weekly abstraction volume monitoring:
- It is recommended that weekly readings of the volumes of water used be taken and kept on record.
- Abstraction volume monitoring can be achieved through the installation of a flow volume metre at the outlet of the borehole.

Table 7-4 lists the boreholes to be monitored on site. These boreholes are to be monitored according to the proposed monitoring schedule outlined above. They are to be monitored as they are within the site boundary and are critical for evaluating site-specific groundwater conditions and potential impacts of abstraction activities.

All monitoring data should be physically recorded and calibrated quarterly and reviewed annually by a qualified hydrogeologist.

Table 7-4: Boreholes to be Monitored at the Site (GCS, 2025b)

Borehole (BH)	Coordinates	
	Latitude	Longitude
BH 3	-27.94484	29.74489
BH 4	-27.9241	29.75607
BH 6	-27.9422	29.74371
BH 7	-27.9272	29.75194
BH 8	-27.9188	29.75715
BH 11	-27.9319	29.74876
BH 12	-27.9422	29.74371
BH 13	-27.9288	29.74929

7.8.3 Monitoring Wetlands

GroundTruth (2025) recommend bi-annual water quality monitoring of CVB 1 and CVB 2 should be undertaken by an independent specialist using a simple *in-situ* water quality test to determine temperature, electrical conductivity, dissolved oxygen, pH, and salinity. In addition, it is recommended that individual ammonia, total nitrate, total phosphate, and *E. coli* water quality tests are taken. These tests should be undertaken twice a year (one test in the dry season and one in the wet season) to ensure that the septic tank systems are not having an overall cumulative impact on the resource quality of the CVB 1 and CVB 2. This monitoring should occur for at least three years from the date of authorisation.

7.8.4 Waste Monitoring

Thirsti applies a structured and integrated approach to waste management, guided by the waste hierarchy of reduce, re-use, recycle, recover, and safe disposal. The management of waste is undertaken in accordance with the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) and supporting environmental legislation.

The Waste Management Plan aims to prevent pollution, minimise waste generation, promote recycling, and ensure the safe handling, storage, and disposal of all waste produced on site. The system is implemented under the oversight of the Health, Safety, Security and Environment Manager, who is responsible for coordinating all waste-related processes in collaboration with area supervisors and the appointed waste management contractors.

The guiding principles and key practices implemented at the Thirsti Bottling Plant include the following:

- Waste segregation at source: Waste is classified and separated into specific streams, including plastic bottles, plastics (LDPE), paper, cardboard, coal ash, general waste, and hazardous chemical waste. Separate containers and storage areas are provided to prevent cross-contamination.
- Minimisation and recycling: The facility prioritises the re-use and recycling of materials to reduce the volume of waste sent to landfill. Plastic and paper-based

waste is compacted, baled, and sent to certified recyclers such as Extrupet, Hua Shu Plastics, and Neopak. Coal ash is re-used internally for the maintenance of farm roads.

- Hazardous waste management: All hazardous chemical waste is stored in sealed and labelled containers within a secure area controlled by the quality department. Disposal of hazardous waste is undertaken by approved and licenced contractors who issue safe disposal certificates to confirm that materials have been treated or disposed of at authorised facilities.
- Use of approved contractors: Waste collection, transport, recycling, and disposal are carried out by certified service providers such as Iron Man Recycling. All contractors operate under formal agreements and are required to provide documentation for each consignment of waste removed from site.
- Documentation and record keeping: All waste leaving the site is measured via the weighbridge, and waste manifests, weighbills, and safe disposal certificates are maintained for each waste stream. These records are reviewed by the Health, Safety, Security and Environment Manager to ensure full traceability from generation to final disposal.
- Monitoring and auditing: Waste management activities are regularly monitored and audited to verify compliance with legal requirements and the conditions of the Waste Management Plan. Contractors are required to submit annual audit results, which are incorporated into the site's management review and legal compliance audits.
- Storage and containment: All waste storage containers are maintained in good condition to prevent leakage, odour, littering, or pest infestation. Measures are in place to ensure that waste cannot be blown away or discharged into the environment.
- Emergency preparedness and response: Procedures are in place to address accidental spills or leakages during waste storage or transportation. Spill kits, personal protective equipment, and response procedures are maintained at the hazardous waste area, and employees are trained in spill containment, clean-up, and reporting.
- Training and awareness: All employees and contractors involved in waste handling receive training on waste segregation procedures, safe handling practices, and emergency response. Continuous awareness programmes are conducted to reinforce compliance and promote environmental responsibility.

This structured system ensures that waste generated at the Thirsti is managed responsibly, with an emphasis on reducing environmental impact, maintaining regulatory compliance, and supporting sustainable operations.

7.9 Auditing and Reporting

Annual review and auditing are essential to ensure that management systems remain current, effective, and relevant to prevailing conditions. These processes verify the appropriateness and suitability of the systems by measuring actual performance against the objectives set.

Where reviews or audits identify shortcomings or gaps, changes or adjustments to the systems will be implemented to address these issues. Performance will consistently be assessed in relation to the established objectives.

Auditing will be undertaken as follows:

- Internal audits: Annually.
- External audits: Annually.
- Reporting to the DWS: Annually.

8 PUBLIC PARTICIPATION

I&APs were informed of the proposed WULA and afforded opportunities to participate throughout the application process. Public participation was undertaken to identify issues and concerns requiring consideration as part of the specialist assessments and decision making process.

8.1 Development of Stakeholder Database

A stakeholder database was initially developed as part of the original WULA process undertaken and was subsequently reviewed and updated for the current WULA re-application process undertaken during 2025 and 2026. The purpose of the database was to identify and record I&APs who may have an interest in, or be affected by, the proposed water uses, and to ensure that stakeholders were provided with information and opportunities to participate throughout the licensing process.

The database was compiled using information obtained from previous stakeholder engagement activities, landowner records, municipal and government contact databases, environmental organisations, community representatives, and stakeholder registrations received during the PPP. Stakeholders included national and provincial government departments, district and local municipalities, environmental non-governmental organisations (NGOs), adjacent and surrounding landowners and occupiers, host communities, and other interested organisations and individuals.

The stakeholder database developed during the original WULA process was utilised for the 2026 re-application process to ensure continuity of stakeholder engagement. Registered stakeholders from the previous process were notified of the updated application through direct email and SMS communications issued on 25 February 2026 and were provided with

details regarding the availability of the Draft WULA Technical Report and the associated 60-day public review period.

The stakeholder database was maintained as a living document throughout both the original and current WULA processes. Additional stakeholders who registered during the public participation period or requested inclusion on the database were added and included in subsequent project communications. The final stakeholder database is provided in APPENDIX A of APPENDIX G.

8.2 Public Participation Process Undertaken During the Original WULA Application

8.2.1 Publication of Newspaper Advertisement

Newspaper advertisements were published in the Newcastle Advertiser to notify stakeholders of the proposed WULA, the availability of draft report, and opportunities to participate in the PPP.

The first advertisement was published in English on 19 March 2021 and informed stakeholders of the commencement of the PPP, the availability of draft reports for review, and the process for registering as an I&AP and submitting comments.

Following delays associated with the COVID-19 pandemic and the implementation of an additional public review period, a second advertisement was published in the Newcastle Advertiser on 4 June 2021 in both English and isiZulu. The advertisement notified stakeholders of the additional 60-day public review period and invited interested parties to review the application documentation and submit comments for consideration as part of the WULA process. Refer to APPENDIX B of APPENDIX G.

8.2.2 Site Notices

Site notices were erected on 19 March 2021 at strategically selected public locations within and surrounding the project area to notify stakeholders of the proposed WULA, the availability of draft reports, and the opportunity to register as I&APs and submit comments. The notices were displayed in English and placed at the following locations:

- Normandien: 27°59'8.75"S; 29°46'49.24"E;
- Thirsti Entrance: 27°56'32.90"S; 29°47'45.60"E;
- Intersection on the P39-1: 27°52'28.98"S; 29°48'43.83"E; and
- Near Scott Street Mall, Newcastle: 27°45'27.92"S; 29°55'47.24"E.

Following delays associated with the COVID-19 pandemic and to ensure stakeholders were provided with a further opportunity to participate in the process, a second round of site notices was erected on 4 June 2021 at the same locations. These notices were displayed in

English, Afrikaans and isiZulu and informed stakeholders of the additional 60-day public review period for the draft reports. Refer to APPENDIX C of APPENDIX G.

8.2.3 Background Information Document and Stakeholder Notification

A BID and Registration and Comment Form (APPENDIX D of APPENDIX G) were prepared and distributed to identified stakeholders, including government authorities, local municipalities, surrounding landowners, environmental organisations, and registered I&APs. The BID provided an overview of the project, the proposed water uses, the regulatory approval process, and opportunities for stakeholder participation.

The distribution of the BID served as the primary mechanism for introducing stakeholders to the project and notifying them of the commencement of the PPP. Stakeholders were invited to register as I&APs and to submit comments, concerns, and recommendations for consideration as part of the WULA assessment.

8.2.4 Availability of the Draft WULA Technical Report

Draft reports were made available for public review and comment for a period of 60 days from 19 March 2021 to 17 May 2021. Stakeholders were notified of the availability of the report and provided with an opportunity to review the application documentation and submit comments for consideration as part of the WULA process.

Following delays associated with the COVID-19 pandemic and to ensure that stakeholders were afforded an additional opportunity to participate, a second 60-day public review period was undertaken from 4 June 2021 to 2 August 2021. During both review periods, stakeholders were invited to review draft reports and submit comments, concerns, and recommendations regarding the proposed water uses.

Electronic copies of draft reports were made available on the GCS website throughout the review periods to facilitate access to the application documentation and supporting information.

8.2.5 Public Meeting

A public meeting was held at the Normandien Farmers Hall (Normandien Sale Yard) on Wednesday, 23 June 2021, from 17:00 to 19:00 as part of the PPP for the WULA. The meeting provided stakeholders and I&APs with an opportunity to engage directly with the project team and specialist consultants.

The purpose of the meeting was to present the proposed water uses, explain the WULA process, provide an overview of the findings of draft reports, and respond to questions raised by attendees. Stakeholders were afforded an opportunity to raise concerns, seek clarification on aspects of the application, and provide comments for consideration as part of the assessment process.

Comments, concerns, and issues raised during the meeting were recorded and incorporated into the Comment and Response Report (CRR) (APPENDIX M of APPENDIX G), where responses were provided by the Applicant and specialist team. A copy of the presentation delivered during the public meeting is included in APPENDIX E of APPENDIX G, while the meeting attendance register is provided in APPENDIX F of APPENDIX G.

8.3 Public Participation Media - Water Use Licence (WU41899)

As part of the current WULA re-application process, a PPP was undertaken in accordance with the requirements of the NWA and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals (GNR 267). The purpose of the process was to inform stakeholders of the updated application, provide access to the revised application documentation, and afford I&APs an opportunity to review and comment on the proposed water uses.

8.3.1 Publication of Newspaper Advertisement

A newspaper advertisement was published in the Newcastle Advertiser on 19 February 2026. The Newcastle Advertiser is a local newspaper circulated within Newcastle, Normandien, and the surrounding areas. The advertisement notified stakeholders of the WULA re-application, informed them of the availability of the Draft WULA Technical Report for review, and invited them to register as I&APs and submit comments on the application. A copy of the advertisement is provided in APPENDIX G of APPENDIX G.

8.3.2 Site Notices

Site notices were erected on 25 February 2026 at prominent public locations within and surrounding the project area to notify stakeholders of the WULA re-application and the availability of the Draft WULA Technical Report for review. The notices provided information regarding the proposed water uses, the public review period, and the process for registering as an I&AP and submitting comments.

The notices were placed at the following locations:

- Newcastle Library, 66 Scott Street, Newcastle, 2940 - 27°45'27.58"S; 29°55'51.49"E.
- Thirsti Security Gate, Buffelshoek Farm Erf 15469 - 27°56'22.24"S; 29°47'09.02"E.
- Thirsti Entrance, P39 Road - 27°56'33.32"S; 29°47'45.60"E.
- SAPS Normandien Police Station, P39 Road, Normandien, 2940 - 27°59'09.82"S; 29°46'49.30"E.

A table indicating the locations of site notices, along with a map illustrating each site notice's position in relation to the project, are provided in APPENDIX H of APPENDIX G.

8.3.3 Distribution of a Background Information Document and Registration and Comment Form

A BID and Registration and Comment Form were distributed via email to stakeholders on 25 February 2026 using the project stakeholder database. The BID provided an overview of the project, the proposed water uses, the regulatory process, and opportunities for stakeholder participation.

The Registration and Comment Form enabled stakeholders to formally register as I&APs and provide comments, concerns, and recommendations for consideration during the assessment process. A copy of the BID and Registration and Comment Form is included in APPENDIX I of APPENDIX G.

8.3.4 Availability of the Draft WULA Technical Report

Stakeholders were notified on 25 February 2026 of the availability of the Draft WULA Technical Report for public review and comment. The report was made available for a 60-day public review period from 26 February 2026 to 30 April 2026, thereby providing stakeholders with an opportunity to review the application documentation and submit comments on the proposed water uses.

To facilitate access to the application documentation, copies of the Draft WULA Technical Report were made available at a number of publicly accessible locations, including Newcastle Library, the Thirsti Security Gate, and electronically via the GCS website. Proof of placement and delivery of the documentation is provided in APPENDIX J of APPENDIX G.

In addition to the newspaper advertisement and site notices, registered stakeholders were notified directly of the availability of the Draft WULA Technical Report and the associated public review period through email and SMS communications. Copies of the stakeholder notification emails are included in APPENDIX L of APPENDIX G, while records of the SMS notifications are provided in APPENDIX K of APPENDIX G.

8.3.5 Availability of the Final WULA Technical Report

Following the close of the public review period, all comments received from stakeholders were reviewed and considered by the Applicant and specialist team. The CRR was updated to record the comments received and the corresponding responses provided.

Where necessary, the Draft WULA Technical Report was revised to address comments and issues raised during the PPP. Upon completion of this process, the Final WULA Technical Report and updated CRR were made available to stakeholders via the GCS website prior to submission of the application to the DWS for consideration.

8.4 Comments and Response Report

Throughout the WULA process, stakeholders were afforded opportunities to review the application documentation and provide comments, raise concerns, and submit recommendations

regarding the proposed water uses. Comments were received through various public participation mechanisms, including written submissions, email correspondence, stakeholder consultations, and the public meeting.

All comments received during both the original WULA process and the current re-application process were recorded and considered by the Applicant and specialist team. Responses were prepared to address the issues raised and, where appropriate, amendments were made to the application documentation and supporting specialist reports.

The CRR provides a comprehensive record of the comments received, together with the corresponding responses provided by the Applicant and project team. The CRR is included in APPENDIX M of APPENDIX G.

9 MOTIVATION IN TERMS OF SECTION 27(1) OF THE NATIONAL WATER ACT, 1998

In terms of Section 27 of the NWA, a responsible authority must take into account all the relevant factors including:

9.1 The Need to Redress the Results of Past Racial and Gender Discrimination

Broad-Based Black Economic Empowerment (B-BBEE) is a key driver of inclusive growth and socio-economic transformation in South Africa. Normandien demonstrates its commitment to South Africa's transformation objectives through tangible empowerment practices and strategic alignment with national policies (DTIC, 2015).

9.1.1 Broad – Based Black Economic Empowerment Status

Normandien holds a Level 8 B-BBEE procurement recognition rating, which signifies that the company is not a full compliant contributor to B-BBEE requirements, enabling clients and business partners to claim 10% procurement recognition for goods and services procured from Normandien. This rating enables Normandien, particularly in state-affiliated and private sector tenders where transformation credentials are essential (Agency, 2019).

9.1.2 Transformation Commitments and Practices

Normandien demonstrates a commitment to socio-economic development, various initiatives. These initiatives focus on addressing key developmental challenges in South Africa by supporting youth empowerment, education, and social transformation initiatives.

These initiatives have been undertaking the following:

- Youth Development: Sports for Lives initiative supports the school communities across South Africa with the aim to change perspectives of athletes to hydration, support their sports performance and positively impact on sporting communities and beyond (Thirsti, 2025).

- Community Development: Thirsti has been able to provide each school to better serve the pupils and the community at large by improving their water infrastructure. They did this by assessing each school's unique water and sanitation requirements and then spending time addressing each need. Over the days that followed, many radical changes were seen at the three schools. JoJo tanks, filtration units, new piping and basins were installed. Nothing could prepare the team for the children's sheer excitement at having fresh drinking water available. There is satisfaction that comes from knowing that not only each individual school, but also the greater community at large, experienced sustainable change.
- Skills development and training: The plant actively supports workforce development through apprentice training programmes for millwrights in partnership with local colleges, as well as work-integrated learning opportunities for chemical engineering students within the quality department. These initiatives build technical skills, improve employability, and strengthen the regional talent pipeline.

These programmes reflect Normandien's commitment to socio-economic upliftment, transformation, and community resilience in alignment with the goals of B-BBEE.

9.2 Efficient and Beneficial Use of Water in the Public Interest

The groundwater abstraction proposed for the Thirsti Bottling Plant is underpinned by principles of efficiency, sustainability, and public value. In accordance with Section 27(1)(c) of the NWA, water use must promote optimal utilisation of South Africa's limited water resources while ensuring socio-economic and environmental benefit. Normandien's water management strategy is deliberately structured to ensure that the use of groundwater is both responsible and beneficial to the broader public interest.

9.2.1 Water Use Efficiency

Recognising the national imperative for water conservation, particularly in water-stressed regions such as KwaZulu-Natal; Normandien employs a rigorous water efficiency framework to minimise abstraction and promote responsible usage. TheThirsti Bottling Plant abstracts water solely from existing on site boreholes, with strict internal controls ensuring that volumes are limited to essential operational needs. These include:

- Water for production processes, including cleaning, rinsing, and bottling of spring water products.
- Sanitation and hygiene facilities for staff and visitors.
- Health and safety needs as per the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).
- Water use is continuously monitored, benchmarked, and refined to optimise operational

performance while conserving groundwater resources.

9.2.2 Public Benefit of the Water Use

The Thirsti Bottling Plant plays a significant role in stimulating local socio-economic development, with water use acting as an enabler for broader economic and community benefits. Key public interest contributions include:

- Sustainable employment: Normandien provides long-term job opportunities to residents of Normandien and surrounding areas, directly supporting livelihoods and reducing local unemployment.
- Local procurement and supplier development: The plant prioritises procurement from small, medium, and micro-enterprises in the region, thereby fostering inclusive economic growth.
- Waste recycling and circular economy participation: Normandien facilitates collection and recycling initiatives for PET bottles, supporting environmental sustainability and creating secondary employment opportunities.
- Health and safety: The provision of clean, reliable water supports hygiene and occupational health standards for employees, in compliance with national legislation.
- Alignment with B-BBEE transformation goals: Water use underpins the ongoing operational viability of Normandien, enabling it to continue investing in youth upliftment, education support, and other community transformation initiatives.

  Investment in water security for schools: Normandien contributes to the Woolworths Water Fund, which focuses on improving water infrastructure in predominantly rural schools, thereby enhancing water access, sanitation, and learning conditions for vulnerable learners.

9.2.3 Sustainable Resource Management

Normandien's water stewardship approach is embedded in broader environmental sustainability objectives, as articulated in the National Water Resource S Strategy II (DWS, 2013). The company acknowledges the shared nature of water resources and the importance of maintaining aquifer health for future generations.

To ensure that groundwater abstraction is environmentally sound and aligned with integrated water resource management principles, Normandien will implement the following measures:

- Controlled abstraction volumes, based on detailed hydrogeological assessments, to prevent over-extraction and ensure aquifer sustainability;
- Ongoing groundwater monitoring, including regular assessment of water levels and quality to detect potential impacts;

- Maintenance of borehole infrastructure, to ensure operational integrity and minimise contamination risks;
- Full compliance with WUL conditions, including reporting and record keeping obligations, to maintain transparency and enable regulatory oversight;
- Adaptive management practices, which enable responsive adjustments to water use protocols in line with changing hydrological, climatic, or operational conditions.

Through these measures, Normandien ensure that its water use remains aligned with national priorities, is environmentally responsible, and continues to deliver lasting socio-economic benefits in the public interest.

9.3 The Socio-Economic Impact

9.3.1 Impact of Authorising the Water Use(s)

9.3.1.1 Economic Impact

The Thirsti Bottling Plant plays a vital role in the local and regional economy, particularly given its location in a rural area of KwaZulu-Natal where employment opportunities are limited. The continued authorisation of groundwater use is essential to ensure the uninterrupted operation and growth of the plant.

Currently approximately 350 people are employed across the operations, with job creation spanning administrative, technical, sales, finance, human resources, production, maintenance and logistics functions. In addition to direct employment, the plant stimulates indirect employment opportunities through engagement with manufacturers, marketing agencies, and maintenance service providers throughout KwaZulu-Natal and South Africa more broadly.

The economic benefits of authorising the water use include:

- Sustained employment, both direct (e.g. drivers, sales teams, plant operators) and indirect (e.g. service providers, suppliers, distribution networks);
- Support for local enterprises and contractors, many of which are empowered through B-BBEE-compliant procurement practices;
- Contribution to local economic development, through the circulation of income within the rural economy and increased business activity;
- Resilience and long-term viability of operations, particularly important in the context of climate change and increasing water scarcity.

By ensuring reliable access to groundwater, the licence will enable Normandien to continue contributing meaningfully to inclusive economic growth, rural development, and local livelihoods.

9.3.1.2 Social Impact

The benefits of Thirsti Bottling Plant's water use extend beyond economic development to encompass significant social impacts, particularly through community upliftment and emergency relief initiatives.

- Youth Development: Through initiatives such as the Sports for Lives programme, Normandien supports school-based sporting activities across South Africa. These interventions promote physical wellness, academic motivation, and the holistic development of youth, fostering long-term societal benefits.
- Community Resilience and Humanitarian Support: During the devastating fires in Knysna, Normandien responded swiftly by donating over 31,500 litres of water to affected communities. Partnering with Gift of the Givers and Shoprite Checkers, the water was distributed to thousands in need, providing critical relief in a time of severe disruption and water shortages.
- Ongoing Donations: Regular water donations are made to various programmes and initiatives, reinforcing the company's continued support for communities in need.

These programmes highlight Normandien's role as a responsible corporate citizen committed to building resilient communities, supporting vulnerable populations, and improving access to essential services.

9.3.1.3 Impact of Failing to Authorise the Water Use(s)

Failure to authorise the proposed groundwater use would have significant adverse socio-economic consequences, including:

- Operational disruption or potential closure of the Thirsti Bottling Plant, jeopardising the sustainability of a major rural employer;
- Loss of jobs, directly affecting over 350 individuals and indirectly impacting numerous workers and service providers within the extended value chain;
- Reduced investment in local enterprise development, B-BBEE procurement, and community initiatives;
- Negative impacts on tax revenue and government service delivery, resulting from decreased business income, payroll, and corporate contributions;
- Weakened resilience of rural economies, with knock-on effects for poverty levels, social cohesion, and household livelihoods.

In 2025, Thirsti was compelled to invest R250 million in establishing a new bottling facility in Tulbagh, Western Cape, due to the inability to secure a reliable power supply to the Normandien plant. A failure to secure the groundwater rights necessary to sustain and expand current

operations would be comparably catastrophic for the KwaZulu-Natal region, placing both existing jobs and future growth prospects at risk.

In conclusion, the authorisation of groundwater use is not only critical for the continued functioning of Normandien operations but also for maintaining its positive economic and social footprint in KwaZulu-Natal and beyond.

9.4 Catchment Management Strategy Applicable to the Relevant Water Resource

Thirsti Bottling Plant operations in Normandien are located within V31F quaternary catchment, part of the Pongola-Mtamvuna WMA. This area falls under the jurisdiction of the Pongola-Umzimkulu Catchment Management Agency (CMA), which is responsible for overseeing water resource management in the region.

Key strategic focus areas of the Catchment Management Strategy (CMS) include strengthening water use authorisation processes through improved validation, registration, and enforcement; enhancing infrastructure development by aligning with major initiatives such as Phase II of the Lesotho Highlands Water Project; and promoting climate resilience through conservation and demand management interventions. Stakeholder engagement is also a core priority, with efforts underway to establish inclusive forums that foster trust and participatory governance.

To mitigate key risks such as unlawful water abstraction, return flow pollution, and institutional capacity constraints, Pongola-uMzimkhulu CMA is investing in institutional development, improved intergovernmental coordination, and robust Information and Communication Technology systems for enhanced data reliability (DWAF, 2013). The CMS further ensures alignment with transboundary water obligations, reinforcing Pongola-uMzimkhulu CMA's mandate to enable equitable, sustainable, and resilient water resource management.

For Normandien, alignment with this strategy is crucial for ensuring legal compliance, contributing to regional sustainability objectives, and securing long-term water security for its operations in the V31F quaternary catchment.

9.4.1 Objectives of the Catchment Management Strategy

The CMS, once finalised for the Pongola-Mtamvuna WMA, will seek to:

- Promote the equitable allocation of water resources, particularly addressing historical imbalances in access and use.
- Support integrated water resource management (IWRM), ensuring alignment of environmental, social, and economic objectives.
- Strengthen stakeholder participation and local governance through decentralised management via CMAs.
- Enhance water quality protection and monitoring to meet ecological and human use

needs.

- Facilitate climate resilience through adaptive management strategies and water conservation initiatives.
- Align water use authorisation processes with strategic infrastructure, economic hubs, and transboundary water transfers, including those from the Lesotho Highlands Water Project.

9.4.2 Strategic Alignment with National Water Resource Strategy, Second Edition

The National Water Resource Strategy, Second Edition (NWRS II) identifies the Pongola-Mtamvuna WMA as one of South Africa's most economically significant yet water-stressed regions. Key priorities in the NWRS for the Pongola-Mtamvuna WMA include:

- Improving institutional efficiency and capacity-building through CMAs.
- Supporting industrial and mining growth without compromising environmental flow requirements.
- Managing return flows, pollution, and water transfers within the broader Pongola-Mtamvuna system.
- Implementing water conservation and demand management (WC/WDM) measures across all sectors.

9.5 Likely Effect of the Water Use to be Authorised on the Water Resource and on Other Water Users

9.5.1 Groundwater

A detailed geohydrological assessment (GCS, 2019) indicates that the groundwater abstraction proposed for the Thirsti Bottling Plant will primarily affect a confined fractured aquifer system. The cone of depression, or radius of influence, varies from approximately 30 m to 639 m around each borehole, depending on transmissivity, storativity, and operational pumping schedules.

Importantly, the weathered zone, which typically sustains baseflow to surrounding streams and wetlands, is expected to experience minimal to no drawdown, due to the confined nature of the aquifer targeted for abstraction. As such, impacts on baseflow-dependent watercourses and groundwater-dependent ecosystems are anticipated to be negligible to non-existent.

A summary of the borehole-specific hydrogeological parameters is presented in Summary of the Radius of Influence for each Borehole:

Table 9-1: Summary of the Radius of Influence for each Borehole (GCS, 2019)

Parameter	T	t	s	Radius of influence	Radius impact zone	Estimated drawdown within the influence area
Units	**metres squared /day**	**days**		**metres**		
Borehole 3	1	121 (based on 8 hours pumping per day)	0.19	37.9	Fractured Aquifer	1 to 0.001 m
Borehole 4	31	121 (based on 8 hours pumping per day)	0.5	129.9	Fractured Aquifer	1 to 0.001 m
Borehole 6	18.5	121 (based on 8 hours pumping per day)	0.8	79.3	Fractured Aquifer	1 to 0.001 m
Borehole 7	18.5	121 (based on 8 hours pumping per day)	0.5	100.4	Fractured Aquifer	1 to 0.001 m
Borehole 8	2.4	121 (based on 8 hours pumping per day)	0.01	255.6	Fractured Aquifer	1 to 0.001 m
Borehole 11	7	121 (based on 8 hours pumping per day)	0.6	56.4	Fractured Aquifer	1 to 0.001 m
Borehole 12	12	121 (based on 8 hours pumping per day)	0.02	404.2	Fractured Aquifer	1 to 0.001 m
Borehole 13	15	121 (based on 8 hours pumping per day)	0.01	639.0	Fractured Aquifer	1 to 0.001 m

Note:

T = aquifer transmissivity

t = exploitation time/ pumping time

s = aquifer storativity

These parameters indicate a low likelihood of interference with neighbouring water users, given the moderate drawdowns and relatively contained influence radii. Normandien will implement ongoing monitoring and adaptive management practices to ensure the abstraction remains within environmentally sustainable thresholds.

9.6 Class and Resource Quality Objectives of the Water Resource

The Thirsti Bottling Plant falls within the Ngagane River Catchment (Quaternary Catchment V31F), which forms part of the Pongola-Mtamvuna WMA. The dominant groundwater resource type in this area is a fractured rock aquifer, and its Resource Quality Objectives (RQOs) are defined by the DWS (2021) for Integrated Unit of Analysis (IUA) 2: Ngagane River.

The groundwater resource in this area is currently classified as Class C/D, indicating marginal to poor quality in certain hotspots, largely due to legacy and active mining activities. The key

concern in this context is the induced mobilisation of contaminants such as salinity (TDS), metals, and other constituents of concern.

Table 9-2: Summary of the Groundwater RQOs per Resource Unit (DWS, Determination Of Water Resource Classes And Associated Resource Quality Objectives In The Thukela Catchment, 2021)

IUA	GMU	Sub-component	Resource Quality Objective	Indicator(s)	Measure / Numerical Limit	Context
IUA2. Ngagane River	**GRU-2**	**Quality**	**Constituents of Concern**	Monthly salinity measurements: TDS (mg/l)	TDS (salinity): Concentration should be limit to ≤ 450mg TDS/l. Note: Hotspots with TDS ~2 400 mg TDS/l.	Natural water quality signature: Ca/Na-HCO_3 Long-term TDS trend should not approach +10% (∴~500 mg/l).
				pH value	pH Value: >5.5 to <9.5 pH units.	
				Macro element concentrations:	Quarterly analyses required and individual concentrations should be limit to a Class 1 (Good) water quality criteria:	Constituents of Concern has an impact of the Health and Aesthetic criteria of the water. The upper limit should be a Class 1 criteria, however, due to specific geological formations, the background Na-Cl concentrations could breach this limit and is therefore a characteristic of the groundwater quality in specific areas.
				Sodium	<65 mg Na/l. Long-term trend should not approach +10% (∴72 mg/l).	
				Total Alkalinity	Dominant anion hydrochemical constituent – should remain <300 mg HCO^3/l.	
				Chloride	Chloride: <100 mg Cl/l. Long-term trend should not approach+10% (∴110 mg/l).	
				Sulphate	Sulphate: <200 mg SO_4/l. Long-term trend should not approach+10% (∴220 mg/l).	
				Microbiological status (Total coliform counts) Nutrients	<10 counts/100 ml.	Total coliform counts and nitrate/nitrite concentrations are indicators of domestic pollution and should be regarded as critical water quality indicators – annual trends are therefore required through specific monitoring programmes.
				Nitrate	Less than 10 mgNO_3-N/l.	
				Toxin– Fluoride	<1.0 mg F/l.	
				Toxin– Arsenic	<0.05 mg As/l.	
				Dissolved Metals	<0.2 mg Fe/l and <0.4 mg Mn/l.	

Normandien is committed to meeting or exceeding the RQOs through:

- Routine groundwater quality monitoring;
- Protection of aquifer integrity through well-maintained infrastructure;
- Periodic hydrochemical analysis to track trends in key indicators;
- Adaptive management aligned with catchment-level water quality targets.

The abstraction strategy and mitigation measures in place are designed to protect the integrity of the water resource, while ensuring no degradation of quality for current or future users in the region.

9.7 Investments Already made and to be made by the Water User in Respect to the Water Use in Question

Thirsti Bottling Plant, through its operating entity Normandien, has made substantial capital, social, and environmental investments to support the sustainable use of water resources and long-term socio-economic development in the Normandien region. These investments reflect the company's deep-rooted commitment to responsible water stewardship, job creation, and rural upliftment.

9.7.1 Capital Investments (CAPEX)

Normandien has invested over R400 million to establish and expand its state-of-the-art bottling facility, with the following key infrastructure developments:

- Main factory building – R125 million
- Plant and machinery - R275 million

At present, additional capex planned include building a plastics manufacturing factory and a new dedicated Eskom powerline to support future growth.

9.7.2 Employment Creation

As a major employer in a rural area with limited formal economic activity, Normandien has contributed significantly to local livelihoods:

- 350 permanent jobs created to date, with all labour sourced from surrounding informal settlements (Normandien and Newcastle areas).
- An additional 50 jobs are planned within the next 2–3 years to support production expansion.
- In rural KwaZulu-Natal, it is estimated that one job supports up to ten dependents, indicating that Thirsti's employment footprint supports approximately 4000 people within the local community.

9.7.3 Community Support and NGO Engagement

Normandien has implemented extensive community outreach programmes, particularly focused on education, water access, and food security. These include:

- Supplying fresh drinking water to local schools, many of which lack adequate infrastructure.
- Sponsoring bottled water for school events and feeding schemes at no-fee-paying schools.
- Undertaking infrastructure repairs and upgrades to school water supply systems, including boreholes, JoJo tanks, guttering, rainwater harvesting, and filtration systems.
- Thirsti plays a critical role in ensuring the continuous supply of safe drinking water to metropolitan areas, particularly during prolonged municipal water outages, such as those experienced with Rand Water supply disruptions.

School-specific investments include:

- Gijimani Primary School
    - R39,502.50 for filtration system, rewiring, pump mechanism replacement, handwash basin installation.
- Haig Combined School
    - Pipework upgrades, filtration system, external basin installation, tank repair and relocation, reliable water supply established.
- Lindokuhle Primary School
    - R14,275.50 for rainwater harvesting infrastructure (6 classrooms, five pit toilets), ultrafiltration, chlorine dosing, and generator for water pumping.
- Ncandu Primary School
    - Sponsorship of local sports teams and leagues with bottled water and energy drinks.

These initiatives not only ensure clean water access but also contribute to a healthier learning environment, improved attendance, and long-term community development.

9.7.4 Environmental Management Expenditure

Normandien has invested in proactive environmental protection and regulatory compliance, including:

- Hydropedological Study – R49,350.

- WULA – R34,300.
- Groundwater Vulnerability Assessment – R41,380.

These studies support evidence-based water resource management and demonstrate the company's commitment to sustainable and informed water use.

9.8 The Strategic Importance of the Water Uses to be Authorised.

The authorisation of groundwater use for the Thirsti Bottling Plant holds significant strategic value; both for the operational continuity of the business and for its sustained contribution to national and regional development priorities.

Water is a foundational input into the bottled water production process, and securing reliable access to this resource is essential to maintaining the core operations. The company plays a pivotal role in the food and beverage sector, which is recognised as a key contributor to South Africa's Gross Domestic Product and as a major source of formal employment. The authorisation of water use will directly enable Normandien to continue:

- Supporting job creation across its operations and supply chains, including manufacturing, logistics, finance, distribution, and retail;
- Stimulating rural economic development in Normandien and surrounding areas, where employment opportunities are limited;
- Contributing to national food security and resilience, particularly during times of municipal water supply constraints or climate-related water disruptions.

Beyond its economic footprint, Normandien's strategic importance is underpinned by its commitment to environmental sustainability. The company abstracts water from a confined aquifer system in a controlled and scientifically informed manner, with a strong emphasis on long-term aquifer protection, monitoring, and responsible use.

Moreover, Normandien embraces a shared value model that extends its impact beyond commercial objectives. This includes:

- Youth development and education support, which build long-term human capital;
- Community upliftment programmes, aimed at improving access to water and sanitation infrastructure;
- Empowerment of historically disadvantaged individuals, through skills development and inclusive supply chain practices in alignment with B-BBEE objectives.

The responsible authorisation of Thirsti Bottling Plant's water use is therefore strategically aligned with South Africa's environmental, social, and economic policy priorities. It supports sustainable rural industrialisation, enhances resilience in water-scarce regions, and reflects

the kind of responsible corporate citizenship envisioned under the NWA.

9.9 Quality of Water in the Water Resource which may be required for the Reserve and for meeting International Agreements

The Thirsti Bottling Plant is located within Quaternary Catchment V31F, which forms part of the Pongola-Mzimkulu catchment in the Pongola-Mtavuna WMA. This area falls under national water management jurisdiction and is subject to reserve determinations in terms of Section 16 of the NWA, which requires that sufficient quantity and quality of water be allocated for ecological and BHN before other water uses can be authorised.

Water quality within the catchment is monitored by the DWS, focusing on key parameters such as:

- Electrical Conductivity.
- Nutrients (e.g., nitrates, phosphates).
- pH and salinity.
- Biological indicators, including total coliforms and other health-related parameters.

While the Pongola-Mzimkulu catchment is not directly transboundary, the broader Pongola-Mtavuna WMA influences downstream catchments that approach the international boundaries of Lesotho and Eswatini. Consequently, although this project does not fall within a directly shared international river system, water quality management in the area remains important for compliance with South Africa's international obligations under various basin-level agreements and protocols.

Importantly:

- The proposed groundwater use for the Thirsti Bottling Plant is drawn from a confined fractured aquifer, and the abstraction is not expected to interact with surface water flows or significantly alter the water quality available for reserve requirements.
- No discharge or effluent is proposed that would degrade surface water quality or affect downstream users.
- Groundwater quality monitoring will be conducted in accordance with the WUL conditions to ensure ongoing compliance with both national environmental standards and international commitments, where applicable.

In summary, the water use associated with the Thirsti Bottling Plant will not negatively affect the quality or availability of water required for the ecological reserve, nor will it compromise South Africa's obligations under international water-sharing agreements. Ongoing compliance monitoring and responsible groundwater management will ensure the continued protection of this strategic water resource.

9.10 The Probable Duration of any undertaking for which a Water Use is to be Authorised

The water use for which authorisation is sought is intended to support the long-term operational continuity of the Thirsti Bottling Plant in Normandien, KwaZulu-Natal. The facility forms part of a strategic and ongoing commercial enterprise in the food and beverage sector, with no defined end date currently planned.

Thirsti's business model is based on sustained growth and long-term market demand for bottled water products, underpinned by continued investment in infrastructure, job creation, and rural economic development. As such, the water use forms a permanent and essential component of the undertaking's core operations.

Accordingly, it is anticipated that the water use authorisation will be required for the full remaining life of the project and will remain in effect until such time as the Thirsti Bottling Plant ceases operations or until a revised application is submitted in response to changing operational needs or regulatory requirements.

10 CONCLUSION

The Thirsti Bottling Plant requires authorisation for water uses in terms of Section 21(a), (c), (g) and (i) of the NWA to support its ongoing operations and proposed expansion. The application covers abstraction from eight production boreholes with a combined volume of 281 371 m^3 per annum, infrastructure located within 500 m of wetlands, and the operation of an existing 68.16 m^3 septic tank and French drain. Hydrogeological assessment indicates abstraction is from a confined fractured aquifer, with a calculated radius of influence ranging from about 69 m to 496 m. On a sub-catchment basis the abstraction scale is category A (small-scale) relative to recharge. When managed as proposed, the expected effect on connected surface waters is minimal, provided pumping is staggered and monitoring is maintained.

Hydrological and freshwater studies identify localised risks at stormwater outlets, along release channels, and where septic infrastructure lies near wetlands. These risks are manageable through the detailed mitigation already specified in the management plan: maintaining stormwater control and energy dissipation structures, installing and maintaining sediment barriers, restoring indigenous vegetation in buffers, upgrading access for rapid septic maintenance, and implementing the bi-annual surface water checks for key nutrients and *E. coli*. The monitoring programme proposes routine surface water, groundwater quality, groundwater level, and abstraction volume tracking, with responsibilities assigned to site personnel and independent specialists as appropriate. This framework provides an early-warning system and a basis for adaptive management if thresholds are approached.

Socio-economic analysis shows the operation supports approximately 350 jobs across plant

operations, logistics, sales, and administration, while stimulating indirect employment through local suppliers and service providers. Ongoing community programmes, youth development initiatives, and proven emergency water support strengthen the project's positive social footprint in the region. Authorising the water uses will therefore secure livelihoods, sustain local enterprise participation, and contribute to rural economic stability, while aligning with national objectives for responsible use of strategic water resources.

On the basis of the specialist evidence and the integrated mitigation, authorisation is recommended, subject to the following core conditions that reflect the report's commitments:

- Keep total abstraction within licenced volumes and stagger pumping across boreholes to avoid cumulative drawdown and interference.
- Maintain the full surface- and groundwater monitoring suite and retain records for compliance auditing, with annual data review to confirm no adverse trends.
- Maintain stormwater infrastructure, energy dissipation and sediment controls, and rehabilitate disturbed areas with indigenous vegetation to protect wetlands.
- Implement the septic system management measures, including rapid access maintenance, sludge removal, buffer vegetation upkeep, and downstream contingency controls during any failure events.
- Review performance against RQOs and adjust site controls where required under the adaptive management approach.
- Continue socio-economic and community programmes and retain B-BBEE-aligned local procurement to maximise shared benefits.

With these conditions in place, the activity is environmentally acceptable and socio-economically desirable, and it can proceed in a manner that protects water resources while supporting inclusive growth in the local area.

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APPENDIX A: CURRICULUM VITAE AND QUALIFICATIONS

Paula Tolksdorff

SENIOR TECHNICAL MANAGER

CORE SKILLS

- Environmental Legislation
- Equator Principles, IFC Performance Standards, World Bank EHS Guidelines
- Environmental and Social Impact Assessments
- Stakeholder Engagement and Management
- Environmental Management Programmes
- Operation and Construction Environmental Management Plans and Procedures
- Management Systems and Frameworks incl. ISO 14001
- Compliance Auditing, Due Diligence & Project Management
- Waste & Water Management

DETAILS

Academics

- Baccalaureus Technologiae (B-Tech), Engineering Civil, Urban and Rural Development, University of the Witwatersrand, 1997
- National Higher Diploma: Civil Engineering, University of the Witwatersrand, 1994
- National Diploma: Civil Engineering, University of the Witwatersrand, 1993
- MSc. Environmental Management, University of North West (two years course work complete 2011/2012)

Short Courses

- Certificate in Public Participation, International Association of Public Participation
- Centre of Environmental Management SAATCA approved course in Implementing Environmental Management Systems (ISO 14001)
- IEMA Approved Foundation course in Environmental Auditing
- IEMA Approved Carbon Footprint Management Course
- CESA, Developing Mentorship Skills for Management and Professionals
- Water Governance Course, Carin Bosman Sustainable Solutions

Languages

- English
- Afrikaans

Countries Worked In

Botswana, Democratic Republic of the Congo, Guinea, Liberia, Mozambique, Russia, Saudi Arabia, South Africa, Tanzania, Zambia and Zimbabwe

PROFILE

Paula brings over 30 years of specialised experience in the environmental sector, working across various industries, including global industrial and mining clients, as well as commercial developments. Her career has taken her through significant projects across Africa, where she has gained a deep understanding of how environmental and social licenses to operate impact both operations and project outcomes.

With a strong foundation in sustainability, Paula applies her expertise to integrate and maintain effective, sustainable practices across a wide range of operational contexts. As an Environmental Assessment Practitioner and Professional Natural Scientist, her skills are both robust and multifaceted. She excels in conducting environmental and social (E&S) impact assessments and in developing comprehensive E&S management programs tailored to the specific needs of each project. Her work includes crafting and implementing E&S management systems for both construction and operational phases, ensuring they adhere to international standards, as well as local regulatory requirements.

Paula is also highly experienced in stakeholder engagement, ensuring clear communication and collaboration across all parties involved in a project. Her capabilities extend to due diligence and compliance auditing, where she provides critical oversight to ensure regulatory compliance and operational integrity. Additionally, she has extensive experience managing water and waste resources, promoting responsible and sustainable practices.

Through her well-honed project management skills, Paula effectively leads complex projects, consistently ensuring that sustainability goals are met. Her career and diverse background demonstrate a deep commitment to advancing environmental stewardship and sustainable development across challenging and diverse environments.to advancing environmental stewardship and sustainable development across challenging and diverse environments.

Professional Affiliations:

- Environmental Assessment Practitioners Association of South Africa (2019/509)
- South African Council for Natural Scientific Professions (152904)
- International Association for Impact Assessment South Africa (1745)
- International Association Public Participation (IAP2SA014)

Work Experience

Period	Employer	Position	Role/ Responsibility
Oct 24 – Current	GCS	Senior Technical Manager – Environmental Group	As Technical Manager, Paula is responsible for overseeing the development and growth of environmental services. She leads business development efforts, builds and maintains client relationships, and develops and implements business strategies to drive the organisation's success. Paula manages a wide range of responsibilities, including overall project management, team leadership, and financial oversight, ensuring that projects are delivered on time and within budget while aligning with the organisation's long-term goals. In her technical capacity, Paula conducts environmental and social impact assessments, designs and implements environmental management programmes, and develops operational and construction environmental management plans and procedures. She plays a key role in establishing environmental management systems and engages with stakeholders to foster collaboration and ensure compliance. Her duties also include conducting compliance audits, due diligence assessments, and managing water and waste programs. Additionally, Paula provides environmental training and oversees project management from inception to completion. Her combined experience in technical and managerial roles equips her with a deep understanding of environmental practices and strategic leadership in various operational contexts.
Sep 2023 – Jun 2024	OMI Solutions (Pty) Ltd, Pretoria	Principal Environmental Assessment Practitioner	As a Principal Environmental Assessment Practitioner, Paula was responsible for leading business development efforts, managing client relationships, and developing business strategies to ensure the growth and success of the environmental services offered. She oversaw project management, guiding teams through the delivery of projects, and maintained financial oversight to ensure budgets and timelines were adhered to. In her technical capacity, Paula's role as an Environmental Assessment Practitioner and Professional Natural Scientist involved conducting environmental and social impact assessments, designing environmental management programmes, and developing both operational and construction environmental management plans. She was also responsible for implementing environmental management systems, managing stakeholder engagement, conducting compliance audits, performing due diligence assessments, and overseeing water and waste management. Her work included delivering environmental training and managing projects through their entire lifecycle, providing strategic guidance and ensuring regulatory compliance throughout.
Nov 2022 – Aug 2023	Digby Wells Environmental (Pty) Ltd	Principal Environmental Assessment Practitioner	

Work Experience

Period	Employer	Position	Role/ Responsibility
Nov 2019-Aug 2022	Current Hatch Africa (Pty) Ltd, Johannesburg	Regional Director Africa for the Environmental Services Group	As Regional Director, Paula was tasked with leading the development and growth of the Environmental Services Group across Africa. This role involved overseeing business development efforts, building and maintaining client relationships, and developing and implementing the business strategy to drive the organisation's success in the region. She managed a broad spectrum of responsibilities, including overall project management, team leadership, and financial oversight, ensuring that projects were delivered on time and within budget, while aligning with the group's long-term goals. In her role as an Environmental Practitioner, Paula was deeply involved in conducting environmental and social impact assessments, designing and implementing environmental management programmes, and developing operational and construction environmental management plans and procedures. She also played a key role in establishing environmental management systems and engaging with stakeholders to foster collaboration and ensure compliance. Her duties further extended to conducting compliance audits, due diligence assessments, and managing water and waste programs. Paula's work also encompassed delivering environmental training and overseeing the management of various projects from inception to completion. Her experience in both technical and managerial capacities equipped her with a comprehensive understanding of environmental practice and strategy in diverse operational contexts.
2005-2019	Terra Pacis Environmental (Pty) Ltd	Managing Director (founding member)	As a Director of Terra Pacis, Paula was responsible for the development of the Environmental Impact Assessment discipline, the management of business development, client relationship management, the development of the business strategy, overall project management, team management and financial management. As an Environmental Practitioner, Paula duties included: environmental and social impact assessments, environmental management programmes, operation and construction environmental management plans and procedures, environmental management systems, stakeholder engagement and stakeholder management, compliance auditing, due diligence, water and waste management, environmental training and project management.
2006-2009	Cymbian Environmental and Social Consulting Services	Director (founding member)	As a Director of Cymbian, Paula was responsible for the development of the Environmental Impact Assessment discipline, the management of

Period	Employer	Position	Role/ Responsibility
			business development, client relationship management, the development of the business strategy, overall project management, team management and financial management. As an Environmental Practitioner, Paula duties included: environmental and social impact assessments, environmental management programmes, operation and construction environmental management plans and procedures, environmental management systems, stakeholder engagement and stakeholder management, compliance auditing, due diligence, water and waste management, environmental training and project management.
2005-2008	Contract to: Golder Associates Africa Pty Ltd	Environmental Consultant	Paula assisted on environmental and social impact assessments and environmental management programmes.
2005	ERM Southern Africa, Johannesburg	Snr Environmental Consultant	As an Environmental Practitioner, Paula duties included: environmental and social impact assessments, environmental management programmes, operation and construction environmental management plans and procedures, environmental management systems, stakeholder engagement and stakeholder management, compliance auditing, due diligence, water and waste management, environmental training and project management.
1998-2005	Contract to Anglo Gold Ashanti Limited, Johannesburg	Environmental Consultant	As an Environmental Practitioner, Paula duties included: environmental and social impact assessments, environmental management programmes, operation and construction environmental management plans and procedures, environmental management systems, stakeholder engagement and stakeholder management, compliance auditing, due diligence, water and waste management, environmental training and project management.
1996–1998	Anglo American, Johannesburg	Civil Engineering Technician and Environmental Consultant	As an Environmental Practitioner, Paula duties included: environmental and social impact assessments, environmental management programmes, operation and construction environmental management plans and procedures, environmental management systems, stakeholder engagement and stakeholder management, compliance auditing, due diligence, water and waste management, environmental training and project management.
1996–1996	Hamilton Associates, Rosebank	Civil Engineering Technician	Assisted civil engineers plan, design, and build residential development projects including services (access roads/ water/sewage/stormwater).

Period	Employer	Position	Role/ Responsibility
1990-1996	Stuart Scott Incorporated, Sandton	Civil Engineering Technician	Assisted civil engineers plan, design, and build highways, bridges, and services (water/sewage/stormwater). Worked on the site of a large highway construction project and a infrastructure development project.

Key Experience

Environmental and social impact assessments (including the development of environmental and social management programmes/plans/systems)

- Environmental Management Plan Update for North Mara Gold Mine Limited, Tanzania, Barrick Gold Corporation.
- Environmental Impact Study and Management Plan Kisanfu Project, Democratic Republic of the Congo, Phelps Dodge Congo SPRL.
- Environmental and Social Impact Assessment for the Proposed Chirundazi Dam and Associated Supporting Infrastructure, Karo Platinum, Zimbabwe.
- Environmental and Social Impact Assessment for the Opencast Expansion Project, Karo Platinum, Zimbabwe.
- Scoping and Environmental Impact Assessment for the Sasol Destoning Project, Mpumalanga Province, South Africa.
- Scoping and Environmental Impact Assessment for the Sasol Syferfontein Tweedraai Expansion, Mpumalanga Province, South Africa.
- Scoping and Environmental Impact Assessment for the 100 MW Namane Solar PV Plant, South Africa, Namane Generation (Pty) Ltd.
- Environmental Authorisation and Atmospheric Emissions Licence for the Copper Nickel Recovery Plant, Rand Refinery Limited, South Africa.
- Environmental Authorisation and Water Use Licence (by way of a Basic Assessment) for the Light Industrial Development on proposed Kya Sand Extension 104, Randburg, South Africa.
- Environmental Authorisation and Atmospheric Emissions Licence (by way of Scoping and Environmental Impact Assessment) for Mamatwan Mine New Sinter Plant, Samancor Manganese (Pty) Limited (BHP Billiton), South Africa.
- Environmental Authorisation, Waste Management Licence and Atmospheric Emissions Licence (by way of Scoping and Environmental Impact Assessment) for the M14 Furnace, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton), South Africa.
- Environmental Authorisation and Waste Management Licence (by way of Scoping and Environmental Impact Assessment) for the upgrade of the existing Pelletising Plant to an Agglomeration Plant, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton), South Africa.
- Environmental Authorisation and Atmospheric Emissions Licence (by way of Scoping and Environmental Impact Assessment) for the Medium Carbon Ferro Manganese Converter Project, Transalloys (Pty) Ltd, South Africa.
- Environmental Authorisation and Atmospheric Emissions Licence (by way of Scoping and Environmental Impact Assessment) for the Construction and Operation of Two Furnaces and Associated Infrastructure, Transalloys (Pty) Ltd.
- Environmental Authorisation and Atmospheric Emissions Licence (by way of Scoping and Environmental Impact Assessment) for Proposed Phosphoric Acid Plant, Hi-Fos (Pty) Ltd, South Africa.
- Waste Management Licence (by way of a Basic Assessment) for the Refurbishment of West Plant Sludge Dam 3 and Associated Mixing facility, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton).
- Water Use Licences for the Nyakallong and Virginia Wastewater Treatment Works Upgrade, Matjhabeng Local Municipality, Free State, South Africa.
- Water Use License Application, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton), South Africa.

Risk assessments

- Environmental Risk Assessment for the Hard Ice Plant at Mponeng Mine, AngloGold Ashanti, South Africa.
- Environmental Risk Assessment for the Surface Cooling System Expansion for Ventersdorp Contact Reef B120 Level Project, West Wits Mponeng Mine, AngloGold Ashanti, South Africa.
- Dam Risk Assessment Goedgevonden Colliery, Xstrata Coal, South Africa.
- Environmental Risk Assessment for the Coal fired boilers, Newlands, SAB Miller, South Africa.

Feasibility studies

- Zimplats Selous Base Metals Refinery (BMR) Feasibility Study; Supporting Environmental Studies (environmental legal opinion and permitting requirements, environmental impact analysis, energy management and GHG emissions reduction study, water management study), Zimplats, Zimbabwe.
- Water Supply Feasibility Study (environmental legal opinion and permitting requirements), for Mondi South Africa (Pty) Ltd, South Africa.
- Port Durnford Prefeasibility Study Project, Tronox KZN Sands (Pty) Ltd, Richards Bay, South Africa.
- Prefeasibility study for the construction of a new converting facility, (environmental design criteria, regulatory review and permitting requirements, emissions

modelling for technology selection, opportunities to improve GHG emissions and energy management), Confidential Project, South Africa.
- Establishment of an Aluminium Recycling Plant (site sensitivity analysis, regulatory review and permitting requirements, provision of cost estimates to obtain environmental permits and licences), (Confidential Project), South Africa.
- Feasibility study for the processing of a by-product in the platinum industry, (environmental design criteria, environmental legal opinion and permitting strategy, environmental legal register, environmental and human health impact analysis, water management, contractor social management plan, construction environmental management plan), Confidential Project, South Africa.

Environmental engineering and monitoring

- Review of Environmental Design Criteria for the Development of an Iron Ore Mine in Mauritania, El Aouj Mining Company, Northern Africa.
- Review of the Environmental Protection Measures developed for the construction and operation of a Gold Mine in Russia with particular focus on identifying relevant monitoring requirements, Kinross Gold.
- Environment Design Criteria for an SO2 Abatement Plant, Anglo American Platinum, South Africa.
- Sustainable design options study for the Nimba Iron Ore Project, Société des Mines de Fer de Guinée (SMFG) Guinea and Liberia.
- Onshore and offshore environmental baseline studies, compilation of environmental monitoring/management plans and procedures, and environmental compliance monitoring for the construction of a LNG plant in the Afungi Peninsula in the Palma District of Cabo Delgado Province, CCSJV, Mozambique.
- Product and waste storage areas upgrade project at the Port of Durban, Bidvest Tank Terminals, KwaZulu-Natal, South Africa.
- Salvage Yard Layout, Detailed Design and Stormwater Management, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton), South Africa.
- Development of Water Balances for 1) Free State Operations, 2) Vaal River Operations and 3) West Wits Operations, AngloGold Ashanti, South Africa.
- Clean and Dirty Water Separation Studies for 1) Vaal River Operations (Mines and Processing Plants) and 2) West Wits Operations (Mines and Processing Plants), AngloGold Ashanti, South Africa.

Circular economy

- Scoping exercise to develop and Extended Producer Responsibility Scheme for a multi-national drink and brewing company (Confidential Project), South Africa.
- Concept Study for the Hillside Used Beverage Can (UBC) Recycling Project, South32, South Africa.

Environmental management systems and auditing

- Development of an Environmental Management System at Lumwana Mine, Zambia, Barrick Gold Corporation.
- Development of an Environment Management System (ISO 14001) including assurance of certification for ERGO, Anglogold Ashanti
- Environmental Management System (ISO 14001) development for Scaw Metals.
- Development of an Environment Management System (ISO 14001), Kimberley Mines, De Beers Consolidated Mines.
- Review and updating of the Environmental Management System (ISO 14001) at Newlands, SAB Miller.
- The Development and Implementation of processes and tools to comply with conditions defined in the Waste Management Licences, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton).
- Vegetation Control Procedure; Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton).
- The Development of Standard Operating Procedures for the Materials Management Department, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton).
- Admox Bagging Plant, Admox Bagging Plant, Admox Pelletising Plant and OBC Fume Extraction Operation Environmental Management Plan; Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton).
- Internal ISO 14001 Audit, Venetia Mine, De Beers Consolidated Mines.
- Internal ISO 14001 Audit, Voorspoed Mine, De Beers Consolidated Mines.
- Internal ISO 14001:2015 Audit Report for Harmony Central Gold Plant in the Free State Province.
- Internal ISO 14001:2015 Audit Report for Harmony One Gold Plant in the Free State Province.

Environmental policy and legislation
• Review the NEOM Environmental Standards and Policies, Saudi Arabia. • Developing a Greenhouse Gas reporting framework for Department of Mineral Resources and the Department of Energy, Northern Cape Province, South Africa. • Legal Opinion on Requirement for Environmental Authorisation of the Proposed Emergency Diesel Power Generation Project at Wessels Mine, Samancor Manganese (Pty) Limited (BHP Billiton), South Africa. • Environmental Legal Opinion Proposed Soya and Sunflower Bean Operations, Boksburg, South Africa. • Strategic Planning on New Furnace Location, Samancor Manganese (Pty) Ltd (BHP Billiton), South Africa.
Due diligence and technical advisory
• Independent Expert Report Roggeveld Wind Farm Phase 1 And Associated Infrastructure, South Africa. • Technical Advisory services for a Power Purchase Agreement (PPA) for a gas to power plant near Maputo, Mozambique (Confidential Project). • Environmental Due Diligence for an in-land and port side bauxite facility, Republic of Guinea (Confidential Project). • Environmental Due Diligence for the Brush-Arc UG2 Smelting at Richards Bay Alloys, Anglo American Marketing Ltd. • Environmental component of the Independent Engineering Review, for the New Generation Capacity Under the Risk Mitigation IPP Procurement Program (Confidential Project).
Auditing
• Bi-annual Environmental Performance Assessment Audit of the Tailings Facility and associated infrastructure at Harmony Kareerand Operations, Harmony Gold Mining. • Water Use Licence Compliance Audit at Farms K/Kraal 342 JQ, Rooikoppies 297 JQ and Elandsdrift 467 JQ, south of Marikana in the North West Province, Tharisa Minerals (Pty) Ltd. • Peer Review of Audits on the Construction Environmental Management Programme for Anglo American Platinum's Polokwane Metallurgical Complex within the province of Limpopo. • Audit of the Waste Management Practice at Mponeng and Kopanang Mine, AngloGold Ashanti. • External Audit Reports for the Waste Management Licences, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton). • Audit of the Water Use Licence held by Goedgevonden Colliery, Xstrata Coal South Africa. • Annual Internal Audit of the Water Use Licence for Xstrata Coal South Africa (Pty) Ltd Tweefontein Division. • Annual External Water Use Licence Audit, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton). • Annual Audit of the Record of Decision and Environmental Management Plan for the Fouriespruit Stream Diversion and Old Slag Area, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton). • Annual Environmental Performance Audit for the Pelletising Plant, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton). • Environmental Legal Compliance Assessment for the Construction Phase of the M14 Furnace Project Environmental Authorisation, Metalloys Samancor Manganese (Pty) Ltd (BHP Billiton). • Waste Management License Audit for the Slagment Operation, AfriSam Southern Africa (Pty) Ltd. • Environmental-Legal Compliance Assessment Report SCE Ashman (Proprietary) Limited: Vanderbjilpark Plant. • Environmental-Legal Compliance Assessment of the Waste Management Licence and Atmospheric Emission Licence for A-Thermal Retort Technologies (Pty) Ltd.

DECLARATION

I, Paula Tolksdorff hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I

undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature:  Date: 17 March 2025

Environmental Assessment Practitioners Association of South Africa

Registration No. 2019/509

Herewith certifies that

PAULA JANE TOLKSDORFF

is registered as an

Environmental Assessment Practitioner

Registered in accordance with the prescribed criteria of Regulation 15. (1) of the Section 24H Registration Authority Regulations (Regulation No. 849, Gazette No. 40154 of 22 July 2016, of the National Environmental Management Act (NEMA), Act No. 107 of 1998, as amended).

Effective: 01 March 2025

Expires: 31 March 2026

Chairperson

Registrar

SAQA
SOUTH AFRICAN QUALIFICATIONS AUTHORITY

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Paula Jane Tolksdorff

Registration Number: 152904

is a registered scientist

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

Environmental Science (Professional Natural Scientist)

Effective **12 June 2024** Expires **31 March 2027**

President of Council

Chief Executive Officer

To verify this certificate scan this code

TECHNIKON WITWATERSRAND

BACCALAUREUS TECHNOLOGIAE

ENGINEERING: CIVIL (URBAN)

INGENIEURSWESE: SIVIEL (STEDELIK)

is awarded to / word toegeken aan

PAULA-JANE LEWIS

Date of Birth / Geboortedatum

1971-01-24

Student Number / Studentenommer

8913463

with effect from / met ingang van

1997-07-01

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

SD No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

H.W. van Eyk

Vice-Chancellor & Principal
Visekanselier & Prinsipaal

Deputy Vice-Chancellor & Vice-Principal
Adjunkvisekanselier & Viseprinsipaal

Issued with the approval of the Certification Council for Technikon Education (SERTEC) in terms of section 9 of The Certification Council for Technikon Education Act 1986 (Act 88 of 1986)
Uitgereik met die goedkeuring van die Sertifiseringsraad vir Technikononderwys (SERTEC) ingevolge artikel 9 van die Wet op die Sertifiseringsraad vir Technikononderwys, 1986 (Wet 88 van 1986)

No. / Nr. B 0524

NORTH-WEST UNIVERSITY ®
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Private Bag X6001, Potchefstroom
South Africa, 2520

Tel: (018) 299-1111/2222
Web: http://www.nwu.ac.za

MRS PJ TOLKSDORFF
P O BOX 41409
CRAIGHALL
2024

2011/12/14

23119128 - 2011

Dear MRS TOLKSDORFF

EXAMINATION RESULTS

Web address: http://www.nwu.ac.za/admin/index.html

NB Any errors and/or omissions on your 2011 record must be reported before 17 February 2012.

Herewith the results of the past examination. We trust that you were rewarded for your effort and hard work.

Qualification : 2181061 M IN ENVIRON MAN
Curriculum Code : N824P ENVIRONMENTAL ANALYSIS AND MANAGEMENT

Date	Module Name	Module Code	Module Type	Mark	Result
201111	ENVIRONMENTAL MANAGEMENT II	OMBO 8 78	Core module	69	Passed

2012 Graduate students: In the case of an exception, if we have to re-schedule your ceremony, we will inform you in February per SMS and letter.

DIRECTOR : ACADEMIC ADMINISTRATION

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

NORTH-WEST UNIVERSITY ®
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Private Bag X6001, Potchefstroom
South Africa, 2520

Tel: (018) 299-1111/2222
Web: http://www.nwu.ac.za

MRS PJ TOLKSDORFF
P O BOX 41409
CRAIGHALL
2024

2012/12/11

23119128 - 2011

Dear MRS TOLKSDORFF

EXAMINATION RESULTS

Web address for examination results: http://www.nwu.ac.za/content/exam-results

Herewith the results of the past examination. We trust that you were rewarded for your effort and hard work.

Qualification : 2181061 M IN ENVIRON MAN
Curriculum Code : N824P ENVIRONMENTAL MANAGEMENT
Method of Delivery : PART TIME

Date	Module Name	Module Code	Module Type	Mark	Result
201211	ENIVORMENT ANALYSIS 2	OMBO 8 79	Core module	75	Distinction

Registration schedule 2013:
Undergraduate and Honours students see :
http://www.nwu.ac.za/content/nwu-potchefstroom-campus-current-students-intranet-and-portal

NB: Any errors and/or omissions on your 2012 record must be reported before 18 January 2013.

CAMPUS REGISTRAR

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

BD No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

CEM

SAATCA D15

Centre for Environmental Management

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

This is to certify that

PJ TOLKSDORFF
7101240049089

successfully completed and
passed SAATCA approved examination

Implementing Environmental Management Systems (ISO 14001)

CEM-03.1/0117/2011

22-24 June 2011

NQF Level: 7

Prof. JG Nel
Executive Manager:
Centre for Environmental Management
Course Leader

Prof. JJ Pienaar
Dean Faculty of Natural Science

Carin Bosman
Sustainable Solutions

This Certificate is issued to
certify that

Paula Tolksdorff

has attended a 3 day Training Workshop entitled

Water Governance in South Africa

held on

9-11 May 2023

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

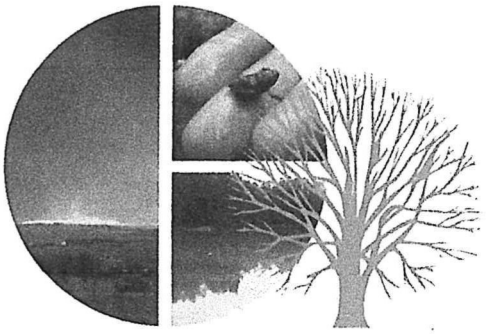
Commissioner of Oaths - Ryan Harold Currie

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

WISA
Water Institute of Southern Africa

Carin Bosman, Director: CBSS
SACNASP: WISA2023-0412-002542
ECSA: WISA2023-0412-002542 (3pt)



Our environmental- and water governance solutions help you to take sustainable management decisions

PO Box 26442 ♦ Gezina ♦ 0031 ♦ http://www.cbosss.com/training/

CESA

Consulting Engineers South Africa

This is to acknowledge that

Paula Tolksdorff

Attended the Online

Developing Mentorship Skills for

Management and Professionals

On 21-22 February 2022

This qualifies for 2 CPD Points
for Continuing Professional Development
CESA-2049-11/2024

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

Chris Campbell
School of Consulting Engineering
Signed on 22 February 2022
Certificate number 29764

NETWORX
For Career Development

Certificate of Competence

This is to certify that

Paula Jane Tolksdorff

ID Number: 7101240049089

Has successfully completed the

Assessor Course

115753 Conduct outcomes-based assessment NQF Level 5 Credits 15

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Curle

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

UBhengu

Mylet Ursula Bhengu
Chief Executive Officer

29 November 2019

Date

ETDP SETA SAQA

Certificate Number: NETW/00001902/2019

ETDP SETA Accreditation Number: 10222

LEGISLATIVE COMPLIANCE SPECIALISTS

REG NO. 2006/014854/07

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Cu

ID No: 38272 Date: 15 Sept 2021

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

This is to certify that

P. Tolksdorff

Name

710124 0049 089

ID Number

Has successfully completed the following LCS course

Legal Liability

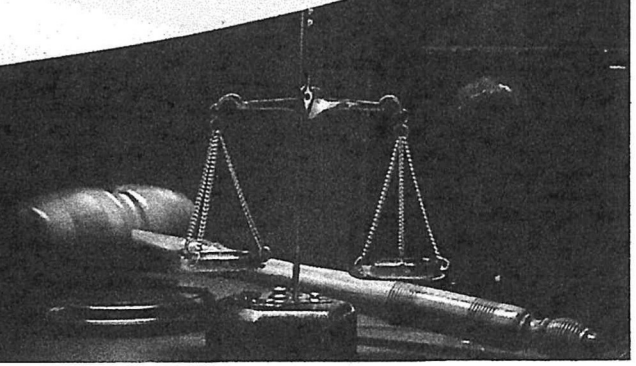
31 May 2021

Date

Facilitator / Assessor

ETDP SETA, SOR No: 61101, US Code: 7978, Endorsement No: US-10

OHS-ACT No. 85 of 1993



Aspects International

IEMA Approved Foundation Course in Environmental Auditing (South Africa)

This is to certify that

Paula Tolksdorff

Attended and Successfully Completed
the above Training Programme on
19 - 23 October 2009
and achieved 87% at Examination

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

BD No: 38232 Date: 7/9/2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

Signed ..... Chief Examiner

Certificate No: SA/0911/9
Issue Date 05/11/09

iema Approved Training Provider

Signed ..... Course Tutor

ASP/FLEA/01109/SOUTH AFRICA

Aspects International Ltd. Trelawna, Daleside Park, Darley, Harrogate, North Yorkshire, HG3 2PX. United Kingdom. T: +44 (0)1423 781 218 E: info@aspexint.com W: www.aspexint.com

Aspects International

IEMA Approved Carbon Footprint Management Course : An Introductory Programme

This is to certify that

Paula Jane Tolksdorff

Attended and Successfully Completed the above Training Programme on

6-7 July 2009

Certificate No: PubCF2/SA/0907/23

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Curtis

CO No: 38232 Date: 25 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

Signed .....

Chief Examiner

iema Approved Training Provider

Signed .....

Course Tutor

Aspects International Ltd. Trelawna, Dalside Park, Darley, Harrogate, North Yorkshire, HG3 2PX. United Kingdom. T: +44 (0)1423 781 218 E: info@aspexint.com W: www.aspexint.com

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Curtis

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

The International Association for Public Participation

Certificate in Public Participation awarded to

Paula Tolksdorff

October 2009

iap2

International Association for Public Participation

President, IAP2

Training Committee Chair, IAP2

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

BD No: 38232 Date: 9 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

The International Association for Public Participation

Paula Tolksdorff

has completed IAP2's

Communication for Effective Public Participation

October 2009

iap2

International Association for Public Participation

President, IAP2

Training Committee Chair, IAP2

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Curtis

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

The International Association for Public Participation

Paula Tolksdorff

has completed IAP2's

Techniques for Effective Public Participation

October 2009

International Association for Public Participation

President, IAP2

Training Committee Chair, IAP2

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

ID No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

The International Association for Public Participation

Paula Tolksdorff

has completed IAP2's

Planning for Effective Public Participation

October 2009

International Association for Public Participation

President, IAP2

Training Committee Chair, IAP2

Certificate of Attendance

Faculty of Engineering and the Built Environment
(School of Mining Engineering)

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Cu...

No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston
Johannesburg, 2191

This is to certify that

P Tolksdorff

during the period

16 January 2007

has attended and participated in the course

1 Day Report Back from the 1st International Seminar on Mine Closure, Perth Australia 2006

Huw R Phillips

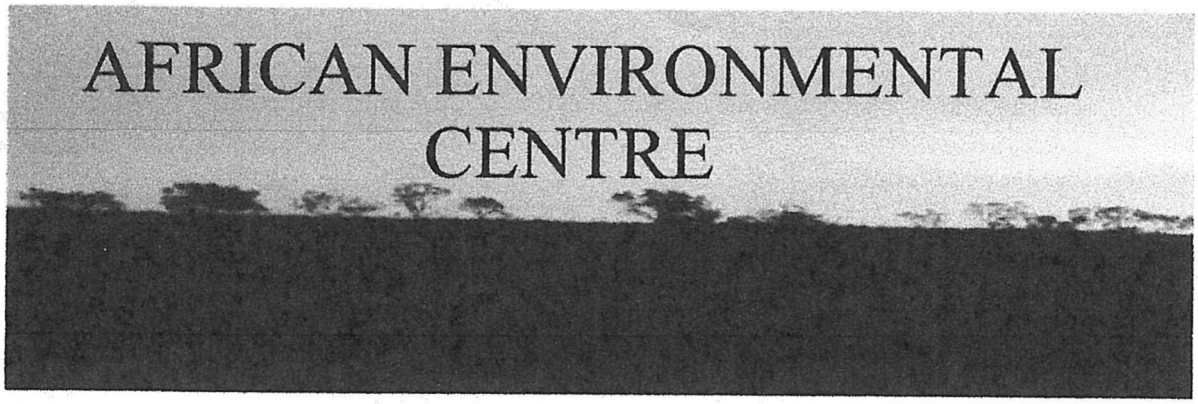
Head, School of Mining Engineering

B M Macquet

Dean, Faculty of Engineering
& the Built Environment

Date of Issue: 16th January 2007

AFRICAN ENVIRONMENTAL CENTRE



This is to certify that

Paula Tolksdorff

has successfully completed
the following short course

I certify that this document is a true copy of the original which was examined by me and that, from my observations, the original has not been altered in any manner.

SIGNATURE

Commissioner of Oaths - Ryan Harold Currie

SD No: 38232 Date: 7 Sept 2024

New Life Church, 1 Grosvenor Road, Bryanston, Johannesburg, 2191

NEMA EIA Regulations

on the

23 October 2006

Director

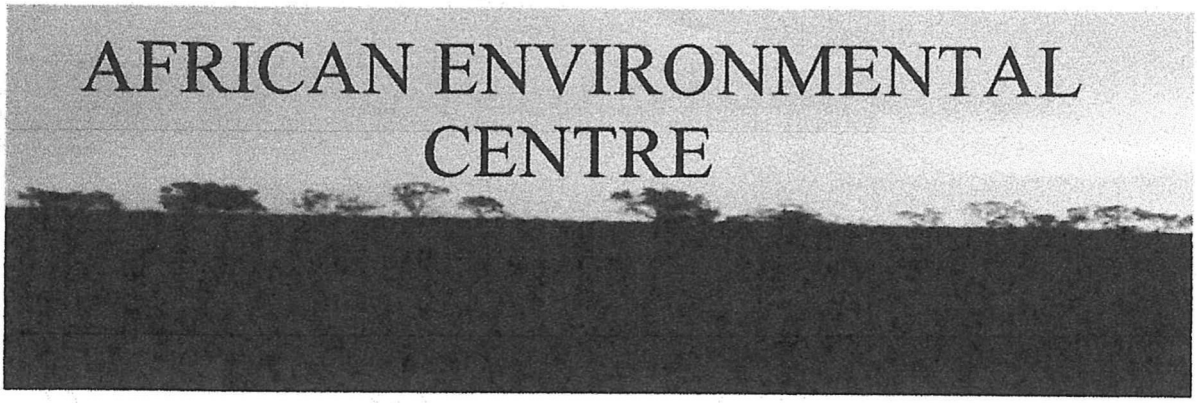
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NEMA EIA Regulations

on the

23 October 2006

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APPENDIX B: HYDROLOGICAL ASSESSMENT

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Hydrological Assessment for the Thirsti Bottling Plant Water Use Licence Application

Report

Version - Final V3

18 February 2026

Normandien Farms (Pty) Ltd

GCS Project Number: 25-0109

Client Reference: BPO005496

THIRSTI™



GCS Environment South Africa (Pty) Ltd **Reg No:** 2002/028494/07
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EXECUTIVE SUMMARY

GCS Environment South Africa (Pty) Ltd was appointed by Normandien Farms (Pty) Ltd to prepare a Water Use licensing Application for the Thirsti Bottling Plant (Thirsti) near Newcastle, KwaZulu-Natal. The water use is for industrial use, sourced from groundwater supply. The project area is situated in quaternary catchment V31F of the Pongola-Mtamvuma Water Management Area. This report presents findings of the surface water assessment for the Thirsti site.

This surface water impact assessment had the following objectives:

- Update the study area's hydrological functions and ecological water requirements.
- Develop a hydrological cycle for the sub-catchment associated with the project area, illustrating the sub-catchment hydrological components that may be impacted.
- Undertake a site walkover assessment to confirm the existing stormwater management practices.
- Update the 1:20, 1:50 and 1:100-year peak flow return periods, to undertake flood line modelling. The aim is to identify possible exclusion zones.
- Update the stormwater model and evaluate the 1:2, 1:20, 1:50 and 1:100-year stormwater flood volumes and runoff patterns.
- Compile surface water and stormwater monitoring plans to monitor the impact on the receiving environment; and
- Compile a detailed hydrological report with hydrological impacts identified.

Five hydrological response units were found in the project area. The hydrological response units are mainly head-cuts of the Horne River from the Thukela River system.

According to available historical weather data (rainfall station 0370807_W). The station recorded 50 years of rainfall from 1959 to 2009. The total mean annual precipitation (MAP) for catchment V31F is 791 millimetres per annum (mm/a). Recent rainfall records on-site indicate that the annual precipitation is 1 042 mm/a. Evapotranspiration data from the WR90 dataset indicate that the average annual evapotranspiration (MAE) for the area is 1 276 mm/a.

Thirsti lies at an elevation that ranges 1 050 and 1 450 metres above mean sea level (mamsl). The lowest elevation values are in the drainage feature valleys in the eastern and northern portions of Thirsti. According to the published geological data, the study area is underlain by rocks of the Volksrust and Estcourt Formations, which have been intruded by Jurassic-age dolerites that form a confined aquifer.

Four wetlands are identifiable at Thirsti, with direct hydrological linkage to the Thirsti Bottling activities (refer to Section 3.6). The wetland assessment study indicated that the ecological condition of the two valley-bottom wetlands and the two seep wetlands ranges from **moderately modified** to **critically modified**. Heavy modification of this ecological infrastructure is attributed to the presence of invasive alien plants, erosion, infilling associated with water supply dams, and alteration of natural vegetation due to historical farming activities and invasive alien plants. The groundwater assessment indicates minimal impact on wetlands, as abstraction occurs from a deep aquifer and potential septic tank discharge is limited.

A flood line study was undertaken and is presented in Section 5. The access roads and borehole locations were the only infrastructure in in the flood lines. It must be noted that the flood lines produced are representative of a worst-case scenario to account for the probable maximum flood risk. Flood control precautionary measures should be taken to avoid increasing the flood impact, infrastructure damage, reduced accessibility of the plant, and human health hazards. Some boreholes are located in the 1:100-year flood line. As such, the presence of the borehole infrastructure in the flood line could alter the natural flood regime, increase erosion risk, or result in operational disruptions if the pipelines or borehole pumps experience damage. However, the floods are not likely to introduce surface runoff into the borehole as they are all sealed, and their collars are elevated above-ground. Application form DW781 will be completed as part of this application, as the borehole infrastructure is situated within a flood line, thereby altering the natural characteristics of a watercourse.

A stormwater management plan was developed for Thirsti and is presented in Section 6. Current stormwater management practices have clean and contaminated catchments for Thirsti. The Rational Method was used to calculate the anticipated runoff volumes from the delineated sub-catchments, and the performance of the current stormwater management practices was assessed, based on estimated peak stormwater discharges for each of the stormwater sub-catchments. In addition to the existing stormwater control measures, two additional options are recommended to the east of Thirsti. Waste (laundry wash water, litter etc.) in and around Thirsti requires attention as littered items end up in the surrounding environment. Sediment management through silt traps and erosion control measures downstream of the outlet pipes was also recommended.

The surface water impact was evaluated as presented in Section 8, focusing on operational impacts. The impact level was assessed following the Best Practice Guideline G4: Impact Prediction, considering a thorough understanding of the impact's nature, potential mitigation strategies, and how these strategies alter the impact profile once implemented. Post-mitigation, the identified impacts are considered low to negligible. Cumulative impacts relate to the presence of pine and pecan nut afforestation, which is expected to have an ongoing impact on Thirsti's hydrological cycle.

The following water and waste management activities are relevant to the hydrological impact assessment:

- Seven groundwater abstraction boreholes.
- One pond for plant wash-water and laundry wastewater.
    - Design specifications for the pond were unknown to the GCS hydrologist at the time of writing this report.
- Three wetlands downstream of Thirsti.
- A septic tank.
- Impermeable to semi-permeable built-up areas.

A monitoring plan for the surface water and stormwater was compiled and is available in Section 9.

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TABLE OF ABBREVIATIONS

Abbreviation	Description
1D	One-dimensional
A	Area
ALOS	Advanced Land Observing Satellite
BH	Borehole
BPG	Best Practice Guidelines
C	Runoff coefficient
CAT	Central Africa Time
CSIR	Council for Scientific and Industrial Research
SWMP	Storm Water Management Plan
CWB	Conceptual Water Balance
DALRRD	Department of Agriculture, Land Reform and Rural Development
DFFE	Department of Forestry, Fisheries and the Environment
DTM	Digital Terrain Model
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
G1	Best Practice Guidelines: Stormwater Management
G2	Best Practice Guidelines: Water and Salt Balances
G3	Best Practice Guidelines: Monitoring
GCS	GCS Water and Environment (Pty) Ltd
GIS	Geographic Information Systems
GN	Government Notice
GN R	Government Notice Regulation
HEC-RAS	Hydrologic Engineering Centre's River Analysis System
HRU	Hydrological Response Unit
HSG	Hydrological Soil Group
I	Rainfall intensity
IFD	Intensity-Frequency-Duration
JAXA	Japan Aerospace Exploration Agency
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman
n	Manning's Roughness Coefficients
NEMA	National Environmental Management Agency
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geo-spatial Information
NWA	National Water Act, 1998 (Act 36 of 1998)
PES	Present Ecological State
PFD	Process Flow Diagram
pH	Potential of Hydrogens
Q	Peak flow
RAS	River Analysis System

RM	Rational Method
RQO	Resource Quality Objectives
SANBI	South African National Biodiversity Institute
SANLC	South African National Land Cover
SANRAL	South African National Roads Agency SOC Ltd
SCM	Stormwater Control Measures
SCS	Soil Conservation Services
SDF	Standard Design Flood
SPR	Source-Pathway-Receptor Model/Principle
SUDS	Sustainable Urban Drainage Systems
SWMP	Stormwater Management Plan
SWSA	Strategic Water Source Area
TALK	Total Alkalinity
TDS	Total Dissolved Solids
TIN	Triangulated Irregular Network
TSS	Total Suspended Solids
US	United States
WARMS	Water Allocation Registration Management System
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012
WUL	Water Use Licence
WULA	Water Use Licence Application

TABLE OF UNITS OF MEASURE

Abbreviation	Description
%	Percent
°C	Degrees Celsius
ha	Hectare
km	Kilometre
km/h	Kilometre per hour
km^2	Square kilometres
l	Litres
m	Metres
m^3	Cubic metres
m^3/a	Cubic metres per annum
$m^3/a/ha$	Cubic metre per annum per hectare
m^3/m	Cubic metres per month
m^3/s	Cubic metres per second
mamsl	Metres above mean sea level
mm	Millimetre
mm/a	Millimetres per annum
mm/hr	Millimetres per hour
Mm^3/a	Million cubic metres per annum

1 INTRODUCTION

GCS Environmental (Pty) Ltd (GCS) has been appointed by Normandien Farms (Pty) Ltd (the Client), to conduct a hydrological investigation in support of the application for a Water Use Licence Application (WULA) for the Thirsti Bottling Plant (Thirsti) located south-west of Newcastle, KwaZulu-Natal (Figure 1-1).

Thirsti requires the necessary authorisation in accordance with Section 21 of the National Water Act, 1998 (Act 36 of 1998) (NWA), as amended, for water uses associated with Thirsti operations. A Hydrological Impact Assessment is required by the Department of Water and Sanitation (DWS) as part of a WULA, and this report serves to fulfil this requirement.

1.1 Project background

Thirsti is situated approximately 30 kilometres (km) south-west of the town of Newcastle, located on farm Buffelshoek 15469 in KwaZulu-Natal and is owned by the Client. Production commenced in 2015 with the bottling of natural and sparkling water. More recently, Thirsti diversified its products to include fruit-flavoured water and energy drinks.

Currently, the bottling plant mainly depends on groundwater abstraction. Thirsti water is available across South Africa, and can be purchased from Bargain, Boxer Superstores, Game, Makro, Pick' n Pay, Save Hyper, Shoprite/Checkers, Spar, and Woolworths. Thirsti is also in partnership with the Comrades marathon, the Springboks, the Blue Bulls, the Sharks, and the Nedbank Running Club.

1.2 Study relevance to the season in which it was undertaken

This hydrological assessment was undertaken as a once-off study and relies on historical hydrological and climate data for the Thirsi area, as well as recognised hydrological and water resource databases for South Africa. The data generated during this study are not seasonally bound, as average annual data were applied where required and are scientifically acceptable.

1.3 The objective of this report

The key objective of this assessment is to minimise any potential hydrological impacts of Thirsti operations on the surface and groundwater resources. The sub-objectives were as follows:

- Assess the study area's hydrological functions and ecological water requirements.
- Undertake a site walkover assessment to confirm the existing stormwater management practices.
- Develop a conceptual hydrological cycle for the quaternary catchment associated with the project area, illustrating the hydrological components that may be impacted.

- Investigate the 1:20, 1:50 and 1:100-year flood peaks for flood line mapping to identify exclusion areas and impact zones.
- Investigate the 1:20, 1:50 and 1:100-year stormwater flood volumes and runoff patterns to develop a conceptual stormwater management plan (SWMP) to manage runoff and prevent dirty and clean water mixing, erosion, and sedimentation.
- Evaluate the water reticulation on-site (sources and sinks) and develop a process flow diagram. Develop a conceptual static water balance for the distribution of water at Thirsti.
- Compile a detailed hydrological report with hydrological impacts identified.

1.4 Scope of work

The scope of this report is to conduct a hydrological assessment to support the WULA for Thirsti. This includes:

1. **Site Walkover Assessment:**
    a. A walk-over assessment was undertaken on 28th to 29th May 2025, whereby all present stormwater interventions, groundwater-surface water interaction areas and stream conditions within the DWS regulation area of Thirsti were investigated.
2. **Baseline Hydrology Review:**
    a. Hydro-climatic data collection and analysis.
    b. Catchment delineation and drainage characteristics.
    c. Determination of catchment hydraulic and geometric parameters.
3. **Hydrological Cycle Modelling:**
    a. An illustration of sub-catchment hydrological components established in the baseline hydrology review.
4. **Peak Flows & Flood Line Modelling:**
    a. Peak flood volume calculation for the 1:10, 1:20, 1:50, and 1:100-year recurring events.
    b. Flood line modelling using Hydrologic Engineering Centre's River Analysis System (HEC-RAS) hydraulic software – 1:20, 1:50 and 1:100-year flood lines were presented.
    c. Analysis of the modelling results and limitations.
5. **Storm Water Management Plan and Stormwater Monitoring (SWMP):**
    a. Identification of stormwater sub-catchments (i.e., clean and dirty areas).

b. Determination of stormwater flows and volumes (for 1:20, 1:50, and 1:100-year return periods) was undertaken.

c. Indications and explanations of the placement of stormwater attenuation infrastructure were offered; and

d. A stormwater monitoring system plan was drafted to ensure that the impact of stormwater discharge on the environment is managed and controlled.

6. **Water Balance Estimation (WB):**
    a. A static process flow diagram (PFD) was developed based on the information provided.
    b. An Excel spreadsheet conceptual water balance model was developed.
7. **Impact Assessment:**
    a. A hydrological impact assessment was undertaken to contextualise the potential hydrological impacts associated with this project.
8. **Surface Water Monitoring Plan:**
    a. A surface water monitoring plan was developed.
9. **Reporting:**
    a. This hydrology assessment report, entailing the above-mentioned components, was compiled.

1.5 Available data and information

The following data and information are available and was used during the desktop investigation:

- Revised Water Management Areas (DWS, 2022).
- Quaternary catchments, rainfall, and runoff information for drainage area V3 (Bailey and Pitman, 2016).
- Council for Geoscience 2728 Frankfort 1:250 000 scale geology map.
- 1:5 000 National Wetland Map 5 (CSIR, 2018).
- 30 m Digital Elevation Model (JAXA, 2025).
- 20 m South African National Land Cover Data (DFFE, 2022).
- Modelled historical climate (Meteoblue, 2025).
- South African Soils – SANBI Map Viewer.

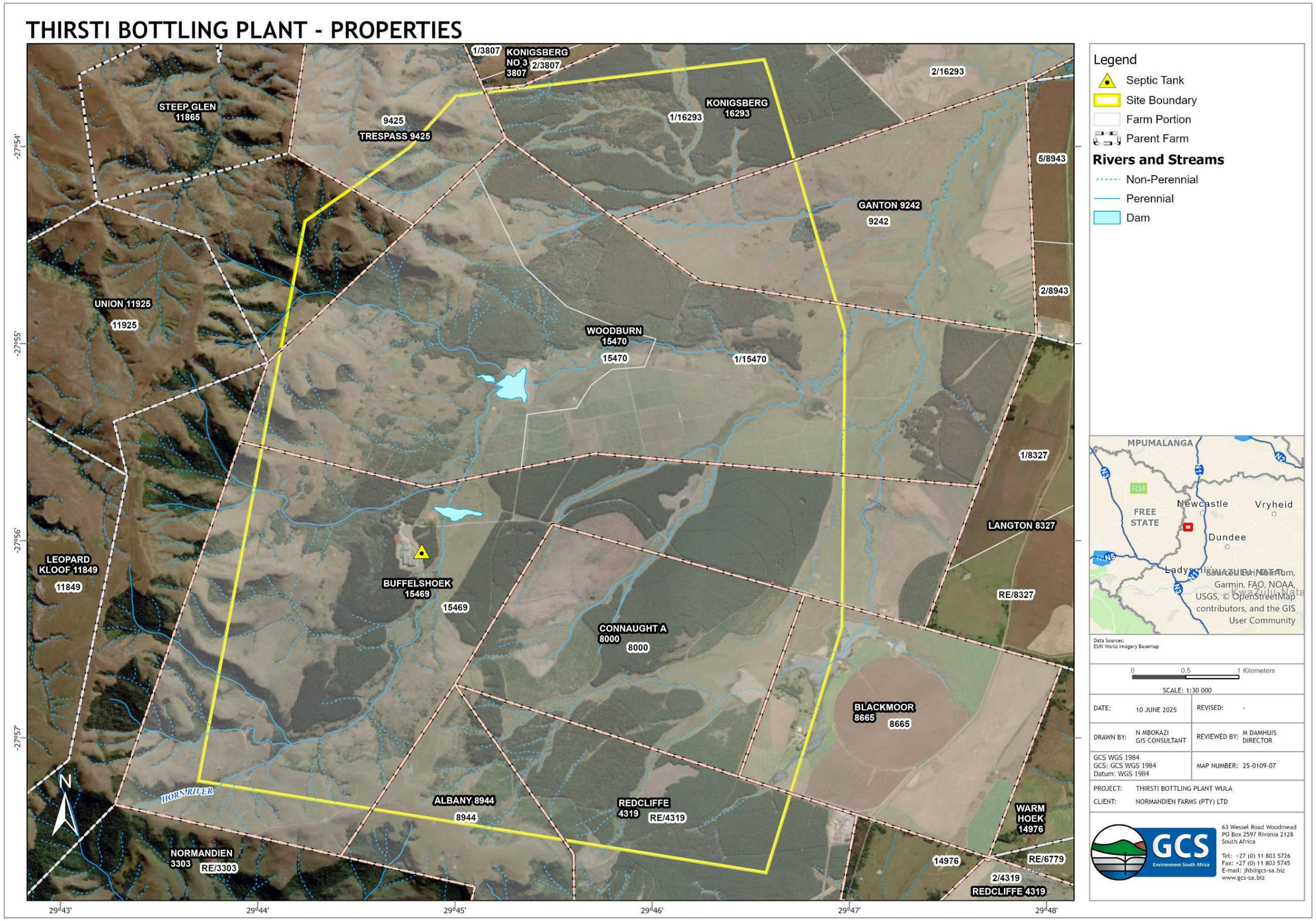


Figure 1-1: Local setting of the Thirsti Bottling Plant

2 METHODOLOGY

The methodological approach for the study is described in the sub-sections below.

2.1 Legal context

The key objective of this assessment is to minimise any potential hydrological impacts of Thirsti operations on the surface and groundwater resources. To achieve this objective, the NWA served as the guidance document.

The NWA is founded on three pillars: sustainable use of limited water resources, equitable distribution, and efficiency. The purpose of the NWA, as stated in Section 2, is to:

- Promote the efficient, sustainable and beneficial use of water in the public interest.
- Facilitate socio-economic development.
- Protect freshwater ecosystems and associated biological diversity.
- Reduce and prevent pollution and degradation of water resources.
- Meet international objectives.

Compulsory licensing is one of the procedures used by the NWA to regulate water allocation and reallocation. Water allocation is implemented by the DWS as a public trustee of the country's water resources.

The NWA governs the use of water and the protection of water resources in South Africa, and the following legislation applies:

- GN 1352, 12 November 1999, National Water Act, 1998 (Act 36 of 1998): Regulations requiring that water use be registered.
- Government Notice Regulation (GNR) 810 of 17 September 2010: Regulations for the Establishment of a Water Resource Classification System (Government Gazette No. 33541).
- GN R131 of 17 February 2017: Regulations requiring that the taking of water for irrigation purposes be measured, recorded, and reported (Government Gazette No. 40621).
- GN R. 267 of 24 March 2017: Regulations regarding the procedural requirements for water use licence applications and appeals (Government Gazette No. 40713).

2.2 Hydrological overview

Hydroclimatic data was sourced from various sources, including the South African Water Resources Study WR2012 database (Bailey and Pitman, 2016), and the Daily Rainfall Data Extraction Utility (Smithers and Schulze, 2002). The hydrological data was refined using climate data from Meteoblue (Meteoblue, 2025) and the Koppen Climate Classification database (Beck *et al.*, 2023).

Based on these sources, it was possible to benchmark the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and the Mean Annual Evaporation (MAE) of the study area as well as the design rainfall data. Data was applied to the Thirsti water balance calculations, runoff peak flow estimates for flood line modelling and stormwater runoff peak flow estimates for stormwater system sizing.

2.2.1 Catchment description and delineation

The 5 m contour data available from the Department of Agriculture, Land Reform and Rural Development (DALRRD) National Geo-spatial Information (NGI) platform does not cover the study area; therefore, the best available data used was a medium- to coarse-scale digital terrain model. A 30 m Digital Terrain Model (DTM) data from the Advanced Land Observing Satellite (ALOS) (JAXA, 2025) were used to delineate the area draining to the streams relevant to this study, sub-catchment flow path as well as to derive river geometry characteristics. These characteristics (area, slopes, and hydraulic parameters) are used to parameterise Thirsti hydraulic model for flood line modelling, water balance modelling and stormwater modelling.

Sub-catchment vegetation and Manning's surface roughness (n-values) coefficients were characterised based on the 2022 South African National Land Cover (SANLC) data (DFFE, 2022).

2.2.2 Design rainfall and peak flow

The Design Rainfall Estimation Software (Smithers and Schulze, 2002) data from the rainfall stations surrounding the study site were used to calculate the 24-hour design rainfall depths for various return periods. Critical storm durations for Rational Methods Alternative 3 were calculated using the Modified Hershfield Equation (Adamson, 1981).

Streams and drainage sections, as well as river segments, were modelled to calculate 1:20, 1:50, and 1:100-year storm flow return periods, applying three widely used methods. These are the Rational Method (RM), Midgley and Pitman (MIPI), and the Standard Design Flood (SDF) methods. A brief description of each of the peak flow methods can be seen in Table 2-1, below.

Methodologies for using the applied peak flow models are explained broadly in the South African Drainage Manual (SANRAL, 2013). The manual guided calibration of the runoff coefficients for the drainage areas, as well as the understanding of the runoff-generating processes and land cover attributes. The resulting peak flows calculated using the selected methods were evaluated, and conservative values were provided as inputs into the 1D HEC-RAS flood line model.

Table 2-1: Summary of peak flow methods

Rational Method

The Rational Method was developed in the mid-19th century and is one of the most widely used methods for calculating peak flows in small catchments (less than 15 km^2). The formula indicates that $Q = CIA$, where I is the rainfall intensity, A is the upstream runoff area, and C is the runoff coefficient. Q is the peak flow. There are 3 alternatives to the Rational Method, which differ in the methodology used to calculate rainfall intensities. The first alternative (RM1) uses the depth-duration frequency relationships approach; the second (RM2) uses the Modified Hershfield Equation; and the third alternative (RM3) uses the Design Rainfall Software for South Africa (SANRAL, 2013).

Midgley and Pitman

The Midgley and Pitman (MIPI) method is an empirical method that relates peak discharge to catchment size, slope, and distance from the drainage point to the centroid of the catchment (Campbell, 1986). The MIPI method uses 10-unit hydrographs for 10 zones in South Africa. The method does not consider overland flow as a component separate from streamflow but considers only the total longest flow path (Campbell, 1986).

Standard Design Flood Method

The SDF method was developed specifically to address the uncertainty in flood prediction under South African conditions (Alexander, 2002). The runoff coefficient (C) is replaced by a calibrated value based on the subdivision of the country into 26 regions or Water Management Areas (WMAs). The design methodology is slightly different and looks at the probability of a peak flood event occurring at any one of a series of similarly sized catchments in a wider region, while other methods focus on point probabilities (SANRAL, 2013).

2.3 Flood line modelling

River geometry and hydraulic parameters were derived based on the 30 m ALOS DTM (JAXA, 2025). The RAS mapper module of HEC-RAS software (US Army Corps of Engineers, 2016) was used to prepare river cross-sections and flow paths, as well as provide inputs into a 1D flood model. Visual assessments of riverbanks from the Google Earth Imagery and land cover types (DFFE, 2022), were used to estimate Manning's 'n' coefficients along the streamlines. The 1:20, 1:50, and 1:100-year flood impact zones were exported from RAS mapper into QGIS for spatial visualisation and mapping.

2.4 Stormwater management plan

The SWMP was designed in conjunction with the provided existing infrastructure layout plans and available topographical data. The Rational Method was applied to determine stormwater peak flows (sub-catchments < 15 km^2) within each stormwater sub-catchment and further considers the United States (US) Soil Conservation Service (SCS) hydrological soil types and land impervious percentages.

The SWMP was designed to consider relevant South African legislation – the NWA and the Best Practice Guideline G1: Stormwater Management (DWAF, 2006a).

2.5 Water balance

A schematic presentation of the water PFD for Thirsti was drafted using information obtained from the client regarding the components that require licensing. The PFD represented Thirsti's operational phase. The PFD presents schematically the sources of water, storage, linkages to different uses and losses from the system.

The client provided estimates of the monthly water requirements for the operational phase of Thirsti. The provided estimates of water requirements were used together with the finalised PFDs to calculate average annual water balances.

In cases where there was a lack of information regarding water requirements, reasonable assumptions were made to determine the water balance. Data was further extracted from available specialist reports pertaining to the current activities. The water balance is based on techniques as described by Best Practice Guideline G2: Water and Salt Balances (DWAF, 2006b).

Relevant software employed throughout the study included:

- ArcView 10.7.1 for Geographic Information Systems (GIS) work and mapping.
- Excel software for creating PFDs.
- Excel Software for Water Balance Modelling.

2.6 Hydrological impact assessment

As per GN 982 of the EIA Regulations (2014), the significance of potential hydrological impacts was assessed. Due to the assessment forming part of a larger impact assessment for the study area, the potential impacts and the determination of impact significance were assessed. The process of assessing the potential impacts of the project includes the following four activities:

1. Identification and assessment of potential impacts.
2. Prediction of the nature, magnitude, extent, and duration of potentially significant impacts.
3. Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity.

4. Evaluation of the significance of the impact after the mitigation measures have been implemented, i.e., the significance of the residual impact.

Per GN R982 of the EIA Regulations (2014), the significance of potential impacts was assessed in terms of the following criteria:

1. Cumulative impacts.
2. Nature of the impact.
3. The extent of the impact.
4. Probability of the impact occurring.
5. The degree to which the impact can be reversed.
6. The degree to which the impact may cause irreplaceable loss of resources.
7. The degree to which the impact can be mitigated.

Table 2-2 provides a summary of the criteria used to assess the significance of the potential impacts identified. An explanation of these impact criteria is provided in Table 2-3.

$$\textit{Consequence} = (\textit{Duration} + \textit{Extent} + \textit{Irreplaceability of resource}) \times \textit{Severity}$$

The environmental significance of an impact was determined by multiplying the consequence by probability.

$$\textit{Significance} = \textit{Consequence} \times \textit{Probability}$$

Table 2-2: Proposed Criteria and Rating Scales to be used in the Assessment of the Potential Impacts

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0 - 6 months.
	Short-term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months - 5 years.
	Long-term (4)	The duration of the activity associated with the impact will last more than 5 years.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural, and social functions and processes continue albeit, in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50% likely that an impact will occur.
	Probable (1)	It is between 50 and 70% certain that the impact will occur.
	Definite (2)	It is more than 75% certain that the impact will occur or the impact will occur.
Significance	Very high - negative (-49 to -66)	A function of Consequence and Probability.
	High - negative (-37 to -48)	
	Moderate - negative (-25 to -36)	
	Low - negative (-13 to -24)	
	Neutral - Very low (0 to -12)	
	Low-positive (0 to 12)	
	Moderate-positive (13 to 24)	
	High-positive (37 to 48)	
	Very high - positive (49 to 66)	

Table 2-3: Explanation of assessment criteria

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact of change on the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), site (limited to Thirsti), and regional (limited to the immediate surroundings and closest towns to Thirsti). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid "double counting," specialists have been requested to indicate spatial significance under "intensity" or "impact on irreplaceable resources" but not under "extent" as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced should it be impacted. A resource could be replaced by natural processes (e.g., by natural colonisation from surrounding areas), through artificial means (e.g., by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those who are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable, e.g., red data species that are restricted to a particular site or habitat to a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to Thirsti and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the impact (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the WUL team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact based on the available information and their level of knowledge and expertise. The degree of confidence is not considered in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

2.7 Surface water monitoring plan

The monitoring network is based on the principles of a monitoring network design as described by the DWAF Best Practice Guidelines: G3 Monitoring (DWAF, 2007). The methodological approach that the monitoring plan follows is represented in Figure 2-1, below.

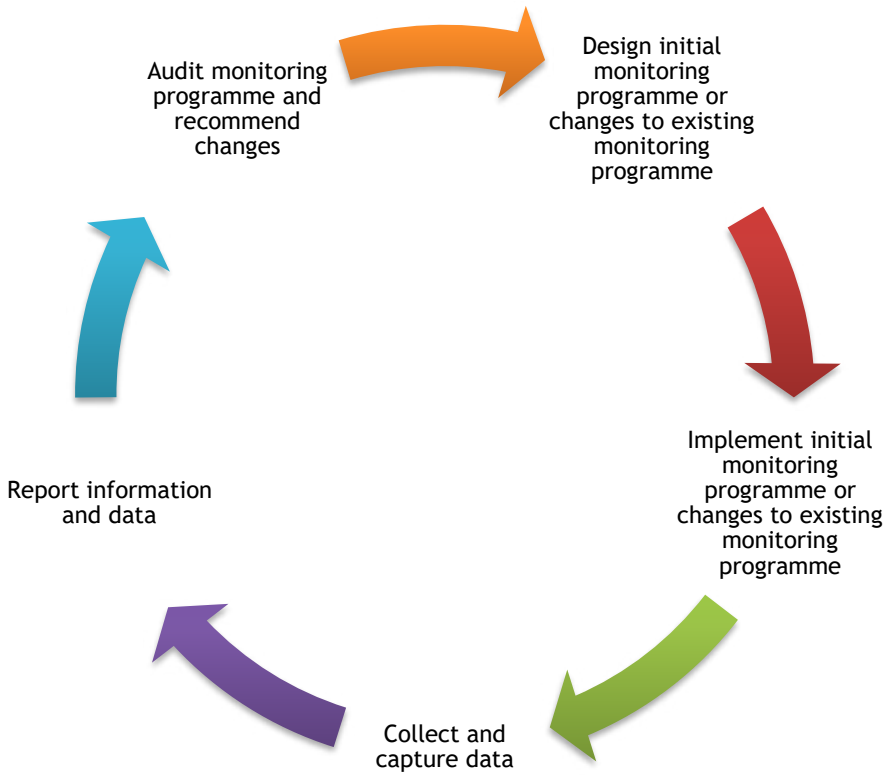


Figure 2-1: Monitoring Process

A comprehensive surface water monitoring program has been developed, outlining the specific water quality constituents that will be analysed. This program details the sampling frequency, ensuring that data is collected at regular intervals, and specifies the exact locations of the sampling points.

3 SITE OVERVIEW AND HYDROLOGY

Thirsti is a water bottling operation situated in quaternary catchment V31F in the Pongola-Mtamvuma WMA (DWS, 2022). Thirsti is owned by Normandien Farm, which is on the farm Buffelshoek 15469 (**2729DC/DD),** located east of the Ncandu Nature Reserve in a lower-lying valley. Thirsti lies at an elevation range of 1 050 to 1 450 mamsl, with an average slope gain of 7 percent (%) from the south-west to north-east direction.

Access to Thirsti is via P39 road, which is approximately 30 km south-west from the town of Newcastle. The Thirsti Bottling Plant is linked to the national road network via a gravel road, which connects to the P39 road leading to Newcastle before feeding to Boundary Street, then Scott Street (R34) inside the town.

This section describes the outcomes of the information and data review for the study area. It also includes a summary of statutes and policy frameworks that are relevant to the reported activities.

3.1 Sub-catchments/hydrological response units

Four hydrological response units (HRU) with an extent range of 1.628 to 7.074 km^2 were identified based on a 30 m digital elevation model (DEM). These sub-catchments are elongated in shape (Figure 3-1) and are well-drained with an average slope ranging between 5% and 18% (Table 3-1, Figure 3-2).

The delineated sub-catchments are drained by tributaries of the Horne River that lies about than 200 m away from Thirsti. The HRUs are characterised by perennial and non-perennial drainage lines. The Horne River feeds the Ngagane River off the N11, both which form part of the Thukela River System. Several small farm dams (mainly off-channel) can be seen in the quaternary catchment. Within the Normandien Farms, surface water is stored in the Kingston-Rooi Dam that is 6 m in height. Low flows are maintained through a Siphon spillway type. The dam was first registered in 1983 with a 300 000 cubic metre (m^3) capacity. The dam is an embarkment-type and is currently used for pecan nut irrigation.

3.2 Land cover and slope

Based on the reclassified 2022 national land cover map (Figure 3-1; DFFE, 2022), Thirsti sub-catchments are mainly covered by grasslands and some woody vegetation. A 30 m DTM was used to determine the slope rise (%) for each HRU (Figure 3-2). The slope rise is one of the key parameters in flood line modelling. Meanwhile, the vegetation and land cover observed on-site were essential for estimating the Manning's coefficients (n-values).

The land cover maps, previous reports and field observations confirm three wetlands within the Normandien Farm, two valley-bottom wetlands and hillslope seep wetland type (Figure 3-8). The Normandien Farm hosts a pine plantation, and according to Le Maitre et al.(2020) the V31F quaternary losses approximately 1-5% of annual streamflow due to dense afforestation stands. This makes afforestation potentially the most significant impact that currently affects the status of freshwater systems in the area, followed by the effects of wetland grazing and trampling by cattle.

Table 3-1: Thirsti sub-catchment characteristics

Sub-catchment		HRU01	HRU02	HRU03	HRU04	HRU05
Area (km²)		3.915	1.628	3.387	4.391	7.074
Longest drainage line (km)		2.151	0.918	1.713	1.482	2.519
Average slope (%)		5.02	9.60	18.05	16.14	13.19
Slope (%)	<3	48.19	16.11	1.91	5.91	6.29
	3-10	39.07	48.12	10.43	30.56	34.08
	10-30	11.67	35.18	77.82	54.23	55.29
	>30	1.07	0.59	9.84	9.29	4.34
Land cover (%)	Thick bush & plantation	40.97	21.10	38.76	45.67	38.41
	Light bush & farmlands	36.57	8.75	0.00	0.38	1.86
	Grasslands	20.79	68.34	60.97	53.40	59.70
	No Vegetation	1.67	1.81	0.27	0.55	0.04

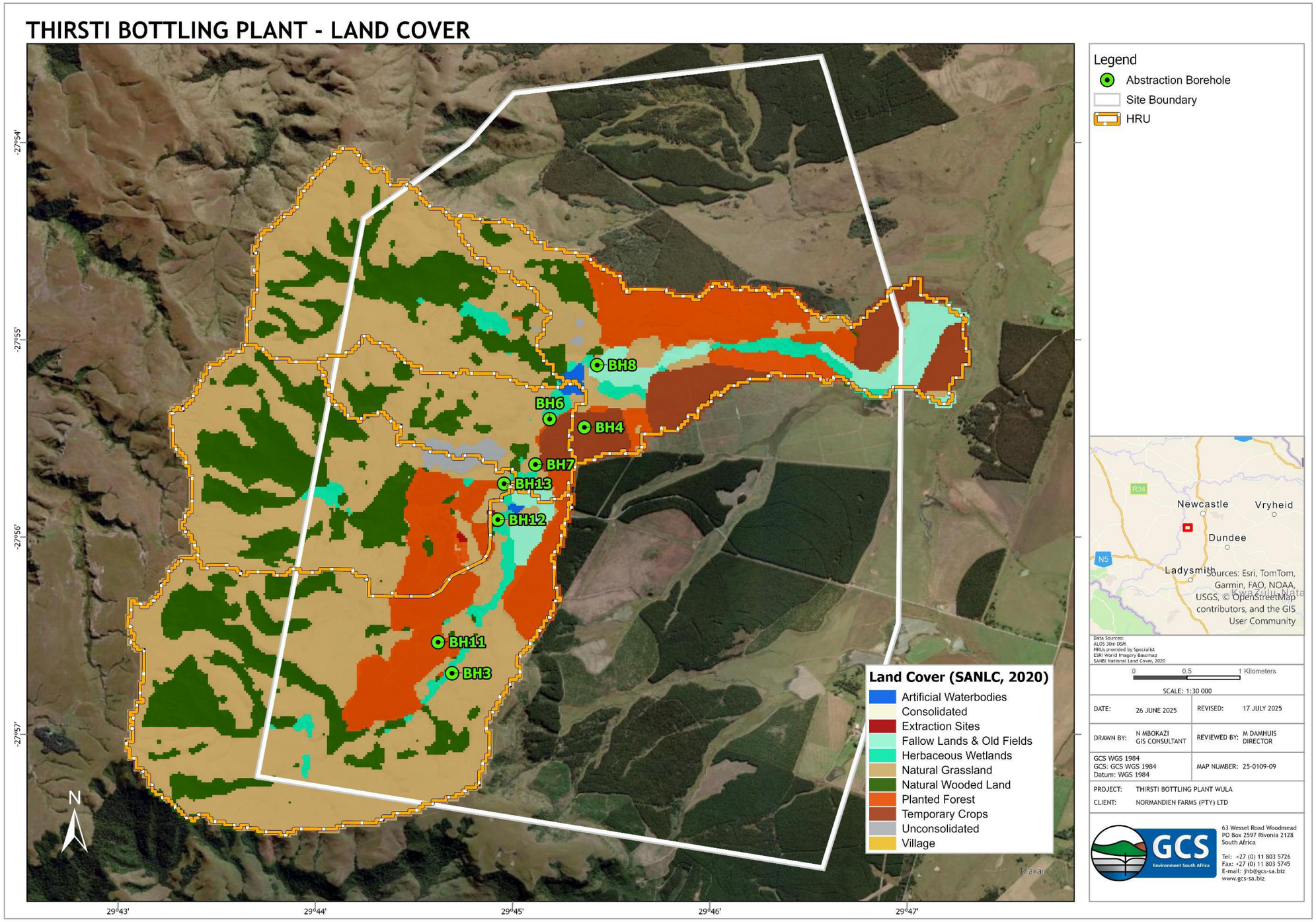


Figure 3-1: Sub-catchments and land cover types

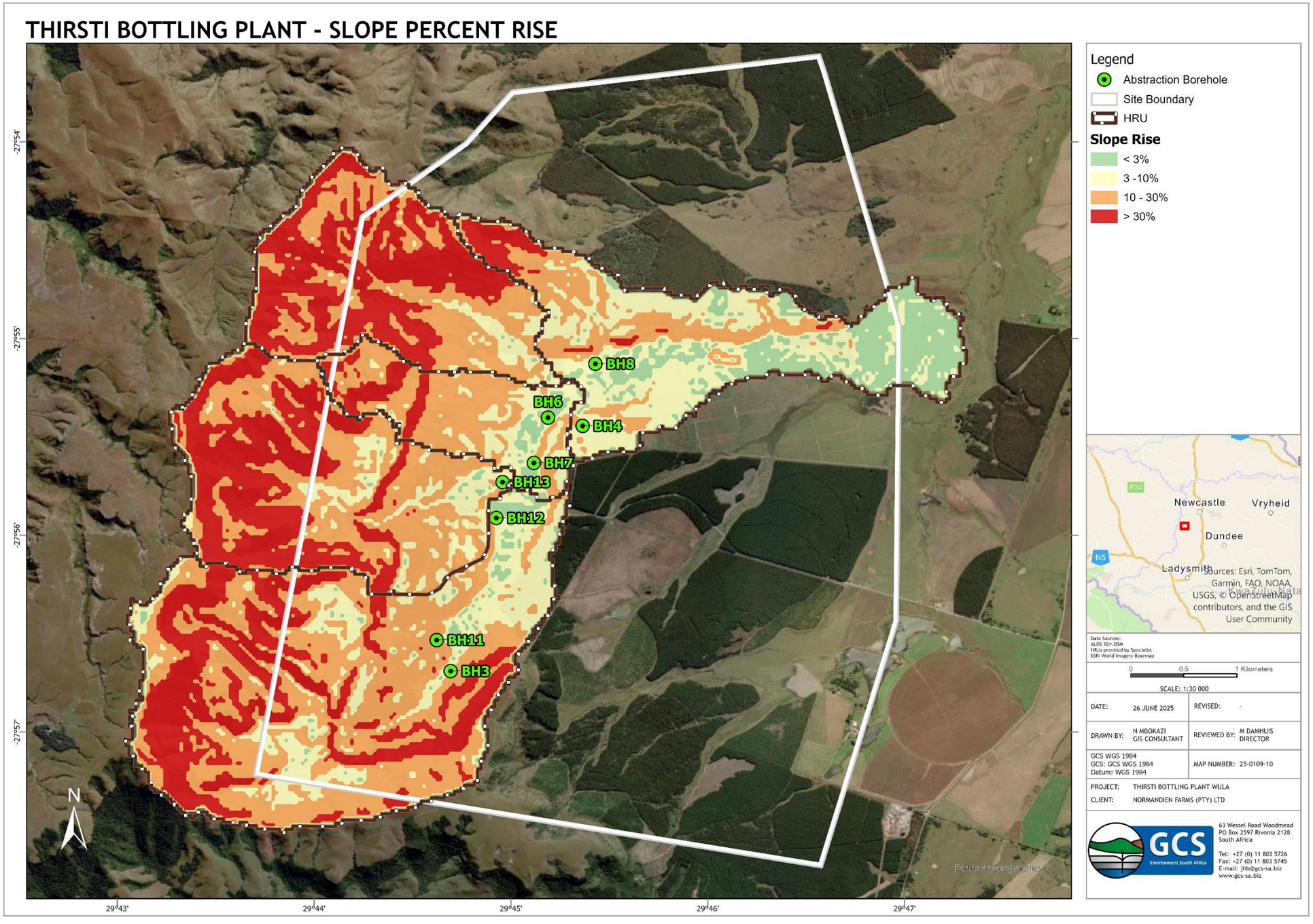


Figure 3-2: Sub-catchments and slope rise percentage

3.3 Regional climate

Thirsti is in the sub-humid climate region of South Africa. Per the global distribution of Köppen-Geiger climate zones (Beck *et al.*, 2023), the study area falls in the subtropical highland climate or temperate oceanic climate with dry winters.

3.3.1 Temperature

Simulated monthly temperature patterns for Newcastle, KwaZulu-Natal (27.76°S; 29.93°E), which is 26 km north-east of the study area, are shown in Figure 3-3. Mean monthly temperatures in the area typically range from 0 degrees Celsius (°C) to 33°C, with July being the coldest month and September, October, and November being the warmest months.

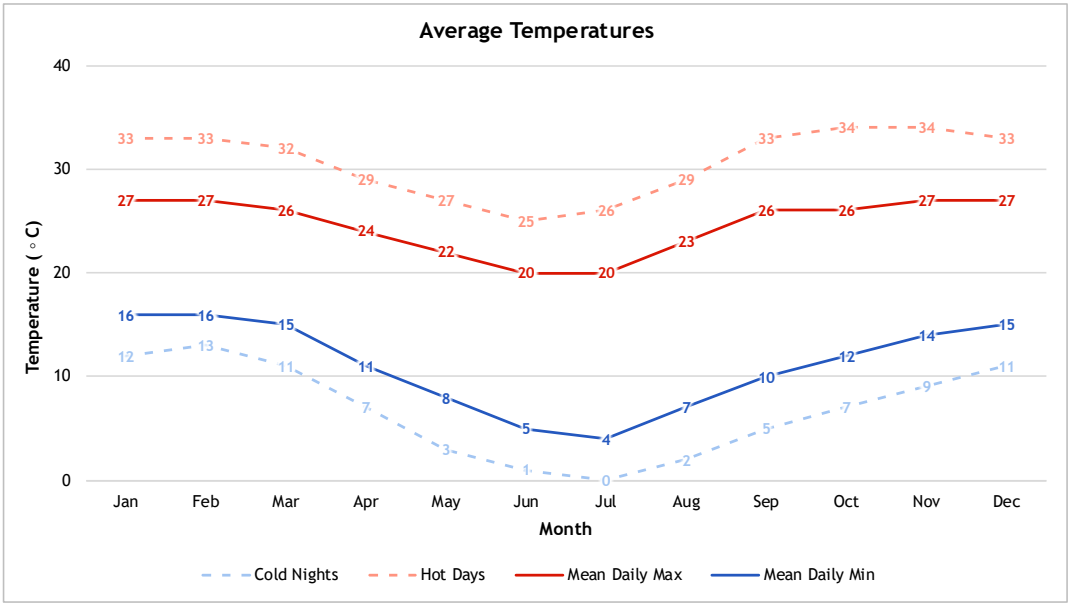


Figure 3-3: Mean annual temperatures since 1940 (Meteoblue, 2024)

3.3.2 Wind speed and direction

Wind speed (hours per year) and the wind direction for Newcastle are shown in Figure 3-4. The study area is dominated by North-West blowing winds (up to 40 km/h for 4.2 hours in a year). The wind rose also shows some moderate (up to 30 km/h for 7.2 hours per year) winds blowing to the South-East.

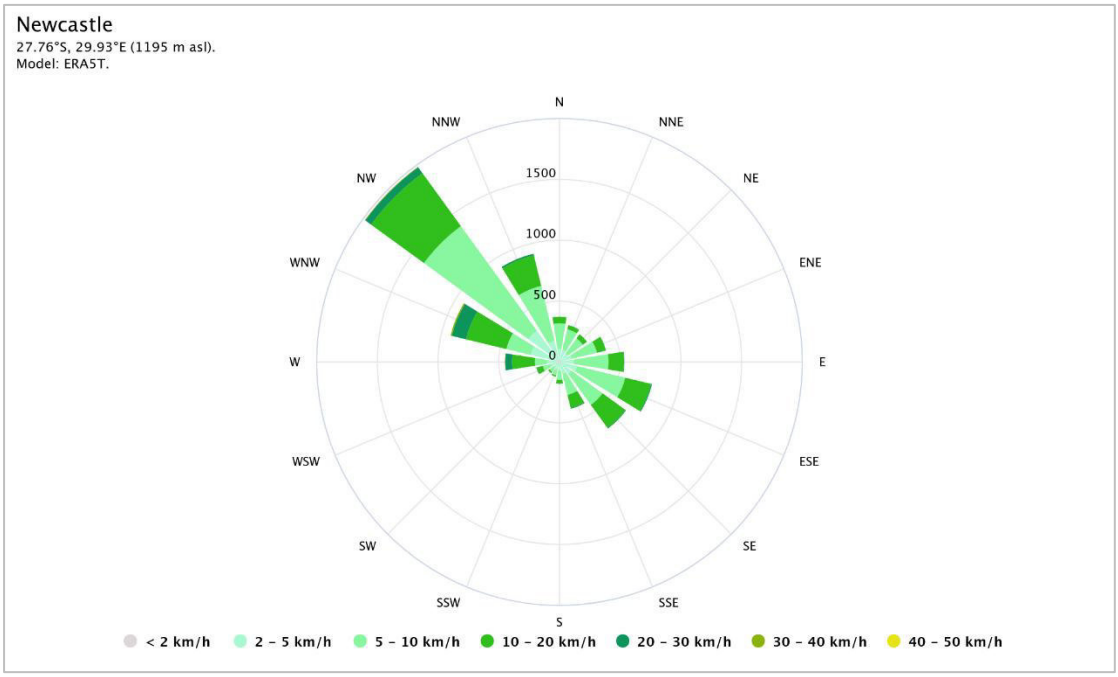


Figure 3-4: Wind rose showing wind direction and speed for the town of Newcastle (Meteoblue, 2025)

3.3.3 Rainfall and evaporation

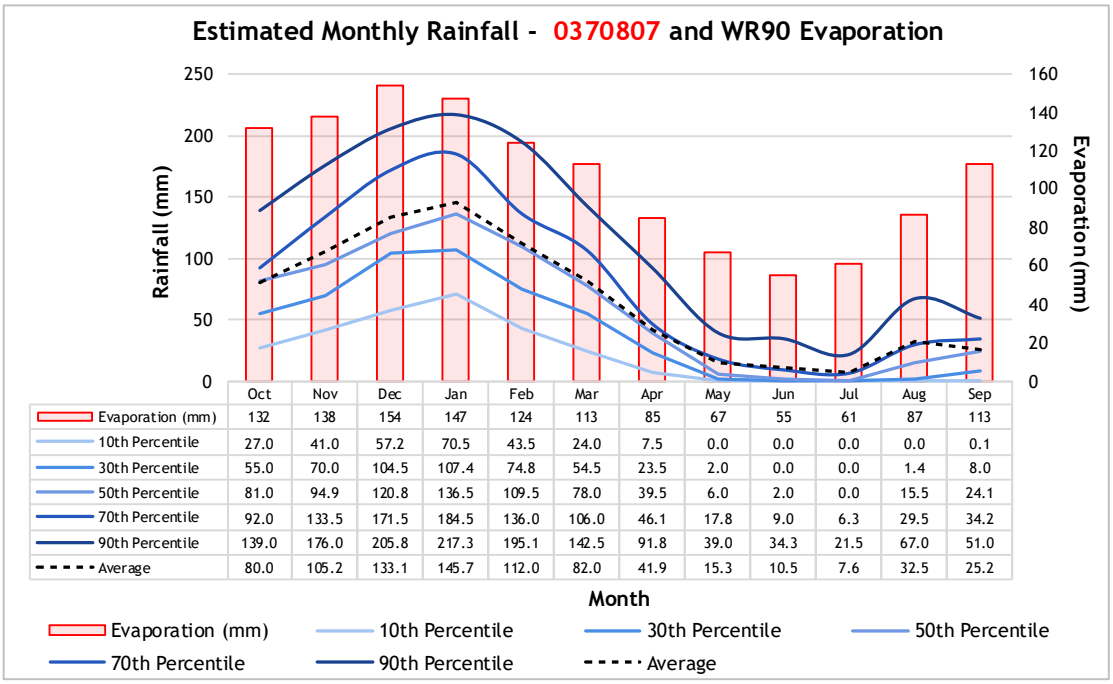
Thirsti is in V3B rainfall zone, with an estimated MAP of about 791 mm/a between 1920 and 2009 (Bailey and Pitman, 2016), which is less than the 834 mm/a for the V3B zone. Nearby rainfall was sourced from rainfall station 0370807_W near Chelmsford Dam, which is less than 24 km east of Thirsti (Table 3-2). The station recorded 50 years of rainfall from 1959 to 2009.

Table 3-2: Summary of MAP of closest rainfall stations (Smithers & Schulze, 2002)

Name	Station ID	Distance (km)	Record (years)	MAP (mm/a)
BIDEFORD	0334543_W	9.7	29	788
MUNROS WINKEL	0370352_W	10.5	29	895
CECILIA, NEWCASTLE	0370655_A	14.5	31	931
BRAKKRANS	0370116_W	18	618	618
MOEDERSRUS	0370407_W	18.1	30	980
CHELMSFORD DAM	0370807_W	23.5	50	791
Average for rainfall zone V3B				**834**

As can be seen in Figure 3-5, rainfall percentiles (10^{th}, 30^{th}, 50^{th}, 70^{th}, 90^{th}) are plotted alongside average values, while evaporation is shown with red bars. Rainfall from this station is likely to follow the historic trends shown in Figure 3-5, such that 80% of MAP may fall in the ranges of 271 mm/a and 1 308 mm/a. Peak rainfall is expected in the late summer months, and peak evaporative losses are expected in December (Figure 3-5).

Evaporation data for Thirsti were extracted from the WR90 database. Thirsti falls within evaporation zone 12A. The MAP clearly exceeds the MAE (Figure 3-5), supporting the earlier statement that the project area experiences a sub-humid climate.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation (mm)	132	138	154	147	124	113	85	67	55	61	87	113
10th Percentile	27.0	41.0	57.2	70.5	43.5	24.0	7.5	0.0	0.0	0.0	0.0	0.1
30th Percentile	55.0	70.0	104.5	107.4	74.8	54.5	23.5	2.0	0.0	0.0	1.4	8.0
50th Percentile	81.0	94.9	120.8	136.5	109.5	78.0	39.5	6.0	2.0	0.0	15.5	24.1
70th Percentile	92.0	133.5	171.5	184.5	136.0	106.0	46.1	17.8	9.0	6.3	29.5	34.2
90th Percentile	139.0	176.0	205.8	217.3	195.1	142.5	91.8	39.0	34.3	21.5	67.0	51.0
Average	80.0	105.2	133.1	145.7	112.0	82.0	41.9	15.3	10.5	7.6	32.5	25.2

Figure 3-5: Estimated historic rainfall for station 0370507_W (Oct 1968 to Oct 2004) and mean annual evapotranspiration (WR90) for the project area

3.3.3.1 Site-specific rainfall

Daily rainfall for Thirsti was also provided by the client for the recent years (Jan 2021 to Feb 2025), at a daily timestep. This data was aggregated to monthly averages to maintain consistency with the catchment rainfall, generating a record of 50 months (or 1 520 days). Rainfall peaks have been increasing in the recent years during the summer months, as shown by the trendline's positive slope (Figure 3-6).

Rainfall from the catchment underestimates site-specific rainfall during the wet months (September to May) but overestimates site-specific rainfall during the drier months. This input data uncertainty can lead to inaccurate site hydrological cycle estimates, affecting evapotranspiration, infiltration, baseflow, and runoff rates etc. As the design rainfall is based on these regionalised estimates, peak flow underestimates can lead to inadequate flood and stormwater impact estimations. Therefore, the use of the upper design rainfall limit is well suited to better accommodate the underestimates in regional rainfall, given that the design rainfall is the best available dataset.

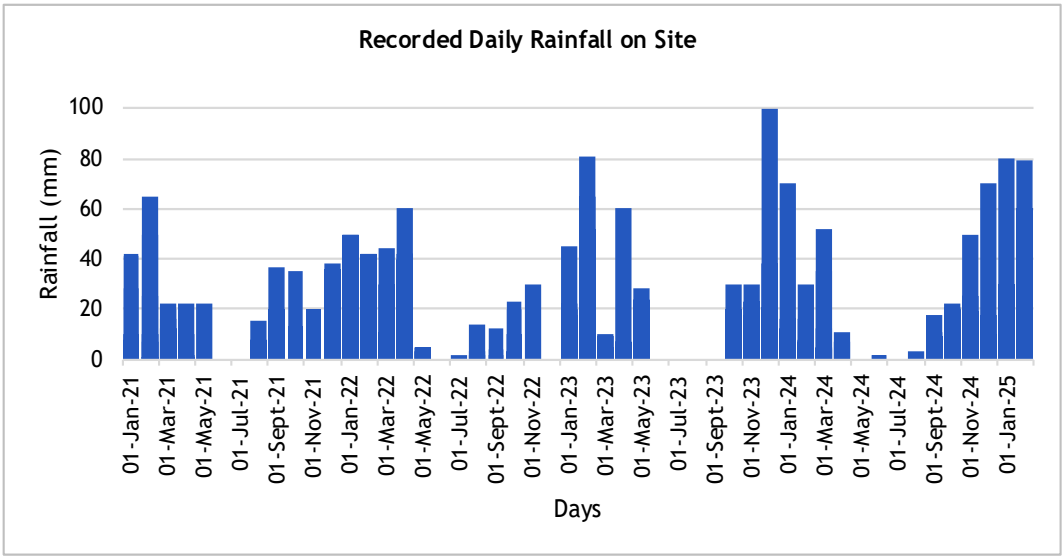


Figure 3-6: Daily rainfall recorded at Thirsti site

3.3.4 Surface water and hydrology

The study area falls within the uplands of the V31F catchment (Figure 3-7). Thirsti is located within the Northern Drakensburg Strategic Water Source Area (SWSA) (Le Maitre *et al.*, 2017). *SWSAs are high yielding arears (MAR ≥135 mm/a) that account for 50% of all annual runoff in South Africa, although they occupy less than 10% of the country's landmass.*

The Northern Drakensburg SWSA spans 10 302 km^2, covering KwaZulu-Natal and parts of Lesotho, which makes it a transboundary SWSA. This SWSA contributes 4.94% [or 2 376 m^3/a per hectare (ha)]) to the national streamflow budget. The viability of this strategic water source area is threatened by land degradation due to overgrazing and invasive alien plants, which point to the need for protecting and restoring headwater catchments.

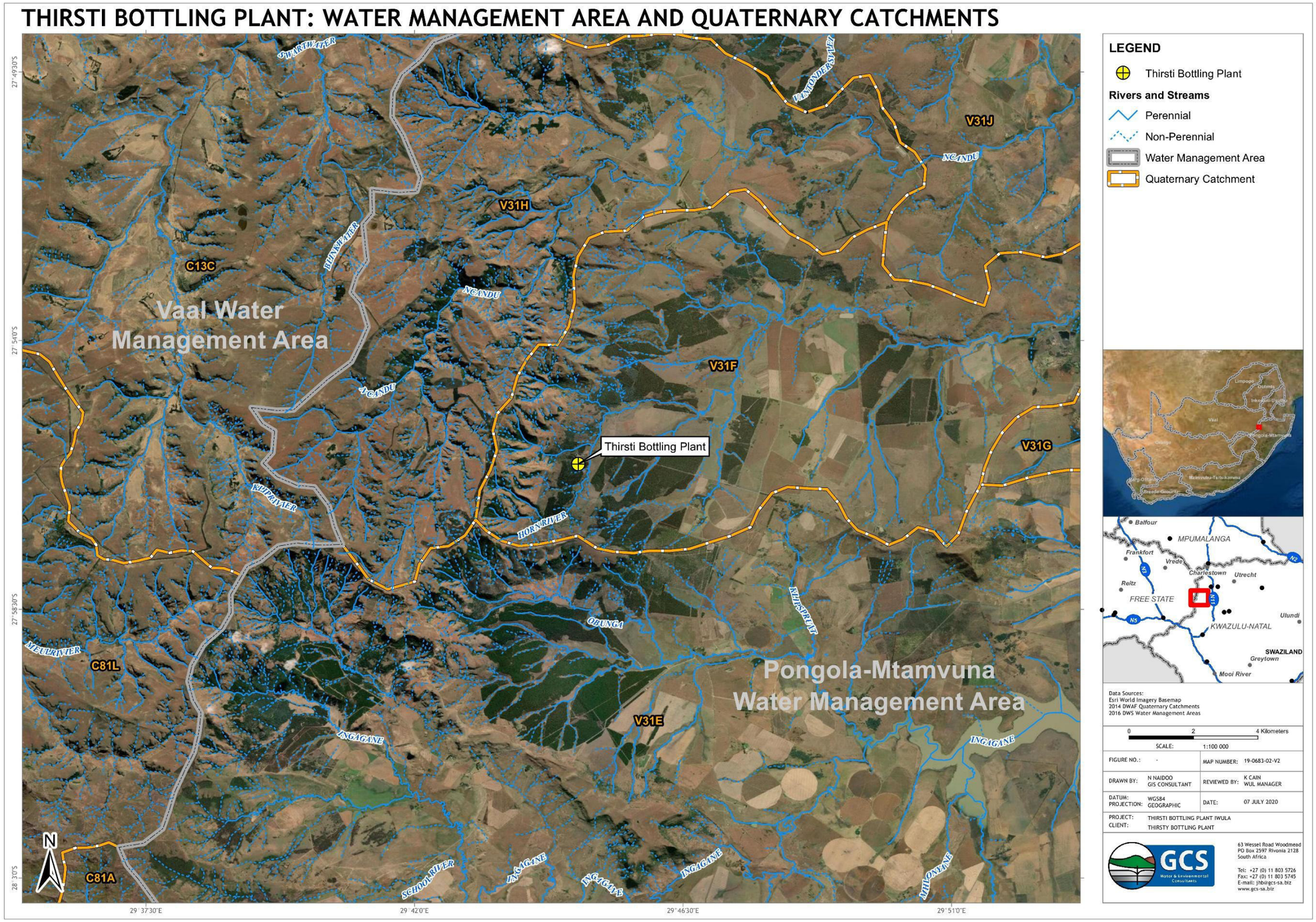
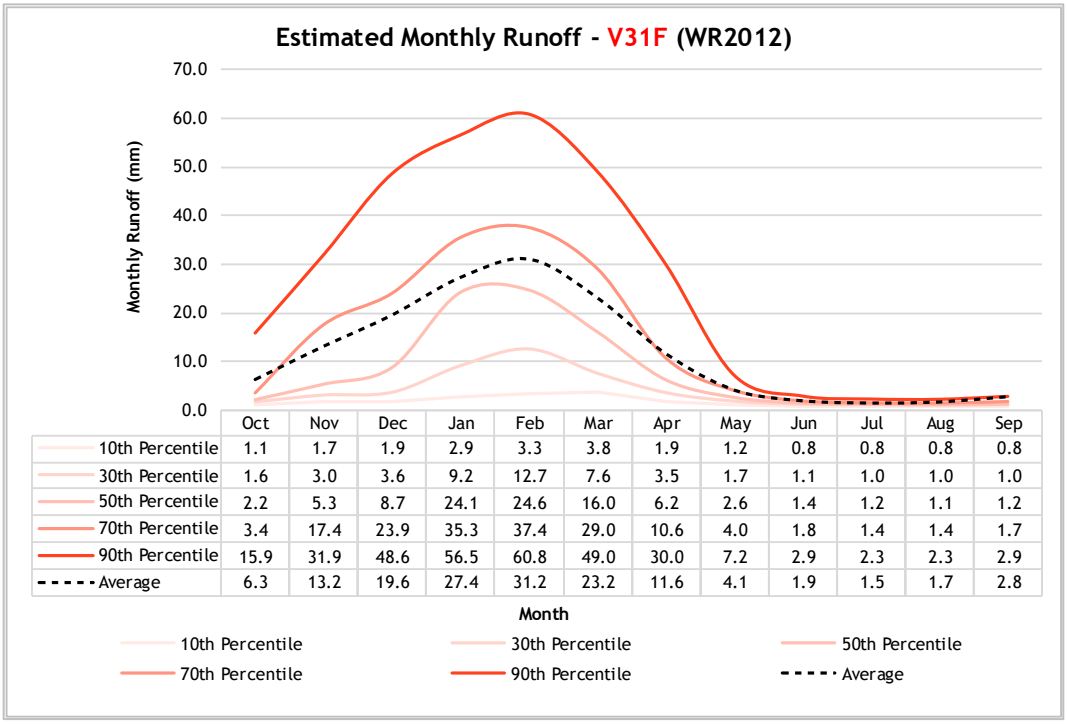


Figure 3-7: **Water Management Area and catchments in which Thirsti is located**

3.3.5 Natural runoff

Natural Runoff from the V31F quaternary catchment is shown in Figure 3-8. Streamflow percentiles (10th, 30th, 50th, 70th, 90th, in mm) are plotted alongside average values. These runoff estimates are outdated as they cover the period 1920 to 2009 and may not capture recent climate change events; however, they are the best available dataset for South Africa (WR2012).



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	1.1	1.7	1.9	2.9	3.3	3.8	1.9	1.2	0.8	0.8	0.8	0.8
30th Percentile	1.6	3.0	3.6	9.2	12.7	7.6	3.5	1.7	1.1	1.0	1.0	1.0
50th Percentile	2.2	5.3	8.7	24.1	24.6	16.0	6.2	2.6	1.4	1.2	1.1	1.2
70th Percentile	3.4	17.4	23.9	35.3	37.4	29.0	10.6	4.0	1.8	1.4	1.4	1.7
90th Percentile	15.9	31.9	48.6	56.5	60.8	49.0	30.0	7.2	2.9	2.3	2.3	2.9
Average	6.3	13.2	19.6	27.4	31.2	23.2	11.6	4.1	1.9	1.5	1.7	2.8

Figure 3-8: Simulated runoff for quaternary V31F for the period 1920 - 2009 (WR2012)

Runoff for the V31F quaternary catchment is estimated at 144.5 mm/a [or 22.49 million cubic metres (Mm^3/a)]. This is equal to approximately 23% of the MAP. Runoff in this area exhibits high seasonality and inter-annual variability, with high summer flows (Figure 3-8), following a similar pattern to the estimated rainfall.

3.4 The class and the resource quality objectives of the water resource

The Horne River lies about 290 m south of the Thirsti Bottling Plant. A present ecological state (PES) assessment for the Horn River could not be found. According to the National Freshwater Ecosystem Priority Areas (NFEPA) river classification (SANBI, 2011), the study area falls within an Upstream Management Area. Upstream Management Areas are sub-quaternary catchments where human activities need to be managed to prevent degradation of downstream river Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas. In addition, no Resource Quality Objectives (RQO) have been determined for the Horn River.

3.5 Local geology and soils

According to the 1:250 000 geological map (2728 Frankfort), Thirsti is underlain by sediments of the Karoo Sequence, notably the olive green and grey mudstone along with subordinate sandstone of the Normandien Formation. These layers overlie the older bluish-grey or dark-grey mudstone and shale of the Volksrust Formation. In the western part of Thirsti, there are younger dolerite intrusions observed as large sheets and elongated dykes; however, these intrusions do not extend into the eastern portion of Thirsti. In the northeastern area, alluvial deposits are present in proximity to the drainage lines. All geological formations on Thirsti are components of the Karoo Supergroup.

Soils in the area are generally red, yellow, or greyish, primarily composed of parent material from the dolerite, sandstone of the Vryheid Formation, and shales of the Volkrust Formation. A sub-dominant soil group are Mispah forms from the Escourt Formation. Soils on the western side of Thirsti are characterised by limited pedological development. The red and yellow soils underlying the Thirsti laydown area and the water resource areas in the east are weakly structured and well-drained. The hydrological soil group (HSG) classification for the project area is B/C (refer to Table 3-3), indicating that the soils in the area have a moderately low to high stormflow potential.

Table 3-3: Characteristics of the four basic SCS hydrological soil groups

Hydrological Soil Group	Characteristics
Soil Group A	*Low stormflow potential*. Infiltration is high and permeability is rapid in this group. Overall drainage is excessive to well-drained (Final infiltration rate ~ 25 mm/h. Permeability rate > 7.6 mm/h).
Soil Group B	*Moderately low stormflow potential*. The soils of this group are characterised by moderate infiltration rates, effective depth and drainage. Permeability is slightly restricted (Final infiltration rate ~ 13 mm/h. Permeability rate 3.8 to 7.6 mm/h).
Soil Group C	*Moderately high stormflow potential*. The rate of infiltration is slow or deteriorates rapidly in this group. Permeability is restricted. Soil depth tends to be shallow (Final infiltration rate ~ 6 mm/h. Permeability rate 1.3 to 3.8 mm/h).
Soil Group D	*High stormflow potential*. Soils in this group are characterised by very low infiltration rates and severely restricted permeability. Very shallow soils and those of high shrink-swell potential are included in this group (Final infiltration rate ~ 3 mm/h. Permeability rate < 1.3 mm/h).
Notes: The typical final infiltration and permeability rates given above both refer to saturated soil; Final infiltration rates refer to soils with a short grass cover; Infiltration rate is controlled by surface conditions whereas permeability rates are controlled by properties of the soil profile.	

3.6 Wetland areas

3.6.1 Wetland study conducted by GroundTruth

As part of this WULA, GroundTruth was also appointed by GCS to identify, delineate and assess freshwater ecosystems found in Normandien Farms (GroundTruth, 2025). This assessment was an update of the 2019 wetland study aimed to support the surface water storage expansion (Wet Earth Eco-Specs, 2019).

Recognising the natural variability of surface water levels, GroundTruth delineated the wetlands within a 500 m buffer of borehole location in Normandien Farms based on topography, vegetation, and soils during a field visit on 28th to 29th May 2025.

Four wetlands were identified and delineated within the 500 m buffer zone, including two valley-bottom wetlands and two seep wetlands. The first is situated to the east of Thirsti with an extent of 54.28 ha, and the second is situated further north with an extent of 12.86 ha. Both valley-bottom wetlands are on-channel and are linked to the Horne River. Both wetlands experience pressure from agricultural activities, including cattle grazing, hay production, irrigation dam, pecan nut plantation, and invasive alien plants.

The seep wetlands have a combined size of 1.05 ha. They border the riparian area and the dam wall. Vegetation cover on these ecosystems is mainly natural grasslands, mistbelt forests, and pine plantations, with different degrees of erosion identified one each wetland.

From the hydrological standpoint, the streamflow regulation, erosion control and flood attenuation importance of the channelled-valley bottom wetlands post-borehole ranges from **very low** to **moderate**. For the seep wetlands the range of importance for the three above-mentioned criteria under the borehole abstraction scenario ranges from **very low** to **moderately low**. From the ecological standpoint, the combined EIS category for the two valley-bottom wetlands for the post-borehole scenario is considered to be moderately important (Category **C)** and marginally important (Category **D)**. Whereas the EIS category for the two seep wetlands is Category **D**. In terms of ecological integrity, the overall PES score of the wetlands for the post-borehole scenario ranges from **Moderately Modified** (Category **C**) to critically modified (Category **F**).

Some of the recommended measures discussed in the wetland assessment (GroundTruth, 2025) include establishing and maintaining an appropriate buffer zone between the septic tank and the wetlands. The recommendation also includes that the buffer zone should be vegetated with native plant species. In the event of a septic tank system failure, the strategic placement of sandbags to divert potential overflow and encourage infiltration into the surrounding soil, to prevent contaminating the nearby water resources is also recommended. The earlier wetland study recognised that the wetland lies in a private land and are surrounded by a water supply dam existing within its delineation. Therefore, it was recommended that further wetland degradation should be avoided.

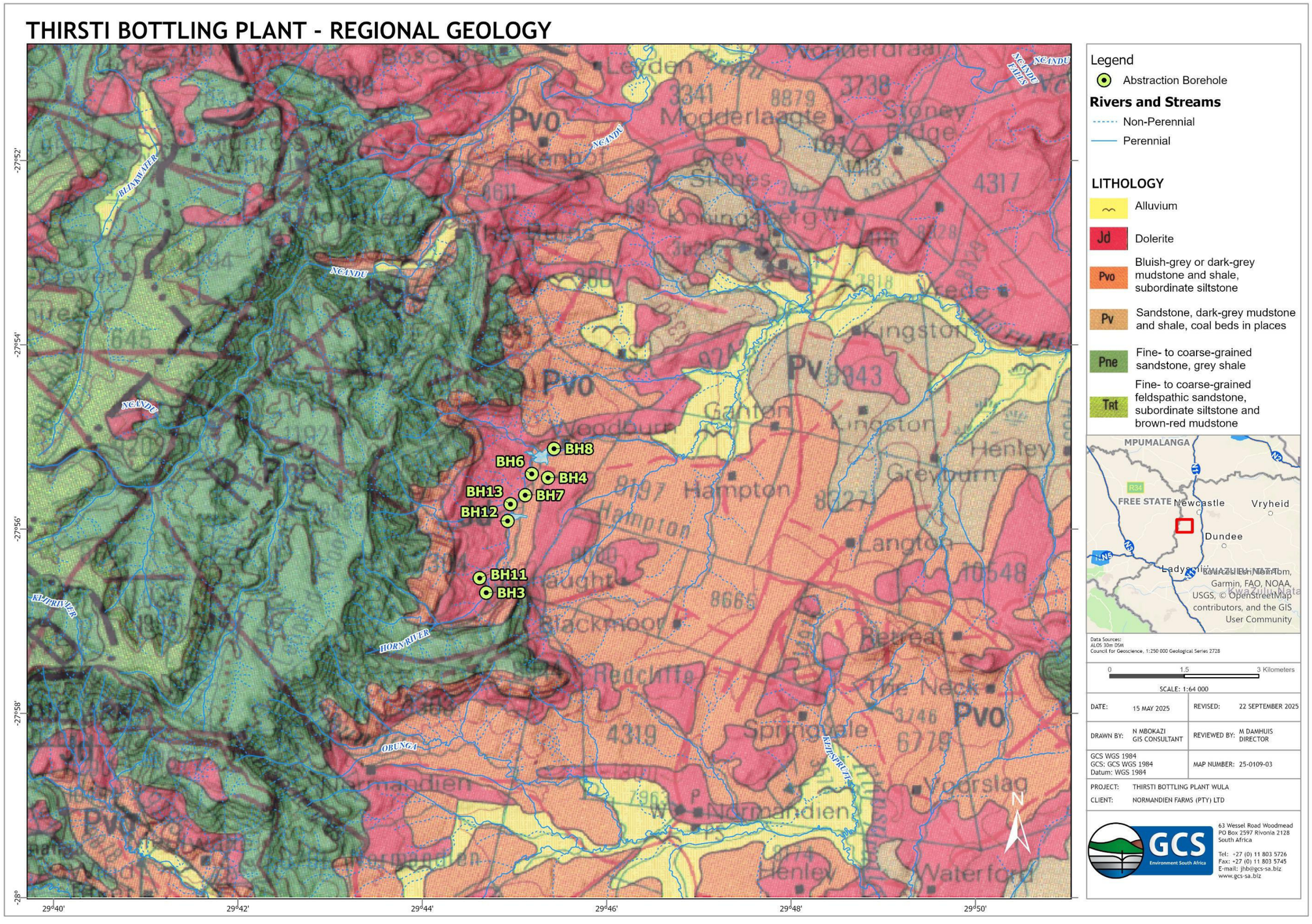


Figure 3-9: Regional geology

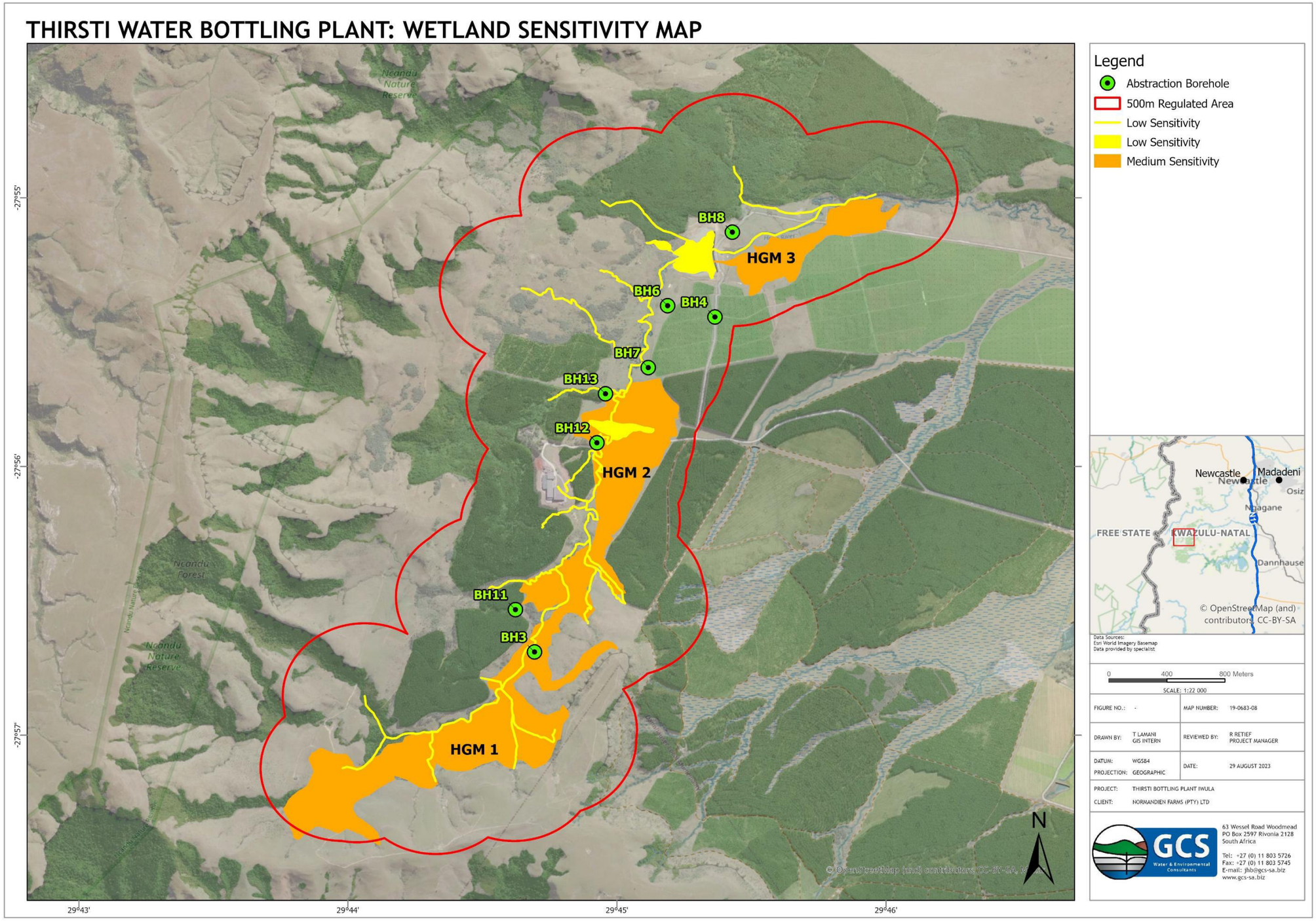


Figure 3-10: Thirsti wetland sensitivity map

3.7 Present ecological state (PES) and ecological importance and sensitivity (EIS)

Table 4-4 provides a summary of the PES and ecological importance and sensitivity (EIS) for the quaternary catchment associated with Thirsti (WRC, 2015)

Table 3-4: Summary of PES and EIS for the quaternary catchment (SANBI, 2011)

Quat	PES	EIS
V31F	Class C: Moderately Modified	Moderate

3.8 Water users within the sub-catchments associated with Thirsti

According to the Water Allocation Registration Management System (WARMS, 2024), there are two (2) active WARMS water uses within a 2.5 km radius and within the sub-catchments. One (1) of the users is a surface water user, and one (1) is a groundwater user. The information is summarised in Table 3-5.

Table 3-5: Summary of WARMS users identified in the study area

ID	Latitude	Longitude	User	Resource Type	Resource Name	Register Status	Lawfulness Finding	Registered Volume (m^3/a)
21019345	-27.94350	29.73475	Company	Borehole	Horn River Catchment	Active	Lawfulness still to be determined	3 600
21019345	-27.93156	29.74983	Company	River/stream	Horn River	Active	Lawful	300 000

The Hydrogeological Investigation (GCS, 2025) has recommended an annual abstraction rate from seven (7) boreholes on-site of 618 579 m^3/a which will be applied to Thirsti hydrological model.

3.9 Overview of the hydrological cycle

Key water cycle processes are shown in (Figure 3-11), representing the balance and movement of water within the natural system. Based on the information attained for this study area (as presented in this section), existing and anticipated water uses, runoff and estimated baseflow to wetland areas, a sub-catchment specific hydrological cycle was developed.

With regards to the hydrological cycle for the sub-catchment, the following is estimated:

- The combined area of all relevant HRUs is 20.35 km^2.
- Average rainfall over the surface of the sub-catchments is in the order of 16.14 Mm^3/a (~52% of the total water budget).
- Average evaporation is in the order of 10.08 Mm^3/a (27.8% of the total water budget).
- Average runoff accounts for a volume in the order of 3.11 Mm^3/a (9.9% of the total water budget).

- The average groundwater contribution to baseflow to rivers/wetlands/streams is in the order of 1.05 Mm^3/a (4.1% of the total water budget).
- The average groundwater recharge is in the order of 0.97 Mm^3/a (3% of the total water budget).
- Surface water stored in the dam amounts to 0.30 Mm^3/yr (0.93% of the total water budget); and
- Existing and planned groundwater use (GCS, 2025) account collectively for 0.62 Mm^3/a (1.93% of the total water budget).

Evapotranspiration naturally accounts for the largest share of natural water losses in the study area, which makes sense due to naturally dense vegetation and higher soil moisture in sub-humid climates. It can be expected that any additional evergreen biomass, bare ground surfaces, and exposed water bodies will result in higher evaporative losses. Therefore, there is a constant need to identify opportunities for sustainable water management practices within the Thirsti site to preserve the resource.

3.9.1 Resource classification and river health objectives

The recommended water resource class for the Ngagane River (draining Quaternaries V31E-K) is Class 3, and the ecological category to be maintained is Class C (GN 46032). The Environmental Flow Requirements from quaternary V31F is 336.65% of MAR or 160.12 m^3/a.

The primary water user within quaternary V31F is afforestation, which is classified as a streamflow-reducing activity.

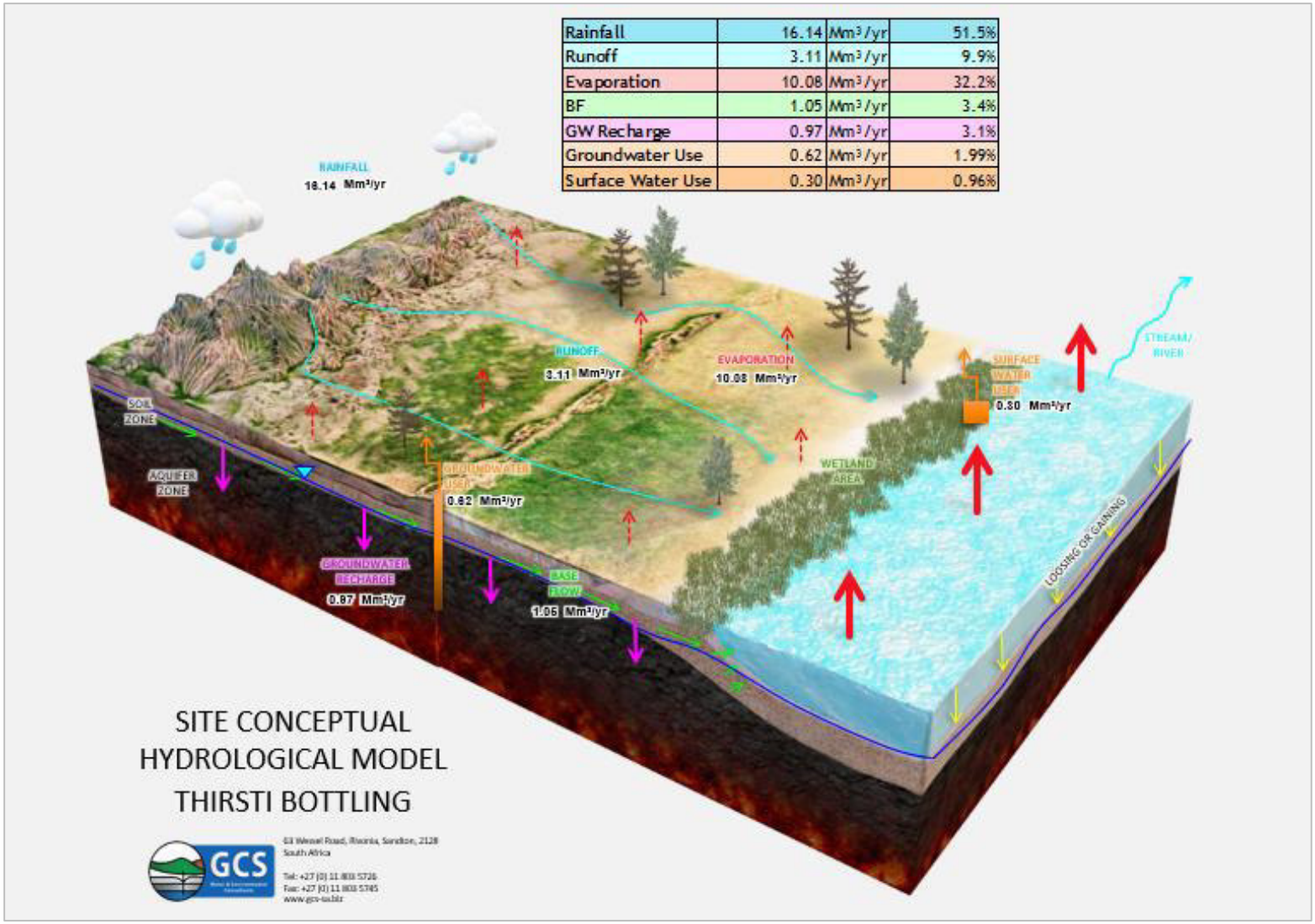


Figure 3-11: Simplified overview of the hydrological cycle for the delineated sub-catchments

4 SITE WALKOVER ASSESSMENT

A site walkover was conducted on 28th to 29th May 2025. Thirsti assessment was intended to gather information that would support the hydrological assessment and water balance analysis for Thirsti. Stormwater diversion channels, roof gutters, pipe outlets, wastewater drains, and a septic tank were among the relevant infrastructure identified during Thirsti visit.

4.1 Site description

Thirsti is surrounded by a pine plantation that belongs to the Client. Within the farm, there is a 5-year-old Peacan Nut plantation and its associated irrigation dam. Livestock keeping is another activity by the Client.

4.1.1 Hydrological features

Thirsti is located adjacent to a seasonally inundated valley-bottom wetland to the east. The wetland vegetation is modified by grazing cattle and the afforestation activities upstream. In particular, selective grazing may suppress some grass species (to be confirmed by the wetland assessment). Meanwhile, the tall trees cast shade over the wetland as early as 13:00 CAT (Photo 6), which may facilitate the succession of shade-tolerant vegetation in the wetland. While this impact is less applicable to Thirsti, cumulative impacts can be expected from grazing, afforestation, groundwater withdrawal, and effluent discharged from the plant. Plant wash-water and laundry water are treated before discharge to the environment, with potential spillages from the septic tank and plastic pollution from the plant being key areas of concern. The likelihood of septic tank spillages has been reduced through proactive management and control measures implemented by Thirsti, including routine inspections and staff education campaigns, as well as proactive maintenance.

The waterways are a mixture of perennial and non-perennial head-cuts, whose flow is clearly influenced by livestock and the surrounding afforestation activities. The riverbanks are either vegetated with grasslands and patches of trees, native trees, or invasive alien trees. The meandering channels typically have debris from dry stocks of the surrounding woody vegetation, rocks, sediment, and cut up to 1.6 m from the surface level in some places. The debris from upstream evidently blocks the culverts surrounding the plant (Photo 3), which may increase the flood impact and alter the natural flow regime.

4.1.2 Infrastructure and pollutant sources

The processing plant covers 6.36 ha or 0.1 km^2, although water is sourced from the larger Normandien Farm. Of the plant extent, 3.9 ha is situated on a raised foundation, approximately 5 m above the natural ground surface, in the eastern direction. The main plant has a surface area of about 1.5 ha and has a roof gutter to catch and direct rainfall to the underground drainage system (Photo 14). The plant sources electricity from roof solar panels and an on-site coal-fired steam plant. Piles of bituminous coal and ash are stocked on-site (no photo was taken).

Other impervious surfaces include the gravel access road (area = 0.55 km * 0.1 km), a concrete ramp to the loading zone (0.22 km * 0.1 km), and a paved car park (0.70 ha). The car parking area is uneven and sinking on the western side of the plant, which can be attributed to the underlying soils.

The plant is surrounded by infiltration and storage tanks on the western side. Spillages from these tanks are channelled to the underground drainage system through two channels along the perimeter of the plant. Stormwater from the plant area is directed to an underground drainage system (Photo 14) discharged to the environment using pipe outlets (Photo 8). In certain areas, these outlets can induce erosion, which requires attention to prevent further damage.

The plant wash-water pond is filled with plastic waste blown away from the plant by the wind (Photo 10), and contains foam (Photo 9), which may be from the laundry waste line.

Blackwater is discharged to a 90 m^3 septic tank. The previous spillages observed at the septic tank were attributed to blockages caused by foreign objects such as gloves and hairnets (Photo 13 in Table 4-1). Since then, Thirsti has upgraded the septic system, including installing a manhole to improve access and maintenance. These improvements, coupled with regular inspections and proactive maintenance schedules, have reduced the likelihood of any impacts occurring at the septic tanks. This report considers these initiatives in its impact assessment.

4.1.3 Stormwater infrastructure inspection

Evidence of debris accumulation around culverts points to flow disruption and a potential increase in overtopping onto the gravel roads (Photo 5). The access roads are not well-drained (no photo was taken), leading to mud accumulation and inaccessibility of some infrastructure (e.g., borehole 3).

The paved driveways around the Thirsti are uneven due to the weight of heavy vehicles and inadequate support from the underlying clay soils (Photo 11). Silt runoff from the driveways also ends up at the stormwater control points, leading to potential stormwater ponds on-site.

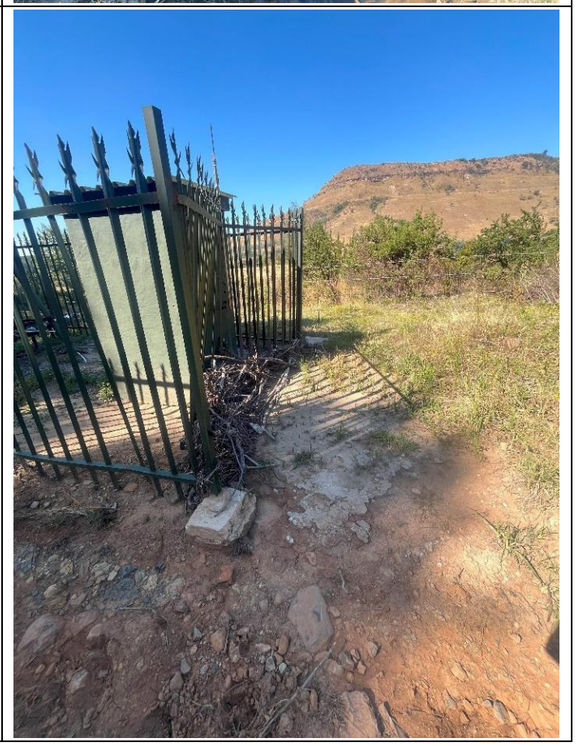
Signs of rill erosion are observed on the plant wash-water outlet line (Photo 10) and runoff control lines (Photo 8), possibly caused by water droplets and flow speeds. Splash erosion around the borehole housing is also evident. This erosion is primarily caused by water droplets from housing roofs, spillways, and leakage from storage tanks.

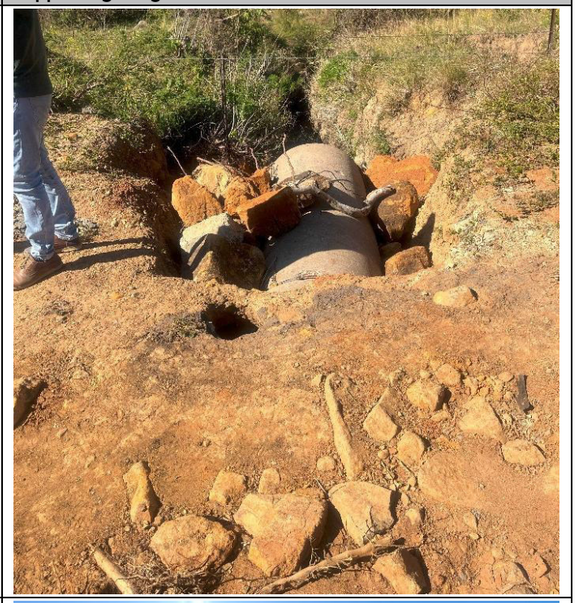
4.2 Observations and photographs

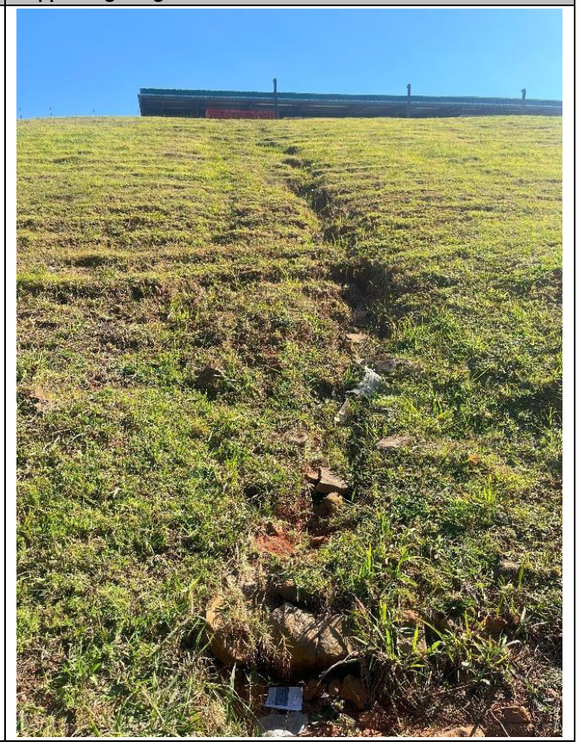
Notable observations made on-site are listed in (Table 4-1).

Table 4-1: Photographs of areas visited within the Normandien Farms

No.	Position	Location Description	Observations	Supporting image
1	27°55'46" S 29°44'46" E	Below the plant entrance	• Ponding due to current flows. • Erosive force controlled by vegetation presence. • Outlet pipe invisible (measurements could not be taken). • Water diverts to roadside.	
2	27°56;11" S 29°44'47" E	Below the plant; road crossing	• Effluent enters the culvert, but no erosion signs at the outlet. • Trash and dislocation of water visible, and odour present.	

No.	Position	Location Description	Observations	Supporting image
3	27°55;55” S 29°44’56” E	Channel towards dam, entrance access road	• Storm water culvert below the dirt road blocked by debris and sediment. • Water quality observations include water discoloration, and a dead dog disposed on a freshwater line.	
4	27°56'31.96" S 29°44'37.36" E	Borehole 11	• Exposed soil around the borehole enclosure shows evidence on ongoing sheet erosion. • Debris at the back of the borehole fencing indicates that recent floods may have reached this area of the bank, possible due to blocked culverts downstream.	

No.	Position	Location Description	Observations	Supporting image
5	27°56'26" S 29°44'40" E	Below borehole 11	• Erosion on the sides of the culvert outlet. • Woody debris blocking the inlet.	
6	27°56'26" S 29°44'40"E	Water course below borehole 11	• Flood line visible on the bank (temporary wetland zone). • By 1pm, the plain is shaded by the adjacent pine plantation.	
7	27°56'10" S 29°44'47 " E	Watercourse behind the plant	• Storm water diversion culvert placed adjacent to a pollutant outlet. • Faecal contamination could potentially have come from the septic tank area and discharged into a watercourse. • There is visible debris and litter either blown from the waste area or transported from the plant facility.	

No.	Position	Location Description	Observations	Supporting image
8	27°56'6.8" S 29°44'49" E	Between the plant and plantation (SW)	• Runoff control outlets from elevated plant to the road show early signs of incision. • Roaming cattle grazes on the greener grass around the channels. • Vegetation declines on footpath areas parallel to the plant (from main gate to the rear side) indicate early signs of erosion. • Rock presence within-channels may slow down water pressure, but not enough to offset erosive pressure of flowing water when active.	

No.	Position	Location Description	Observations	Supporting image
9	27°56'0.4" S 29°44'47" E	Below the new loading area	• Wastewater outlet to the environment has caused a hole due to ongoing waterflow and unmitigated erosive force. • Although treated, detergent foam is visible at the outlet.	
10	27°55'60" S 29°44'47 "E	Pond	• Gully presence towards the wastewater sink is evidence of long-term and ongoing erosion from the plant. • Plastic presence at the sink indicates that waste from the plant is carried by winds and deposited elsewhere.	

No.	Position	Location Description	Observations	Supporting image
11	27°56'3.1" S 29°44'43" E	Inner and outer perimeter of the plant	• Driveway behind the plant showing signs of unstable soils.	
12	27°56'3.1" S 29°44'43" E	Outer perimeter of the plant	• Stationery water on the storm water drain, and presence of silt and sediment from the sinking driveway.	

No.	Position	Location Description	Observations	Supporting image
13	27°56'2.7" S 29°44'49" E	Septic tank	• Presence of surface water, tissues, and faecal content on the surface around the septic tank indicates signs of blockage, possibly by foreign objects from the ablution facilities. • Recent upgrades to the septic tank system have subsequently resolved these issues.	
14	27°56'3.9" S 29°44'45" E	Ground gutters surrounding the perimeter of the main plant	• Rainwater captured by the root gutters is directed to the underground drains via ground gutters.	

5 FLOOD LINE ASSESSMENT

Informed by the objective of identifying possible exclusion zones, the 1:20, 1:50, and 1:100 peak flow return periods were updated for the project area (Table 5-1). This undertaking was followed by a static flood line modelling. The flood line assessment aims to provide a worst-case inundation scenario for evaluating potential flooding impacts. Refer to **Appendix A** for the estimation process.

The design rainfall data (Smithers and Schulze, 2002) used to estimate flood impacts is provided in Table 5-1. These estimates show the worst-case scenario, or the upper limit "U". For the target return periods, flash floods (peak flows below 6 hours) can be expected when the daily rainfall magnitude reaches 129 mm, 152 mm and 171 mm. These are the most dangerous floods, and they can be attributed to the soil's inability to absorb intense rainfall within a short space of time.

Table 5-1: Summary of design rainfall data used for peak flow estimation cubic meters per second (m^3/s)

Duration	Return Period (years)						
	2	5	10	20	50	100	200
5 min	19.8	26	30.4	34.9	41.2	46.3	51.5
10 min	24.1	31.7	37.2	42.6	50.3	56.6	63
15 min	27.1	35.7	41.8	47.9	56.5	63.6	70.8
30 min	34.5	45.4	53.1	61	71.9	80.9	90
45 min	39.7	52.2	61.2	70.2	82.8	93.1	103.6
1 hr	43.9	57.7	67.6	77.5	91.5	102.9	114.5
1.5 hr	50.5	66.4	77.8	89.2	105.3	118.4	131.8
2 hr	55.8	73.4	85.9	98.6	116.3	130.8	145.6
4 hr	66.2	87	101.9	116.9	137.9	155.1	172.7
6 hr	73.1	96.2	112.6	129.2	152.4	171.4	190.8
8 hr	78.5	103.2	120.8	138.6	163.5	183.9	204.7
10 hr	82.9	109	127.7	146.5	172.8	194.3	216.3
12 hr	86.7	114	133.5	153.2	180.7	203.2	226.2
16 hr	93	122.4	143.3	164.4	193.9	218.1	242.8
20 hr	98.3	129.3	151.4	173.7	204.9	230.4	256.5
24 hr	102.8	135.2	158.3	181.6	214.2	241	268.2
1 day	87.2	114.7	134.3	154.1	181.7	204.4	227.5
2 days	104.2	137	160.5	184.1	217.2	244.2	271.9
3 days	115.6	152.1	178.1	204.3	241	271.1	301.7
4 days	128.1	168.5	197.3	226.4	267.1	300.4	334.3
5 days	138.8	182.5	213.7	245.1	289.2	325.2	362
6 days	148.1	194.8	228	261.6	308.6	347.1	386.3
7 days	156.4	205.8	240.9	276.4	326	366.7	408.2

5.1 Calculated flood peak flows

A combination of the Rational Method (RM3), SDF, and MIPI methods (**Appendix A**) was used to determine the flood peak flows for the perennial and non-perennial watercourses within the delineated HRUs. Time concentrations were calculated based on the HRU size and physical parameters.

5.1.1 Estimated flood return periods

Table 5-2 shows a summary of the calculated flood peak flows. The MIPI and SDF methods produced slightly higher flood peaks than the Rational Method. To balance the strengths and weaknesses of the various methods, an aggregate estimate (geometric mean) of all three will be used and applied to the HEC-RAS model.

Table 5-2: Summary of design peak flows for the delineated hydrological response units in (m^3/s)

Catchments		HRU01	HRU02	HRU03	HRU04	HRU05
Method	Return period	Peak flows (m^3/s)				
Rational Method (RM3)	1:20-year	6	7	8	3	4
	1:50-year	9	11	11	5	6
	1:100-year	13	14	15	6	8
SDF	1:20-year	13	30	33	13	16
	1:50-year	22	43	48	19	23
	1:100-year	32	55	61	24	29
MIPI	1:20-year	35	46	53	24	32
	1:50-year	46	60	69	31	42
	1:100-year	54	70	81	36	49
Cumulative (Geomean)	**1:20-year**	**14**	**21**	**24**	**69**	**82**
	1:50-year	**21**	**30**	**33**	**99**	**117**
	1:100-year	**28**	**38**	**42**	**126**	**148**

5.2 Flood line modelling process

5.2.1 Software

HEC-RAS 6.4.1 was used to flood the elevation profile for the 1:20, 1:50 and 1:100-year flood events. HEC-RAS is a hydraulic programme designed to perform one-dimensional hydraulic calculations for a range of applications, from a single watercourse to a full network of natural or constructed channels. The software is used worldwide and has consequently been thoroughly tested through numerous case studies.

5.2.2 Topography profile data

A triangulated irregular network (TIN) from the 30 m DTM forms the foundation for the HEC-RAS model and was used to extract elevation data for the river profile together with the river cross-sections. Furthermore, the TIN was used to determine placement positions for the cross-sections along with the river profile, such that the watercourse can be modelled to the resolution of the provided topographical data. The positions of the river sections were further refined, by evaluating Google Earth Imagery and its correlation to the DTM elevations (i.e., does the actual position of a river/stream correlate to the sub-catchment drainage line generated).

5.2.3 Manning's roughness coefficients

Manning's roughness factor (n) is used to describe the channel and adjacent floodplains' resistance to flow. A Manning's factor of 0.04 best represents the frictional characteristics of the channel (river) and ranges from 0.03 to 0.08 for the floodplain areas.

5.2.4 Inflow and boundary conditions

Based on the HRUs and the confirmed drainage lines/streams in the project area, one (1) HEC-RAS river was defined for each HRU (representing the non-perennial stream), consisting of both critical depth (upstream) and normal depth slope boundary conditions. The normal depth slope was determined based on the ALOS DTM slope rise for the given sub-catchment drainage line.

5.2.5 Hydraulic structures

Hydraulic structures were not incorporated into the HEC-RAS model. Modelling these hydraulic structures would have been hampered by the lack of good resolution topographical data (better than 30 m ALOS data), as such, including these structures would have been ineffective in the hydraulics of the streams.

5.2.6 Model assumptions

In line with the development of the flood lines, the following assumptions were made:

- The topographic data available for the study area is of sufficient accuracy and coverage to enable hydraulic modelling at a suitable level of detail.
- The Manning's 'n' values used are considered suitable for use in the flooding events modelled, representing all the channels and floodplains.
- No abstractions or discharges into the streams/rivers were considered during the modelling.
- *Hydraulic structures were not entered into the model due to the resolution of available topography data.*

- Steady-state hydraulic modelling was undertaken, which assumes the flow is continuous at the maximum peak rate; and
- A mixed flow regime that is tailored to both subcritical and supercritical flows was selected for running the steady-state model.

5.3 Flood line delineation and possible impacts

Estimated flood lines for the 500 m regulated zone around Thirsti Bottling at Normandien Farms are shown in Figure 5-1. From the flood line study, the following observations can be made:

- The water bottling facility is situated outside of the modelled flood lines.
- The existing boreholes (BH-6, 7, 8, 11, 13, and 14) are likely situated within the flood lines; and
- The dirt access road from the main road to the plant crosses over a flood line and could potentially become inundated.

The presence of borehole infrastructure inside the 1:100-year flood line poses damage risk to the infrastructure and may alter the natural flood regime. During flood events, piping infrastructure above-ground leading out of the boreholes could be struck and damaged or severed by debris in the flood waters. The pipe damage or pumps malfunction could result in operational disruption. The surface around the casing could erode (depending on the construction and whether there is a concrete pad around the boreholes). The casing itself could be scoured or eroded (again, depending on the boreholes' construction).

5.3.1 Limitations

The identified flood impacts may differ from those presented here, and more accurate estimates could be better articulated by a dynamic flood model and the availability of finer-resolution elevation data. Some of the key limitations related to the previous conclusion are stated below.

- The flood study conducted here is a deterministic analysis, with rainfall as a key input. A steady-state model produces worst-case conditions but overlooks the changes in antecedent soil moisture and storage within the system.
- The design rainfall itself is based on regionalised estimates from surrounding rainfall stations. As mentioned in Section 3.3.3, the regional rainfall underestimates wet season magnitudes, implying that the flow magnitudes from the flood return periods could be more than those in Section 5.1.1.

- Topography is one of the primary factors of runoff. For flood line modelling, this is represented by the elevation model, and its reliability is limited by the quality of the available DTM. The 30 m resolution dataset used here inevitably produces irregular flood lines that require manual adjustment to follow the natural drainage lines. This was done to improve the flood line display.
- Although hydraulic structures are present on-site, these were not included in the flood line assessment, owing to the coarse resolution elevation data used.

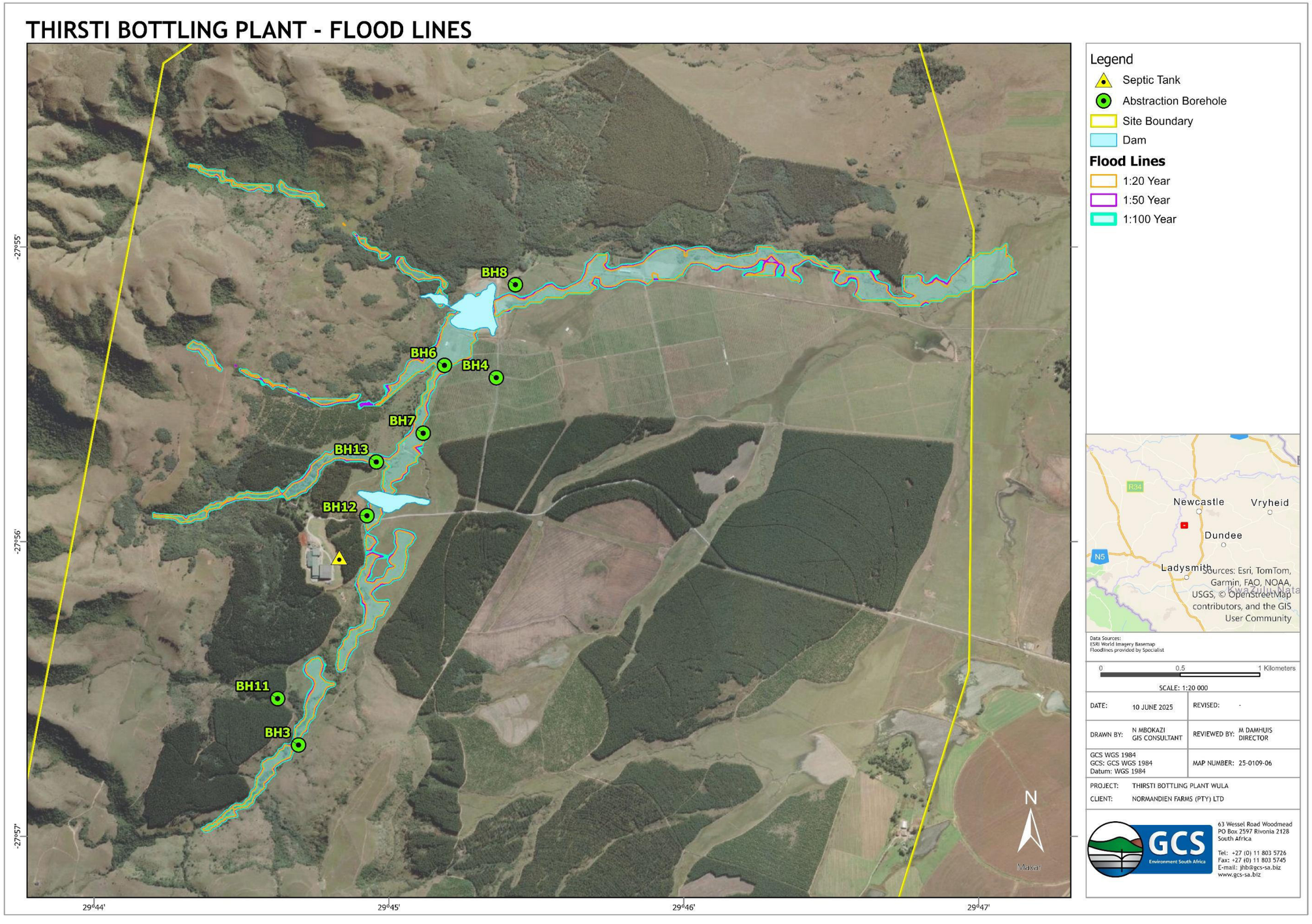


Figure 5-1: Simulated 1:20, 1:50 and 1:100-year flood inundation zones for the Buffelshoek 15469 and Woodburn 15470 properties

6 STORMWATER MANAGEMENT PLAN

There is a need for drainage systems due to the interaction between human activities and the natural water cycle. Drainage systems encompass both wastewater and stormwater. In accordance with Section 19 of the NWA and the Best Practice guidelines G1 (DWAF, 2006a), a SWMP was developed for Thirsti based on the available hydrological data and understanding of the Thirsti layout. Important to note, at the time of this undertaking, the client could not provide detailed layout plans. This SWMP is a high-level preliminary plan to inform the final layout. This SWMP aims to assess the current stormwater management infrastructure and propose supplementary systems should there be an identified requirement and is limited to the main Thirsti Bottling Plant.

6.1 Aim of a stormwater management plan

According to Best Practice Guideline – G1: Stormwater Management (2006) (DWAF, 2006a) the SWMP for Thirsti will seek to achieve specific objectives based on a philosophy of protecting the environment from impacts. This is of utmost importance as the sedimentation and erosion of drainage streams should be minimised. This can be achieved using the following:

- Clean and dirty water should be separated, and it should be ensured that all stormwater structures are designed to keep dirty and clean water separate and can accommodate a defined precipitation event.
- The clean water catchment area should be maximised, and clean water should be routed to a natural watercourse with minimal damage to that watercourse in terms of quantity and frequency of discharge.
- Dirty areas should be minimised, and runoff from these areas contained and treated for reuse. Natural watercourses and the environment should be protected from contamination by dirty areas by ensuring that the dirty water cannot enter the clean water system by spillage or seepage.

The SWMP further aims to:

- Illustrate likely stormwater sub-catchments (HRUs) and preferential overland runoff flow paths.
- Determine likely dirty and clean water HRUs.
- Provide water containment and diversion systems to prevent the mixing of clean and dirty water and prevent soil erosion and flooding.
- Attenuate stormwater back to the natural environment; and
- Maintain the downstream water quantity and quality requirements.

6.2 Existing stormwater infrastructure and measures

Based on Thirsti visit observations, Sustainable Urban Drainage Systems (SUDS) have been considered for stormwater management at the Thirsti Bottling Plant. To mimic natural systems, the SUDS principles aim to use cost-effective solutions with low environmental impact to manage stormwater runoff. This involves collecting, storing, and cleaning the water before gradually releasing it back into the environment, such as into existing watercourses.

- The current stormwater system on-site manages runoff from various sources, like pine plantations upstream, through a surface water diversion berm.
- Rainwater from the Thirsti laydown area, which sits on an elevated bed, plant wash-water, laundry water, and spills from storage tanks are routed through an underground drainage system to a pond located at the lowest elevation point just outside Thirsti.
- Rainwaters captured by the walkways, driveways, the parking lot and the smaller buildings flow overland.
- The sewer system discharges to a septic tank (90 m^3), urban areas, and plant wash-water.

6.3 Input, assumptions and limitations

6.3.1 Input

The following data and resources were used in the preparation of this stormwater management assessment:

- Topographic Data:
    - As previously explained, 5m contour data and other higher-resolution data were not available for the study area; therefore, the 30 m DTM was employed as the foundation upon which stormwater catchments were delineated.
- Land Use and Land Cover:
    - Site observations and ortho imagery were used to derive Manning's Coefficients based on the observed land cover and land use.
- Rainfall Depths:
    - Design storms were derived using the Design Rainfall Estimation Software (Smithers & Schulze, 2002).
- Hydrologic and Hydraulic Modelling:
    - The Rational Method was used to calculate runoff volumes for the delineated stormwater sub-catchments.

- Site Drainage Infrastructure:
    - Existing infrastructure data are based on-site observations and infrastructure observed on the ortho imagery.

6.3.2 Assumptions

- Catchment boundaries and sub-catchment delineations were generated using available topographic data and assumed to be accurate based on the current understanding of water flow on-site.
    - Catchments were delineated using Global Mapper (Blue Marble Geographics, 2021) and the watershed function.
    - Catchments were then further delineated and refined by hand where necessary.
- Rainfall is assumed to be evenly distributed over the catchments for each design event.
    - The Design Rainfall Estimation Software was used to gain representative rainfall depth values at Thirsti.
- No significant changes in upstream or downstream conditions are expected during the design storm events considered.
- All stormwater control measures (SCMs) and detention features are assumed to function as designed under normal operating conditions.

6.3.3 Limitations

- The accuracy of the model is dependent on the quality and resolution of the input data. Any errors in input data may affect the reliability of the results.
- Runoff rates are estimated based on field conditions, vegetation, or land use.
- This report does not account for the maintenance performance of stormwater infrastructure over time, which may influence long-term functionality.
- The SWMP does not incorporate climate change projections or changes in rainfall intensity-frequency-duration (IFD) relationships over time.
- Recommendations and conclusions are based on current best practices and standards; regulatory or policy changes after the report date may necessitate updates.

6.4 Rational method runoff estimation and design rainfall depths

The Rational Method is a widely used hydrological technique for estimating peak runoff rates from small catchments, particularly in urban and semi-urban environments. The method is expressed by the formula:

$$Q = C \times I \times A$$

Where:

Q is the peak runoff (m^3/s),

C is the runoff coefficient (dimensionless), representing the proportion of rainfall that becomes runoff,

I is the rainfall intensity (mm/hr), and

A is the catchment area (ha or km^2).

This method assumes that peak runoff occurs when the entire catchment contributes simultaneously, typically when the rainfall duration equals the time of concentration. While the Rational Method provides a simple and practical tool for estimating design flows, its validity is generally limited to small catchments (typically less than 200 hectares) where stormwater infrastructure is designed for short-duration, high-intensity events. It is less accurate in large or highly complex catchments where flow routing, storage, and spatial rainfall variability become significant.

To derive the rainfall intensity (I), 24-hour rainfall depths from design storm events (e.g., 1:20, 1:50 and 1:100-year recurrence intervals) are often used in conjunction with intensity-duration-frequency curves. These 24-hour depths offer a consistent and conservative basis for estimating potential peak runoff, especially in ungauged or poorly monitored areas, and align with regulatory and engineering design standards.

The following table summarises the 24-hour design rainfall depths extracted from the Design Rainfall Estimation Software and utilised for Thirsti in the runoff calculation process using the Rational Method.

Table 6-1: Summary of design rainfall depths (Smithers and Schulze, 2002)

Area	24hr rainfall depths (mm)		
	1:20	1:50	1:100
Thirsti Bottling Plant	181.6	214.2	241.0

6.5 Stormwater characterisation

Thirsti is situated in the upper reaches of the Horn River in a valley on the western banks of a tributary of the Horn River. The valley walls are situated west of Thirsti, sloping downwards towards the tributary in an eastern direction. The upstream runoff will therefore be in a general west to east direction across Thirsti.

6.5.1 Stormwater catchment delineation

Stormwater catchments for Thirsti are indicated in Figure 6-5. Fifteen (15) stormwater sub-catchments characterise the runoff generated upstream from and on Thirsti. The clean upstream catchments (C1-2) comprise plantations. The on-site dirty water catchments are mostly built-up with pavements, the plant and roads. Vegetation and lawns are maintained on and around Thirsti.

6.5.2 Flow directions in stormwater catchments

- **C1-2**
  - Upstream catchments from Thirsti, mostly vegetated with plantations.
  - C1 and C2 will see stormwater flowing in an eastern direction towards Thirsti.
  - Water from these catchments is captured by a **diversion channel** that runs for several metres in a northern direction.
- **C3-4**
  - This catchment characterises runoff from lawns situated between the plantation catchments and Thirsti.
  - Runoff generated in this catchment will flow eastwards towards an existing **stormwater channel** located between the lawns and the plant, which flows south towards the underground drainage system.
- **C8**
  - This catchment characterises runoff generated north of the plant and the access gate.
  - Runoff generated in this catchment will flow northeast to an existing **stormwater/wash-water infiltration pond** located between the plant and the downstream plantations.
- **C5-7 and C9-12**
  - These catchments characterise the runoff generated on the plant footprint.
  - C6 represents runoff generated on the roof of the plant.
  - C5, C7, C9 and C11 characterise runoff generated around Thirsti on the pavements, roads and parking lots.
  - C10 and C12 characterise runoff that will be generated on the lawns either side of the road in C11.
- **C13-15**
  - These catchments characterise runoff generated on the side slopes of the raised platform on which the facility is located

6.6 Stormwater flows and volumes

Peak flows for each catchment were determined using the Rational Method and are summarised in Table 6-2.

Table 6-2: Stormwater catchment peak flows

Name	Area (km^2)	Manning's Coefficient	24-hour Rainfall Depth (mm)			Peak Runoff (m^3/s)		
			1:20	1:50	1:100	Q_{20}	Q_{50}	Q_{100}
C1	0.112	0.12	181.6	214.2	241	**0.678**	**0.800**	**0.900**
C2	0.015	0.12	181.6	214.2	241	**0.092**	**0.109**	**0.122**
C3	0.003	0.035	181.6	214.2	241	**0.005**	**0.006**	**0.007**
C4	0.002	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C5	0.004	0.025	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C6	0.015	0.024	181.6	214.2	241	**0.018**	**0.022**	**0.025**
C7	0.003	0.025	181.6	214.2	241	**0.004**	**0.005**	**0.005**
C8	0.009	0.025	181.6	214.2	241	**0.011**	**0.013**	**0.014**
C9	0.003	0.025	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C10	0.002	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C11	0.002	0.025	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C12	0.001	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C13	0.017	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C14	0.005	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**
C15	0.002	0.035	181.6	214.2	241	**0.004**	**0.005**	**0.006**

6.7 Stormwater systems analysis and placement recommendations

The following is recommended in addition to the existing stormwater measures (Figure 6-6):

- The current above-ground stormwater channels have been hydraulically analysed, and it is concluded that the systems are appropriately sized to contain a 1:100-year storm event based on the design rainfall depths identified in this section. The stormwater surface within these channels can be viewed in **Appendix B**.
- Two additional downstream channels are recommended as indicated in Figure 6-6 and their dimensions are illustrated in **Appendix B**.
    - The first is a **concrete channel** downstream of the road section east of the plant. The channel must be flush with the road and enter the underground system via a drain in the same manner as the concrete channel west of the plant. This channel will have runoff routed to the infiltration pond.
    - The second is an **earth trench** north of Thirsti and east of the access road near the entrance to the plant to capture runoff from C8. This channel will capture sediment-laden runoff and route it to the infiltration pond.
- Sediment trap or capture measures are recommended within all channels on-site, as sediment was noted during Thirsti visit.

- Check dam sediment traps in the form of sandbags or rock strips that can be placed inside the channels (Figure 6-1). This will lower the velocity of runoff and filter out sediment to a certain degree.



Figure 6-1: In-channel sandbag and rocky check dams

- For the stormwater and wash-water outlets, the following mitigation measures are recommended to curb erosion and remove unwanted matter from the outflows:
  - Litter such as plastic bottle caps, hair nets, etc, were noted at the discharge points. This should be prevented. Dewatering socks can be placed around the outlet of the pipes to capture litter, debris and sediment that may be in the runoff and wash-water (Figure 6-2). This will also aid in dispersing the water exiting the outlet pipes to reduce erosion on the slopes of the platform.
  - Stiff grass barriers (Figure 6-3) can be placed upstream of the infiltration pond near the inlet to filter the incoming water.
  - For the erosion channels forming downstream of the outlet pipes, it is recommended to rehabilitate these artificial drainage lines with rocky reinforcement. This will include the placement of rocks along the erosion channel called riprap (Figure 6-4) to protect against further degradation. The outlets of these artificial drainage lines created by the outlet pipes should end in a small reno mattress to disperse the water and encourage overland flow and velocity reduction.



Figure 6-2: Dewatering sock on outlet pipes

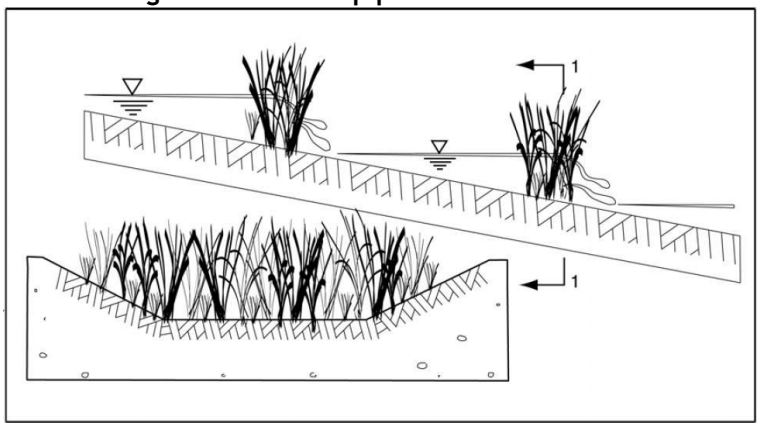


Figure 6-3: Typical placement of stiff grass barriers within a drainage channel



Figure 6-4: Riprap at downstream end of a pipe (left) and reno mattresses (right)

- It is imperative to conduct regular maintenance and inspections on all stormwater infrastructure to ensure that debris does not cause obstructions or contribute to material being transported by runoff. The plant and its associated paved and unpaved surfaces should be kept free of litter and other unwanted materials that could enter the stormwater system and impact the surrounding environment.

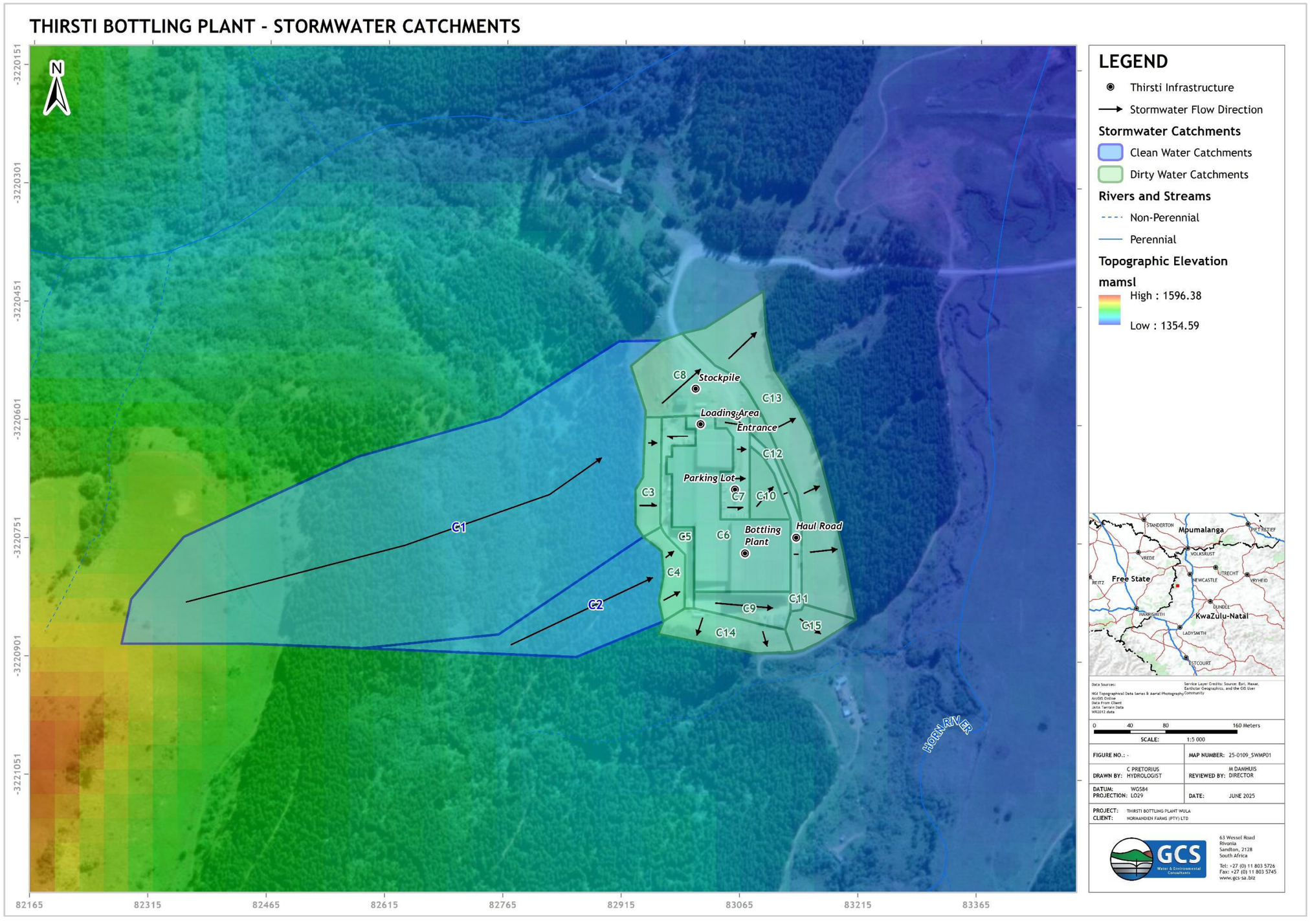


Figure 6-5: Delineated stormwater sub-catchments for the Thirsti Bottling Plant

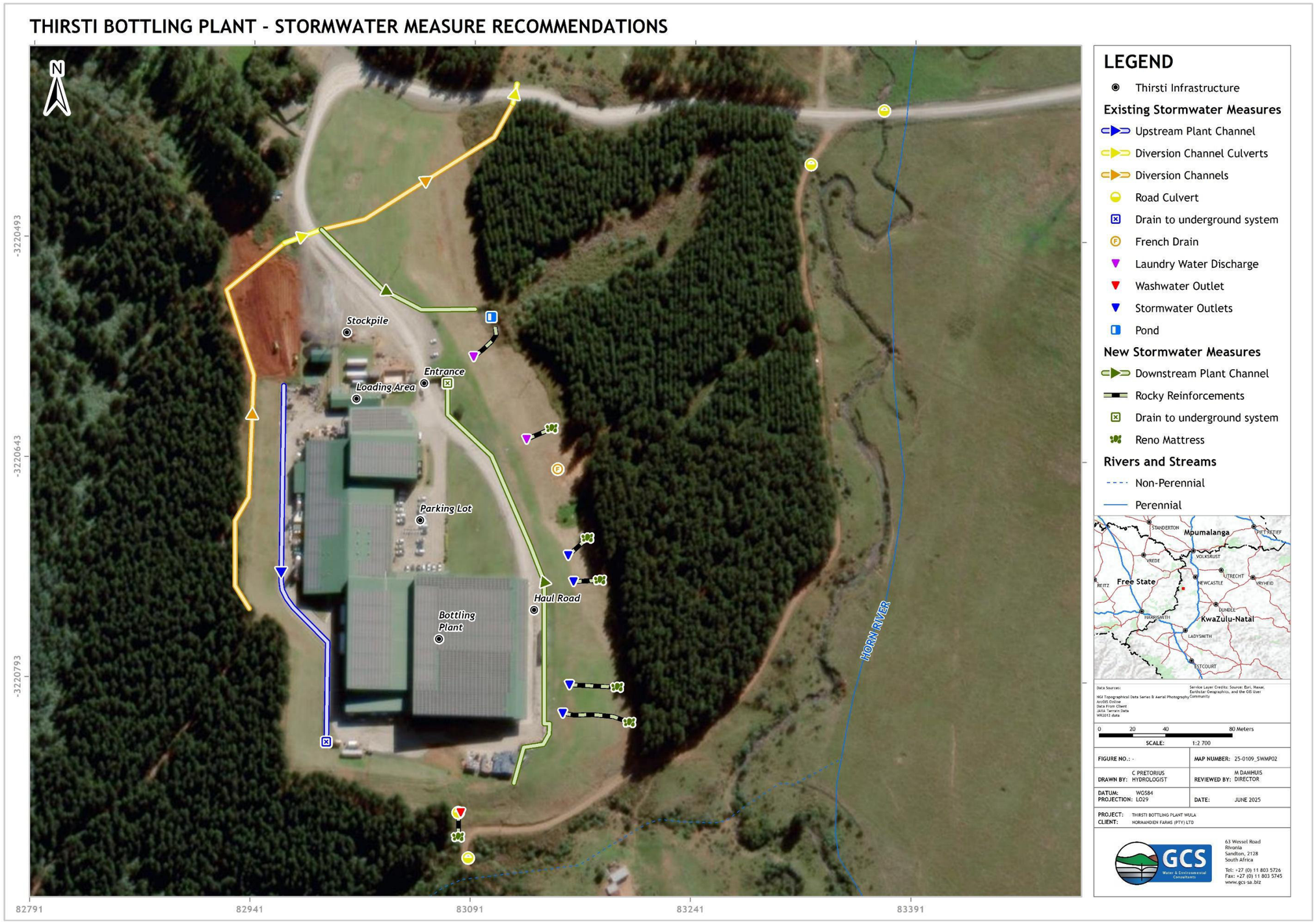


Figure 6-6: Existing and proposed stormwater infrastructure for the Thirsti Bottling Plant

7 WATER BALANCE

A water balance is a systematic procedure of accounting for delta storage of water on a facility by accounting for water inflows and outflows. A graphical or tabular form is typically used. While DWS prefers to see the tabular form, the graphical form is also ideal. Using the graphical form, it is possible to visualise all water sources and potential losses on the premises in a simple schematic (i.e., the water reticulation system), offering the reader a comprehensive understanding of the process. The water balance ensures a consistent sense of how water is used for current and future activities, for both the client and the DWS.

Where on-site losses are applicable, the water balance should detail any re-use of these losses. In cases where there is no re-use and the effluent wastewater, treated wastewater, or brine is discharged or disposed of (as is the case with Thirsti), this should align with water uses specified in Section 21 of the NWA.

7.1 Water balance boundaries

The water balance is limited to the Thirsti Bottling footprint area of the Buffelshoek Farm, and it uses a combination of flow data and calculated estimates.

7.2 Model assumptions and limitations

Data for the water balance was provided by the client, but domestic uses were estimated based on parameters from Thirsti assessment.

Waste ratios are relatively high (37% loss per annum) due to the requirements for calcium descaling in the syrup and flavour changes during production (Plant 2). The flavour changes are done for three batches a day, and the machines are rinsed before each batch. For still water production, the machine is rinsed once a week. After treatment, wastewater from production and the laundry room is discharged into a sump. This discharge area also acts as a groundwater recharge point.

The following assumptions were made regarding domestic use:

- There are 276 workers on-site each day, and assuming a rural allocation of 25L per person per day, domestic use works out to 196.65 m^3/m.
    - Each employee is estimated to flush 11 litres, 4 times a day.
- Lab coats for each employee are washed on-site, and there is one GIRBAU RMG 613 washer on-site. Seven loads are made each day for seven days a week. Assuming 70L of water consumption per cycle, the monthly consumption for laundry would be 7.98 m^3/m.
    - 44% of laundry water is released as waste after each cycle.

- Based on the annual waste ratios for 2024, 37% of the bottling water is treated wash-water and released to the environment.
- Initial storage in tanks was assumed to be zero.

The following limitations are noted:

- Surface water and rainwater are not used, and thus not considered in the model.
- Plant-specific requirements were not given, and thus, industrial use is lumped for both still water and juicing plants.
- The domestic consumption rates are not precisely known, and thus, domestic consumption is limited to the assumptions made above.

7.3 Process flow diagram

Figure 7-1 illustrates the PFD for the Thirsti Bottling Plant in Normandien Farm. The bottling process consists of two plants: Plant 1 for still and sparkling water, and Plant 2 for flavoured beverages. Before water enters each plant, it goes through several quality control steps, including sterilisation and filtration. Each plant has an inbuilt collection, filtration, and treatment system for wash-water before it is released to the environment via the drain outlet system.

Thirsti sources water from groundwater resources, pumped via numerous boreholes. Some of these boreholes form the basis for this application.

At any given day (24-hour period), the Thirsti plant hosts nearly 300 employees. Their lab coats are washed on-site, and laundry water is also sourced from the storage tanks. Laundry water is treated in a sedimentation tank before being discharged into the environment.

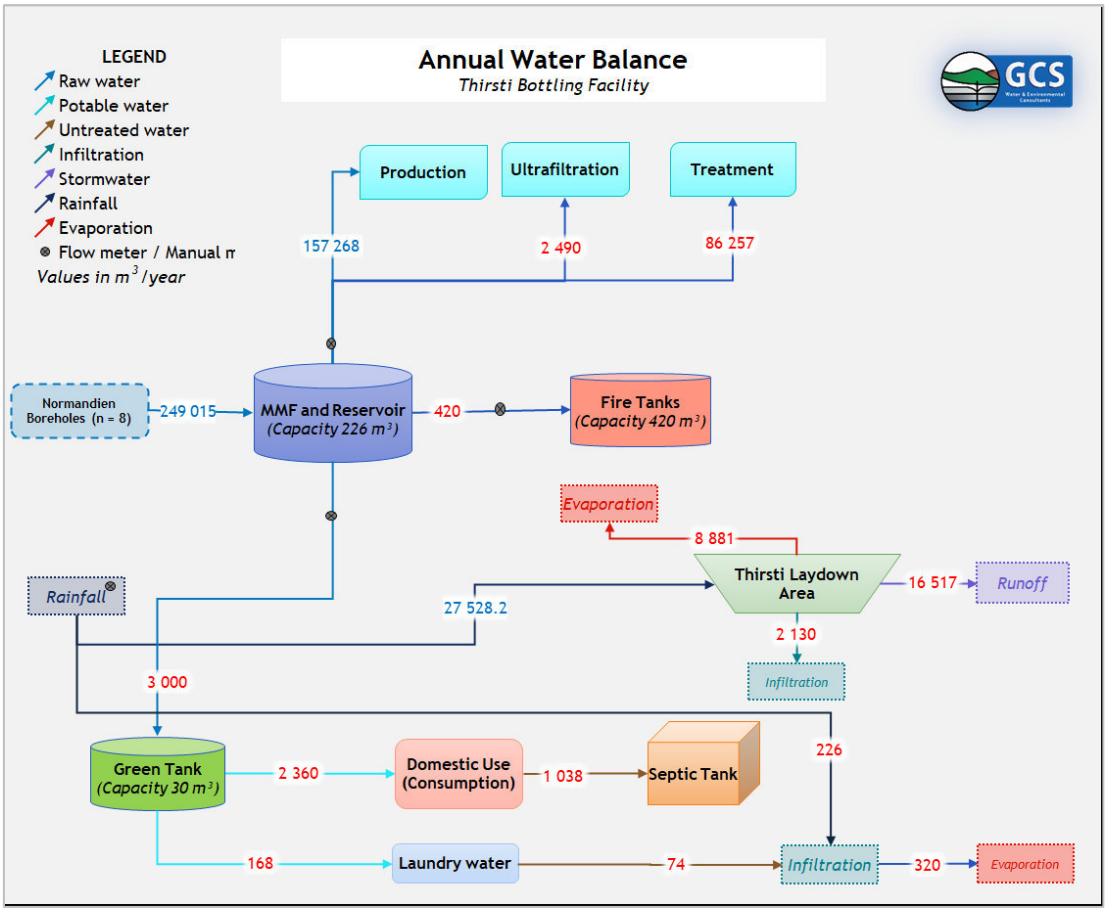


Figure 7-1: Process flow diagram used to develop the water balance

7.4 Water balance calibration

The water balance, as illustrated by the PFD above, consists of three main components, requirements, losses, and supply. A water balance is computed using the mass balance equation, which can be simplified as follows:

Total Requirement + Total loss = Total supply

With reference to the Best Practise Guidelines G2: Water and Salk Balances (DWAF, 2006b), the water balance is stable and acceptable if the accuracy range falls between the -10% to 10% range.

7.5 Water balance outcomes

As previously discussed, the DWS prefers the water balance to be presented in a tabular format. The annual water balance for the Thirsti Bottling plant for the year 2024 is summarised in Table 6-1. *A salt balance was not undertaken as part of the water balance as it was not included in the current project's scope.*

The following observations were made:

- In the year ending December 2024, Thirsti abstracted 249 015 m^3 for industrial and domestic use, compared to an allowable limit of 281 376 m^3.
- All rainfall water captured on the Thirsti laydown area (~27 528.2 m^3/a) is released back to the environment.
- As expected, groundwater abstraction was found to be the primary source of water supply for industrial use.
- Based on the provided data and information, 159 724 m^3 was used for bottling and domestic use (THIRSTI, 2024), with bottling accounting for 64.2% of water requirements in 2024.
- A total proportion of 36.8% was discharged as plant wash-water.
- 420 m^3/a (or 410 000 l) is intended for fire emergency storage.
- The water balance is acceptable as it falls within the specified threshold of 10% accuracy.

Table 7-1: Water balance results - annual (average)

Facility Name	Water Circuit/stream	Quantity (m^3/a) - IN	Water Circuit/stream	Quantity (m^3/a) - OUT	Balance
Factory laydown area	From: Rainfall	27 528.2	To: Runoff	16 517	
			To: Evapotranspiration	8 881	
			To: Infiltration	2 130	
	Total	**27 528**	**Total**	**27 528**	**0**
Groundwater Use	From: Boreholes	249 015	**To: Reservoir**	**249 015**	
		249 015		**249 015**	**0**
Bottling Process	From: Reservoir	249 015	To: Production	157 268	
			To: Green Tank	3 000	
			To: Ultrafiltration	2 490	
			To: Treatment	86 257	
	Total	**249 015**	**Total**	**249 015**	**0**
Domestic water circuit	From: Green Tank	3 000	To: Domestic Areas	2 360	
			To: Laundry	168	
			To: Fire emergency storage	420	
			To: Spill & leaks	53	
	Total	**3 000**	**Total**	**3 000**	**0**
Waste water circuit	From: Domestic Areas	1 038	To: Septic Tank	1 038	
	From: Laundry	168	To: Laundry wastewater	74	
	From Rainfall	226	To: Evaporation	320	
	Total	**1 432**	**Total**	**1 432**	**0**
Ember = Assumed RED = Estimated BLUE = Available Data	*Total IN*	529 990	*Total Out*	529 990	0
Percent Error					*0.00%*

8 HYDROLOGICAL IMPACT ASSESSMENT

8.1 Objective

The anticipated hydrological impacts associated with the operational setting were assessed. The focus on operational impacts was due to the fact that the bottling plant was already operational and had been constructed by cutting and filling the landscape.

The impact rating was developed the source-pathway-receptor (SPR) model (DWAF, 2008). The SPR model focuses on various pollution sources, transport pathways, and primary receptors within the study area.

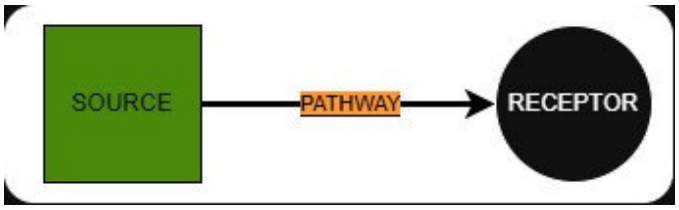


Figure 8-1: General risk assessment components (DWAF, 2008)

8.1.1 Identification of potential source areas

The potential sources of contamination and associated impacts on the surface water environment were defined for various activity areas (refer to Table 8-2), namely:

- Untreated laundry water entering the infiltration pond for uncontaminated process water.
- Poor quality runoff from the coal-fired boiler stockpiles (i.e., bitumen and waste ash stockpiles).
- Increased flood impact due to blocked culverts.
- Increased erosion impact on stormwater release points without energy dissipaters.
- Decreased local flow regulation capacity due to dewatering from boreholes.
- Water resource contamination due to septic tank spills (if maintenance Schedules are not adhered to).
- Poor quality seepage from potential oil and fuel spills from heavy delivery vehicles and staff vehicles parked on-site.
- Poor quality runoff from sedimentation of drainage lines due to exposed soils or unvegetated surface runoff during storm events.
- Pine plantation zones.

8.1.2 Evaluation of surface water exposure pathways

The SPR linkages are listed in Table 8-1 below. These were derived considering Thirsti setting and the surrounding environment.

8.1.3 Identification of potential receptors

The ecological infrastructure associated with Thirsti boundaries (Table 8-1), vadose zone soils and potentially the deep groundwater aquifer remain the primary receptors of potential impact-generating activities at Thirsti.

Table 8-1: Summary of exposure pathways and potential receptors

Pathway	Potential Receptor	Notes
Erosive stormwater runoff	• Surrounding grassland areas • Horne River tributaries • Adjacent valley-bottom wetland	Continuous stormwater release into the environment without erosion buffer systems in place.
Direct discharge of effluent into the perched aquifer	• River and wetland ecosystems • Groundwater resources • Downstream water users	Leakages from the septic tank and untreated wastewater from plant activities. Potential leachate from the coal-fired plant stockpiles. Potential leachate from parked vehicles.
Groundwater contribution to baseflow	• Shallow and deep aquifer storages • Wetlands • Surface water users	Abstraction activities by Normandien Farms.

8.2 Approach

The impact assessment step includes the consideration of hazard, the probability for hazard occurrence, and the potential consequences.

Professional judgement was used to determine the impact level, based on a sound understanding of the nature of potential impacts, potential mitigation measures that can be implemented, and the changes in the impact profile after mitigation. The mitigation measures were derived from the mitigation hierarchy (avoid > reduce > transfer > accept > prepare contingency plans).

8.3 Outcomes – Hydrological impact assessment

During the operation of the Thirsti Bottling Plant, groundwater abstraction, storage, and wastewater discharge are expected to occur daily. The impacts listed in Table 8-2 can be expected, and these relate to water quality impacts, modification of surface water availability, and changes in the natural flood regime.

The hydrological impact during the plant operation is estimated to be **moderate to high**. After implementing the mitigation measures, the impact is expected to drop to low.

8.3.1 Surface water impacts

Four sources of surface water impacts were identified:

- Earthen dam within a wetland exclusion zone.
- Built-up areas.
- Stormwater release points.
- Plant wash-water outlets.
- Dense pine stands (streamflow-reducing activity).

Changes in interflow contributions from the vadose zone and subsequent shallow water table:

- Pumping from boreholes.
- This impact is negligible as borehole drilling and test records show that Thirsti abstracts from deep the fractured Karoo aquifer.

Modifications in baseflow contributions because of abstraction from deep groundwater aquifer storages. These effects of this activity have no mitigation as abstraction is expected to continue. However, it is recommended that water abstraction be kept at sustainable levels and that losses from pipe leaks, as well as storage tanks, be minimised.

8.3.2 Cumulative impacts

As abstraction of groundwater for bottling and domestic use on-site, as well as the associated pecan nut orchards, pine plantations (streamflow-reducing activity), and livestock watering are all expected to take place in the same property, cumulative hydrological impacts can be expected. These impacts are related to baseflow contributions to surface water availability, and no mitigation can measure can be suffused as abstraction is likely to continue in the long-term. However, clearing less-economically viable woody species on the 1:100-year flood line to augment runoff is recommended.

Table 8-2: Estimated hydrological impacts (operational phase)

IMPACT DESCRIPTION		SIGNIFICANCE PRE-MITIGATION								RECOMMENDED MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION							
Applicable area	POTENTIAL ENVIRONMENTAL IMPACT	Severity (1-3)	Extent (1-6)	Duration (1-4)	Reversibility (0-1)	CONSEQUENCE	Probability	Significance	IMPACT RATING		Magnitude	Spatial Scale	Duration	Irreversibility	CONSEQUENCE	Probability	Significance	IMPACT RATING
OPERATIONAL PHASE																		
Primary Surface Water Receivers: - Perennial stream; Channelled valley-bottom wetland																		
An earthen dam within 500 m of a valley-bottom wetland	Impeding or diverting water flow in a water course and alteration of bank characteristics.	3	3	4	1	24	Definite (2)	48	H	• No mitigation possible. • The earth dam intended for pecan nut irrigation was constructed over 5 years ago and may not be economically feasible for the owner to remove. • Minimum flows are maintained by an outlet control point for downstream ecosystems.	3	3	4	1	24	Definite (2)	48	H
Built-up areas/ Bottling Plant Facility	Presence of impermeable structures may increase overland flow and soil detachment.	2	1	4	1	12	Definite (2)	24	M	• Thirsti already has stormwater conveyance structures to ensure that rainfall is captured and slowly released to the environment. • Install erosion control systems along storm flow release points.	2	1	4	1	12	Definite (2)	24	M
Stormwater release points Plant wash-water outlets	Soil cover loss and sedimentation of waterways by ongoing stormwater release from plant Poor quality overland runoff, plastic pollution and uncontrolled erosion from the channel.	2	1	4	1	12	Definite (2)	24	M	• Ensure that sediment barriers are in place immediately at the end of stormwater release points, to prevent sediment runoff and erosion. • Design energy dissipation structures using naturally occurring materials. • Regular maintenance and monitoring. • Restore vegetation where possible.	2	1	4	1	12	Definite (2)	24	M
Pine plantation	Disproportionally high evaporation rates, delays in flow attenuation, reductions in low flow volumes, can be expected because of dense pine stands.	3	2	4	1	21	Definite (2)	42	H	• No mitigation possible, pine stands are expected to remain until their harvest date. • Ensure compliance with streamflow-reducing activity licence requirements.	3	2	4	1	21	Definite (2)	42	H
Interflow contributions from vadose zone and subsequent shallow water table																		
Pipeline areas, culverts, and dirt access roads, which were backfilled with collapsible soils; or stormwater control outlets; and water leakages which may cause soil subsidence	Leakages from pipeline, post-earthwork activities; and constant flow from stormwater control pipes. This may cause sedimentation on the watercourse, leading to increased flood impacts.	2	1	4	1	12	Probable (1)	12	L	• Visual assessment for signs of erosion or contamination. • Undertake regular clearing of debris and sediment build-up on culverts and waterways.	2	1	4	1	12	Probable (1)	12	L
On-site effluent disposal	Spillage of effluent from the septic tank may contaminate the nearby water resources.	2	2	4	1	14	Definite (2)	28	H	• As part of this WUL application, Thirsti has installed a manhole to enable quicker maintenance works on the septic tank. • Regular maintenance to clear blockage. • Routine bacteriological analysis on surface water. • Regular removal of sludge built-up. • Policy improvements on-site: ○ Avoid disposing of wipes, sanitary products, or non-biodegradable materials down the system. ○ Schedule routine quarterly or annual inspections. • Expand septic tank capacity.	2	2	4	1	14	Probable (1)	14	M

Coal boiler	Hydrocarbons may form coal and ash stockpiles, leading to contamination of the nearby water resources.	3	2	3	1	18	Definite (2)	36	H	• Dispose of ash stockpiles only on landfill sites that meet the minimum structural standards. • Store unused coal in runoff-controlled zones. • Cover any stockpiles with appropriate materials.	3	2	3	1	18	Improbable (0)	0	N
Vehicle parking areas and driveway	Oil and fuel spills and leakages at vehicle park areas, and in the project areas, may cause poor quality seepage and runoff.	2	1	1	1	6	Probable (1)	6	L	• Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. • Place oil drip trays under parked construction vehicles and hydraulic equipment at Thirsti. • Have hydrocarbon spill kits on-site.	2	1	1	1	6	Improbable (0)	0	N
Pond	Microfibres and chemicals in laundry wastewater may directly contaminate sub-surface water resources and degrade water quality.	2	2	3	1	12	Definite (2)	24	M	• Laundry wastewater must be treated before release to the environment. • Ensure routine water quality monitoring.	2	2	3	1	12	Improbable (0)	0	N
Built-up areas	Impermeable areas decrease rainfall infiltration into recharge soils and thus reduce interflow to downstream wetland areas.	1	1	5	1	7	Probable (1)	7	L	• No mitigation required. • Thirsti already has storm water diversion structures to ensure that rainfall is captured and slowly released to the environment.	1	1	5	1	7	Probable (1)	7	L
Pumping from boreholes	Dewatering perched groundwater near wetlands and river systems may impact natural soil-flow processes.	1	1	2	1	4	Improbable (0)	0	N	• No mitigation required. • However, records of Thirsti boreholes suggest that groundwater is drawn from a confined aquifer network. • Thus, impact on the soil-water flow process is negligible.	1	1	2	1	4	Improbable (0)	0	N
Pine plantation zones	Reduced vertical recharge, and interflow into and out of less mature plantation areas.	1	1	5	0	6	Definite (2)	12	L	• No mitigation is possible. • Reducing plantation areas is the only way to reduce impact. • However, may not be economically feasible for the landowner.	1	1	5	0	6	Definite (2)	12	L
Baseflow contributions from deep aquifer storage																			
Abstracting groundwater from the seven abstraction boreholes	Ongoing abstraction for industrial use combined with a streamflow-reducing activity (pine plantation) will lead to decrease in groundwater contribution to baseflow, possibly leading to wetland modification.	1	1	4	1	6	Definite (2)	12	L	• No mitigation possible. • Groundwater abstraction from the confined aquifer system is likely to continue. • However, abstracting beyond acceptable limits should be avoided. • Follow the water management protocol and avoid unnecessary water losses.	1	1	4	1	6	Definite (2)	12	L
Pecan nut and Pine plantations on-site	Reductions in winter runoff because of water use impact from pecan nut and pine plantations.	1	2	4	1	7	Definite (2)	14	M	• Avoid establishing plantations in groundwater recharge zones or close to watercourses and wetlands. • Clear invasive alien plants within 20 m of river lines, within groundwater recharge zones or within the 1-100-year flood line and floodplains. • Install piezometers to help monitor groundwater levels around plantation areas.	1	2	4	1	7	Probable (1)	7	L

9 SURFACE WATER MANAGEMENT PLAN

The plant is constructed on an elevated bed, and all stormwater from the surrounding upstream environment is diverted to the downstream watercourse and wetlands via pipes and cut-off trenches. A stormwater drainage system on-site collects stormwater and discharges it into the main drainage system. Wastewater from bottling and laundry is treated on-site and checked before being released into the environment. Drainage is collected at the infiltration pit, which is separate from the natural drainage lines and located at the lowest elevation of the plant.

However, the visible erosion, detergent foam, and plastic pollution near the infiltration pit are three areas of concern that could be reversed with minimal effort and ongoing maintenance.

In addition to the current stormwater management practices, it is proposed that a stormwater and surface water monitoring programme be implemented to monitor water quality in and around Thirsti. During operations, it is essential to monitor runoff entering Thirsti from the upstream afforestation area and runoff leaving Thirsti to ensure that only water of adequate quality is released into the environment.

9.1 Short-term monitoring

During any construction upgrades or maintenance activities that involve soil disturbance and sediment stockpiles, water and soil monitoring should be targeted at active areas and equipment or heavy machinery parking. Drip trays should be placed and monitored underneath parked construction vehicles (if any) to help identify vehicles that require repairs or exclusion from Thirsti, thereby preventing contamination during service.

If areas of concern (or areas where erosion is increasing or sedimentation is observed) are identified through visual observation, it is recommended that additional water samples be collected from the observation point or the nearest water source. Mitigation measures should then be formulated based on the observed scale of impact.

9.2 Long-term monitoring

From the assessment undertaken, it is anticipated that the water courses downstream of the bottling plant and those around the borehole points are the receptors of any potential pollution from the activity (i.e., overland runoff, seepage, interflow, stormwater discharge, etc.). It is recommended that long-term monitoring focus on these areas and entail visual inspections on a monthly to quarterly basis during the operational phase.

The stormwater release points around the Thirsti laydown areas, the pond, the septic tank, and the roadway culverts are the proposed observation and monitoring points.

9.3 Monitoring duration and responsibility

It is proposed that monitoring be conducted as specified in Table 9-1 for the duration of the activity taking place. Stormwater monitoring is recommended to be done at the end of a storm event. If concerns are noted, then monitoring must be conducted more frequently until the issues are resolved. The need for further monitoring of Thirsti can be evaluated by the local environmental authorities or DWS representatives. Monitoring responsibility will fall with Thirsti.

Table 9-1: Proposed monitoring points, frequencies, and sample analyses

Site	Frequency	Type	Field Measurements	Laboratory Analyses / Action
Stormwater Monitoring points	Twice per rainy season, once within the first significant rainfall event (>10mm/d) and following a significant rainfall event near the end of the season (March/April). During the storm event or once the storm has subsided. Avoid sampling stagnant water.	Field assessment and laboratory (if required)	pH EC TDS Sediment load	If field measurements indicate a contaminant trend, such as visual pollution of water, it is recommended that a sample be submitted for analytical testing. The following should typically be screened: • pH, Conductivity, Total dissolved solids (TDS), and total suspended solids (TSS). • Biological oxygen demand (BOD). • Sulphate and Nitrate.
Surface water monitoring	Bi-annually for the duration of operations.	Field assessment and laboratory	pH EC TDS Sediment load	If field measurements indicate a contaminant trend, it is advised that a sample be submitted for analytical testing. The following should typically be screened: • pH, Conductivity, TDS, and TSS. • BOD. • Calcium, Magnesium, Sodium, Potassium, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Iron, Manganese, Fluoride, Aluminium, Total Alkalinity (TALK), Ammonia, Ammonium. • Total coliforms, *E. Coli*, Faecal coliforms.
Hydraulic monitoring	Monthly visual inspection of stormwater systems.	Field visual assessment	Flow (if possible)	Clear systems of noted debris to ensure the free flow of water during storm events.

10 CONCLUSIONS AND RECOMMENDATIONS

Based on the surface water impact assessment conducted for the Thirsti Bottling Plant, the following conclusions and recommendations can be made:

10.1 Environmental setting

- The project area is situated southwest of Newcastle Town, in KwaZulu-Natal, South Africa.
    - Thirsti is found within quaternary V31C of the Pongola-Mtamvuma WMA.
        - The catchment experiences temperate oceanic climate with dry winters, and the mean annual rainfall is 791 mm/a. The catchment's annual evapotranspiration is 1 276 mm/a.
        - Historic natural runoff for this catchment is estimated at 22.49 Mil.m^3/a.
        - The area contributes to the Northern Drakensburg SWSA.
    - The nearest drainage line to Thirsti is the Horne River, which is fed by perennial and non-perennial tributaries.
    - Two large-sized valley-bottom wetlands (with a combined area of 54.28 ha) can be found within the Normandien Farm boundary, and the Thirsti Bottling Plant falls within the 500 m wetland buffer zone.
    - Based on a 30 m DTM, five HRUs with an area range of 1.6 to 7 km^2 were delineated.
    - The flood peak assessment revealed that Thirsti is susceptible to flood impact, notwithstanding the assessment's limitations.

10.2 Water and wastewater management

Normandien Farms uses water for four activities: pine plantations (indirect groundwater use), pecan nut plantations (irrigated using surface water storage), livestock watering (run-of-river use), and water bottling at Thirsti (groundwater abstraction and spring water use). The employees at Thirsti, as well as the planned fire control dams, source water from the existing storages that are linked to borehole abstractions. To facilitate sustainable water use, Thirsti has an automated water monitoring system that controls water abstractions and outflows to infiltration tanks. Additional monitoring systems are in place within each plant, which also aid in quality checks and assurance. The septic tank system will be managed to prevent potential spillages by avoiding the disposal of wipes, sanitary products, or non-biodegradable materials down the system. Scheduled routine quarterly or annual inspections will be conducted to catch early signs of blockage or pipe deterioration.

10.3 Flood impact management

The 1:100-year flood line is considered an exclusion zone (buffer area). The Toolkit for Water Services (DWAF, 2004) recommends that no borehole infrastructure be placed in areas prone to flooding. Presence of the borehole infrastructure in the flood line could alter the natural flood regime, increase erosion risk, or result in operational disruptions if the pipelines or borehole pumps experience damage. Therefore, since the borehole housings are already existing structures, proper flooding protocols and erosion control measures need to be implemented. An example of this would be to build aprons around borehole housings to divert peak flows away from the infrastructure. Additionally, an exemption should be applied for, as infrastructure is located in the 1:100-year flood zone.

Regular inspections and clearing of waterways and culverts are also recommended to reduce the impact of flooded access roads.

Care should be taken when developing or expanding linear infrastructure into demarcated flood areas. If development does occur in the exclusion zone, proper flood mitigation protocols should be implemented.

10.4 Stormwater management

A SWMP was developed for the Bottling Plant site. Upstream and on-site runoff catchments were delineated, and upstream runoffs were diverted as far as possible. Two additional stormwater channels were recommended to the east of the plant. Attention should be given to the waste generated in and around Thirsti, as many littered items ultimately enter the environment through wash-water and runoff. Sedimentation should also be mitigated using silt traps, as discussed in Section 6.7. Measures were also recommended to attend to erosion noted downstream of outlet pipes.

10.5 Reasoned opinion on whether the activity should be authorised

GCS's assessment concludes that the proposed activities present a medium to high impact on the hydrological environment, with manageable impacts as outlined in Section 8. It is expected that mitigation measures to counteract the predicted negative impacts will be incorporated into the EMPr during operational phases of the bottling activities. The decision to authorise the water use lies with the DWS and will be informed by this report and other associated reports, including socio-economic considerations. From a socio-economic perspective, approving this WULA would enable Normandien Farms to abstract groundwater from the deep groundwater aquifer, thereby securing industrial water use to support local economic development and sustainable employment for the local community.

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APPENDIX A: FLOOD PEAK CALCULATION SHEETS

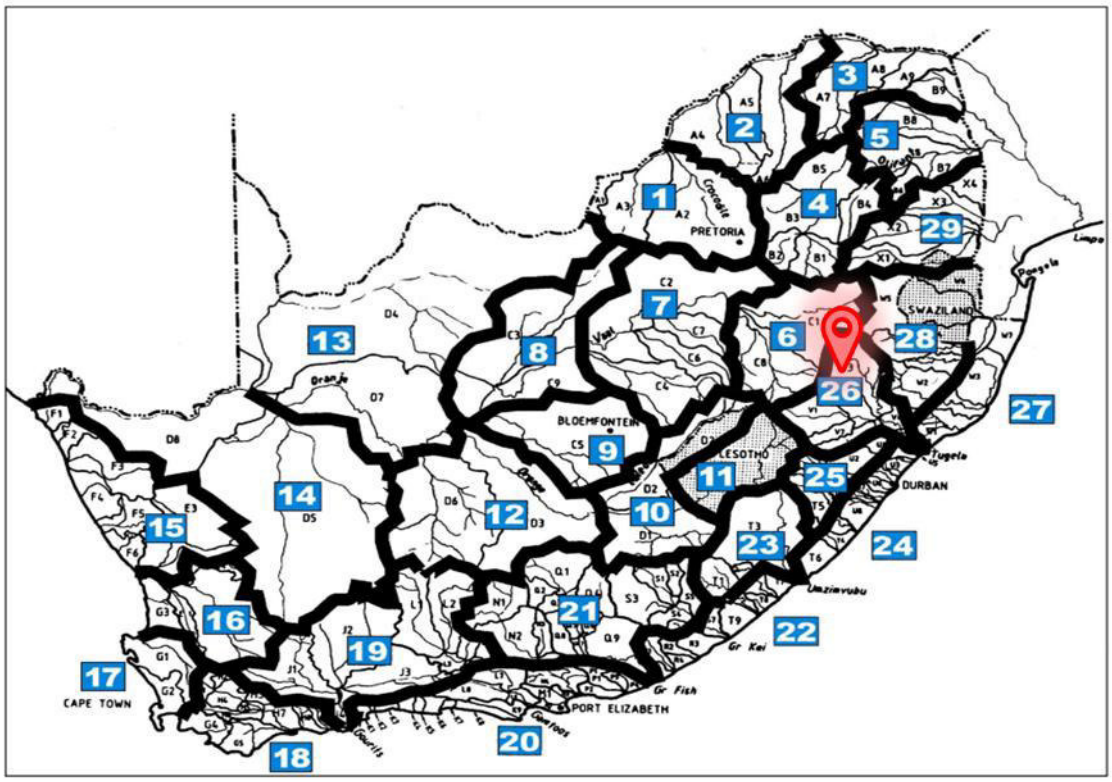


Figure 11-1: Standard Design Flood (SDF) drainage basin selection

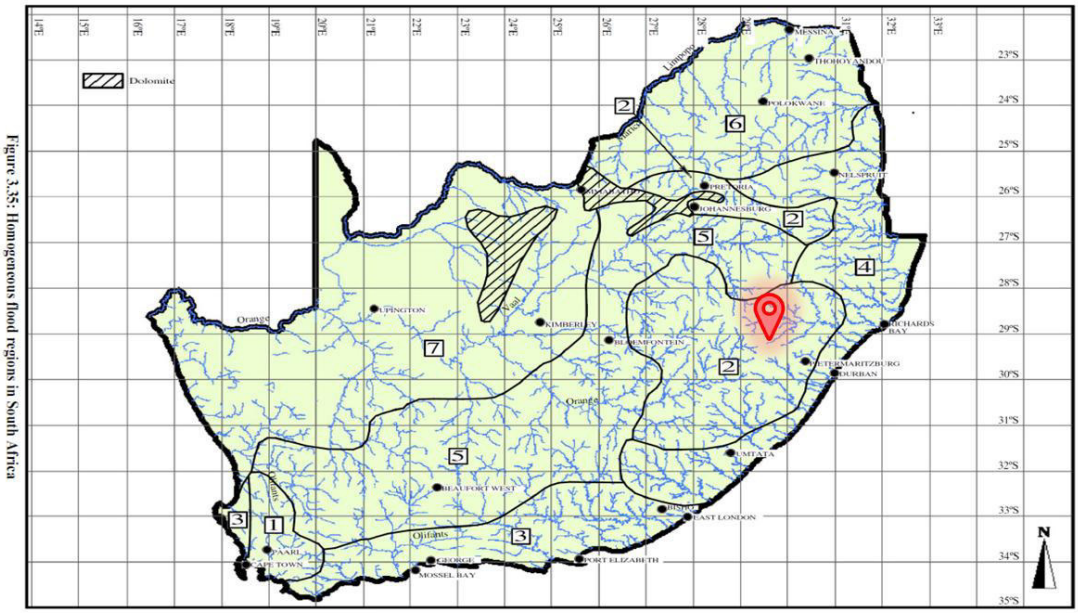


Figure 11-2: Homogeneous flood region in South Africa, selection for MIPI method

RATIONAL METHOD 3							
Description of catchment		HRU48					
River detail		Thirsti_North					
Calculated by		Sinetemba Xoxo, PhD		Date		Friday, 20 June 2025	
Physical characteristics							
Size of catchment (A)	3.387	km^2		Rainfall region		V3B	
Longest watercourse (L)	1.713	km		Area distribution factors			
Average slope (S_{av})	0.0018	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual rainfall (MAR)	791.30	mm					
Rural				URBAN			
Surface slope	%	Factor	C_s	Description	%	Factor	C2
Vleis and pans (<3%)	0.02	0.03	0.00	Lawns			
Flat areas (3 - 10%)	0.10	0.08	0.01	Sandy,flat<2%	0	0.08	0
Hilly (10 - 30%)	0.78	0.16	0.12	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.10	0.26	0.03	Heavy s,flat<2%	0	0.15	0
Total	1.00	0.53	0.16	Heavy s,steep>7%	0	0.3	0
Permeability	%	Factor	C_p	Residential Areas			
Very permeable	0	0.04	0.00	Houses	0	0.5	0
Permeable	90	0.08	7.20	Flats	0	0.6	0
Semi-permeable	10	0.16	1.60	Industry			
Impermeable	0	0.26	0.00	Light industry	0	0.6	0
Total	100	0.54	8.80	Heavy industry	0	0.7	0
Vegetation	%	Factor	C_v	Business			
Thick bush & plantation	0.39	0.04	0.02	City centre	0	0.8	0
Light bush & farm-lands	0.00	0.11	0.00	Suburban	0	0.65	0
Grasslands	0.61	0.21	0.13	Streets	0	0.75	0
No vegatation	0.00	0.28	0.00	Max flood	0	1	0
Total	1	0.64	0.14	Total (C2)	0		0
Time of concentration (TC)							
Overland flow		Defined watercourse					
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		Use Defined watercourse			
2.213	hours	1.143	hours				
Run-off coefficient							
Return Period (years)	2	5	10	20	50	100	PMF
Run-off coefficient, C_1	0.091	0.091	0.091	0.091	0.091	0.091	
Adjusted for dolomitic areas, C_{1D}	0.091	0.091	0.091	0.091	0.091	0.091	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.045516565	0.050068221	0.054619878	0.061	0.076	0.091	
Combined run - off coefficient, C_T	0.045516565	0.050068221	0.054619878	0.061	0.076	0.091	
Rainfall							
Return Period (years)	2	5	10	20	50	100	PMF
Point rainfall (mm), P_T	67.31	88.45	103.60	118.85	140.20	157.69	
Point Intensity (mm/h), P_{it}	58.90	77.40	90.66	104.00	122.68	137.99	
Area reduction factor (%),ARF_T	1.061	1.061	1.061	1.061	1.061	1.061	
Average intensity (mm/hour),I_T	62.488	82.115	96.186	110.339	130.162	146.397	
Return Period (years)	2	5	10	20	50	100	PMF
Peak flow (m3/s)	2.676	3.868	4.943	6.332	9.253	12.54	0.00

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment		HRU48					
River detail		Thirsti_North					
Calculated by		Sinetemba Xoxo, PhD		Date		Friday, 20 June 2025	
Physical characteristics							
Size of catchment (A)	3.387	km^2		Days of thunder per year (R)		17	days
Longest watercourse (L)	1.713	km		Time of concentration, t		68.567	minutes
Average slope (S_{av})	0.0018	m/m		Time of concentration, T_c	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		1.1428
SDF Basin	26						
2-year return period rainfall (M)	61	mm					
Rainfall							
Return Period (years), T	2	5	10	20	50	100	200
Point precipitation depth (mm) $P_{t,T}$	23.6	39.9	52.1	64.4	80.6	92.9	105.2
Area reduction factor (%),ARF_T	1.061	1.061	1.061	1.061	1.061	1.061	1.061
Average intensity (mm/hour),I_T	21.9	37.0	48.4	59.8	74.9	86.3	97.7
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)		50		
Return Period (years), T	2	5	10	20	50	100	200
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	2.58
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	0.538
Peak flow (m3/s)	3.10	9.62	15.59	22.30	32.26	40.58	49.40

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	Catchment Area	MAP	S	L	Lc	Constant K_T				Catchment Parameter	Peak Flows			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU48	3.387	791.3	0.0018	1.71	1.71	0.83	1.04	1.36	1.6	0.0490	28.17	35.29	46.15	54.30

RATIONAL METHOD 3							
Description of catchment	HRU60						
River detail	Thirsti_NW						
Calculated by	Sinetemba Xoxo, PhD			Date	Friday, 20 June 2025		
Physical characteristics							
Size of catchment (A)	4.391	km^2		Rainfall region	V3B		
Longest watercourse (L)	1.482	km		Area distribution factors			
Average slope (S_{av})	0.0016	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual rainfall (MAR)	791.30	mm					
Rural				URBAN			
Surface slope	%	Factor	C_s	Description	%	Factor	C2
Vleis and pans (<3%)	0.06	0.03	0.00	Lawns			
Flat areas (3 - 10%)	0.31	0.08	0.02	Sandy,flat<2%	0	0.08	0
Hilly (10 - 30%)	0.54	0.16	0.09	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.09	0.26	0.02	Heavy s,flat<2%	0	0.15	0
Total	1.00	0.53	0.14	Heavy s,steep>7%	0	0.3	0
Permeability	%	Factor	C_p	Residential Areas			
Very permeable	0	0.04	0.00	Houses	0	0.5	0
Permeable	90	0.08	7.20	Flats	0	0.6	0
Semi-permeable	10	0.16	1.60	Industry			
Impermeable	0	0.26	0.00	Light industry	0	0.6	0
Total	100	0.54	8.80	Heavy industry	0	0.7	0
Vegetation	%	Factor	C_v	Business			
Thick bush & plantation	0.46	0.04	0.02	City centre	0	0.8	0
Light bush & farm-lands	0.00	0.11	0.00	Suburban	0	0.65	0
Grasslands	0.53	0.21	0.11	Streets	0	0.75	0
No vegatation	0.01	0.28	0.00	Max flood	0	1	0
Total	1	0.64	0.13	Total (C2)	0		0
Time of concentration (TC)							
Overland flow	Defined watercourse						
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		Use Defined watercourse			
2.123 hours		1.067 hours					
Run-off coefficient							
Return Period (years)	2	5	10	20	50	100	PMF
Run-off coefficient, C_1	0.091	0.091	0.091	0.091	0.091	0.091	
Adjusted for dolomitic areas, C_{1D}	0.091	0.091	0.091	0.091	0.091	0.091	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.045347611	0.049882372	0.054417133	0.061	0.075	0.091	
Combined run - off coefficient, C_T	0.045347611	0.049882372	0.054417133	0.061	0.075	0.091	
Rainfall							
Return Period (years)	2	5	10	20	50	100	PMF
Point rainfall (mm), P_T	56.44	74.24	86.88	99.72	117.63	132.29	
Point Intensity (mm/h), P_{it}	52.89	69.56	81.42	93.45	110.23	123.97	
Area reduction factor (%),ARF_T	1.046	1.046	1.046	1.046	1.046	1.046	
Average intensity (mm/hour),I_T	55.330	72.777	85.176	97.765	115.316	129.694	
Return Period (years)	2	5	10	20	50	100	PMF
Peak flow (m3/s)	3.060	4.428	5.653	7.246	10.588	14.35	0.00

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment	HRU60						
River detail	Thirsti_NW						
Calculated by	Sinetemba Xoxo, PhD			Date	Friday, 20 June 2025		
Physical characteristics							
Size of catchment (A)	4.391	km^2		Days of thunder per year (R)	17	days	
Longest watercourse (L)	1.482	km		Time of concentration, t	64.029	minutes	
Average slope (S_{av})	0.0016	m/m		Time of concentration, T_c	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		1.0671
SDF Basin	26						
2-year return period rainfall (M)	61	mm					
Rainfall							
Return Period (years), T	2	5	10	20	50	100	200
Point precipitation depth (mm) $P_{t,T}$	23.2	39.1	51.2	63.3	79.2	91.3	103.3
Area reduction factor (%),ARF_T	1.046	1.046	1.046	1.046	1.046	1.046	1.046
Average intensity (mm/hour),I_T	22.7	38.4	50.2	62.0	77.6	89.5	101.3
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)	50			
Return Period (years), T	2	5	10	20	50	100	200
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	2.58
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	0.538
Peak flow (m3/s)	4.16	12.93	20.96	29.98	43.37	54.56	66.41

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	Catchment Area	MAP	S	L	Lc	Constant K_T				Catchment Parameter	Peak Flows			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU60	4.391	791.3	0.0016	1.48	1.48	0.83	1.04	1.36	1.6	0.0803	36.33	45.52	59.53	70.03

RATIONAL METHOD 3							
Description of catchment		HRU61					
River detail		Thirsti_South					
Calculated by		Sinetemba Xoxo, PhD		Date		Friday, 20 June 2025	
Physical characteristics							
Size of catchment (A)	7.074	km^2		Rainfall region		V3B	
Longest watercourse (L)	2.519	km		Area distribution factors			
Average slope (S_{av})	0.0013	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual rainfall (MAR)	791.30	mm					
Rural				URBAN			
Surface slope	%	Factor	C_s	Description	%	Factor	C2
Vleis and pans (<3%)	0.06	0.03	0.00	Lawns			
Flat areas (3 - 10%)	0.34	0.08	0.03	Sandy,flat<2%	0	0.08	0
Hilly (10 - 30%)	0.55	0.16	0.09	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.04	0.26	0.01	Heavy s,flat<2%	0	0.15	0
Total	1.00	0.53	0.13	Heavy s,steep>7%	0	0.3	0
Permeability	%	Factor	C_p	Residential Areas			
Very permeable	0	0.04	0.00	Houses	0	0.5	0
Permeable	90	0.08	7.20	Flats	0	0.6	0
Semi-permeable	10	0.16	1.60	Industry			
Impermeable	0	0.26	0.00	Light industry	0	0.6	0
Total	100	0.54	8.80	Heavy industry	0	0.7	0
Vegetation	%	Factor	C_v	Business			
Thick bush & plantation	0.38	0.04	0.02	City centre	0	0.8	0
Light bush & farm-lands	0.02	0.11	0.00	Suburban	0	0.65	0
Grasslands	0.60	0.21	0.13	Streets	0	0.75	0
No vegatation	0.00	0.28	0.00	Max flood	0	1	0
Total	1	0.64	0.14	Total (C2)	0		0
Time of concentration (TC)							
Overland flow		Defined watercourse					
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		Use Defined watercourse			
2.851	hours	1.735	hours				
Run-off coefficient							
Return Period (years)	2	5	10	20	50	100	PMF
Run-off coefficient, C_1	0.091	0.091	0.091	0.091	0.091	0.091	
Adjusted for dolomitic areas, C_{1D}	0.091	0.091	0.091	0.091	0.091	0.091	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.045358918	0.04989481	0.054430702	0.061	0.075	0.091	
Combined run - off coefficient, C_T	0.045358918	0.04989481	0.054430702	0.061	0.075	0.091	
Rainfall							
Return Period (years)	2	5	10	20	50	100	PMF
Point rainfall (mm), P_T	60.23	79.19	92.71	106.39	125.49	141.14	
Point Intensity (mm/h), P_{it}	34.71	45.63	53.43	61.31	72.32	81.34	
Area reduction factor (%),ARF_T	1.041	1.041	1.041	1.041	1.041	1.041	
Average intensity (mm/hour),I_T	36.137	47.514	55.627	63.835	75.298	84.688	
Return Period (years)	2	5	10	20	50	100	PMF
Peak flow (m3/s)	3.221	4.658	5.950	7.624	11.141	15.10	0.00

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment		HRU61					
River detail		Thirsti_South					
Calculated by		Sinetemba Xoxo, PhD		Date		Friday, 20 June 2025	
Physical characteristics							
Size of catchment (A)	7.074	km^2		Days of thunder per year (R)		17	days
Longest watercourse (L)	2.519	km		Time of concentration, t		104.116	minutes
Average slope (S_{av})	0.0013	m/m		Time of concentration, T_c	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		1.7353
SDF Basin	26						
2-year return period rainfall (M)	61	mm					
Rainfall							
Return Period (years), T	2	5	10	20	50	100	200
Point precipitation depth (mm) $P_{t,T}$	26.2	44.2	57.8	71.5	89.5	103.1	116.7
Area reduction factor (%),ARF_T	1.041	1.041	1.041	1.041	1.041	1.041	1.041
Average intensity (mm/hour),I_T	15.7	26.5	34.7	42.9	53.7	61.9	70.0
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)		50		
Return Period (years), T	2	5	10	20	50	100	200
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	2.58
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	0.538
Peak flow (m3/s)	4.64	14.40	23.34	33.39	48.31	60.77	73.97

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	Catchment Area	MAP	S	L	Lc	Constant K_T				Catchment Parameter	Peak Flows			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU61	7.074	791.3	0.0013	2.52	2.52	0.83	1.04	1.36	1.6	0.0405	42.17	52.84	69.10	81.30

RATIONAL METHOD 3							
Description of catchment	HRU51						
River detail	Thirsti_Central						
Calculated by	Sinetemba Xoxo, PhD			Date	Friday, 20 June 2025		
Physical characteristics							
Size of catchment (A)	1.628	km^2		Rainfall region	V3B		
Longest watercourse (L)	0.918	km		**Area distribution factors**			
Average slope (S_{av})	0.0010	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual rainfall (MAR)	791.30	mm					
Rural				**URBAN**			
Surface slope	**%**	**Factor**	C_s	**Description**	**%**	**Factor**	**C2**
Vleis and pans (<3%)	0.16	0.03	0.00	**Lawns**			
Flat areas (3 - 10%)	0.48	0.08	0.04	Sandy,flat<2%	0	0.08	0
Hilly (10 - 30%)	0.35	0.16	0.06	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.01	0.26	0.00	Heavy s,flat<2%	0	0.15	0
Total	1.00	0.53	0.10	Heavy s,steep>7%	0	0.3	0
Permeability	**%**	**Factor**	C_p	**Residential Areas**			
Very permeable	0	0.04	0.00	Houses	0	0.5	0
Permeable	90	0.08	7.20	Flats	0	0.6	0
Semi-permeable	10	0.16	1.60	Industry			
Impermeable	0	0.26	0.00	Light industry	0	0.6	0
Total	100	0.54	8.80	Heavy industry	0	0.7	0
Vegetation	**%**	**Factor**	C_v	**Business**			
Thick bush & plantation	0.21	0.04	0.01	City centre	0	0.8	0
Light bush & farm-lands	0.09	0.11	0.01	Suburban	0	0.65	0
Grasslands	0.68	0.21	0.14	Streets	0	0.75	0
No vegatation	0.02	0.28	0.01	Max flood	0	1	0
Total	1	0.64	0.17	Total (C2)	0		0
Time of concentration (TC)							
Overland flow	Defined watercourse						
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$			Use Defined watercourse			
1.916 hours	0.901 hours						
Run-off coefficient							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Run-off coefficient, C_1	0.091	0.091	0.091	0.091	0.091	0.091	
Adjusted for dolomitic areas, C_{1D}	0.091	0.091	0.091	0.091	0.091	0.091	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.045338997	0.049872897	0.054406796	0.061	0.075	0.091	
Combined run - off coefficient, C_T	0.045338997	0.049872897	0.054406796	0.061	0.075	0.091	
Rainfall							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Point rainfall (mm), P_T	54.91	72.23	84.55	97.03	114.46	128.73	
Point Intensity (mm/h), P_{it}	60.92	80.13	93.79	107.64	126.98	142.80	
Area reduction factor (%),ARF_T	1.086	1.086	1.086	1.086	1.086	1.086	
Average intensity (mm/hour),I_T	66.176	87.043	101.885	116.927	137.935	155.127	
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Peak flow (m3/s)	1.357	1.963	2.507	3.213	4.695	6.36	0.00

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment	HRU51						
River detail	Thirsti_Central						
Calculated by	Sinetemba Xoxo, PhD			Date	Friday, 20 June 2025		
Physical characteristics							
Size of catchment (A)	1.628	km^2		Days of thunder per year (R)	17	days	
Longest watercourse (L)	0.918	km		Time of concentration, t	54.085	minutes	
Average slope (S_{av})	0.0010	m/m		Time of concentration, T_c	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		0.9014
SDF Basin	26						
2-year return period rainfall (M)	61	mm					
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Point precipitation depth (mm) $P_{t,T}$	22.2	37.4	48.9	60.4	75.6	87.2	98.7
Area reduction factor (%),ARF_T	1.086	1.086	1.086	1.086	1.086	1.086	1.086
Average intensity (mm/hour),I_T	26.7	45.0	58.9	72.8	91.2	105.0	118.9
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)	50			
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	2.58
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	0.538
Peak flow (m3/s)	1.81	5.63	9.12	13.05	18.88	23.75	28.91

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	Catchment Area	MAP	S	L	Lc	Constant K_T				Catchment Parameter	Peak Flows			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU51	1.628	791.3	0.0010	0.92	0.92	0.83	1.04	1.36	1.6	0.0599	18.89	23.67	30.95	36.41

RATIONAL METHOD 3							
Description of catchment		HRU49					
River detail		Thirsti_OUT					
Calculated by		Sinetemba Xoxo, PhD		Date		Friday, 20 June 2025	
Physical characteristics							
Size of catchment (A)	3.915	km^2		Rainfall region		V3B	
Longest watercourse (L)	2.151	km		Area distribution factors			
Average slope (S_{av})	0.0005	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual rainfall (MAR)	791.30	mm					
Rural				URBAN			
Surface slope	%	Factor	C_s	Description	%	Factor	C2
Vleis and pans (<3%)	0.48	0.03	0.01	Lawns			
Flat areas (3 - 10%)	0.39	0.08	0.03	Sandy,flat<2%	0	0.08	0
Hilly (10 - 30%)	0.12	0.16	0.02	Sandy,steep>7%	0	0.16	0
Steep Areas (>30%)	0.01	0.26	0.00	Heavy s,flat<2%	0	0.15	0
Total	1.00	0.53	0.07	Heavy s,steep>7%	0	0.3	0
Permeability	%	Factor	C_p	Residential Areas			
Very permeable	0	0.04	0.00	Houses	0	0.5	0
Permeable	90	0.08	7.20	Flats	0	0.6	0
Semi-permeable	10	0.16	1.60	Industry			
Impermeable	0	0.26	0.00	Light industry	0	0.6	0
Total	100	0.54	8.80	Heavy industry	0	0.7	0
Vegetation	%	Factor	C_v	Business			
Thick bush & plantation	0.41	0.04	0.02	City centre	0	0.8	0
Light bush & farm-lands	0.37	0.11	0.04	Suburban	0	0.65	0
Grasslands	0.21	0.21	0.04	Streets	0	0.75	0
No vegatation	0.02	0.28	0.00	Max flood	0	1	0
Total	1	0.64	0.10	Total (C2)	0		0
Time of concentration (TC)							
Overland flow		Defined watercourse					
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$		Use Defined watercourse			
3.318	hours	2.229	hours				
Run-off coefficient							
Return Period (years)	2	5	10	20	50	100	PMF
Run-off coefficient, C_1	0.090	0.090	0.090	0.090	0.090	0.090	
Adjusted for dolomitic areas, C_{1D}	0.090	0.090	0.090	0.090	0.090	0.090	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.044860627	0.049346689	0.053832752	0.060	0.074	0.090	
Combined run - off coefficient, C_T	0.044860627	0.049346689	0.053832752	0.060	0.074	0.090	
Rainfall							
Return Period (years)	2	5	10	20	50	100	PMF
Point rainfall (mm), P_T	73.06	95.97	112.45	128.96	152.14	171.12	
Point Intensity (mm/h), P_{it}	32.78	43.06	50.45	57.86	68.26	76.77	
Area reduction factor (%),ARF_T	1.078	1.078	1.078	1.078	1.078	1.078	
Average intensity (mm/hour),I_T	35.334	46.415	54.387	62.375	73.584	82.764	
Return Period (years)	2	5	10	20	50	100	PMF
Peak flow (m3/s)	1.724	2.491	3.184	4.078	5.959	8.08	0.00

STANDARD DESIGN FLOOD (SDF) METHOD														
Description of catchment			HRU49											
River detail			Thirsti_OUT											
Calculated by			Sinetemba Xoxo, PhD					Date		Friday, 20 June 2025				
Physical characteristics														
Size of catchment (A)			3.915	km^2				Days of thunder per year (R)		17	days			
Longest watercourse (L)			2.151	km				Time of concentration, t		133.730	minutes			
Average slope (S_{av})			0.0005	m/m				Time of concentration, T_c	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$			2.2288		
SDF Basin			26											
2-year return period rainfall (M)			61	mm										
Rainfall														
Return Period (years), T			**2**	**5**	**10**	**20**	**50**	**100**	**200**					
Point precipitation depth (mm) $P_{t,T}$			27.8	46.8	61.3	75.7	94.7	109.2	123.6					
Area reduction factor (%),ARF_T			1.078	1.078	1.078	1.078	1.078	1.078	1.078					
Average intensity (mm/hour),I_T			13.4	22.6	29.6	36.6	45.8	52.8	59.8					
Run-off coefficient														
Calibration factors	C_2 (%)		15		C_{100} (%)		50							
Return Period (years), T			**2**	**5**	**10**	**20**	**50**	**100**	**200**					
Return period factors (Y_T)			0	0.84	1.28	1.64	2.05	2.33	2.58					
Run-off coefficient, C_T			0.150	0.276	0.342	0.396	0.458	0.500	0.538					
Peak flow (m3/s)			2.19	6.80	11.03	15.78	22.82	28.71	34.95					

MIDGLEY & PITMAN (MIPI) METHOD														
River Detail	**Catchment Area**	**MAP**	**S**	**L**	**Lc**	**Constant K_T**				**Catchment Parameter**	**Peak Flows**			
	(km^2)	(mm)	m/m	km	km	1:10 year	1:20 Year	1: 50 year	1: 100 year	(Dimensionless)	1:10 year	1:20 Year	1: 50 year	1: 100 year
HRU49	3.915	791.3	0.0005	2.15	2.15	0.83	1.04	1.36	1.6	0.0190	25.41	31.84	41.63	48.98

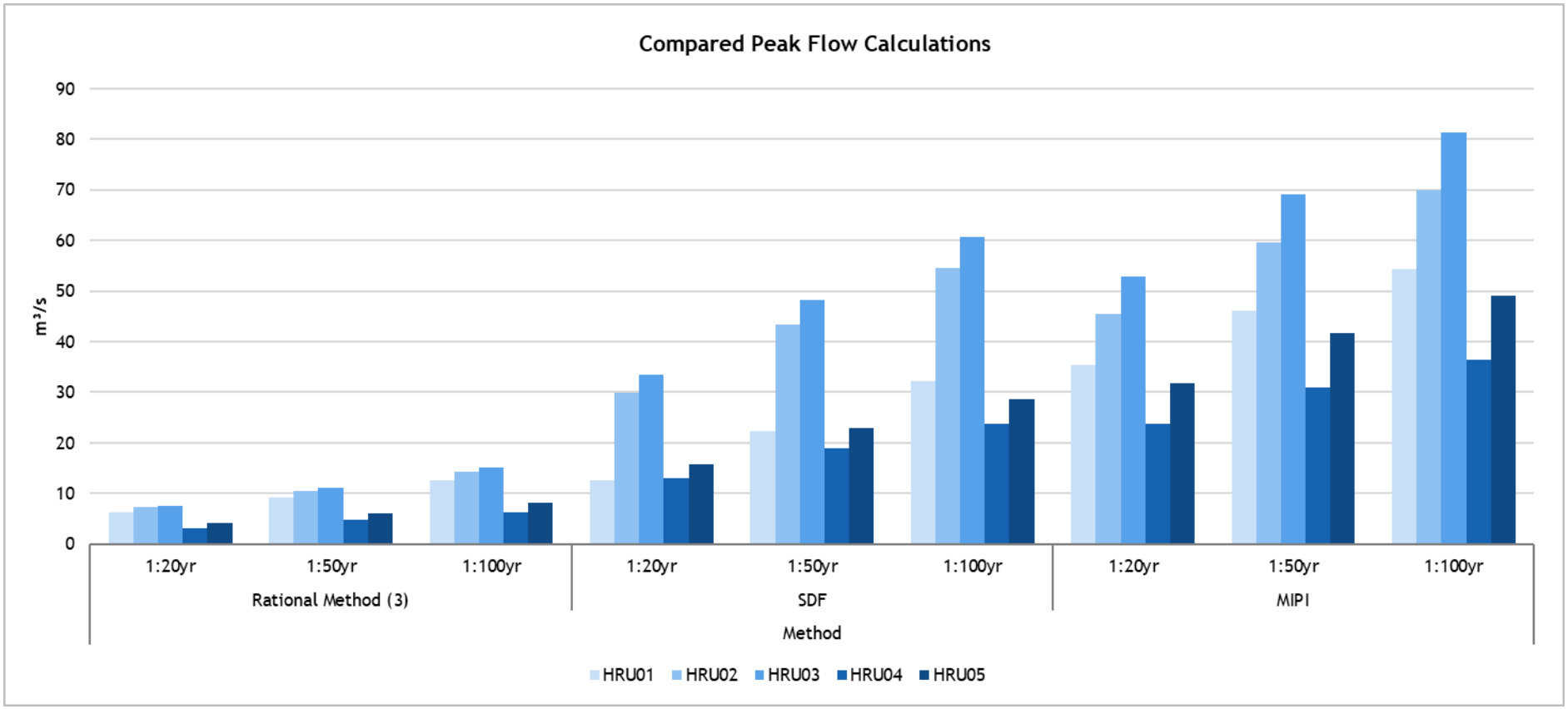
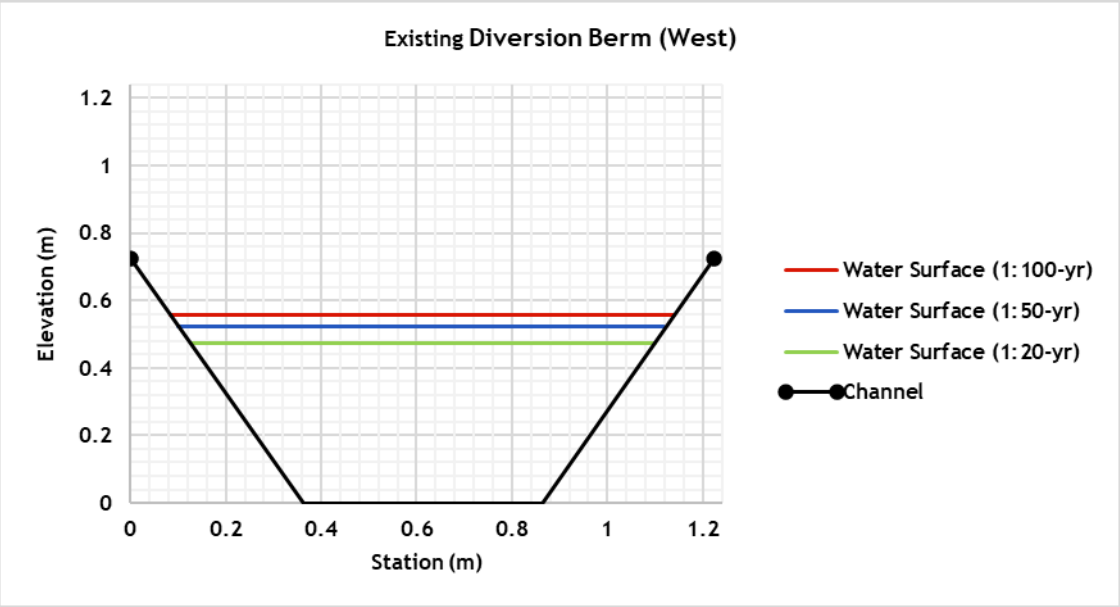
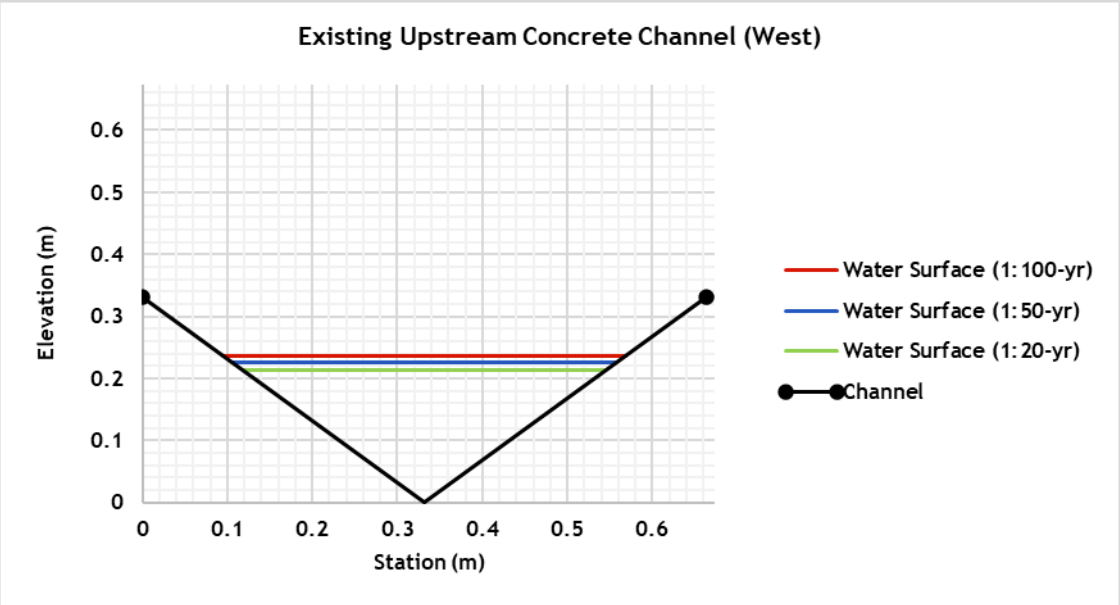


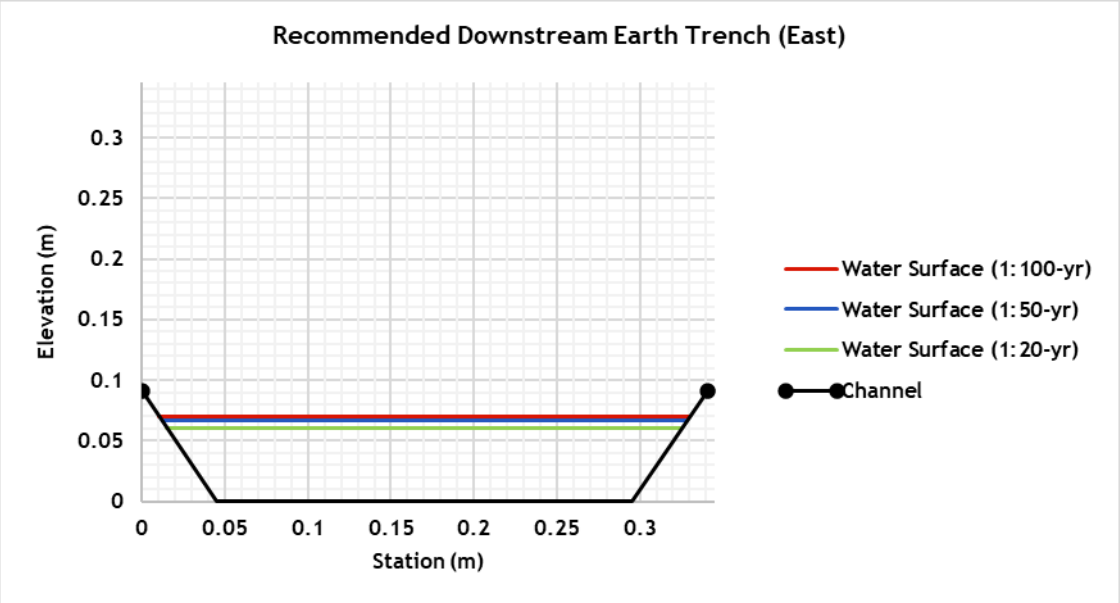
Figure 11-3: Comparative peak flow calculations for the delineated HRUs

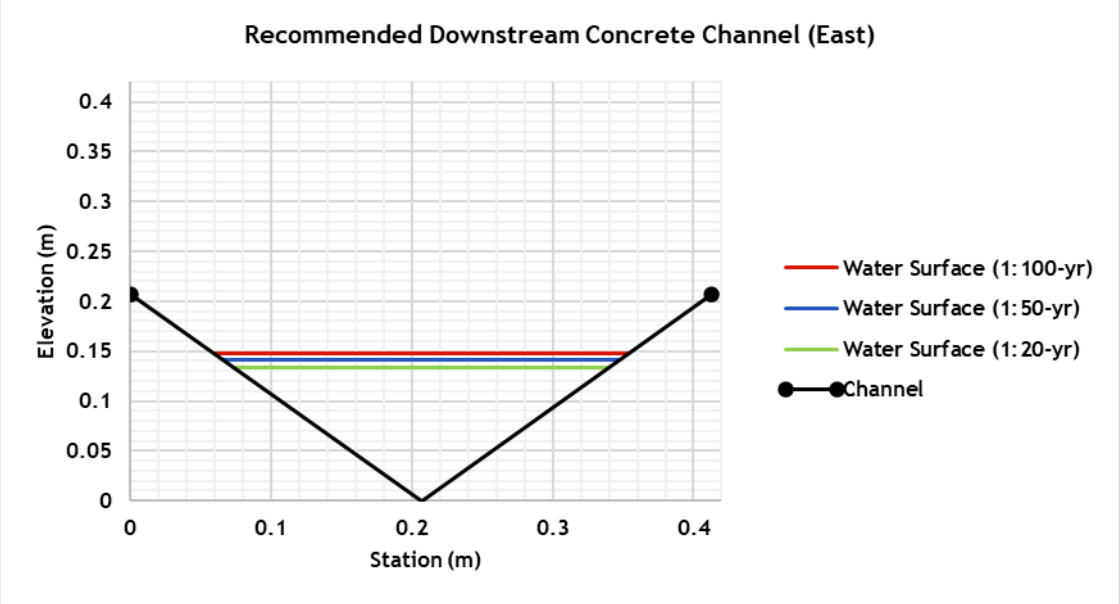
APPENDIX B: STORMWATER SYSTEM SIZING

The following illustrates the dimensions of the channels on-site, both current and recommended, and indicates the anticipated water surface levels for the 1:20, 1:50, and 1:100-year storm events that affect the channels.






Recommended Downstream Earth Trench (East)
Elevation (m)
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.05
0.1
0.15
0.2
0.25
0.3
Station (m)
Water Surface (1:100-yr)
Water Surface (1:50-yr)
Water Surface (1:20-yr)
Channel


Recommended Downstream Concrete Channel (East)
Elevation (m)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.1
0.2
0.3
0.4
Station (m)
Water Surface (1:100-yr)
Water Surface (1:50-yr)
Water Surface (1:20-yr)
Channel

APPENDIX F: DISCLAIMER AND DECLARATION OF INDEPENDENCE

The opinions expressed in this report have been based on-site /project information supplied to GCS Environment South Africa (Pty) Ltd by Normandien Farms Pty (Ltd) and are based on public domain data, field data and data supplied to GCS by the direct client and end client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions is entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report apply to Thirsti conditions and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge, nor had the opportunity to evaluate.

APPENDIX G: DETAILS OF THE SPECIALISTS, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

PROJECT TITLE

Thirst Bottling Plant - Hydrological Investigation for WULA

SPECIALIST INFORMATION

Specialist Company Name:	GCS Environment South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:	Chané Pretorius			
Specialist Qualifications:	MSc Environmental Sciences (Hydrology & Geohydrology) BSc Hons. Environmental Sciences (Hydrology & Geohydrology) BSc. Geology and Botany			
Professional affiliation/registration:	Cert Sci Nat 136692			
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Postal address:	63 Wessel Rd, Rivonia, Gauteng			
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Telephone:	+27 (0) 11 803 5726	Fax:		
E-mail:	chane@gcs-sa.biz			

Specialist Company Name:	GCS Environment South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:	Sinetemba Xoxo			
Specialist Qualifications:	PhD (Hydrology) MSc Water Resource Science BSc Hons. Environmental Science BSc. Geology and Environmental Science			
Professional affiliation/registration:	Cand Sci Nat 121080			
Physical address:	63 Wessel Rd, Rivonia, Gauteng			
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Telephone:	+27 (0) 11 803 5726	Fax:		
E-mail:	chane@gcs-sa.biz			

DECLARATION BY THE SPECIALISTS

I, Chané Pretorius, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Water Act, its Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the relevant Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken concerning the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; and
- all the particulars furnished by me in this form are true and correct.



Signature of the Specialist

GCS

Name of Company:

18 February 2026

Date

I, Sinetemba Xoxo, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Water Act, its Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the relevant Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken concerning the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; and
- all the particulars furnished by me in this form are true and correct.



Signature of the Specialist

GCS

Name of Company:

18 February 2026

Date

APPENDIX H: CVS OF SPECIALIST TEAM



CORE SKILLS

- Water Resources Modelling
- Integrated Water Resources Planning & Management
- Systems Analysis
- Spatial Analysis
- Technical report and writing
- Proposal writing

LANGUAGE

- IsiXhosa (Proficient)
- English (Proficient)

EXPERTISE

- Hydrological modelling
- Integrated Water Resource Management
- Multi-criteria Decision Analysis
- Scenario Planning
- Participatory modelling
- Land degradation assessments (SDG 15.3.1)
- Water Stress Assessments (SDG 6.4.2)

PROFESSIONAL MEMBERSHIPS

International Association for Hydrological Scientists - Reg. No 21898

Water Institute of Southern Africa - Reg. No 395410

GCS THE GCS GROUP

Sinetemba Xoxo, PhD

Hydrologist

PROFILE

Prior to joining consulting, Sinetemba served as a postdoctoral researcher in nature-based solutions and a postgraduate researcher in water resources at the Institute for Water Research, Rhodes University. His interests span from hydrological modelling and nature-based solutions to inclusive governance of land and water resources.

Working closely with Assoc. Prof. Jane Tanner and Emeritus Prof. Denish Hughes at IWR and in collaboration with Dr Olivier Barreateau at INRAE (France), he spent his PhD years developing a water reallocation model for equitable water restrictions. He also developed a system to empower previously excluded water users from group decision making processes. This is where he identified the value for integrated or coupled modelling to aid decision-making in the global south.

Sinetemba has been involved in a few Water Research Commission Projects, thee GEF5 Sustainable Land Management Project in the Eastern Cape and contributed to 7 publications including five peer reviewed articles in international journals.

ACADEMIC BACKGROUND

PhD, Hydrology 2025
Rhodes University

MSc, Water Resource Science 2020
Rhodes University

BSc (Hons), Environmental Science 2018
Rhodes University

BSc. Geology & Environmental Science 2017
Rhodes University



CORE SKILLS

- Project Management
- Hydrological Assessment
- Groundwater impact and risk assessment
- Hydrological and flood line modelling
- Stormwater Management
- Water Balance Studies
- WC/WDM Strategies
- GIS and Mapping
- Data Analyses
- Computer literacy
- Technical report writing

LANGUAGE

- English (Fluent)
- Afrikaans (Home language)

EXPERTISE

- Project Management of hydrological projects for mining, industrial and renewable energy industries.
- Hydrological Assessment including
  - Flood Lines
  - Stormwater Management Plans
  - Water and Salt Balances
  - Water Conservation and Water Demand Management Plans
- Hydrological modelling includes:
  - PCSWMM
  - EPA SWMM
  - HEC-RAS
  - HEC-HMS

PROFESSIONAL MEMBERSHIPS

- SACNASP: Certified Natural Scientist (Cert.Sci.Nat) No. 136692

Chané Pretorius

Project Hydrologist

PROFILE

As a Project Hydrologist at GCS Water and Environmental, I specialise in providing comprehensive hydrological assessments and innovative solutions for water-related challenges. My expertise encompasses hydrological modelling, stormwater management, and water balance analysis, ensuring sustainable water resource planning and management. Driven by a passion for environmental stewardship and a commitment to excellence, I work closely with multidisciplinary teams to deliver data-driven insights and actionable strategies tailored to clients' specific needs.

ACADEMIC BACKGROUND

B.Sc. Environmental Sciences with Geology and Botany 2016
North-West University

B.Sc. (Hons) Environmental Sciences with Hydrology and Geohydrology 2018
North-West University

M.Sc. Environmental Sciences with Hydrology and Geohydrology 2023
North-West University

APPENDIX C: HYDROGEOLOGICAL ASSESSMENT

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Thirsti Bottling Plant - Hydrogeological Investigation for WULA

Report

Version - Final.V2.2

20 February 2026

GCS Project Number: 25-0109

Client Reference: BPO005496

THIRSTI™



GCS Environment South Africa (Pty) Ltd Reg No: 2002/028494/07
Offices: Johannesburg
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THIRSTI

20 February 2026

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Director	Andrew Johnston (MSc, Pr.Sci.Nat.) *CEO*	Andrew Johnstone Digitally signed by Andrew Johnstone Date: 2026.02.20 16:14:48 +02'00'	20 February 2026

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EXECUTIVE SUMMARY

Background:

The Thirsti Bottling Plant (Thirsti) has appointed GCS Environment South Africa (Pty) Ltd (GCS) to update the hydrogeological investigation conducted by GCS in 2019 as a part of a Water Use Licence Application (WULA) in accordance with Section 21 of the National Water Act, 1998 (No. 36 of 1998) (NWA). The WULA pertains to the Thirsti Bottling Plant WULA Project (the Site), located in Normandien, New Castle, KwaZulu-Natal.

Thirsti production commenced in 2015 with the bottling of natural and sparkling spring water, and more recently, fruit-flavoured water. The production is dependent on groundwater and surface water as its primary water source, with the current supply network comprising eight (8) operational production boreholes.

To assess the yield and sustainability of each borehole and to understand the aquifer dynamics on-site, several aquifer tests have been undertaken over the years (**refer to Appendix A**). In 2014, Dr. Levin conducted an aquifer test on borehole BH3. This was followed by a more comprehensive aquifer testing program conducted by GCS in 2019, covering the remaining seven (7) operational boreholes.

Site Locality

The Site is located on the Buffelshoek 5469 farm. It is characterised by a diverse natural landscape and is located within Quaternary Catchment V31F of the Pongola-Mtamvuna Water Management Area. The Site experiences a subtropical highland climate, with warm, wet summers and cold, dry winters. The Mean Annual Precipitation (MAP) is 920 millimetres per annum (mm/a), with most of the rainfall falling in the summer months. However, Mean Annual Evaporation (MAE) significantly exceeds the MAP, ranging from 1,300 to 1,450 mm/a, creating a net water deficit.

Hydrocensus Boreholes

The available borehole data from the National Groundwater Archive (NGA) database indicates that there are seven (7) boreholes within a 5-kilometre (km) radius of the Site with groundwater levels ranging from 3.91 metres below ground level (mbgl) to 20 mbgl, with an average groundwater level of 8.795 mbgl. Hydrocensus data from both GCS (2019) and Dr. Levin (2016) identified an additional fourteen (14) boreholes on-site with groundwater levels ranging from 4.41 mbgl to 17.84 mbgl. None of the identified boreholes were found upstream of the Site.

The aquifer test data indicate that variability in transmissivity values across the Site ranges from 2.43 square metres per day (m^2/day) to 34.35 m^2/day. The average transmissivity values for the respective geological units on-site are as follows:

- Jurassic Dolerite Formation: Transmissivity ranges from 7.71 m^2/day to 34.35 m^2/day.

- Volksrust Formation: Transmissivity ranges from 2.43 m^2/day.

Aquifer Testing

Constant Rate Tests were undertaken on the abstraction boreholes (BH4, BH6-BH7, and BH11-BH13) at pre-determined discharge rates; their pumping test results are summarised in the table below:

Borehole ID	Coordinates		Static Water Level (mbgl)	Pump Depth (mbgl)	Yield (l/s)	Available Drawdown (m)	Maximum Drawdown Achieved (m)	Pumping Duration (min)	Recovery Period (min)
	Latitude	Longitude							
BH4	-27.9241	29.75607	8.92	34	1.54	30.18	2.5	480	195
BH6	-27.9422	29.74371	9.45	30	4.5	45.2	<50	18	14.5
BH7	-27.9272	29.75194	5.8	37	1.54	31.2	2.34	480	791
BH8	-27.9188	29.75715	11.1	55	5.4	43.9	42	540	14
BH11	-27.9319	29.74876	2.19	48	3	32.81	18.8	1440	95
BH12	-27.9422	29.74371	9.45	67	3	44.5	26.65	1440	167
BH13	-27.9288	29.74929	9.02	37	6	21	4.4	1440	880

Based on a 12-hour daily pumping schedule (calculated using the Flow Characteristic (FC) method), the total volume of groundwater abstraction for the eight (8) abstraction boreholes on-site is summarised in the table below:

Borehole ID	Recommended Sustainable Abstraction Rate [12-Hour Daily Pump Schedule]		
	[l/s]	m^3/d	m^3/a
BH3	2.44	105.41	38 474
BH4	10.47	452.30	165 091
BH6	*The pumping outlet was reached after 18 minutes*		
BH7	6.65	287.28	104 857
BH8	3.68	158.78	58 026
BH11	3.82	165.02	60 234
BH12	3.82	165.02	60 234
BH13	8.35	360.72	131 663
Total	**39.23**	**1 694.53**	**618 579**

Note that abstraction from BH6 is not recommended unless it is retested at a lower yield.

The data on the table indicates a total volume of 1 694.53 cubic metres per day (m^3/day), which equates to an annual abstraction of 618 579 cubic meters per annum (m^3/a). The calculated FC volume is approximately double the long-term sustainable abstraction needed for Thirsti's production. Thirsti's proposed volume for long-term sustainable groundwater abstraction is 770.88 m^3/day, equivalent to 253 778 m^3/a. This indicates that Thirsti's proposed abstraction from the boreholes falls within sustainable parameters for each borehole.

The groundwater balance calculated for the delineated sub-catchment indicates that a total of 2 918 072 m^3/a of groundwater is available for abstraction. Following the recommended abstraction volume of 618 579 m^3/a, a surplus of 2 299 493 m^3/a is expected to remain available within the sub-catchment. This suggests that the proposed groundwater use is within sustainable limits and does not exceed the estimated recharge capacity of the area.

Based on the Department of Water and Sanitation (DWS) scale of abstraction categories, the recommended groundwater abstraction across the delineated sub-catchment is classified as Category A – "Small-Scale" abstraction. This classification reflects that the volume of groundwater to be abstracted is well within the sustainable limits of the aquifer system relative to the estimated recharge, indicating a low potential for negative impacts on the groundwater resource.

Based on the guide for determining the level of stress of a groundwater resource unit, there is an abstraction of 677 842 m^3/a (existing groundwater use and recommended abstraction) within the delineated sub-catchment classifies the unit as Status Category C (0.2 – 0.5). This indicates a moderate level of stress on the aquifer system, suggesting that while groundwater use is within sustainable limits. However, ongoing monitoring and groundwater management strategies are recommended to prevent overexploitation.

The radius of influence from the abstraction boreholes ranges between 69.21 m and 496.36 m. Groundwater is abstracted from a confined aquifer system, which is hydraulically separated from the overlying unconfined aquifer. As a result, impacts on surface water features such as streams and wetlands are expected to be minimal. However, simultaneous pumping of all eight boreholes could significantly increase the cumulative radius of influence, leading to aquifer drawdown, interference between boreholes, and reduced yields. This may have a negative impact on surrounding groundwater users and the connected surface water bodies.

A field survey conducted by GCS in 2019 identified certain on-site activities with the potential to impact both the quantity and quality of groundwater. These contaminating activities, if left unmanaged, could pose an environmental impact. However, based on the findings of the hydrogeological impact assessment and the implementation of mitigation measures outlined in this study, conducted in accordance with Government Notice Regulation (GNR) 982 of the Environmental Impact Assessment (EIA) Regulations (2014). The potential impacts of these activities are assessed to be neutral to very low in significance after mitigation.

To ensure the long-term sustainable management of the groundwater resource, all monitoring data are to be physically recorded and calibrated on a quarterly basis and subjected to annual review by a qualified Hydrogeologist. This regular evaluation will support the early identification of any anomalies, allowing for timely mitigation and adaptive management of the groundwater system on-site.

Recommendations:

Based on the findings of this hydrogeological assessment, the following recommendations are made:

- Based on a 12-hour daily pumping schedule (calculated using the FC method), the recommended total volume of groundwater abstraction for the eight (8) abstraction boreholes on-site is 1 694.53 m^3/day, which equates to an annual abstraction of 618 579 m^3/a.

Borehole ID	Sustainable Abstraction Rate [12-Hour Daily Pump Schedule]		
	[l/s]	m^3/d	m^3/a
BH3	2.44	105.41	38 474
BH4	10.47	452.30	165 091
BH6	*The pumping outlet was reached after 18 minutes*		
BH7	6.65	287.28	104 857
BH8	3.68	158.78	58 026
BH11	3.82	165.02	60 234
BH12	3.82	165.02	60 234
BH13	8.35	360.72	131 663
Total	**39.23**	**1 694.53**	**618 579**

- To prevent source contamination, it is recommended that all abstraction boreholes should be properly cased and sealed to prevent surface water and contaminant ingress, and regular inspection and maintenance of on-site septic tanks and pit latrines are recommended to prevent leakage into the subsurface and the potential contamination of the aquifer.
- Due to the potential impact of Pecan nut and Pine plantations on groundwater quantity and quality, it is recommended that buffer zones be established where planting is restricted, particularly in groundwater recharge zones.
- Installation of piezometers and quarterly monitoring of groundwater levels in and around the plantation areas to detect any changes in groundwater levels.
- It is recommended that the operational boreholes be pumped on a rotational basis to reduce cumulative drawdown and prevent interference between boreholes.
- It is recommended that a quarterly hydrochemical assessment and groundwater level monitoring be maintained to ensure early detection of any changes that could influence neighbouring groundwater users. Where feasible, an updated groundwater model and cumulative impact assessment should be developed to further support sustainable groundwater management.

Reasoned Opinion:

This assessment cannot find any grounds or identify hydrogeological conditions that could potentially hinder the approval of the WUL for the Site. This is grounded on the assumption that the proposed mitigation measures (Section 7) and monitoring program (Section 8) will be implemented and adhered to.

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GLOSSARY OF TERMS

*A **confined aquifer** is a formation in which the groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations; confined groundwater is generally subject to a pressure greater than atmospheric pressure.*

*An **unconfined, water table** or phreatic aquifer are different terms used for the same aquifer type, which is bounded from below by an impermeable layer. The upper boundary is the water table, which is in contact with the atmosphere so that the system is open.*

***Aquifer** – A body of rock, consolidated or unconsolidated, that is sufficiently permeable to conduct groundwater and to yield significant quantities of water to wells and springs.*

***Discharge Area** – An area in which there is an upward component of the hydraulic head in an aquifer. Groundwater flows toward the land surface in a discharge area and escapes as a spring, seep, or baseflow to streams, or by evaporation and transpiration.*

***Drawdown** – The decline of the water table or potentiometric surface as a result of withdrawals from wells or excavations.*

***Fracture** – A crack, joint, fault or another form of break in rock caused by mechanical failure.*

***The groundwater table** is the surface between the zone of saturation and the zone of aeration, as well as the surface of an unconfined aquifer.*

***Hydraulic conductivity (K)** is the volume of water that will move through a porous medium in unit time under a unit hydraulic gradient through a unit area measured perpendicular to the area [L/T]. Hydraulic conductivity is a function of permeability and the fluid's density and viscosity.*

***The hydraulic gradient** is the rate of change in the total head per unit distance of flow in each direction.*

***Hydraulic Head** – Generally, the altitude of the free surface of a body of water above a given datum.*

***Joint** – A fracture in rock along which there has been no visible movement.*

***An observation borehole** is a borehole drilled at a selected location to observe parameters such as water levels.*

***Permeability** is related to hydraulic conductivity but is independent of the fluid density and viscosity and has the dimensions L^2. Hydraulic conductivity is therefore used in all the calculations.*

***pH** is a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity.*

***Piezometric** head (ϕ) is the sum of the elevation and pressure head. An unconfined aquifer has a water table, and a confined aquifer has a piezometric surface, which represents a pressure head. The piezometric head is also referred to as the hydraulic head.*

***Pumping** tests are conducted to determine aquifer or borehole characteristics.*

***Recharge** is the addition of water to the zone of saturation through the vadose/unsaturated zone.*

***Sandstone** is a sedimentary rock composed of abundant rounded or angular fragments of sand set in a fine-grained matrix (silt or clay) and firmly united by a cementing material.*

***Sedimentary Rock** – A layered rock resulting from the consolidation of sediment deposited by some geologic agent such as water, wind, or ice. Typical sedimentary rocks include sandstone, limestone and shale.*

***Shale** is a fine-grained sedimentary rock formed by the consolidation of clay, silt or mud. It is characterised by a finely laminated structure and is sufficiently indurated so that it will not fall apart on wetting.*

***The static water level** is the level of water in a borehole that is not affected by the withdrawal of groundwater.*

Storativity *is the two-dimensional form of the specific storage and is defined as the specific storage multiplied by the saturated aquifer thickness.*

Total dissolved solids *(TDS) is a term that expresses the quantity of dissolved material in a sample of water.*

Transmissivity *(T) is the two-dimensional form of hydraulic conductivity and is defined as the hydraulic conductivity multiplied by the saturated aquifer thickness.*

Water table *is the surface between the vadose zone and the groundwater, that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.*

List of Abbreviations

Acronym	Description
BH	Borehole
BHN	Basic Human Needs
DEA	Department of Environmental Affairs
DTM	Digital Terrain Model
DWA	Department of Water Affairs
DWAF	Department of Water and Forestry
DWS	Department of Water and Sanitation (previously DWA and DWAF)
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EWR	Ecological Water Requirements
FC	Flow Characteristics
GCS	GCS (Pty) Ltd
GNR	Government Notice Regulation
GWBF	Groundwater Contribution to Baseflow
GRDM	Groundwater Resource Directed Measures
GRIP	Groundwater Information Project
GW	Groundwater
IGRD	Intermediate Groundwater Reserve Determination
MAE	Mean annual Evaporation
mamsl	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgl	Metres Below Ground Level
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NIWIS	National Integrated Water Information System
SANS	South African National Standards
SCM	Site Conceptual Model
SOW	Scope of Work
SW	Surface Water
T	Transmissivity (m^2/d)
t	Time (days)
TDS	Total dissolved solids
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012
WULA	Water Use Licence Application

Acronym	Description
WUL	Water Use Licence

List of Units of Measurement

Units	Description
%	Percent
°C	Degrees Celsius
K (k)	Hydraulic Conductivity (m/day)
Km^2	Kilometre
l/d	Litres per day
l/s	Litres per second
m	Metres
mm	Millimetres
mm/a	Millimetres per annum
m^3	Cubic metres
m^3/a	Cubic metres per annum
m^3/day	Cubic metres per day
m^2/d	Square metres per day
mg/l	Milligrams per litre
ml	Millilitre
T	Transmissivity (m^2/d)

1 INTRODUCTION

The Thirsti Bottling Plant (Thirsti) appointed GCS Environment SA (Pty) Ltd (GCS) to update the hydrogeological investigation conducted by GCS in 2019 as a part of a Water Use Licence Application (WULA) in accordance with Section 21 of the National Water Act, 1998 (No. 36 of 1998) (NWA). The WULA pertains to the Thirsti Bottling Plant WULA Project (the Site), located in Normandien, New Castle, KwaZulu-Natal.

Thirsti commenced in 2015 with the bottling of natural and sparkling spring water and, more recently, fruit-flavoured water. The production is dependent on groundwater and surface water as its primary water source, with the current supply network comprising eight (8) abstraction boreholes. (Table 1-1).

To assess the yield and sustainability of each borehole and to understand the aquifer dynamics on-Site, several aquifer tests have been undertaken over the years. In 2016, Dr. Levin conducted an aquifer test on BH3 (Levin, 2016). A more comprehensive aquifer testing program was conducted by GCS in 2019, covering the remaining seven (7) boreholes (GCS, 2019).

Table 1-1: Borehole information summary.

Proposed Section 21(a) - Type Water Abstraction							
Water use	Use Description	Site Name	Coordinates (WGS84 DD Format)		Property	Use Volume (m^3/a)	Approximate 12-Hour Operational Yield (l/s)
			X	Y			
1	Operational Use	BH3	29.74489	-27.94483	Farm Buffelshoek No. 15469	30 660	1.9
2	Operational Use	BH4	29.75607	-27.92406	Portion one of Farm Woodburn 15470	23 652	1.5
3	Operational Use	BH6	29.75314	-27.92336	Remainder of Farm Woodburn 15470	15 768	1.0
4	Operational Use	BH7	29.75194	-27.92720	Remainder of Farm Woodburn 15470	23 652	1.5
5	Operational Use	BH8	29.75715	-27.91880	Remainder of Farm Woodburn 15470	29 959	1.9
6	Operational Use	BH11	29.74371	-27.94221	Farm Buffelshoek No. 15469	39 420	2.5
7	Operational Use	BH12	29.74876	-27.93186	Farm Buffelshoek No. 15469	39 420	2.5
8	Operational Use	BH13	29.74929	-27.92883	Farm Buffelshoek No. 15469	78 840	5.0

1.1 Objectives

The main objectives of the study were as follows:

- Understand baseline groundwater quantity and quality that can be used as a benchmark for future comparison purposes.
- Assess the current status of groundwater resources in general and any fatal flaws and /or sensitive areas.
- GCS will use the (Levin, 2016) and (GCS, 2019) reports to characterise the Site.
- Understand all groundwater impacts associated with the proposed activities on the groundwater environment.
- Present findings in an understandable and presentable format so that they can be used for decision-making purposes.

2 SCOPE OF WORK

The scope of work (SOW) comprised the following tasks:

- Preliminary Work:
  - Update desktop study,
  - Update Geological and hydrogeological data review (**Section 5)**, and,
  - Update Baseline hydrogeology and desktop hydrocensus (**Section 4.2**),
  - Hydrogeological Conceptual Model (**Section 6**),
  - Update Groundwater Reserve determination (**Section 5.4**),
  - Update Groundwater Impact Assessment (**Section 7**),
  - Update groundwater monitoring plan. (**Section 8**)
- Mapping and Reporting
  - Updated GIS and Mapping with the latest datasets,
  - Provide an up-to-date Hydrogeological report (this document).

3 GEOGRAPHICAL SETTING

3.1 Locality

The Site is located on the Buffelshoek 5469 farm, approximately 28 kilometres (km) southwest of Newcastle in KwaZulu-Natal, South Africa. It is surrounded primarily by herbaceous wetlands, plantations, natural wooded areas, and grassland. To the east of the Site lies the Horn River. Figure 3-3 shows the location of the abstraction boreholes on the Site in relation to the surrounding natural features.

3.2 Topography and Drainage

The Site is situated in Quaternary Catchment V31F of the Pongola-Mtamvuna Water Management Area (WMA) (DWS, 2016). Elevations across the Site range from 1050 metres above mean sea level (mamsl) to 1450 mamsl.

Based on the Site 's topography, natural drainage flows northeast toward the Horn River, which is situated approximately 290 metres (m) downstream of the Site . In the southern part of the Site , there is a non-perennial drainage line that confluences with the Horn River.

3.3 Climate

Climate, amongst other factors, influences soil-water and groundwater recharge processes. The most influential climatic parameters are rainfall and evaporation.

The Site is in the sub-humid climate region of South Africa. Per the global distribution of Köppen-Geiger climate zones (Beck, 2023), the study area falls in the subtropical highland climate or temperate oceanic climate with dry winters.

3.3.1 Rainfall and Evaporation

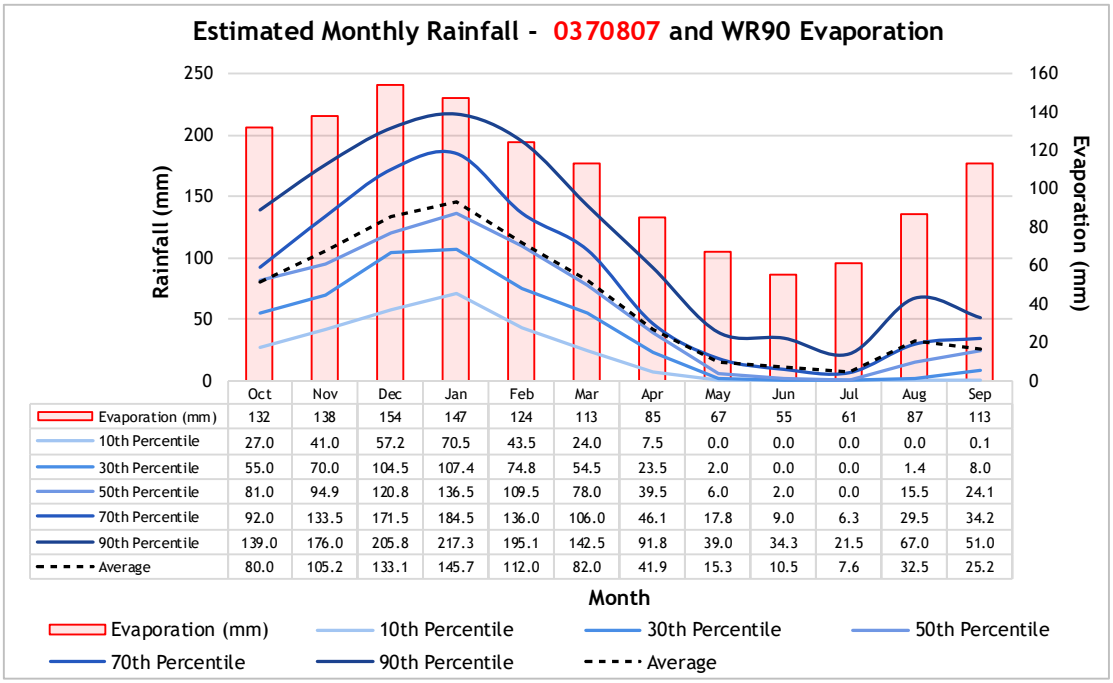
Thirsti is in V3B rainfall zone, with an estimated MAP of about 791 mm/a between 1920 and 2009 (Bailey and Pitman, 2016), which is less than the 834 mm/a for the V3B zone. Nearby rainfall was sourced from rainfall station 0370807_W near Chelmsford Dam, which is less than 24 km east of Thirsti (Table 3-1). The station recorded 50 years of rainfall from 1959 to 2009.

Table 3-1: Summary of MAP of closest rainfall stations (Smithers & Schulze, 2002)

Name	Station ID	Distance (km)	Record (years)	MAP (mm/a)
BIDEFORD	0334543_W	9.7	29	788
MUNROS WINKEL	0370352_W	10.5	29	895
CECILIA, NEWCASTLE	0370655_A	14.5	31	931
BRAKKRANS	0370116_W	18	618	618
MOEDERSRUS	0370407_W	18.1	30	980
CHELMSFORD DAM	0370807_W	23.5	39	791
Average for rainfall zone V3B				**834**

As can be seen in Figure 3-1, rainfall percentiles (10th, 30th, 50th, 70th, 90th) are plotted alongside average values, while evaporation is shown with red bars. Rainfall from this station is likely to follow the historic trends shown in Figure 3-1, such that 80% of MAP may fall in the ranges of 271 mm/a and 1 308 mm/a. Peak rainfall is expected in the late summer months, and peak evaporative losses are expected in December (Figure 3-1).

Evaporation data for Thirsti were extracted from the WR90 database. Thirsti falls within evaporation zone 12A. The MAP clearly exceeds the MAE (Figure 3-1), supporting the earlier statement that the project area experiences a sub-humid climate.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation (mm)	132	138	154	147	124	113	85	67	55	61	87	113
10th Percentile	27.0	41.0	57.2	70.5	43.5	24.0	7.5	0.0	0.0	0.0	0.0	0.1
30th Percentile	55.0	70.0	104.5	107.4	74.8	54.5	23.5	2.0	0.0	0.0	1.4	8.0
50th Percentile	81.0	94.9	120.8	136.5	109.5	78.0	39.5	6.0	2.0	0.0	15.5	24.1
70th Percentile	92.0	133.5	171.5	184.5	136.0	106.0	46.1	17.8	9.0	6.3	29.5	34.2
90th Percentile	139.0	176.0	205.8	217.3	195.1	142.5	91.8	39.0	34.3	21.5	67.0	51.0
Average	80.0	105.2	133.1	145.7	112.0	82.0	41.9	15.3	10.5	7.6	32.5	25.2

Figure 3-1: Estimated historic rainfall for station 0370507_W (Oct 1968 to Oct 2004) and mean annual evapotranspiration (WR90) for the project area

3.3.1.1 Site-specific rainfall.

Daily rainfall for Thirsti was also provided by the client for the recent years (Jan 2021 to Feb 2025), at a daily timestep. This data was aggregated to monthly averages to maintain consistency with the catchment rainfall, generating a record of 50 months (or 1 520 days). Rainfall peaks have been increasing in the recent years during the summer months, as shown by the trendline's positive slope (Figure 3-2).

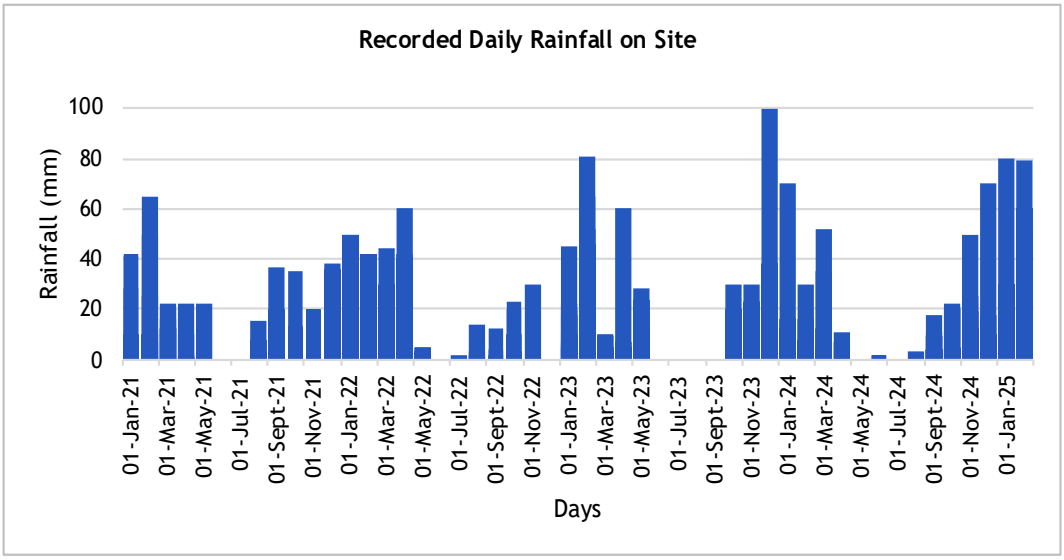


Figure 3-2: Daily rainfall recorded at Thirsti site

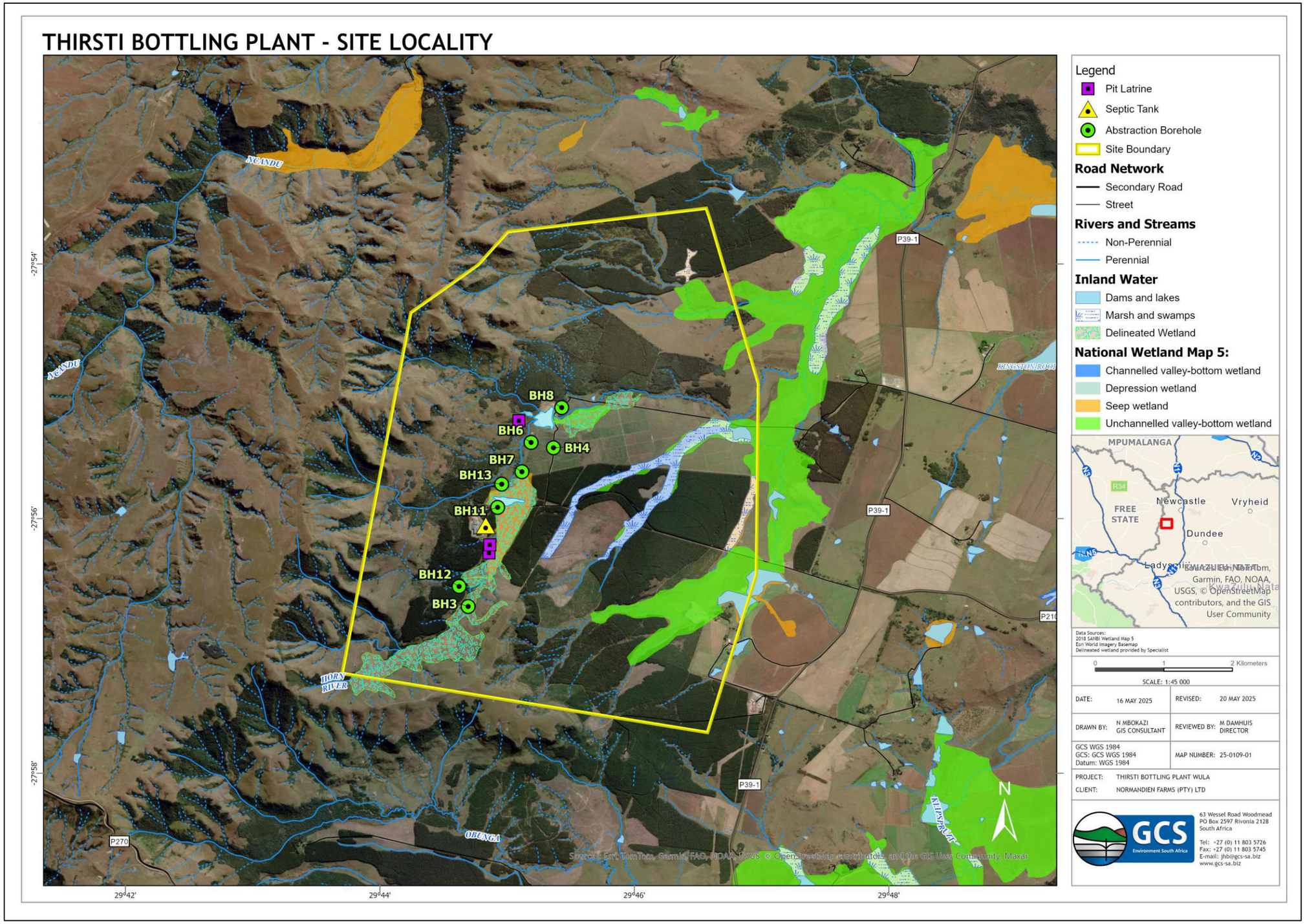


Figure 3-3: Locality map of the Site.

4 METHODOLOGY

A logical and holistic approach was adopted to assess the Site. The Best Practice Guidelines for Impact Prediction (G4) (Department of Water Affairs and Forestry [DWAF], 2008) were considered to define and understand the three basic components of the hydrogeological impact associated with the Site activities:



- **Source term** - The source of the impact;
- **Pathway** - The pathway along which the impact propagates; and
- **Receptor** - The target that experiences the impact.

The approach was used to assess:

1. How the existing/ Site activities could impact groundwater *Quality*; and
2. How the existing/ Site activities could affect the groundwater *Quantity*.

4.1 Literature Review and Desktop Study

The following sources supply an overview of the hydrogeological conditions of the Site, as per the desktop information reviewed for this assessment:

- National Groundwater Archives (NGA) database (NGA, 2025) and borehole data
- 2725 Kroonstad– 1:500 000 Hydrogeological map series (Baran, 2003)
- 2728 Frankfort– 1:250 000 Geological map series
- Literature on similar geology and hydrogeology:
    - A South African Aquifer System Management Classification (Parsons, 1995);
    - Aquifer Classification of South Africa (DWA, 2012);
    - The relationship between South African geology and hydrogeology (Lourens, 2013).
- The following Site-specific investigation reports provided aquifer testing results and background on the general hydrogeological and geological conditions for the Site:
    - Thirsti Bottling Plant Water Supply Investigation Report. Compiled by GCS (Project Number 19-0320, 18 June 2019).
    - Groundwater Vulnerability Assessment for the Thirsti Bottling Plant Report. Compiled by GCS (Project Number 21-0524, 26 September 2023).
    - Thirsti Hydrogeological and Vulnerability Report Compiled by Dr Levin (April 2016).

4.2 Desktop Hydrocensus

The borehole information obtained from the NGA database on 13 May 2025 for the Site area indicates there are seven (7) boreholes situated within a 5 km radius of the Site (NGA, 2025). In 2019, GCS conducted a hydrocensus on-Site and identified two (2) of these, namely BH9 and BH14.

Dr. Levin (2016) also conducted a hydrocensus to identify groundwater users in the vicinity of the Site. twelve (12) boreholes were identified in the 2016 hydrocensus.

Based on the data obtained from the hydrocensus conducted for the Site, it is noted that none of the boreholes identified during the hydrocensus were located upstream.

Table 4-1 lists the groundwater users and boreholes identified on-Site, and their locations are shown in Figure 4-1.

Table 4-1: Summary of desktop boreholes identified in the Site area.

Borehole ID	Latitude	Longitude	Coordinate GPS Accuracy	Elevation (mamsl)	Water level (mbgl)	Depth (m)
NGA 2025						
2729DD00055	-27.9488	29.78498	-	1340	20	18
2729DD00027	-27.9463	29.78303	-	1320	-	65
35081	-27.9283	29.78067	-	1300	5.35	61
34890	-27.9159	29.76246	-	1340	-	-
034892A	-27.9145	29.76724	-	1340	-	-
35097	-27.9134	29.77395	100	1340	3.91	15
34891	-27.9108	29.77216	-	1340	5.92	61
GCS 2019						
BH9	-27.9406	29.75715	-	-	6.84	
BH14	-27.9213	29.7535	-	-	9.34	100
Dr Levin 2016						
2729DD00001	-27.91331594	29.77395	-	-	-	15
2729DD00002	-27.91583577	29.76245	-	-	-	29
2729DD00003	-27.91442586	29.76724	-	-	-	-
2729DD00004	-27.91078609	29.77216	-	-	-	61
2729DD00005	-27.92822051	29.78067	-	-	-	61
2729DDV0011	-27.96277779	29.79639	-	-	9.57	80
2729DDV0012	-27.90499987	29.78833	-	-	17.84	80
2829BA00027	-28.04210803	29.66359	-	-	-	45
2829BAV0007	-28.02738894	29.67918	-	-	9.8	60
2829BBV0005	-28.02877917	29.81859	-	-	6.9	100
BH1	-27.9063	29.70198	-	-	4.41	-
BH2	-27.93903	29.73557	-	-	-	-

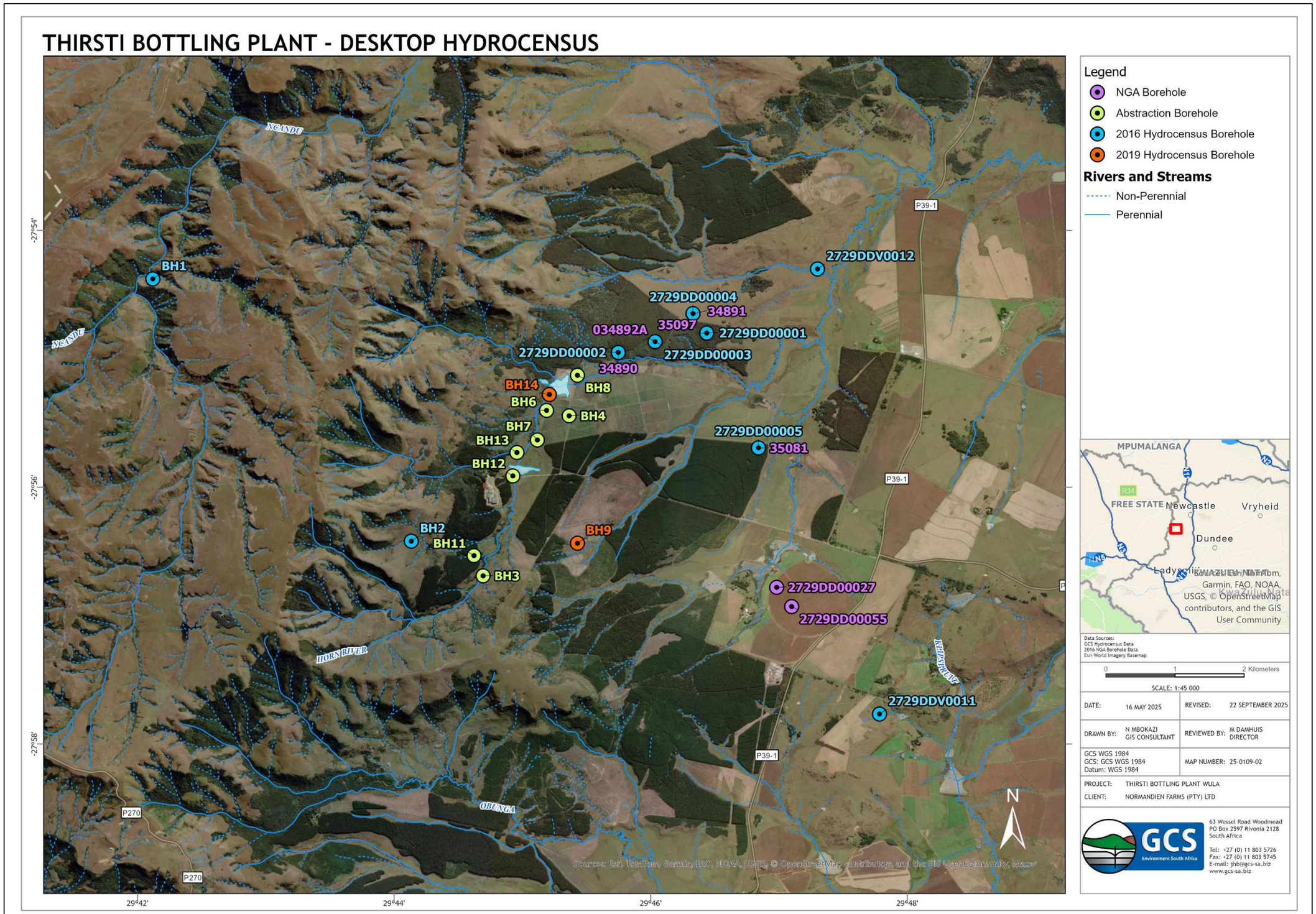


Figure 4-1: Desktop hydrocensus boreholes in the Site area.

4.3 Field Investigation

4.3.1 Aquifer Hydraulic Testing

In 2016, Dr Levin conducted aquifer testing on one (1) of the abstraction boreholes, BH3, on-Site (Levin, 2016). The results are provided in **Appendix A.**

Table 4-2 provides a summary of the aquifer test program conducted by Dr Levin in 2016.

Table 4-2: The results of the aquifer testing conducted by Dr Levin (Levin, 2016).

Borehole ID	Coordinates		Static Water Level (mbgl)	Pump Depth (mbgl)	Yield (l/s)	Available Drawdown (m)	Maximum Drawdown Achieved (m)	Duration (min)	Recovery Period (min)
	Latitude	Longitude							
BH3	-27.94483	29.74489	3.70	80	2.76	76.3	29.68	2880	2240

In 2019, GCS conducted aquifer testing on the seven (7) abstraction boreholes on-Site (GCS, 2019). The results of the aquifer are provided in **Appendix A.**

Table 4-3 provides a summary of the aquifer test program conducted by GCS in 2019.

Table 4-3: The results of the aquifer testing conducted by GCS (GCS, 2019).

Borehole ID	Coordinates		Static Water Level (mbgl)	Pump Depth (mbgl)	Yield (l/s)	Available Drawdown (m)	Maximum Drawdown Achieved (m)	Pumping Duration (min)	Recovery Period (min)
	Latitude	Longitude							
BH4	-27.9241	29.75607	8.92	34	1.54	30.18	2.5	480	195
BH6	-27.9422	29.74371	9.45	30	4.5	45.2	<50	18	14.5
BH7	-27.9272	29.75194	5.8	37	1.54	31.2	2.34	480	791
BH8	-27.9188	29.75715	11.1	55	5.4	43.9	42	540	14
BH11	-27.9319	29.74876	2.19	48	3	32.81	18.8	1440	95
BH12	-27.9422	29.74371	9.45	67	3	44.5	26.65	1440	167
BH13	-27.9288	29.74929	9.02	37	6	21	4.4	1440	880

4.3.1.1 Data Analysis

According to the aquifer test data conducted by GCS in 2019 and Dr levin in 2016, a constant-rate test was undertaken on the water supply production boreholes on the Site for a duration of 8 to 48 hours (Table 4-3) (GCS, 2019; Levin, 2016).

The drawdown and recovery curves from the constant-rate test and recovery monitoring are provided in **Appendix A** and discussed below in terms of the groundwater level response to abstraction.

BH3

During the 48-hour / 2880-minute constant-rate test at BH3, 29.68 m of the available 76.5 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was 100 percent (%) of the pre-test static water level (3.70 mbgl) within 2240 minutes.

From the drawdown response curve, the following are apparent:

- The moderate drawdown relative to the available drawdown, combined with full recovery in a short period, indicates that the aquifer has a responsive system.
- The rapid recovery indicates that the aquifer has good transmissivity and storage characteristics, suggesting that it can sustain a higher yield.

BH4

During the 8-hour / 480-minute constant-rate test at BH4, 2.5 m of the available 35 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was 95 % of the pre-test static water level (8.92 mbgl) within 195 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- The drawdown-time curve was typical of a linear flow regime with a negligible influence from the wellbore storage.
- No indication of a no-flow boundary.

BH6

During the 8-hour / 480-minute constant-rate test, BH6, the groundwater level reached the pump inlet depth (< 50 mbgl) at 18 minutes. Following the cessation of the constant-rate test, groundwater level recovery was relatively rapid and recovered 100 % of the pre-test static water level (9.45 mbgl) within 14.5 minutes.

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.

- A rapid drawdown was observed for the duration of the constant-rate test until the pump inlet was reached at 18 minutes, suggesting that the pump rate at BH6 was much higher than the aquifer storage.

BH7

During the 8-hour / 480-minute constant-rate test at BH7, 2.34 m of the available 37 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was 95 % of the pre-test static water level (5.8 mbgl) within 791 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- The drawdown-time curve was typical of a linear flow regime with a negligible influence from the wellbore storage.
- No indication of a no-flow boundary.

BH8

During the 9-hour / 540-minute constant-rate test at BH8, a 41.6 m of the available 50 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was relatively rapid and recovered 90 % of the pre-test static water level (11.1 mbgl) within 14 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- The drawdown-time curve was typical of a linear flow regime with a negligible influence from the wellbore storage.

BH9

During the 8-hour / 480-minute constant-rate test at BH9, the groundwater level reached the pump inlet (75 mbgl) after 56.5 minutes. Following the cessation of the constant-rate test, groundwater level recovery was 26 % of the pre-test static water level (6.82 mbgl) within 53 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- A continuous drawdown was observed for the duration of the constant-rate test until the pump inlet was reached at 56.5 minutes.

BH11

During the 24-hour / 1440-minute constant-rate test at BH11, an 18.8 m of the available 45.81 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was 90 % of the pre-test static water level (2.19 mbgl) within 95 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- The initial drop in groundwater levels up to 60 minutes was probably due to the wellbore storage and dual porosity conditions.
- After 60 minutes, the drawdown rate decreased with no indication of a no-flow boundary condition.

BH12

During the 24-hour / 1440-minute constant-rate test at BH12, a 26.65 m of the available 59.55 m drawdown was reached at the end of the test period. Following cessation of the constant-rate test, groundwater level recovery was 90 % of the pre-test static water level (9.45 mbgl) within 167 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level was observed up to 997 minutes, after which the system reached a steady-state condition with respect to the applied pumping rate being less than the aquifer storage.
- The initial drop in groundwater level up to 12 minutes was probably due to the well bore storage and dual porosity conditions.
- After 141, 420, and 848 minutes, rapid groundwater level drawdown was observed, possibly indicating dewatering of the corresponding water strikes.

BH13

During the 6-hour/360-minute constant-rate test at BH13, a 6.18 m of the available 48 m drawdown was reached at the end of the test period. Following the cessation of the constant-rate test, groundwater level recovery was 92 % of the pre-test static water level (9.02 mbgl) within 830 minutes.

From the drawdown response curve, the following are apparent:

- Continuous drawdown in groundwater level throughout the constant-rate test indicated that the system did not reach steady-state conditions with respect to the applied pumping rate being greater than the aquifer storage.
- The drawdown-time curve was typical of a linear flow regime with a negligible influence from the wellbore storage.
- No indication of a no-flow boundary.

4.3.1.2 Hydraulic Parameters

The aquifer parameters of the eight (8) abstraction boreholes tested by GCS and Dr Levin were estimated using the Cooper-Jacob and Theis method.

Table 4-4 summaries the hydraulic parameters of the eight (7) abstraction boreholes tested by GCS and Dr Levin.

Table 4-4: Hydraulic parameter (calculated) summary (GCS, 2019).

Borehole ID	Geology	Cooper-Jacob Transmissivity (m^2/d)	Theis Residual Transmissivity (m^2/d)
BH3	Jurassic Dolerite	-	4
BH4	Jurassic Dolerite	31.13	34.99
BH6	Volksrust Formation	*The pumping outlet was reached after 18 minutes*	
BH7	Jurassic Dolerite	*18.5*	*19.7*
BH8	Volksrust Formation	*2.43*	*76.66*
BH11	Jurassic Dolerite	7.71	25.02
BH12	Jurassic Dolerite	*8.52*	*12.11*
BH13	Jurassic Dolerite	34.35	23.93

Transmissivity values vary across the Site, with values between 2.43 m^2/day and 34.35 m^2/day, and the average representative transmissivity of the respective tested geological units was as follows:

- Jurassic Dolerite 7.71 m^2/day to 34.35 m^2/day
- Volksrust Formation 2.43 m^2/day

4.3.1.3 Sustainable Abstraction Rate

According to the GCS (2019) report, the sustainable rate of the abstraction boreholes on-Site has been calculated from analytical methods, using constant-rate test data. The following criteria were used in defining the sustainable yields:

- Sustainable yield calculations were calculated based on a twelve (12) hour per day abstraction schedule.

- The groundwater level during pumping should not reach the depth of the pump inlet (e.g., ~2 m above the main water strike); and
- The analytical calculations accounted for no groundwater recharge to allow for a more conservative approach.

According to the GCS (2019) report, the sustainable abstraction calculations contained the following limitations:

- The groundwater sustainable yield calculations do not account for any other abstractions in the surrounding area.
- Little information was available in terms of groundwater boundaries, including aquifer limits, low-permeable barriers, and recharge flux boundaries. These boundaries may impact the medium to long-term groundwater drawdown response.
- No borehole and/or formation skin effects were taken into account. These skin effects could result in turbulent flow and increase drawdown.
- Aquifer hydraulic tests conducted on existing production boreholes, which were equipped with a pump system, were limited to the specification and yield of the corresponding pump system.

Drawdown and abstraction rate (Q) were determined using the Cooper-Jacob equation:

$$s = \frac{2.3Q}{4\pi T} Log \frac{2.25Tt}{r^2 S}$$

Where:

s - Drawdown [m]
Q - Yield [m^3/d]
T - Transmissivity [m^2/d]
t - Time [d]
r - Radius [m]
S - Storativity [unitless]

Table 4-5 presents the recommended abstraction rates for the seven (7) boreholes on-Site, based on a 12-hour daily pumping schedule. Due to limited aquifer testing data available for BH6, the sustainable yield of BH6 could not be recommended, as the pumping inlet was reached after 18 minutes of pumping. Hence, the FC method could not be applied to determine the recommended abstraction rate.

Based on the FC method estimations, the total recommended sustainable volume of groundwater abstraction at the Site amounts to 1 694.53 m^3/day, which is equivalent to 618 579 m^3/a. This estimate excludes borehole BH6 and is based on a 12-hour daily pumping schedule.

However, Thirsti's long-term sustainable abstraction demand for the eight (8) abstraction is much less than the recommended sustainable volume. (refer to Table 4 6). The total of groundwater abstraction demand for Thirsti is 770.88 m^3/day equivalent to 253 778 m^3/a.

Table 4-5: Recommended long-term sustainable abstraction rate at the Site estimated using the FC method.

Borehole ID	Sustainable Abstraction Rate [12-Hour Daily Pump Schedule]		
	[l/s]	m^3/d	m^3/a
BH3	2.44	105.41	38 474
BH4	10.47	452.30	165 091
BH6	*The pumping outlet was reached after 18 minutes*		
BH7	6.65	287.28	104 857
BH8	3.68	158.78	58 026
BH11	3.82	165.02	60 234
BH12	3.82	165.02	60 234
BH13	8.35	360.72	131 663
Total	**39.23**	**1 694.53**	**618 579**

Table 4-6: Thirsti's current abstraction demand.

Borehole ID	Coordinates		Thirsti's current Abstraction Demand [12-Hour Daily Pump Schedule]		
	Latitude	Longitude	[L/h]	[m^3/day]	m^3/a
BH3	-27.944837	29.744891	7000	84	30 660
BH4	-27.92406	29.75607	5400	64.8	23 652
BH6	-27.92336	29.75314	3600	43.2	15 768
BH7	-27.9272	29.75194	5400	64.8	23 652
BH8	-27.9188	29.75715	6840	82.08	29 959
BH11	-27.931865	29.748759	9000	108	39 420

BH12	-27.942212	29.743712	9000	108	39 420
BH13	-27.928825	29.749289	18000	216	78 840
Total			**64 240**	**770.88**	**281 371**

4.3.2 Field Survey

Likely contamination sources on-Site, which could impact groundwater quantity and quality, have been identified in prior investigations between 14-18 June 2021 (GCS, 2023).

From the field investigation, the following was noted:

- Trucks entering the laydown area at the main gate. If pollution of the soils occurs during the waiting period (i.e. period taken by the truck to load/off-load packages), it may render the nearby boreholes vulnerable to contamination. However, the likelihood of such contamination occurring is considered medium to low.
- Three (3) pit latrines were discovered on-Site. (refer to Figure 3-3).
- A septic tank and French drain are located upstream of BH12. The septic tank receives sewage effluent from the bottling plant (refer to Figure 3-3).

The Site is characterised by various Pecan nut and Pine tree plantations, which pose a quantitative and qualitative impact on the groundwater abstracted at the Site.

- Quality impacts could typically be associated with the use of organic fertilisers, which could pose an impact in terms of nutrient leaching into the groundwater. The application of fertilisers should be minimal in areas close to the boreholes (if applied).
- Quantity impacts could be that of reduced groundwater recharge as a result of the tree's ability to hamper rainfall ingress and take water from shallow groundwater zones. Buffer areas for no tree planting should be considered.

According to GCS (2019), the boreholes at the Thirsti Site are therefore considered to be vulnerable to the activities listed above, of which plantation farming seems to be the dominant impact.

The following analytical calculations were undertaken to determine the travel time of the effluent from the septic tank. The calculations were based on aquifer tests conducted by GCS in 2019 (GCS, 2019).

Average groundwater flow velocity and travel time towards BH8, which is the farthest downgradient borehole, were calculated as follows:

$$Q = -K\frac{\Delta h}{\Delta L}A$$ **Equation 1**

where:

Q	**=**	**volumetric flow rate (L^3/T)**
K	=	hydraulic conductivity is the proportionality constant reflecting the ease with which water flows through a material (L/T)
Δ*h*	=	difference in hydraulic head between two measuring points and as defined for the length (L)
Δ*L*	=	length along the flow path between locations where hydraulic heads are measured (L)
	=	gradient of hydraulic head (dimensionless)
A	=	cross-sectional area of flow perpendicular to the direction of flow (L^2)

Darcy's law (equation 1) can be rewritten as specific discharge, or Darcy Flux, *q*:

$$q = \frac{Q}{A} = -K\frac{\Delta h}{\Delta L}$$ **Equation 2**

To determine the rate of travel, the groundwater velocity, *v*, is calculated. This value is higher than the specific discharge because the water can only pass through the portion of the cross-sectional area that is connected pore space and contributes to the effective porosity, n_e.

$$v = \frac{q}{n_e} = \frac{Q}{A\,n_e} = -\frac{K}{n_e}\frac{\Delta h}{\Delta L}$$ **Equation 3**

The resulting groundwater flow velocity between borehole BH8 (average elevation 1,340 m) and surrounding potential sources of contamination, including the pit latrines (1,386 m), laydown area (1,396 m), plantations (1,420 m), and the septic/French drain system (1,389 m) was calculated as follows:

Table 4-7: FC Analysis Results for 12-Hour Pumping Schedule (GCS, 2019).

Formation	Average Transmissivity [m^2/d]	Average Hydraulic Conductivity (m/d)
Jurassic Dolerite	20.04	0.28
Volksrust Formation	2.13	0.05

Table 4-8: Parameters.

Δh (m)	ΔL (m)	Estimated Porosity (conservative estimate)
Septic Tank		
49	1 966.93	5%
Pit Latrines		
46	2 336.28	5%
Laydown Area		
56	1 985.47	5%
Organic Fertilisers from The Plantations		
80	2 283.29	5%

Results for the Septic Tank

$$v\ (Jurassic\ Dolerite) = -\frac{0.28}{0.05}\ \frac{49}{1\ 966.93} = -\ 0.1395\frac{m}{d}\ or \sim -\ 50.92\ m/year$$

$$v\ (Volkrust\ Formation) = -\frac{0.05}{0.05}\ \frac{49}{1966.93} = -\ 0.025\frac{m}{d}\ or \sim -\ 9.13\ m/year$$

Travel time between the Septic Tank and BH8:

$$Time\ (Jurassic\ Dolerite) = \frac{distance}{velocity} = \frac{1\ 966.93\ \text{m}}{50.92\ \text{m/year}} = \sim \mathbf{38.63\ years}$$

$$Time\ (Volkrust\ Formation) = \frac{distance}{velocity} = \frac{1\ 966.93\ \text{m}}{9.13\ \text{m/year}} = \sim \mathbf{215.44\ years}$$

In a worst-case scenario, it would take 38.63 years for contaminants from the septic tank to reach the BH 8 (the farthest downgradient borehole)through the Jurassic Dolerite contact zones, and 215.44 years through the Volksrust Formation.

Results for the Pit Latrines:

$$v\ (Jurassic\ Dolerite) = -\frac{0.28}{0.05}\ \frac{46}{2\ 336.28} = -\ 0.11\frac{m}{d}\ or \sim -\ 40.15 m/year$$

$$v\ (Volkrust\ Formation) = -\frac{0.05}{0.05}\ \frac{46}{2\ 336.28} = -\ 0.0196\frac{m}{d}\ or \sim -\ 7.19\ m/year$$

Travel time between the Pit Latrines and BH8:

$$Time\ (Jurassic\ Dolerite) = \frac{distance}{velocity} = \frac{2\ 336.28\ \text{m}}{40.15\ \text{m/year}} = \sim \mathbf{58.19\ years}$$

$$Time\ (Volkrust\ Formation) = \frac{distance}{velocity} = \frac{2\ 336.28\ \text{m}}{7.19\ \text{m/year}} = \sim \mathbf{324.93\ years}$$

In a worst-case scenario, it would take 58.19 years for contaminants from the pit latrines to reach the BH 8 (the farthest downgradient borehole) through the Jurassic Dolerite contact zones, and 324.93 years through the Volksrust Formation.

Results for the Laydown Area

$$v\,(Jurassic\ Dolerite) = -\frac{0.28}{0.05}\,\frac{56}{1\,985.47} = -\,0.16\,\frac{m}{d}\ or \sim -\,58.4\ m/year$$

$$v\,(Volkrust\ Formation) = -\frac{0.05}{0.05}\,\frac{56}{1\,985.47} = -\,0.028\,\frac{m}{d}\ or \sim -\,10.22\ m/year$$

Travel time between the Laydown Area and BH8:

$$Time\,(Jurassic\ Dolerite) = \frac{distance}{velocity} = \frac{1\,985.47\ \text{m}}{58.4\ \text{m/year}} = \sim\mathbf{34\ years}$$

$$Time\,(Volkrust\ Formation) = \frac{distance}{velocity} = \frac{1\,985.47\ \text{m}}{10.22\ \text{m/year}} = \sim\mathbf{194.27\ years}$$

In a worst-case scenario, it would take 34 years for contaminants from the laydown area to reach the BH 8 (the farthest downgradient borehole) through the Jurassic Dolerite contact zones, and 194.27 years through the Volksrust Formation.

Results for the Organic Fertilisers from the Plantations

$$v\,(Jurassic\ Dolerite) = -\frac{0.28}{0.05}\,\frac{80}{2\,283.93} = -\,0.196\,\frac{m}{d}\ or \sim -\,71.54\ m/year$$

$$v\,(Volkrust\ Formation) = -\frac{0.05}{0.05}\,\frac{80}{2\,283.93} = -\,0.035\,\frac{m}{d}\ or \sim -\,12.78\ m/year$$

Travel time between the Organic Fertilisers from the Plantations and BH8:

$$Time\,(Jurassic\ Dolerite) = \frac{distance}{velocity} = \frac{2\,283.93\ \text{m}}{71.54\ \text{m/year}} = \sim\mathbf{31.93\ years}$$

$$Time\,(Volkrust\ Formation) = \frac{distance}{velocity} = \frac{2\,283.93\ \text{m}}{12.78\ \text{m/year}} = \sim\mathbf{178.71\ years}$$

In a worst-case scenario, it would take 31.93 years for contaminants from the plantation area to reach the BH 8 through the Jurassic Dolerite contact zones, and 178.71 years through the Volksrust Formation.

4.3.3 Groundwater Quality

GCS was provided with groundwater quality data by Thirsti, and the corresponding laboratory certificate is included in **Appendix B**. Table 4-9 lists the groundwater quality data of the eight (8) boreholes on-Site.

The groundwater quality data provided indicate that the water quality from eight (8) abstraction boreholes was within the requirements of South African National Standards (SANS) 241-1: 2015 drinking water quality standards. Therefore, the groundwater is suitable for domestic use. However, continued monitoring is recommended to ensure ongoing compliance and safeguard water quality over time.

Table 4-9: Groundwater quality results.

Parameter	Risk	Unit	SANS 241-1:2015 drinking water standards		BH3	BH4	BH6	BH7	BH8	BH11	BH12
Conductivity at 25 °C	Aesthetic	mS/m	≤ 170	44	41.0	41.8	39.9	43.4	44.2	39.8	41.7
pH at 25 °C	Operational	pH units	≥ 5 to ≤ 9.7	7.53	7.38	7.35	7.37	7.36	7.44	7.41	7.30
Total dissolved solids	Aesthetic	mg/L	≤ 1 200	295	312	300	267	316	302	338	304
Turbidity	Operational	NTU	<5	1.41	<5	1.72	0.98	1.05	0.80	1.30	2.77
Chemical determinants — macro-determinants											
Ammonia as N	Aesthetic	mg/L	≤ 1.5	-	-	-	-	-	-	-	-
Chloride as Cl^-	Aesthetic	mg/L	≤ 300	4.20	4.87	4.20	5.13	4.11	4.11	5.04	3.80
Fluoride as F^-	Chronic health	mg/L	≤ 1.5	0.11	0.12	0.14	0.15	0.10	0.13	0.10	0.12
Nitrate as N	Acute health	mg/L	≤ 11	<0.10	<0.10	<0.10	0.38	0.47	<0.10	0.34	<0.10
Nitrite as N	Acute health	mg/L	≤ 0.9	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sodium as Na	Aesthetic	mg/L	≤ 200	-	-	-	-	-	-	-	-
Sulphate as SO_4^{2-}	Acute health	mg/L	≤ 500	58.1	48.4	49	44.5	53.3	57.0	44.6	49.4
Sulphide as S^-	Aesthetic	mg/L	≤ 250	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc as Zn	Aesthetic	mg/L	≤ 5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chemical determinants — micro-determinants											
Aluminium as Al	Operational	µg/L	≤ 300	27.7	23.8	<10.0	30.8	30.6	19.4	<10	15.2
Antimony as Sb	Chronic health	µg/L	≤20	<5	<5	<5	<5.00	<5	<5	<5	15.2
Arsenic as As	Chronic health	µg/L	<10	<3	<3.00	<3	<3.00	3	<3	<10	<3
Cadmium as Cd	Chronic health	µg/L	≤3	<1	<1	<1	<1.00	<1	<1	<1	<1
Copper as Cu	Chronic health	µg/L	<2000	<20	<20	<20	<20	<20	<20	<20	<20
Iron as Fe	Chronic health	µg/L	≤300	<20	<20	<20	<20	<20	<20	<20	<20
Lead as Pb	Chronic health	µg/L	≤10	<2	<2	<2	<2	<2	<2	<2	<2
Manganese as Mn	Chronic health	µg/L	≤100	64.3	<10	129	<10	27.5	19.6	<10	120
Mercury as Hg	Chronic health	mg/L	≤6	<1	<1	<1	<1	<1	<1	<1	<1
Nickel as Ni	Chronic health	mg/L	≤70	<5	<5	<5	<5	<5	<5	<5	<5
Selenium Se	Chronic health	mg/L	≤40	<20	<20	<20	<20	<20	<20	<20	<20
Uranium as U	Chronic health	mg/L	≤	-	-	-	-	-	-	-	-
Chemical determinants — organic determinants											
E. coli or faecal coliforms	Acute health	Count per 100 mL	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
Total coliforms	Operational	Count per 100 mL	≤ 10	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
Heterotrophic plate count	Operational	Count per mL	≤ 1 000	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected

***Exceeds the SANS 241-1:2015 Standard Limits**

4.4 Groundwater Quantity/Availability Assessment

An Intermediate Groundwater Reserve Determination (IGRD) (Parsons & Wentzel, 2007) was conducted for the Site to fulfil the requirements of the Water Use Licence concerning groundwater use, in terms of Section 21a of the National Water Act (No. 36 of 1998) (NWA, 1998). The IGRD aims to establish the Groundwater Reserve, thereby quantifying the safe aquifer yield. It is necessary, from a groundwater resource management perspective, to quantify the groundwater quantity and likely impact on the Groundwater Reserve as a result of the proposed abstraction.

The approach to quantifying groundwater is based on the water balance equation, which also gives an estimate of how much groundwater can safely be abstracted from the aquifer for the development of additional groundwater resources.

The Groundwater Reserve determination considers the following parameters:

- Area of the sub-catchment delineated for the Site;
- Effective recharge from rainfall and specific geological conditions;
- Existing abstraction;
- Basic Human needs for the Site;
- Groundwater contribution to baseflow (GWBF); and
- Surplus, if any, is available for abstraction.

The groundwater balance and the reserve determination on a sub-catchment scale are summarised below:

- $GW_{available}$ = (Re) - (EU + BHN + GWBF + PU)

Where:

- $GW_{available}$ = Available groundwater for use.
- Re = Effective recharge to the aquifer.
- GWBF =Groundwater contribution to baseflow.
- EU = Existing groundwater abstraction/use (identified on sub-catchment, excluding applicant).
- PU = proposed use.
- BHN = Basic Human Needs.

Remaining Groundwater availability (whilst "maintaining" groundwater's contribution to the ecological integrity of surface water, and maintaining ecological integrity in its present state) **= recharge – current use – current GWBF**

The following assumptions underlie these equations:

- The aquifer has reached dynamic equilibrium in response to abstraction, where groundwater recharge is equivalent to discharge. As such, the contribution to groundwater availability from storage is not considered.
- Contribution from enhanced recharge is not accommodated (i.e. recharge is constant under abstraction).
- Abstraction is therefore met by reduced discharge (at some time). As discharge is equivalent to recharge (when at dynamic equilibrium), recharge can be used as a proxy for groundwater availability.
- The aquifer is a closed system or a fixed directional flow system.
- If the portion of discharge that is known to support surface water (GWBF) is removed from the availability equation, it is not impacted. I.e., if abstraction is at or set below recharge minus use minus GWBF, then the quantity of GWBF will not be affected.
- Abstraction occurs sufficiently distant from locations of groundwater discharge to surface water, such that abstraction can harness recharge minus use minus GWBF, before reducing GWBF. In other words, it is assumed that abstraction is sufficiently distant from surface water such that the portion of recharge discharging to surface waters is unaffected by the abstraction.

4.5 Hydrogeological Impact Assessment

The potential impacts and the determination of impact significance were assessed. The process of assessing the potential impacts of the project includes the following four activities:

1. Identification and assessment of potential impacts.
2. Prediction of the nature, magnitude, extent, and duration of potentially significant impacts.
3. Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
4. Evaluation of the significance of the impact after the mitigation measures have been implemented i.e., the significance of the residual impact.

As per Government Notice Regulation (GNR) 982 of the Environmental Impact Assessment (EIA) Regulations (2014), the significance of potential impacts was assessed in terms of the following criteria:

I. Cumulative impacts.
II. Nature of the impact.
III. The extent of the impact.
IV. Probability of the impact occurring.

V. The degree to which the impact can be reversed.
VI. The degree to which the impact may cause irreplaceable loss of resources; and
VII. The degree to which the impact can be mitigated.

Table 4-10 provides a summary of the criteria used to assess the significance of the potential impacts identified. An explanation of these impact criteria is provided in Table 4-11.

The net consequence is established by the following equation:

Consequence = (Duration + Extent + Irreplaceability of resource) x Severity

The environmental significance of an impact was determined by multiplying the consequence by the probability.

Table 4-10: Proposed criteria and rating scales to be used in the assessment of the potential impact.

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0-6 months.
	Short-term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months or years.
	Long-term (4)	The duration of the activity associated with the impact will last more than 5 years.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural, and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural, and social functions and processes continue, albeit in a modified way, and valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease, and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50 % likely that an impact will occur.
	Probable (1)	It is between 50 and 70 % certain that the impact will occur.
	Definite (2)	It is more than 75 % certain that the impact will occur, or the impact will occur.
Significance	Very high – negative (-49 to -66)	A function of Consequence and Probability.
	High – negative (-37 to -48)	
	Moderate – negative (-25 to -36)	
	Low – negative (-13 to -24)	
	Neutral - Very low (0 to -12)	
	Low – positive (0 to 12)	
	Moderate – positive (13 to 24)	
	High-positive (37 to 48)	
	Very high – positive (49 to 66)	

Table 4-11: Explanation of assessment criteria.

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact of change on the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), Site (limited to the Site), and regional (limited to the immediate surroundings and closest towns to the Site). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid "double counting", specialists have been requested to indicate spatial significance under "intensity" or "impact on irreplaceable resources" but not under "extent" as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced, should it be impacted. A resource could be replaced by natural processes (e.g., by natural colonisation from surrounding areas), through artificial means (e.g., by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those who are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable e.g., red data species that are restricted to a particular Site or habitat to a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to the Site and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the impact (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the Water Use Licence team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact, based on the available information and their level of knowledge and expertise. The degree of confidence is not taken into account in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

4.6 Water Monitoring Plan

The monitoring network is based on the principles of a monitoring network design as described by the DWAF Best Practice Guidelines: G3 Monitoring (DWAF, 2007). The methodological approach that the monitoring plan follows is represented in Figure 4-2, below.

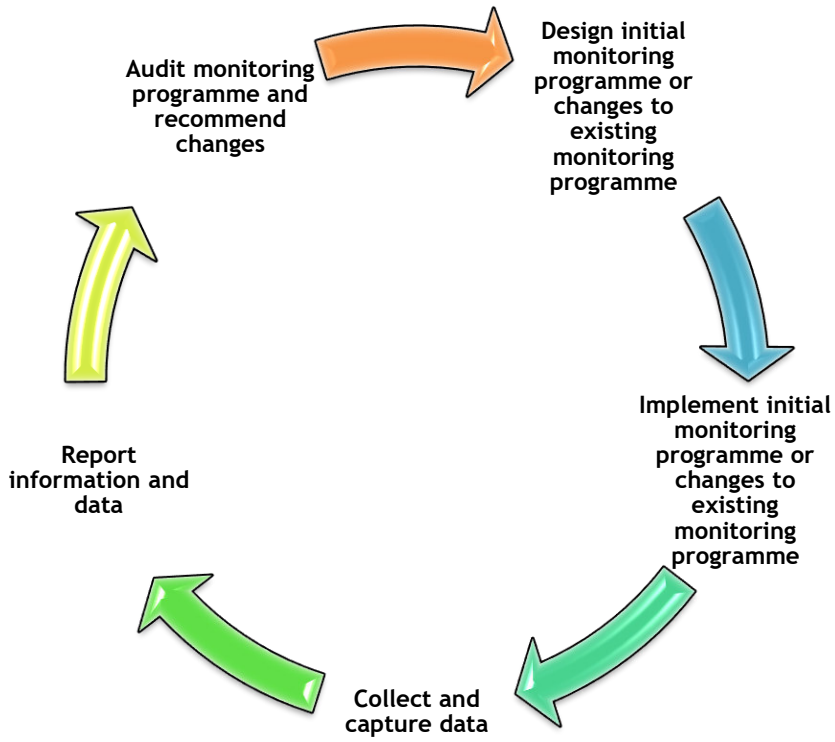


Figure 4-2: Monitoring process.

A groundwater monitoring plan was drafted and is based on the Site's conceptual model and impact assessment.

4.7 Groundwater Management Plan

Groundwater management measures were formulated based on the results of the groundwater impact assessment. A groundwater monitoring network was proposed based on existing and predicted groundwater impacts.

5 PREVAILING GROUNDWATER CONDITIONS

The following section supplies an overview of the prevailing hydrogeological conditions encountered at the Site. The data were derived from available literature sources.

5.1 Geology

According to the 1:250 000 geological map (2728 Frankfort), the Site is underlain by sediments of the Karro Sequence and in particular the olive green and grey mudstone and subordinate sandstone of the Normandien Formation (Pne). This overlies the older bluish-grey or dark-grey mudstone and shale of the Volksrust Formation (Pvo).

In the western section of the Site, there are younger dolerite intrusions in the form of large sheets and long dykes. However, these dolerite intrusions do not extend to the eastern side of the Site. In the northeastern section of the Site, there are alluvium deposits present closer to the drainages.

All of the geology on-Site forms part of the Karoo Supergroup, and based on borehole log data (GCS, 2019) for the Site, the lithostratigraphy generally consists of black shales, grey sandstone, and dolerite.

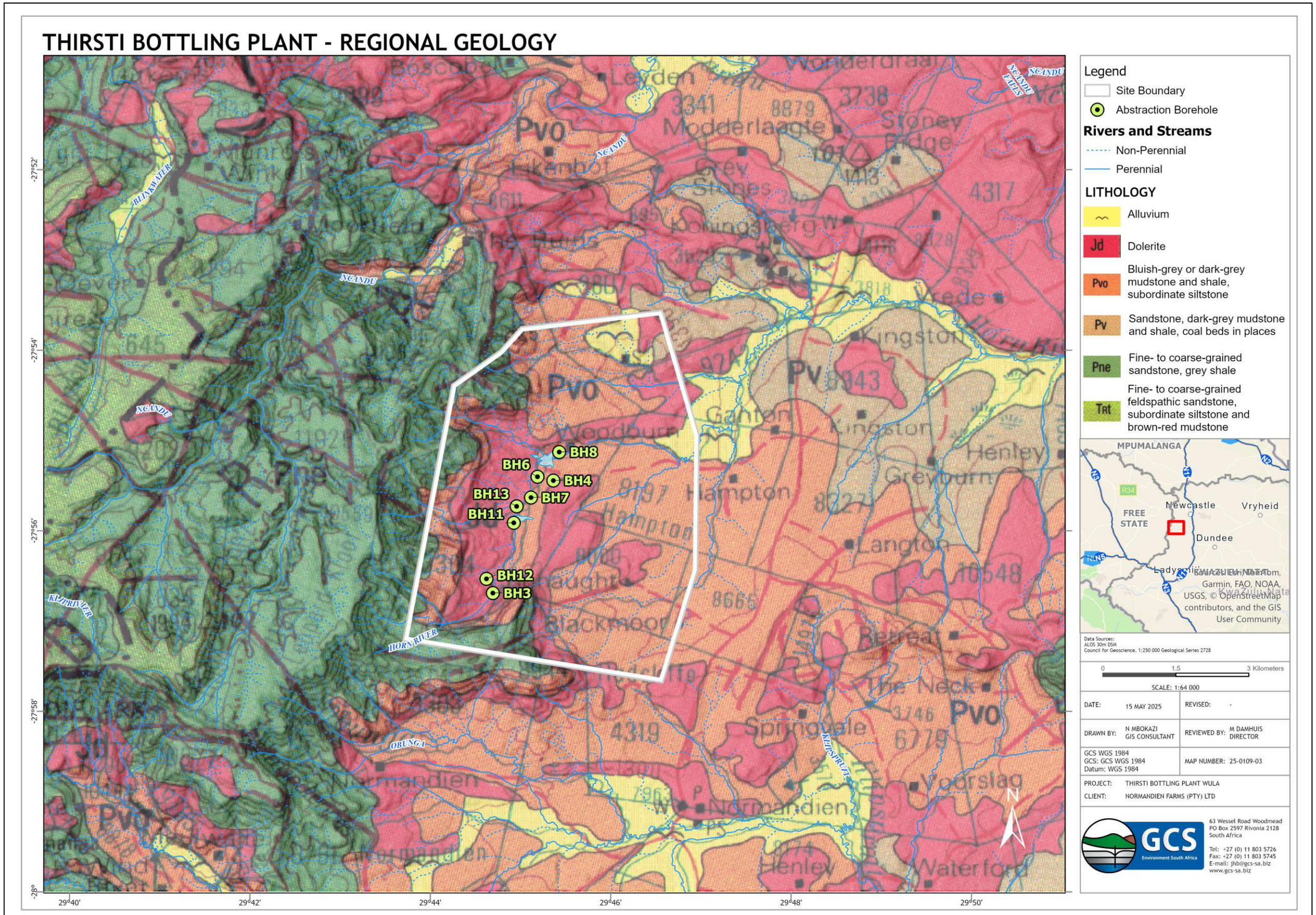


Figure 5-1: The geological map of the Site.

5.2 Aquifer Characteristics and Classification

According to the 1:500 000 hydrogeology map (2725 Kroonstad), the Site is located on an intergranular and fractured aquifer type. Baran (2003) classifies the groundwater yield potential of the Volksrust Formation as low. This assessment is based on empirical data indicating that approximately 40 % of boreholes yield between 0.5 litres per second (l/s) and 2 l/s, while a further 30% yield less than 0.5 l/s.

These values are consistent with the current abstraction rates reported verbally by Thirsti (Levin, 2016). Only 2.9% of boreholes in the formation are documented to yield more than 5 l/s. Baran (2003) further notes that the shales of the Volksrust Formation are effectively impermeable and are considered to contribute to artesian conditions in the underlying fractured pre-Karoo Formations.

The lithology of the Beaufort Group (Estcourt and Normandien Formations) has little effect on the borehole yield and aquifer classification (Baran, 2003). In essence, almost the entire Group, irrespective of lithology and presence or absence of dolerite, is low yielding. The median borehole yield range in this Group falls in the range of less than 0.5 l/s. No evidence of an existing deeper aquifer within the Beaufort Aquifer has been found.

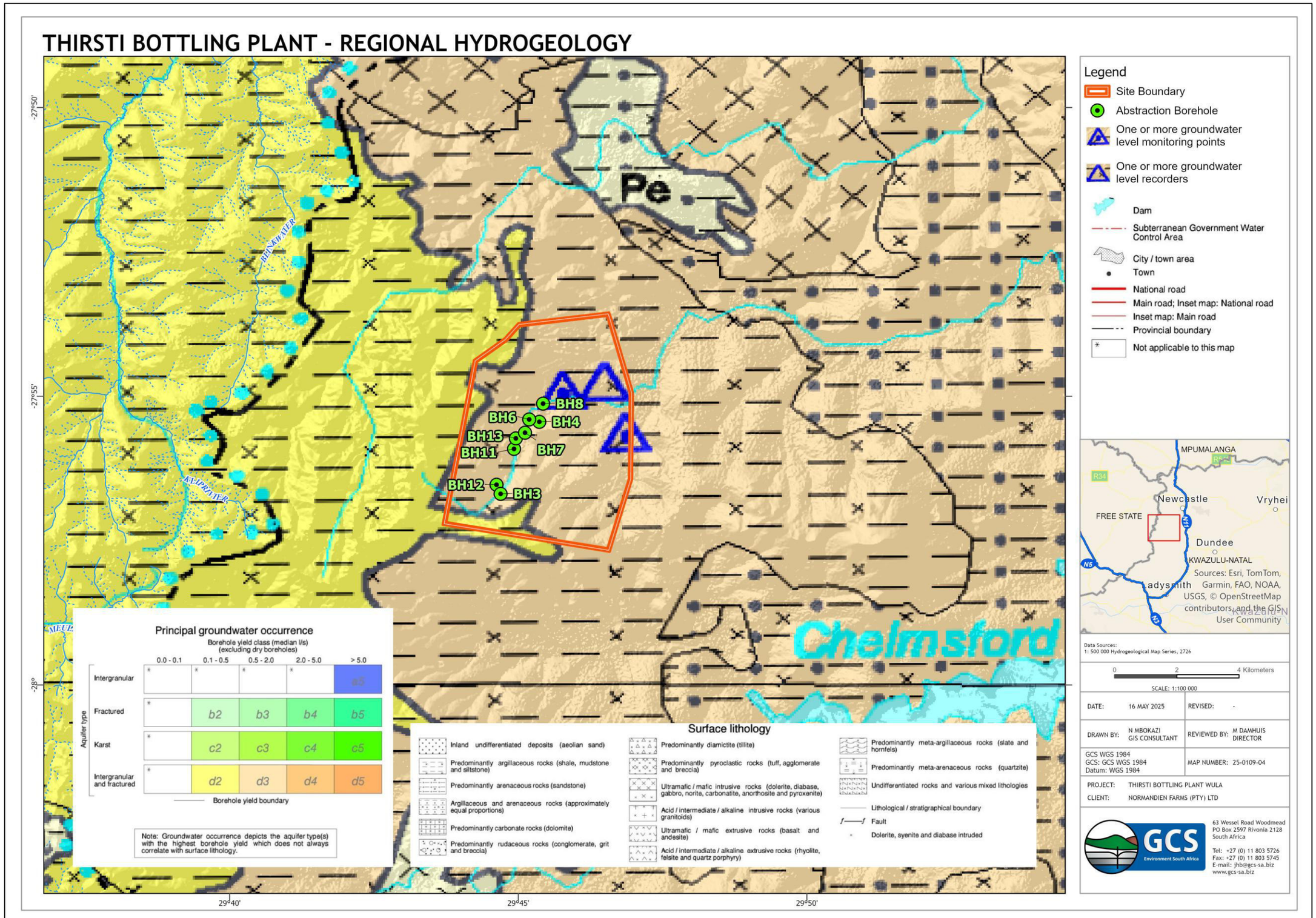


Figure 5-2: The hydrogeology map of the Site.

5.3 Depth to Groundwater

Groundwater level data obtained from the NGA for boreholes within a 5 km radius of the Site indicate groundwater levels ranging from 2.19 mbgl to 20 mbgl, with an average groundwater level of 8.795 mbgl. In comparison, the abstraction boreholes located on-Site have groundwater levels ranging from 3.70 mbgl to 11.1 mbgl. Additionally, the hydrocensus conducted on-Site indicated that groundwater levels of boreholes surrounding the Site ranged from 4.41 mbgl to 17.84 mbgl.

Figure 5-3 plots the relationship between elevation and groundwater levels for all boreholes identified on-Site. The data indicates a strong relationship between groundwater and topography elevation (R=99.75%), suggesting that the groundwater table closely follows the regional topographic elevation. Such a relationship typically indicates that the aquifer system is semi-unconfined. (Freeze and Cherry, 1979).

The Co-Kriging interpolation approach was applied to the water level data to conceptualise the groundwater elevation and flow direction. The results are presented in Figure 5-4 and indicate that the groundwater flow direction mimics the surface water conditions at the Site, which is predominantly flowing from west to east towards the Horn River.

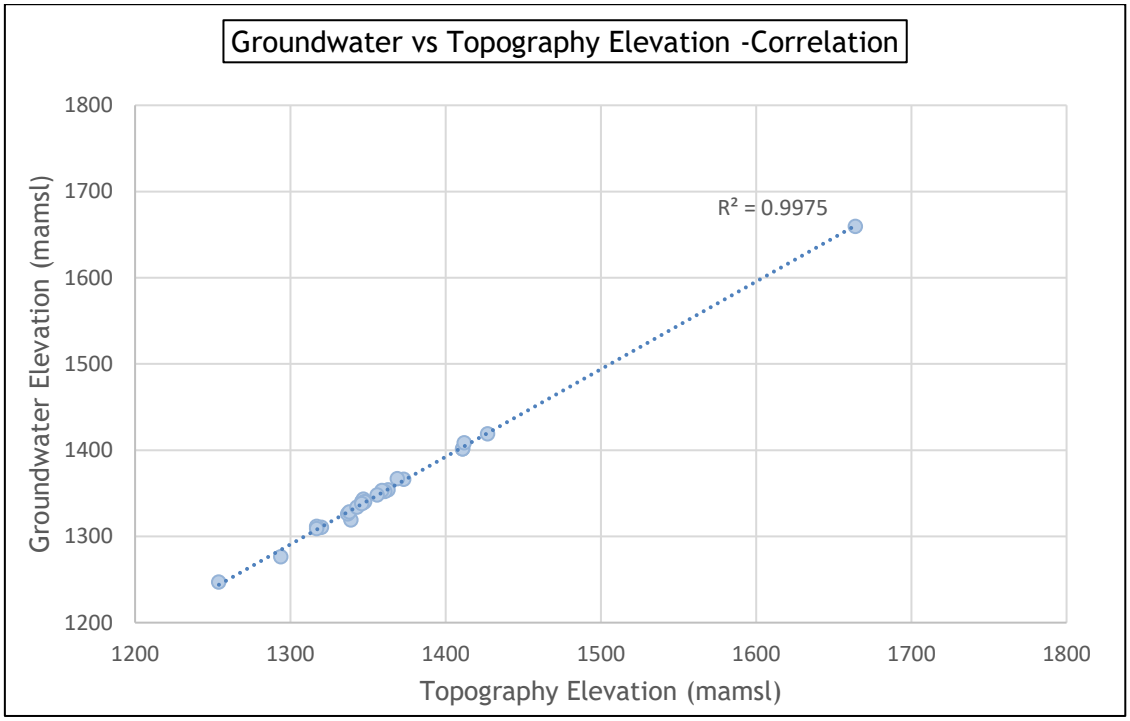


Figure 5-3: Groundwater elevation and topography elevation correlation.

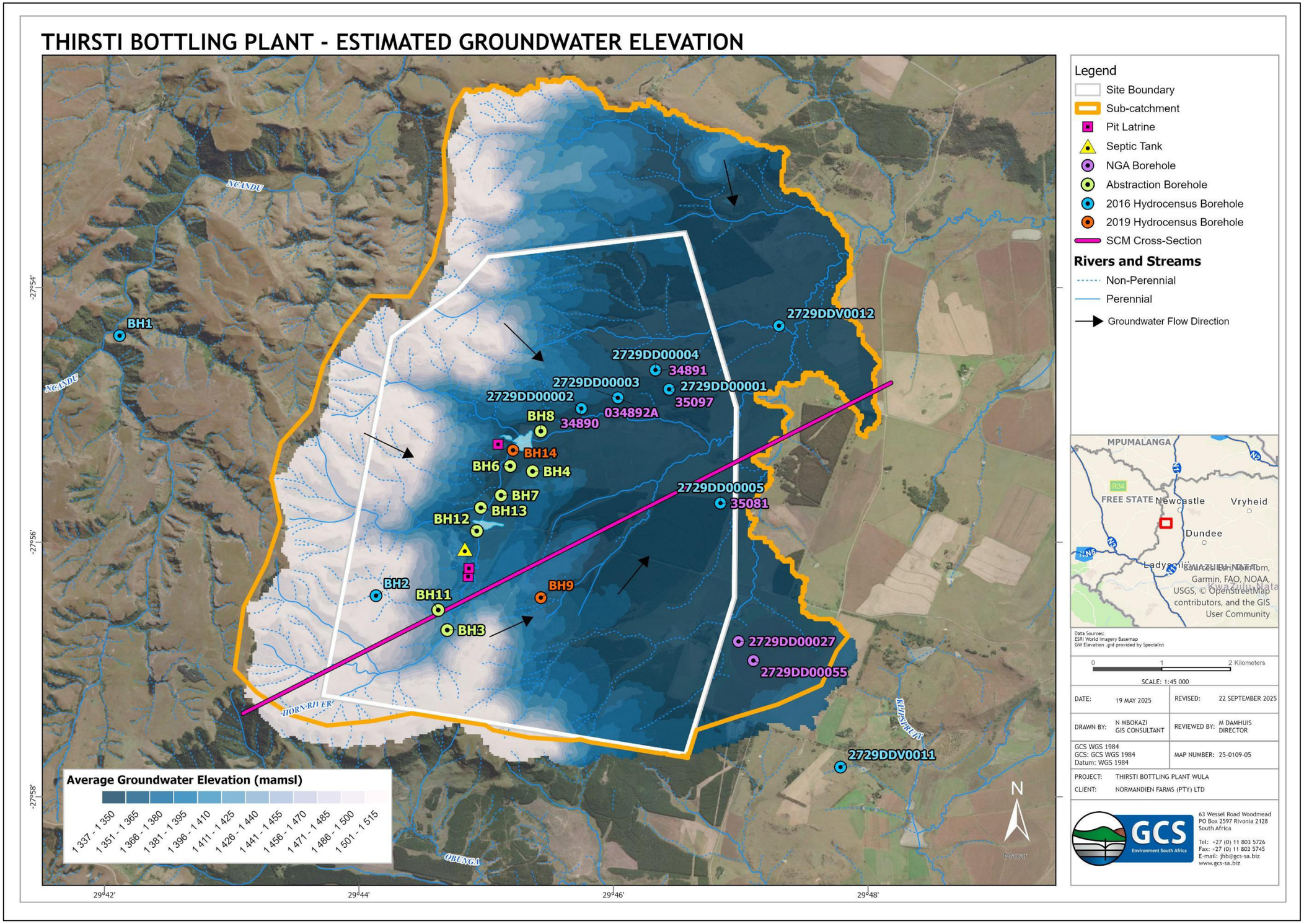


Figure 5-4: **Estimated groundwater elevation and flow direction for the Site.**

5.4 Groundwater Quantity

An IGRD was conducted for the Site. The IGRD aims to quantify the vulnerability of the Groundwater Reserve as a result of groundwater abstraction activities.

It is necessary, from a groundwater point of view, to quantify the groundwater quantity and likely future impacts on quantity. Moreover, the groundwater balance gives an estimate of how much groundwater can safely be abstracted from the aquifer.

The data used for the IGRD calculation was derived from a report compiled by DWS in 2024, titled "Proposed reserve determination of water resources for the Pongola-Mtamvuna Water Management Area Catchment". IGRD was conducted in terms of section 16(3) of the National Water Act, 1998 (Act No. 36 of 1998) (DWS, 2024).

The IGRD for Quaternary Catchment V31F is summarised in Table 5-1 below. The Groundwater Reserve consists of the volume of groundwater required to satisfy the Basic Human Needs (BHN) and to meet the Ecological Water Requirements (EWR) through groundwater contribution to baseflow (GWBF).

Table 5-1: Summarised IGRD for the Quaternary Catchment V31F (DWS, 2024).

Quaternary Catchment	Area (km^2)	Recharge (m^3/a)	Population (Water Services 2011)	Basic Human Needs (m^3/a)	Groundwater contribution to Baseflow (m^3/a)	Total Reserve (m^3/a)	Groundwater Use (WARMS, 2025) (m^3/a)	Allocable Groundwater Total (m^3/a)
V31F	155.0	8 590 000	7 771	70 910	210 000	280 910	165 389	8 143 701

5.4.1 Sub-Catchment Delineation

Sub-catchment was delineated using Global Mapper. A 30m ALOS digital terrain model (DTM) was used as input, and a 1:2500 drainage stream count was applied to define the sub-catchment boundary.

The sub-catchment describes the drainage from the Site as well as the drainage of the Horn River and further describes the groundwater sphere of influence. The sub-catchment has an estimated surface area of 55.54 km^2.

The Groundwater Reserve determination calculation, scale of abstraction, and Stress Index will focus on the delineated sub-catchment. Table 5-2 presents a summary of the hydrogeological information for the delineated sub-catchment.

Table 5-2: Delineated sub-catchment information summary.

Description	Delineated Sub-Catchment	
Surface Area	55.54	[km^2]
Recharge	3 077 991	[m^3/a]
Population	2 785	people
BHN	25 409	[m^3/a]
Baseflow	75 248	[m^3/a]
Groundwater Use	59 263	[m^3/a]
Reserve	100 657	[m^3/a]

5.4.2 Groundwater Recharge (Re)

The effective groundwater recharge from precipitation is the portion of precipitation that reaches the groundwater table. The remainder of the precipitation comprises surface water runoff, evapotranspiration, and soil moisture. The effective recharge is dependent on the geology, soils, surface runoff, and stream morphology, but most importantly for the study area, the effective storage.

Based on values sourced from the IGRD for the Pongola-Mtamvuna Water Management Area Catchment (DWS, 2024), a recharge of 3 077 991 m^3/a is estimated for the delineated sub-catchment (Table 5-3).

Table 5-3: Delineated sub-catchment recharge summary.

Description	Delineated Sub-Catchment	
Total Recharge	18 684 000	[m^3/a]
Delineated Catchment Area	56 312 000	[m^2]
Delineated Catchment Recharge	3 077 991	[m^3/a]

5.4.3 Existing Groundwater Abstraction (EU)

The latest available groundwater abstraction information obtained from the National Integrated Water Information System (NIWIS) database indicates the existing groundwater usage within Quaternary Catchment V31F is in the order of 165 389 m^3/a (NIWIS, 2025) This equates to a calculated 59 263 m^3/a of the existing groundwater usage within the delineated sub-catchment.

5.4.4 Basic Human Needs (BHN)

According to the Government Gazette no 46798 of 26 August 2022, the BHN Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, food preparation, and personal hygiene. Basic Human need is set by the Water Services Act, 1997 (No. 108 of 1997) at 25 litres per person per day. The reserve is calculated by multiplying the number of people living within the confines of a source unit by 25 L/d. The estimated BHN for Quaternary Catchment V31F is 70 910 m^3/a (refer to Table 5-1), which equates to 75 248 m^3/a for the delineated sub-catchment.

5.4.5 Groundwater Contribution to Baseflow (BF)

Baseflow is the low flow in a river during dry or fair-weather conditions, but not necessarily all contributed by groundwater; baseflow includes contributions from delayed interflow and groundwater discharge. Because of the contribution of groundwater to surface water flow in certain circumstances, the volume of groundwater that could be abstracted without impacting the ability of the groundwater to sustain or contribute to the surface water Reserve has to be considered.

The baseflow of groundwater into surface water bodies in Quaternary Catchment V31F is 210 000 m^3/a (DWS, 2024). The groundwater contribution to the baseflow of the delineated sub-catchment is described below and summarised in Table 5-4.

$$\mathbf{Baseflow}_{Catchment\ Area} = \mathbf{Baseflow}_{\ GRU\ Area}\ \mathbf{x}\ \mathbf{Area}_{\ Catchment}$$

Where:

- $Baseflow_{GRU\ Area}$ = value for baseflow in Quaternary Catchment V31F (DWS, 2024) [m/a]
- $Area_{Catchment\ Area}$ - Delineated catchment area [m^2]

Table 5-4: Delineated sub-catchment groundwater contribution to baseflow summary.

Description	Delineated Sub-Catchment	
Baseflow for Quaternary Catchment	210 000	[m^3/a]
Delineated Catchment Area	55 540 000	[m^2]
Delineated Catchment Areas Baseflow	75 248	[m^3/a]

5.4.6 Proposed GW Usage (PU)

Based on FC calculations, the recommended sustainable abstraction rate of the eight (8) abstraction boreholes for a 12-hour pumping schedule, the total recommended groundwater abstraction volume from boreholes is 618 579 m^3/a.

5.4.7 GW Balance

The groundwater balance and the reserve determination on a sub-catchment scale are presented in Table 5-5 and summarised below:

- $GW_{available}$ = (Re) - (EU + BHN + BF + PU)

Where:

- $Gw_{available}$ = Available GW for use.
- Re = Effective recharge to the aquifer.
- BF = Baseflow to surface water streams.
- EU = Existing GW abstraction/use (identified on sub-catchment, excluding applicant).
- BHN = Basic Human Needs.
- PU = Proposed Use.

The following applies to the water balance conducted:

- For this reserve determination, values from the Quaternary Catchment V31F Groundwater Reserve were downscaled to an area of 55.54 km^2 related to the delineated sub-catchment.
- The Groundwater Reserve already includes the BHN and EWR (GWBF) components.

Table 5-5: Sub-catchment groundwater balance and reserve determination summary.

Description	Delineated Sub-Catchment	
Recharge to the Aquifer (Sub-Catchment)	3 077 991	[m^3/a]
Groundwater Reserve	100 657	[m^3/a]
Total Available Groundwater	2 977 334	[m^3/a]
Existing GW Use (WARMS, 2025)	59 263	[m^3/a]
Remaining Available Groundwater	2 918 072	[m^3/a]
Recommended Abstraction	618 579	[m^3/a]
Surplus Groundwater Available	2 299 493	[m^3/a]

Based on the groundwater balance calculated for the delineated sub-catchment (Table 5-5) 2 918 072 m^3/a of groundwater is available for abstraction. Furthermore, a surplus of 2 299 493 m^3/a of groundwater will be available within the delineated sub-catchment after the proposed abstraction of 618 579 m^3/a.

6 SITE CONCEPTUAL MODEL

A Site conceptual model was developed by combining all relevant hydrogeological and geological information of the Site to provide an understanding of the Site composition and governing processes within it.

The Site is situated in Quaternary Catchment V31F of the Pongola-Mtamvuna Water Management Area (WMA) (DWS, 2016). Elevations across the Site range from 1050 metres above mean sea level (mamsl) to 1450 mamsl.

The Site falls within rainfall zone V3B, which receives a MAP of 791 mm/a. The Site falls within evaporation zone 21A, of which MAE is 1 276 mm/a. The MAE far exceeds the MAP for the Site, indicating that evaporative losses are likely to surpass the amount of rainfall received annually. As a result, the Site experiences a net water deficit.

Groundwater levels measured within the Site region varied between 3.70 mbgl to 20 mbgl, showing a strong correlation between groundwater and topographic elevation, suggesting that the groundwater table closely follows the regional topographic elevation. The at the Site groundwater flow from west to east.

The Site is underlain by geological formations of the Karoo Supergroup, primarily consisting of mudstones and sandstones of the Normandien and Volksrust Formations. Dolerite intrusions are present in the western section of the Site. Alluvial deposits are also present on the northeastern side of the Site. However, the abstraction boreholes are drilled into both the Jurassic Dolerite and the Volksrust Formation. The formations have transmissivity values, ranging from 7.71 m^2/day to 34.35 m^2/day for the dolerite, and 1.83 m^2/day to 2.43 m^2/day for the Volksrust Formation.

Hydrogeologically, the Site is located on an intergranular and fractured aquifer type with a borehole yield of 0.5 l/s to 2 l/s

Several point contamination sources have been identified on such as

- Oil spillage from truck operations.
- Pit latrines.
- A septic tank and French drain.

The Site is characterised by Pecan nut and Pine tree plantations, which impact groundwater both quantitatively and qualitatively. These deep-rooted species have high water uptake and contribute to reduced groundwater recharge through evapotranspiration, while also potentially affecting groundwater quality through nutrient leaching and agrochemical runoff. The nearby wetland system acts as a receptor, relying on consistent groundwater inputs to maintain its hydrological and ecological functions. Changes in groundwater quantity or quality from the plantations may therefore compromise the health and function of the wetland ecosystem.

Based on values sourced from the IGRD for the Pongola-Mtamvuna Water Management Area Catchment (DWS, 2024), an estimated recharge of 3,077,991 m^3/a has been calculated for the delineated sub-catchment. The groundwater baseflow into surface water bodies within the sub-catchment is estimated at 75,248 m^3/a.

Based on the FC calculations, the recommended groundwater abstraction volume is 618 579 m^3/a. Groundwater balance calculations indicate that approximately 2 918 072 m^3/a of groundwater is available for abstraction at the sub-catchment scale. After accounting for the recommended abstraction volume, a surplus of 2 299 493 m^3/a remains available within the delineated sub-catchment, indicating that the recommended abstraction is well within sustainable limits.

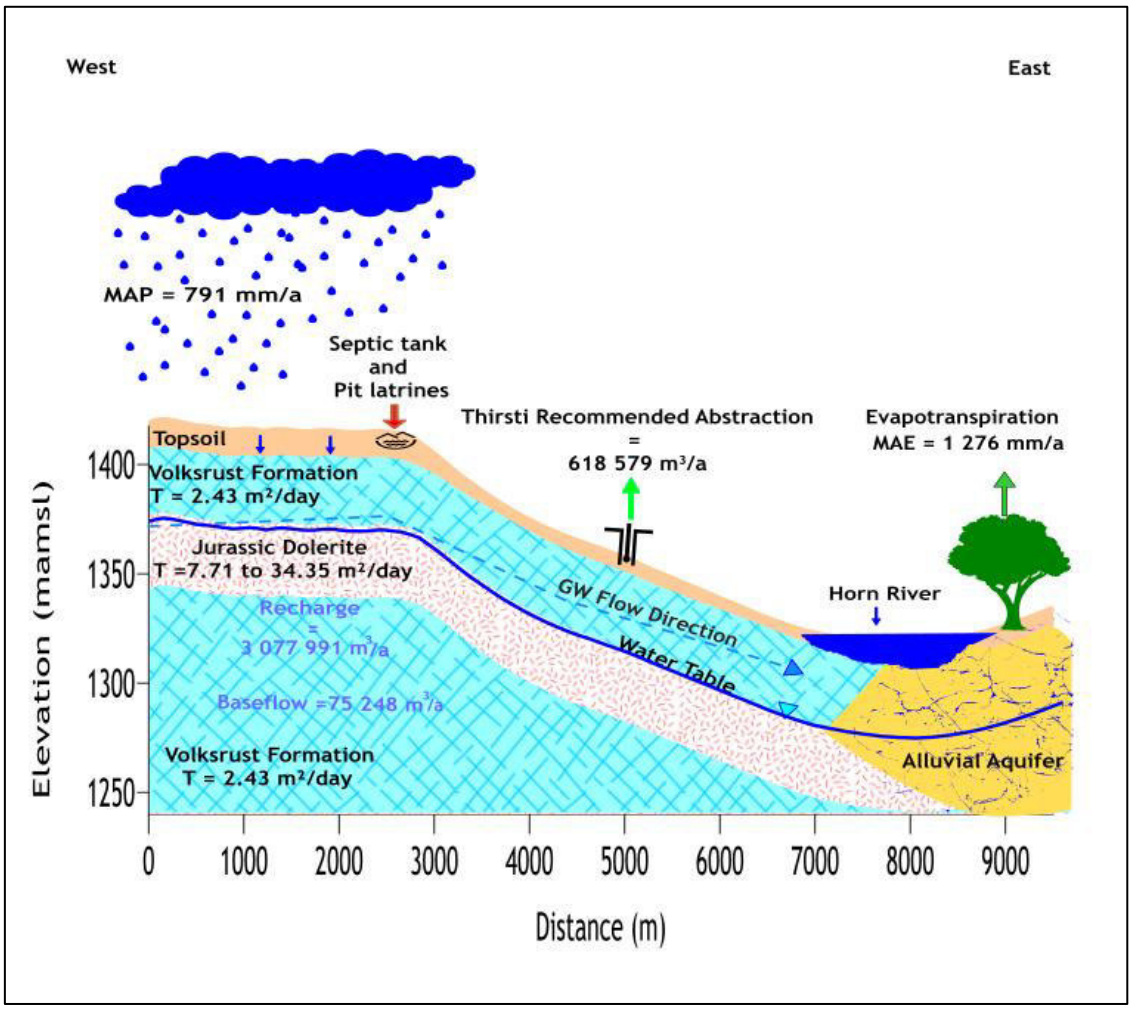


Figure 6-1: Site Conceptual Model (SCM).

7 HYDROGEOLOGICAL IMPACT ASSESSMENT & MITIGATION MEASURES

Impact assessment entails the understanding of the generation of a hazard, the probability that the hazard will occur, and the consequences should it occur. The impact assessment is based on the conceptual Site model and the aquifer testing results and further incorporates a worst-case scenario approach.

The anticipated hydrogeological impacts are discussed in Table 7-4. The net consequence of the hydrogeological impact was established by the following equation:

Consequence = (Duration + Extent + Irreplaceability of resource) x Severity

The environmental significance of an impact was determined by multiplying the consequence by the probability. The impact rating methodology is discussed in Section 4.5.

7.1 Point Source Contamination on-Site

Based on the GCS field investigation conducted between 14–18 June 2021 to identify potential on-Site pollution sources that could impact groundwater quantity and quality (GCS, 2023), the effluent travel time from the septic system and pit latrines to BH8 was calculated (refer to Table 7-1).

Table 7-1: Impact Assessment for the point source contamination at the Site.

Factor	Jurassic Dolerite	Volksrust Formation
Septic tank and French drain		
Travel Time	~38.63 years	~215.44 years
Permeability	Low to moderate (fracture-dependent)	Very low
Impact of Contaminant Migration	Low-negative	Low- negative
Pit Latrines		
Travel Time	~58.19 years	~324.93 years
Permeability	Low to moderate (fracture-dependent)	Very low
Impact of Contaminant Migration	Low-negative	Low-negative
Laydown Area		
Travel Time	~34 years	~194.27years
Permeability	Low to moderate (fracture-dependent)	Very low
Impact of Contaminant Migration	Low-negative	Low-negative

Factor	Jurassic Dolerite	Volksrust Formation
Plantations		
Travel Time	~31.93 years	~178.71 years
Permeability	Low to moderate (fracture-dependent)	Very low
Impact of Contaminant Migration	Low-negative	Low negative

Dolerite generally has low permeability; however, the presence of fractures and joints can significantly enhance groundwater flow. A contaminant travel time of range between 30 to 58 years indicates low impact.

According to the 2728 Frankfort geological map Volksrust Formation consists predominantly of shale and mudstone, which typically has very low permeability. A travel time of range between 178 to 325 years suggests a neutral impact of contaminant migration under natural conditions. The Volksrust Formation provides a natural barrier to groundwater contamination.

The significance of point source contamination impact on the groundwater at the Site is considered low, as the boreholes on-Site are located within a confined aquifer system, which serves as a natural geological barrier to surface-level contaminants.

7.2 Groundwater Quantity Impacts

According to GCS (2019), the Site is characterised by various Pecan nut and Pine tree plantations, which pose a quantitative and qualitative impact on the groundwater abstracted at the Site .

Pecan nut and Pine plantations could reduce groundwater recharge due to the trees' ability to hamper rainfall ingress and take water from shallow groundwater zones, which may lower the water table. For example, the plantations' canopies can intercept rainfall, reducing infiltration to the aquifer. According to GCS (2019), the boreholes at the Thirsti Site are considered to be vulnerable to the activities listed above, of which plantation farming seems to be the dominant impact.

7.3 Dewatering Impact as a Result of Groundwater Abstraction Activities

Thirsti abstracts groundwater from eight (8) boreholes spread across the Site. From available data, the following is noted:

- Groundwater is obtained from the confined fractured aquifer network, as all boreholes target the deep aquifer zone and dolerite contacts (GCS, 2019);
- The confined aquifer system is under pressure;
- Borehole depths range from 50 to 100 mbgl; and

- Groundwater levels range from 2 to 9 mbgl and mimic the topography.

However, given the confined nature of the aquifer and the depth at which groundwater is abstracted, the potential impact on surrounding surface water features and on other groundwater users, particularly those using shallower unconfined aquifers, is considered to be low. The artesian pressure conditions further reduce the likelihood of vertical leakage or drawdown affecting nearby users relying on different aquifer units.

However, it is recommended that the periodic hydrochemical assessment and groundwater level monitoring be maintained to ensure early detection of any changes that could influence neighbouring groundwater users. Where feasible, an updated groundwater model and cumulative impact assessment should be developed to further support sustainable groundwater management.

7.4 Impacts on the Groundwater Reserve

The potential radius of influence of pumping for the abstraction boreholes was determined by applying the Cooper-Jacob equation (1):

$$\boldsymbol{Radius\ of\ Influence}\ (r_e) = 1.5\sqrt{\frac{Tt}{S}} \qquad \textbf{Equation 4}$$

Where:

T = aquifer transmissivity (m^2/day)

t = exploitation time/pumping time (days); and

S = aquifer storativity.

Based on available hydrogeological data (Levin, 2016; GCS, 2019), the radius of influence around the boreholes (known as the cone of depression) is estimated to range between 69.21 m and 496.36 m (refer to Table 7-4 and Figure 7-1).

The expected impact from groundwater abstraction is confined mainly to the fractured aquifer system, which is deep underground. This is because water being abstracted is from the confined aquifer; any drawdown in the upper weathered zone (which typically supports baseflow to nearby streams and wetlands) is expected to be minimal to none.

Groundwater abstraction from the confined aquifer system is not anticipated to result in significant impacts on surface water features, such as streams or wetlands, due to the hydraulic separation between the confined and unconfined aquifers.

However, pumping all eight (8) abstraction boreholes simultaneously may significantly increase the cumulative radius of influence, potentially leading to aquifer drawdown, interference between boreholes, and reduced yields, especially in areas with lower transmissivity, like in BH3 and BH8. This could negatively impact nearby groundwater users and connected surface water bodies, such as the Horn River.

Therefore, to mitigate this, the following is recommended;

- Staggered pumping operations- Implement staggered pumping schedules to reduce cumulative drawdown and avoid interference between boreholes.
- Groundwater level monitoring.
- Hydraulic Modelling- Conduct groundwater modelling to simulate the combined effects of all boreholes under the recommended pumping rate. This can help identify safe operational thresholds.

In accordance with GNR 982 of the EIA Regulations (2014), the significance of the potential impact of staggered pumping operations from the eight (8) abstraction boreholes on surrounding groundwater users is assessed as neutral to very low, provided that mitigation measures are effectively implemented (refer to Table 7-4).

Table 7-2: Radius of influence for abstraction boreholes on-Site.

Parameters	BH3	BH4	BH6	BH7	BH8	BH11	BH12	BH13
T (m^2/day)	4	31	18.5	18.5	2.4	7	12	5
t (days) 12-Hour Pumping Schedule	182.5	182.5	182.5	182.5	182.5	182.5	182.5	182.5
s	0.19	0.5	0.8	0.5	0.01	0.6	0.02	0.01
Tt	730	5657.50	3376.25	3376.25	438.00	1277.50	2190.00	912.50
Tt/s	3842.11	11315	4220.31	6752.50	43800	2129.17	109500	91250
Square Root (Tt) m	61.98	106.37	64.96	82.17	209.28	46.14	330.91	302.08
Radius of Influence (m)	92.98	159.56	97.45	123.26	313.93	69.21	496.36	453.11

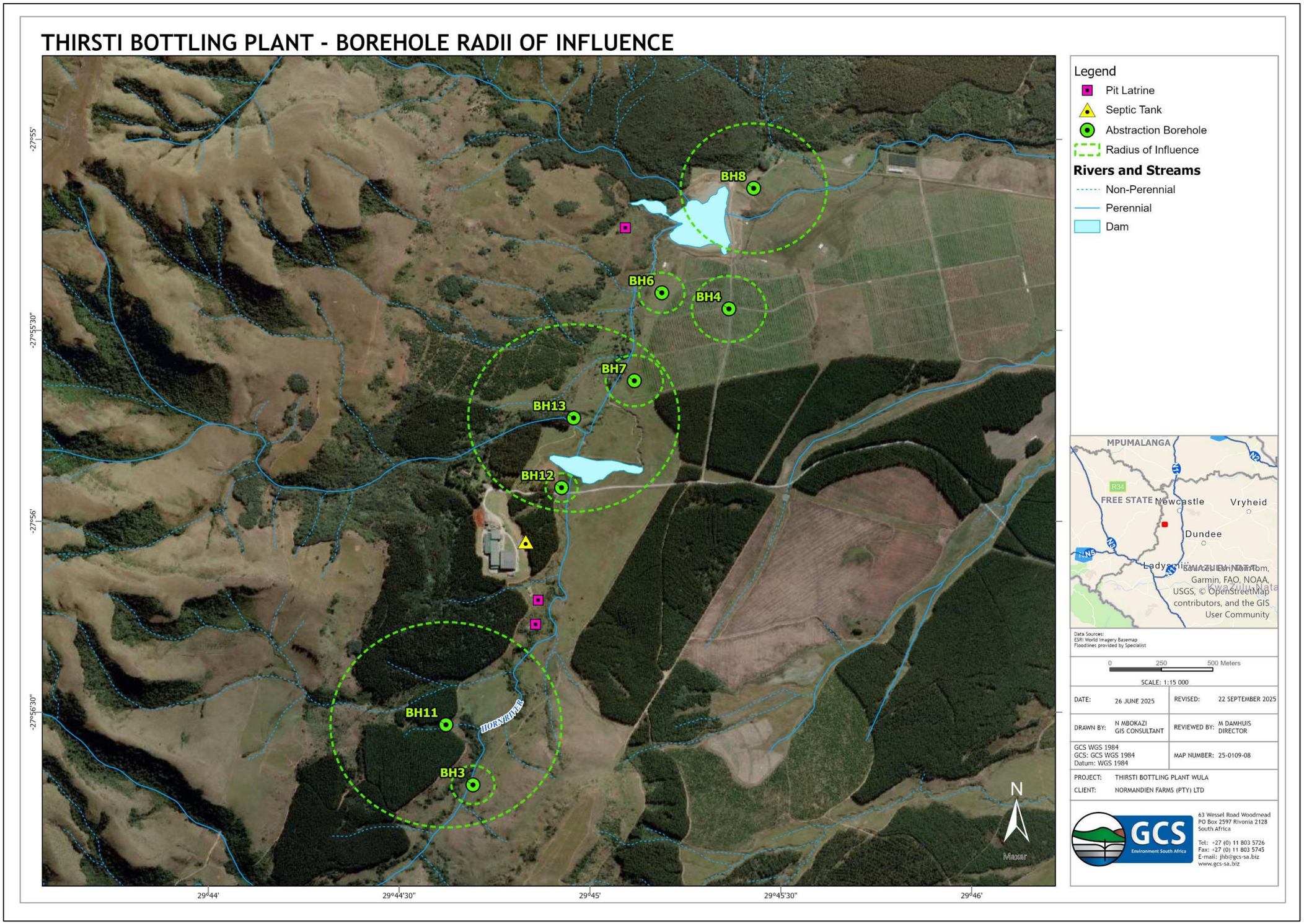


Figure 7-1: Radius of influence for abstraction boreholes on-Site.

7.5 Scale of Abstraction

Based on the DWS "Requirements for WULA: Groundwater Abstraction [S21(a)]", the licence application must be evaluated in terms of three possible categories. Categories A, B, and C each have an applicable list of information requirements for the licence application, as should be provided by the applicant to the DWS:

- Category A – Small-scale abstractions (<60% recharge on the property)
- Category B – Medium scale abstractions (60-100% recharge on the property)
- Category C – Large-scale abstractions (>100% of recharge on the property)

The scale of abstraction is described below.

$$ABS_{scale} = (BHN + ABS_{existing} + ABS_{Proposed} + Baseflow_{GRDM})/Re_{Catchment\ Area} \times 100$$

Where:

- BHN = Basic Human Need
- $ABS_{existing}$ = Existing abstraction within the delineated area
- $ABS_{Proposed}$ = Proposed abstraction within the delineated area
- $Baseflow_{GRDM}$ = Groundwater contribution to baseflow within the delineated area
- $Re_{Catchment\ Area}$ = Recharge over the delineated catchment area

With reference to the DWS scale of abstraction categories, the scale of abstraction after the proposed abstraction from the groundwater unit, relative to recharge, across the delineated sub-catchment area is classified as Category A "Small-Scale" abstraction.

7.6 Stress Index

The status of a groundwater resource unit can be assessed in terms of sustainable use, observed ecological impacts, or water stress. As no ecological reserve is available for the affected catchment, the impact of the proposed abstraction on the ecological reserve cannot be determined.

The concept of stressed water resources is addressed by the National Water Act, 1998 (Act No. 36 of 1998) (NWA), but is not defined. Part 8 of the Act gives some guidance by providing the following qualitative examples of 'water stress':

- Where water demands are approaching or exceeding the available supply;
- Where water quality problems are imminent or already exist; or
- Where water resource quality is under threat.

To provide a quantitative means of defining stress, a groundwater Stress Index was developed by dividing the volume of groundwater abstracted from a groundwater unit by the estimated recharge to that unit (Parsons & Wentzel, 2007).

The Stress Index for an assessment area is defined as follows:

Stress Index = Groundwater Abstraction/ (Recharge – Baseflow)

=59 263 +618 579 / (3 077 991 – 75 248)

= 0.23

The Stress Index and classes described in Table 7-3 is a guide for determining the level of stress of a groundwater resource unit, based on abstraction, baseflow, and recharge.

Table 7-3: Guide for determining the level of stress of a groundwater resource unit.

Present Status Category	Description	Stress Index
A	Unstressed or low level of stress	**<0.05**
B		**0.05 - 0.2**
C	Moderate levels of stress	**0.2 - 0.5**
D		**0.5 - 0.75**
E	Highly Stressed	**0.75 - 0.95**
F	Critically stressed	**>0.95**

Based on the guide for determining the level of stress of the groundwater resource unit, the abstraction of 677 842 m^3/a across the delineated sub-catchment area is classified as Status Category C (0.2 – 0.5). The aquifer unit thus has a moderate level of stress.

Table 7-4: Potential hydrogeological impacts and mitigation measures.

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation						
			Duration	Extent	Severity	Potential for impact on irreplaceable resources	Consequence	Probability	Significance		Duration	Extent	Severity	Potential for impact on irreplaceable resources	Consequence	Probability	Significance
Site Aquifer	The potential radius of influence of pumping for eight (8) abstraction boreholes ranges from 69.21 m and 496.36 m.	Dewatering. Abstracting groundwater from the eight (8) abstraction boreholes	4	2	2	1	-14	2	Moderate - negative (-25 to -36) -28	**Staggered pumping operations and groundwater level monitoring.**	4	2	1	0	-6	1	Neutral - Very Low (0 to -12-) -6
Regional Aquifer	With reference to the DWS scale of abstraction categories, the scale of abstraction after the proposed abstraction from the groundwater unit, relative to recharge, across the delineated sub-catchment area is classified as Category A "Small-Scale" abstraction.	Abstracting groundwater from the eight (8) abstraction boreholes	4	4	1	1	-9	1	Neutral - Very Low (0 to -12) -9	**Abstract only the recommended volume.** **Install a flow metre and dipper tube on the borehole, undertake to monitor abstractions and water level response, and reduce abstraction if the groundwater supply shows a significant decrease.**	4	4	1	0	-8	0	Neutral - Very Low 0 to -12) -0
Local Aquifer	The presence of a septic system and pit latrines on-Site.	Point Source Contamination on-Site	4	3	3	1	-24	1	Low-negative (-13 to -24) - -24	**Ensure all abstraction boreholes are properly cased and sealed, especially through fractured zones in the dolerite, to prevent vertical migration of contaminants** **Implement a quarterly monitoring programme to track changes in water levels and quality.** **Regularly inspect and maintain on-Site sanitation systems to prevent leakage into the subsurface.**	4	3	1	0	-7	0	Neutral - Very Low (0 to -12) -0

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation						
			Duration	Extent	Severity	Potential for impact on irreplaceable resources	Consequence	Probability	Significance		Duration	Extent	Severity	Potential for impact on irreplaceable resources	Consequence	Probability	Significance
Local Aquifer	Pecan nut and Pine plantations on-Site.	Pecan nut and Pine plantations on-Site impact the groundwater quality.	4	3	3	1	-24	1	Low negative (-13 to -24) -24	**Avoid establishing plantations in groundwater recharge zones.** **Monitor groundwater quality regularly.**	4	3	1	0	-7	0	Neutral – Very Low (0 to -12) -0
Local Aquifer	Vehicle Park area and driveway.	Oil and fuel spills and leakages at vehicle park areas and at the Site may cause poor-quality seepage and runoff.	4	3	3	1	-24	1	Low negative (-13 to -24) -24	**Ensure all abstraction boreholes are properly cased and sealed, especially through fractured zones in the dolerite, to prevent vertical migration of contaminants.** **Implement a quarterly monitoring programme to track changes in water levels and quality.** **Regularly inspect and maintain on-Site sanitation systems to prevent leakage into the subsurface.**	4	3	1	0	-7	0	Neutral – Very Low (0 to -12) -0

8 WATER MONITORING

The following monitoring is proposed to monitor the overall environmental impact associated with the activities at the Site and to serve as an early detection system for potential problems:

- **Annual** groundwater quality monitoring, where a sample is taken from the groundwater abstraction borehole. The aim is to determine if there is any degradation of the water that is being used for domestic purposes and to detect issues before they arise. Sample analyses should be as follows (taken in 1 x 1-litre plastic and 1 x 250 ml sterile containers):
    - pH in water at 25ºC
    - Conductivity in mS/m @ 25ºC
    - TDS
    - Bicarbonate Alkalinity as CaCO3
    - Bicarbonate as CaCO3
    - Total Alkalinity as CaCO3
    - Calcium
    - Magnesium
    - Potassium
    - Sodium
    - Chloride
    - Fluoride
    - Nitrate
    - Ammonium
    - Sulphate
    - Aluminium
    - Iron
    - Manganese
    - Microbes (*E. coli*, faecal coliforms, total coliforms)

- **Weekly** groundwater level monitoring:
    - It is recommended that water levels be measured weekly to maintain a record of borehole performance and impact on the groundwater resource.
    - Water level readings can be taken by a hand-held water level dip metre or through the installation of an automated water level logger. Water level loggers are installed just above the pump depth and monitor the level of water in the borehole. The data from the logger should be downloaded at least on a monthly basis or connect directly to a telemetry system to allow for real time monitoring.
    - This data, along with a manual water level measurement, allows for the compilation of monitoring graphs which should be analysed by a qualified Hydrogeologist to ensure long-term sustainable use from the borehole.
- **Weekly** abstraction volume monitoring:
    - It is recommended that weekly readings of the volumes of water used be taken and kept on record.
    - Abstraction volume monitoring can be achieved through the installation of a flow volume metre at the outlet of the borehole

Table 8-1 lists the boreholes to be monitored on-Site. These boreholes are to be monitored according to the proposed monitoring schedule outlined above. They are to be monitored as they are within the Site boundary and are critical for evaluating Site-specific groundwater conditions and potential impacts of abstraction activities.

All monitoring data should be physically recorded and calibrated quarterly and reviewed annually by a qualified Hydrogeologist.

Table 8-1: Boreholes to be monitored at the Site.

Borehole ID	Coordinates	
	Latitude	Longitude
BH3	-27.94484	29.74489
BH4	-27.9241	29.75607
BH6	-27.9422	29.74371
BH7	-27.9272	29.75194
BH8	-27.9188	29.75715
BH11	-27.9319	29.74876
BH12	-27.9422	29.74371
BH13	-27.9288	29.74929

9 CONCLUSIONS

The following conclusions were derived from this investigation:

Thirsti's production, which began in 2015, relies on groundwater and surface water as its primary water sources, with eight (8) operational production boreholes with groundwater levels ranging from 2.19 mbgl to 9.45 mbgl. The Site is located in the Buffelshoek 5469 farm, approximately 28 km southwest of Newcastle in KwaZulu-Natal, South Africa. It is characterised by a diverse natural landscape and is located within Quaternary Catchment V31F of the Pongola-Mtamvuna Water Management Area. The Site experiences a subtropical highland climate, with warm, wet summers and cold, dry winters. The MAP is 920 mm, with most of the rainfall falling in the summer months. However, MAE exceeds the MAP, ranging from 1,300 to 1,450 mm, creating a net water deficit.

The available borehole data from the NGA database indicates that there are seven (7) boreholes within a 5 km radius of the Site with groundwater levels ranging from 2.19 mbgl to 20 mbgl, with an average groundwater level of 8.795 mbgl. Hydrocensus data from both GCS (2019) and Dr. Levin (2016) identified an additional fourteen (14) boreholes on-Site with groundwater levels ranging from 4.41 mbgl to 17.84 mbgl. None of the identified boreholes were found upstream of the Site.

The relationship between elevation and groundwater levels for all boreholes identified on-Site indicates a strong relationship between groundwater and topographic elevation (R=99.74%), suggesting that the groundwater table closely follows the regional topographic elevation, indicating that the aquifer system is semi-confined. The groundwater flow direction at the Site is predominantly from west to east towards Horn River.

According to the 1:250 000 geological map (2728 Frankfort), the Site is underlain by formations of the Karoo Supergroup, primarily comprising mudstones and sandstones of the Normandien and Volksrust Formations. Dolerite intrusions in the form of sheets and dykes are present in the western part of the Site. Alluvial deposits are observed on the northeastern side of the Site near drainage lines.

According to the 1:500 000 hydrogeology map (2725 Kroonstad), the Site is located on a low yielding intergranular and fractured aquifer system with borehole yields of 0.5 and 2 l/s.

The groundwater quality data indicated that the water from all abstraction boreholes on-Site is within the requirements of SANS 241-1: 2015 drinking water quality standards.

The aquifer test data provided to GCS indicates variability in transmissivity values across the Site, ranging from 2.43 m^2/day to 34.35 m^2/day. The average transmissivity values for the respective geological units on-Site are as follows:

- Jurassic Dolerite Formation: Transmissivity ranges from 7.71 m^2/day to 34.35 m^2/day.
- Volksrust Formation: Transmissivity ranges from 2.43 m^2/day.

Based on a 12-hour daily pumping schedule (calculated using the FC method), the recommended total volume of groundwater abstraction for the eight (8) abstraction boreholes on-Site is 1 694.55 m^3/day, which equates to an annual abstraction of 618 579 m^3/a. The calculated FC recommended volume is approximately double the demand of Thirsti's production. Thirsti's long-term sustainable groundwater abstraction demand is 770.88 m^3/day, equivalent to 253 778 m^3/a. This indicates that Thirsti's demand is well within the aquifer's estimated sustainable yield.

The groundwater balance calculated for the delineated sub-catchment indicates that a total of 2 918 072 m^3/a of groundwater is available for abstraction. Following the recommended abstraction volume of 618 579 m^3/a, a surplus of 2 299 493 m^3/a is expected to remain available within the sub-catchment. This suggests that the proposed groundwater use is within sustainable limits and does not exceed the estimated recharge capacity of the area.

Based on the DWS scale of abstraction categories, the recommended groundwater abstraction across the delineated sub-catchment is classified as Category A – "Small-Scale" abstraction. This classification reflects that the volume of groundwater to be abstracted is well within the sustainable limits of the aquifer system relative to the estimated recharge, indicating a low potential for negative impacts on the groundwater resource.

Based on the guide for determining the level of stress of a groundwater resource unit, the existing abstraction of 67 842 m^3/a within the delineated sub-catchment classifies the unit as Status Category C (0.2 – 0.5). This indicates a moderate level of stress on the aquifer system, suggesting that while groundwater use is within sustainable limits. However, ongoing monitoring and groundwater management strategies are recommended to prevent overexploitation.

The radius of influence from the abstraction boreholes ranges between 69.21 m and 496.36 m. Groundwater on-Site is abstracted from a confined aquifer system, which is hydraulically separated from the overlying unconfined aquifer. As a result, impacts on surface water features such as streams and wetlands are expected to be minimal. However, simultaneous pumping of all eight (8) boreholes could significantly increase the cumulative radius of influence, leading to aquifer drawdown, interference between boreholes, and reduced yields. This may have a negative impact on surrounding groundwater users and surface water bodies.

A field survey conducted by GCS in 2019 identified certain on-Site activities with the potential to impact both the quantity and quality of groundwater. These contaminating activities, if left unmanaged, could pose an environmental impact. However, based on the findings of the hydrogeological impact assessment and the implementation of mitigation measures outlined in this study, conducted in accordance with GNR 982 of the EIA Regulations (2014). The potential impacts of these activities are assessed to be neutral to very low in significance.

To ensure the long-term sustainable management of the groundwater resource, all monitoring data are to be physically recorded and calibrated on a quarterly basis and subjected to annual review by a qualified Hydrogeologist. This regular evaluation will support the early identification of any anomalies, allowing for timely mitigation and adaptive management of the groundwater system on-Site.

9.1 Recommendations

Based on the findings of this hydrogeological assessment, the following recommendations were made.

- Based on a 12-hour daily pumping schedule (calculated using the FC method), the recommended total volume of groundwater abstraction for the eight (8) abstraction boreholes on-Site is 1 694.53 m^3/day, which equates to an annual abstraction of 618 579 m^3/a. Note that abstraction from BH6 is not recommended unless the borehole is retested at a lower yield.

Borehole ID	Sustainable Abstraction Rate [12-Hour Daily Pump Schedule]		
	[l/s]	m^3/d	m^3/a
BH3	2.44	105.41	38 474
BH4	10.47	452.30	165 091
BH6	*The pumping outlet was reached after 18 minutes.*		
BH7	6.65	287.28	104 857
BH8	3.68	158.78	58 026
BH11	3.82	165.02	60 234
BH12	3.82	165.02	60 234
BH13	8.35	360.72	131 663
Total	**39.23**	**1 694.53**	**618 579**

- To prevent source contamination, it is recommended that all abstraction boreholes should be properly cased and sealed to prevent surface water and contaminant ingress, and regular inspection and maintenance of on-Site septic tanks and pit latrines are recommended to prevent leakage into the subsurface and the potential contamination of the aquifer.
- Due to the potential impact of Pecan nut and Pine plantations on groundwater quantity and quality, it is recommended that buffer zones be established where planting is restricted, particularly in groundwater recharge zones.

- Installation of piezometers and quarterly monitoring of groundwater levels in and around the plantation areas to detect any changes in groundwater levels.
- It is recommended that the operational boreholes be pumped on a rotational basis to reduce cumulative drawdown and prevent interference between boreholes.
- It is recommended that a quarterly hydrochemical assessment and groundwater level monitoring be maintained to ensure early detection of any changes that could influence neighbouring groundwater users. Where feasible, an updated groundwater model and cumulative impact assessment should be developed to further support sustainable groundwater management.

9.2 Identification of Any Areas that Should Be Avoided.

Buffer zones should be established where Pecan nut and Pine plantation planting is restricted to safeguard the aquifer system on-Site from quality and quantity impacts. The abstraction borehole on-Site is not near any natural tributaries or surface water features.

9.3 Reasoned Opinion on Whether WULA Should Be Approved.

This assessment cannot find any grounds or identify hydrogeological conditions that could potentially hinder the approval of the WUL for the Site. This is grounded on the assumption that the proposed mitigation measures (Section 7) and monitoring program (Section 8) will be implemented and adhered to.

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APPENDIX A: YIELD TEST CERTIFICATE

BOREHOLE TEST RECORD SHEET

REQUEST NO. :	LL2455	MAP REFERENCE :	0	REGION :	Kwazulu-Natal
BOREHOLE NO. :	BOREHOLE 3	COORDINATES (DD-MM-SS)	Lo:	DISTRICT :	Newcastle
ALT. BH. NO. :	0	LATITUDE :	S27 56 41.1	X:	FARM NAME : Normandien
ALT. BH. NO. :	-	LONGITUDE:	E29 44 41.4	Y:	VILLAGE : Normandien

BOREHOLE DEPTH (m):	102.00	DATUM LEVEL ABOVE CASING (m):	0.88	EXISTING PUMP:	None
WATER LEVEL (mbgl):	3.70	CASING HEIGHT (magl):	0.40	CONTRACTOR:	Engeolab
DEPTH OF PUMP (m):	80.00	BH DIAM. (PUMP INLET) (mm):	190	PUMP TYPE :	Submersible

MULTI-RATE DISCHARGE TEST AND RECOVERY

DISCHARGE RATE 1					DISCHARGE RATE 2					DISCHARGE RATE 3				
DATE: 24/08/2015	TIME:			06:15 PM	DATE: 24/08/2015	TIME:			07:18 PM	DATE: 24/08/2015	TIME:			08:17 PM
TIME	DRAWDOWN	YIELD	TIME	RECOVERY	TIME	DRAWDOWN	YIELD	TIME	RECOVERY	TIME	DRAWDOWN	YIELD	TIME	RECOVERY
(min)	(m)	(l/s)	(min)	(m)	(min)		(l/s)	(min)	(m)	(min)	(m)	(l/s)	(min)	(m)
1	0.67		1		1	4.74	2.15	1		1	10.03	3.24	1	
2	0.77		2		2	5.12	2.15	2		2	10.22	3.24	2	
3	0.81	1.07	3		3	5.62	2.15	3		3	10.70	3.25	3	
5	1.07	1.07	5		5	6.27	2.16	5		5	11.78	3.25	5	
7	1.12	1.07	7		7	7.00	2.16	7		7	12.58	3.25	7	
10	1.18	1.07	10		10	6.84	2.15	10		10	13.10	3.25	10	
15	1.25	1.07	15		15	7.45	2.16	15		15	13.58	3.25	15	
20	1.27	1.07	20		20	7.62	2.16	20		20	14.57	3.25	20	
30	1.43	1.07	30		30	8.12	2.15	30		30	15.58	3.25	30	
40	1.89	1.07	40		40	8.57	2.16	40		40	15.77	3.24	40	
50	2.10	1.07	50		50	8.84	2.16	60		50	17.91	3.25	50	
60	2.24	1.07	60		60	9.24	2.16	90		60	19.34	3.25	60	
70			70		70			120		70			70	
80			80		80			150		80			80	
90			90		90			180		90			90	
100			100		100			210		100			100	
110			110		110			240		110			110	
120			120		120			300		120			120	
								360						
			0					420						

DISCHARGE RATE 4					DISCHARGE RATE 5					YIELD (CALIBRATION) TEST				
DATE: 24/08/2015	TIME:			10:40 PM	DATE: 13/10/2014	TIME:			10:30 PM	DATE:	TIME:			
TIME	DRAWDOWN	YIELD	TIME	RECOVERY	TIME	DRAWDOWN	YIELD	TIME	RECOVERY	TIME	DRAWDOWN	YIELD	TIME	RECOVERY
(min)	(m)	(l/s)	(min)	(m)	(min)	(m)	(l/s)	(min)	(m)	(min)	(m)	(l/s)	(min)	(m)
1	21.34	3.50	1	8.92	1			1		1			1	
2	22.20	3.44	2	6.09	2			2		2			2	
3	22.75	3.44	3	4.78	3			3		3			3	
5	23.45	3.40	5	3.93	5			5		4			5	
7	23.97	3.44	7	3.20	7			7		5			7	
10	24.11	3.44	10	2.63	10			10		7			10	
15	24.50	3.28	15	2.07	15			15		9			15	
20	23.57	3.24	20	1.91	20			20		12			20	
30	24.63	3.28	30	1.50	30			30		15			30	
40	24.68	3.16	40	1.37	40			40		20			40	
50	24.71	3.16	50	0.46	50			50		25			50	
60	24.73	3.16	60	0.00	60			60		30			60	
70			70		70			70		40			70	
80			80		80			80		50			80	
90			90		90			90		60			90	
100			100		100			100		70			100	
110			110		110			110		80			110	
120			120		120			120		90			120	
										100				
										110				

COMMENTS

BOREHOLE TEST RECORD SHEET

REQUEST NO. :	LL2455	MAP REFERENCE:		0		Kwazulu-Natal	
BOREHOLE NO.:	BOREHOLE 3	COORDINATES	(DD-MM-SS)	Lo:	0	DISTRICT :	Newcastle
ALT. BH. NO.:	0	LATITUDE :	527 56 41.1	X:	0	SITE NAME:	Normandien
ALT. BH. NO.:	-	LONGITUDE:	E29 44 41.4	Y:	0	FARM NAME:	Normandien
BOREHOLE DEPTH (m):	102.00	DATUM LEVEL ABOVE CASING (m):		0.88		EXISTING PUMP:	
WATER LEVEL (mbgl):	3.70	CASING HEIGHT (magl):		0.40		None	
DEPTH OF PUMP (m):	80.00	BH DIAM. (PUMP INLET) (mm):		190		CONTRACTOR:	Engeolab

CONSTANT RATE DISCHARGE TEST AND RECOVERY

TEST STARTED			TEST COMPLETED		DURATION (min):	5120
DATE:	24/08/2015	TIME: 10:41 PM	DATE:	TIME:	TYPE OF PUMP :	Submersible

* NOTE * Distance between disc and observation holes in m.

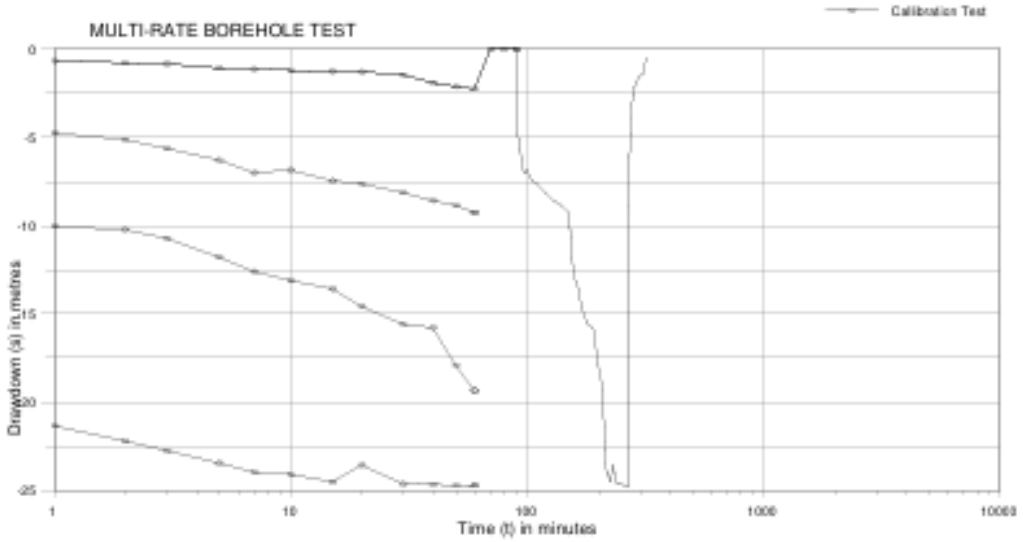
DISCHARGE BOREHOLE					OBSERVATION HOLE 1		OBSERVATION HOLE 2		OBSERVATION HOLE 3	
					Nr : -		Nr : -		Nr : -	
					Distance m: -		Distance: -		Distance: -	
TIME	DRAWDOWN	YIELD	TIME	RECOVERY	TIME	DRAWDOWN	TIME	DRAWDOWN	TIME	DRAWDOWN
(min)	(m)	(l/s)	(min)	s' (m)	(min)	(m)	(min)	(m)	(min)	(m)
1	0.57		1	13.28	1		1		1	
2	1.95	1.95	2	9.70	2		2		2	
3	2.58	1.94	3	7.54	3		3		3	
5	3.37	1.94	5	6.12	5		5		5	
7	4.49	1.93	7	5.42	7		7		7	
10	5.39	1.94	10	4.97	10		10		10	
15	6.42	1.94	15	4.51	15		15		15	
20	6.87	1.94	20	4.17	20		20		20	
30	7.46	1.94	30	3.85	30		30		30	
40	7.87	1.94	40	3.53	40		40		40	
60	8.23	1.94	60	3.24	60		60		60	
90	8.64	1.94	90	2.85	90		90		90	
120	8.73	1.94	120	2.61	120		120		120	
150	8.97	1.94	150	2.22	150		150		150	
180	9.14	1.94	180	2.00	180		180		180	
210	9.17	1.94	210	1.61	210		210		210	
240	9.23	1.94	240	1.49	240		240		240	
300	9.52	1.94	300	0.61	300		300		300	
360	9.59	1.94	360	0.00	360		360		360	
420	9.64	1.94	420		420		420		420	
480	9.77	1.94	480		480		480		480	
540	9.88	1.94	540		540		540		540	
600	9.97	1.94	600		600		600		600	
720	10.07	1.94	720		720		720		720	
840	10.30	1.94	840		840		840		840	
960	10.43	1.94	960		960		960		960	
1080	18.09	3.02	1080		1080		1080		1080	
1200	19.70	3.02	1200		1200		1200		1200	
1320	20.40	3.02	1320		1320		1320		1320	
1440	20.62	3.02	1440		1440		1440		1440	
1560	20.94	3.02	1560		1560		1560		1560	
1680	21.25	3.02	1680		1680		1680		1680	
1800	21.78	3.02	1800		1800		1800		1800	
2160	23.16	3.28	2160		1920		1920		1920	
2240	23.24	3.28	2240		2040		2040		2040	
2400	26.30	3.28	2400		2160		2160		2160	
2640	28.97	3.28	2640		2280		2280		2280	
2880	29.68	3.28	2880		2400		2400		2400	

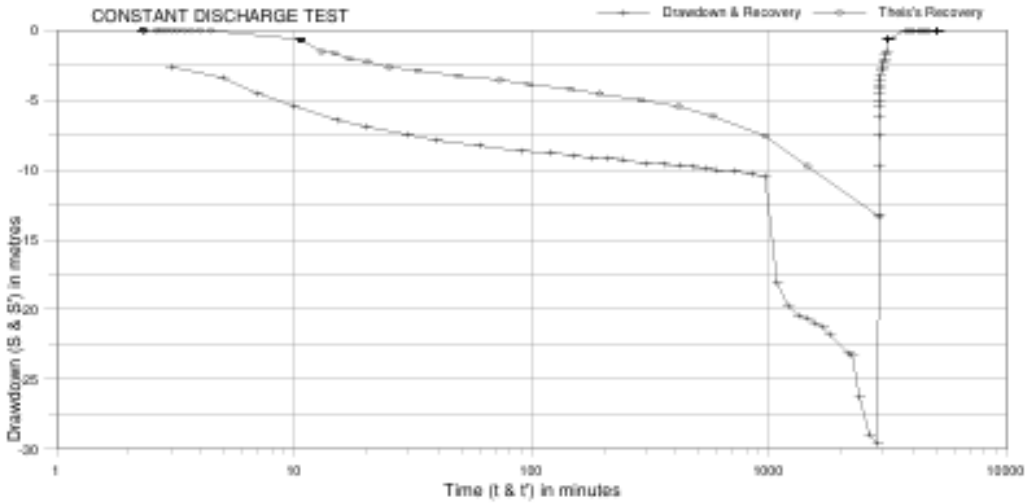
TOTAL TIME PUMPED (min): t
AVERAGE YIELD (l/s):

t' = total time since pumping started.
t'' = time since pumping stopped.

COMMENTS: 1).

BOREHOLE Nr. BOREHOLE 3





REGION :	Kwazulu-Natal	BOREHOLE NO :	BOREHOLE 3	MAP REFERENCE :	
DISTRICT :	Newcastle	DEPTH :	102	LATITUDE :	S27 56 41.1
FARM NAME :	Normandien	WATER LEVEL :	3.7	LONGITUDE:	E29 44 41.4
VILLAGE :	Normandien	DEPTH OF PUMP:	80	Lo SYSTEM :	

MULTI-RATE BOREHOLE TEST — DATE TESTED : 24/08/2015

TEST Nr	YIELD (l/s)	DURATION (min)	DRAWDOWN (m)	RECOVERY (min)	RECOVERY (m)	Q/s (l/s/m)
1		90	2.24			
2	2.16	60	9.24			0.23
3	3.25	60	19.34			0.17
4	3.24	60	24.73	50	0.46	0.13
5						
CALIBRATION	0.00/0.00					

CONSTANT-RATE DISCHARGE TEST — DATE TESTED : 24/08/2015

AVE. YIELD (l/s)	DURATION (min)	DRAWDOWN (m)	RECOVERY (min)	RECOVERY (m)	kD (m^2/day)	S
2.76	2880	29.68	2240		4.0	1.00E-03
OBS. HOLE 1						
OBS. HOLE 2						
OBS. HOLE 3						

Recommendations

BOREHOLE:		BOREHOLE 3	Theis Method	Normandien		EQUIPMENT TYPE
DISCHARGE RATE			12 hr/day	2.44	l/s	MOTORISED
			12 hr/day	104.6	m3/d	
LAT	S27 56 41.1	Max Q	9 hr/day	3.25	l/s	MOTORISED
			9 hr/day	104.6	m3/d	
LONG	E29 44 41.4		24 hr/day	1.22	l/s	MOTORISED
			24 hr/day	104.6	m3/d	
		Critical water level		47.7	mbgl	
	12 Hr Cycle	Dynamic water level		20.6	mbgl	
	9 Hr Cycle	Dynamic water level		24.9	mbgl	
	24 Hr Cycle	Dynamic water level		14.7	mbgl	
		Depth of pump		80.0	m	

T	4.00	m2/day
h	41.00	m
u	1.5E-09	
w(u)	19.7108	
Theis	104.60	m3/day
Rest WL	3.7	m
Critical h	44	m

Depth to strike / boundary =

Recommendations

1.) A monitoring facility must be installed for this borehole and the waterlevel of the borehole must be measured regularly.
2.) The maximum abstraction rate for the borehole is the yield indicated for the 9 hour pumping cycle
3.) It is recommended that the 9 hour pumping cycle be used and the borehole be allowed to recover for the remainder of the time(15hrs)
4.) Do not over pump initially!!
5.) Water quality monitoring should take place to ensure good water quality.

Recovery Check		
CD Yield (l/s)	2.8	
CD Duration (hr)	2880.0	
Rec Duration (hr)	2240.0	
Total (CD + Rec)		5120.0
Drawdown (CD)	29.7	
Rec		
% Rec		100.0
Airlift Yield	1.8 (l/s)	
Inflow on a 24 hr/day	1.6 (l/s)	

MAX YIELD FOR GIVEN PERIOD: Q/st Metho

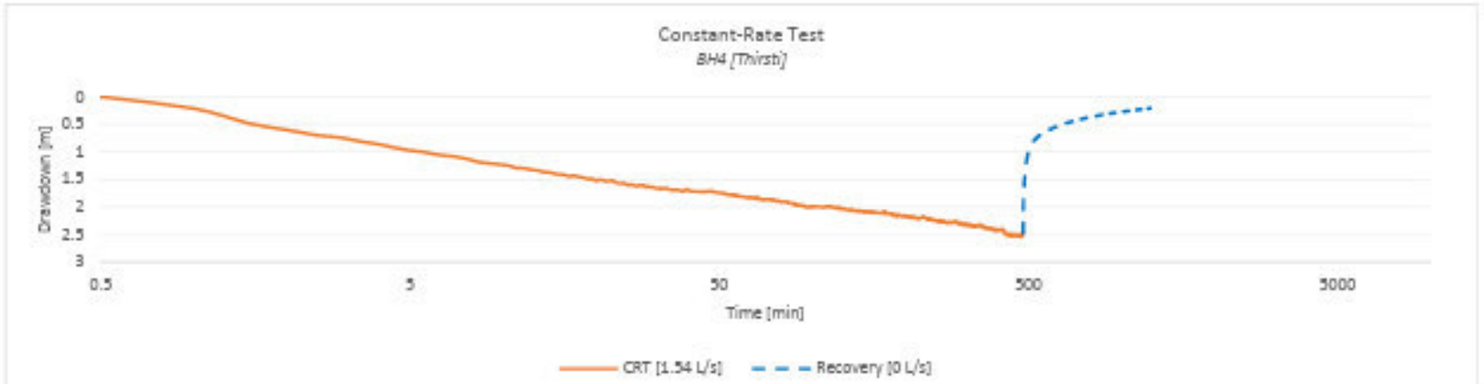
Q/st	0.13	24 hR
Drawdown	41.00	
Q max	5.48	

Q/st	0.27	12 hR
Drawdown	41.00	
Q max	11.22	

Q/st	0.28	9 Hr
Drawdown	41.00	
Q max	11.44	

NOTE: A monitoring facility must be installed in all equipped boreholes.

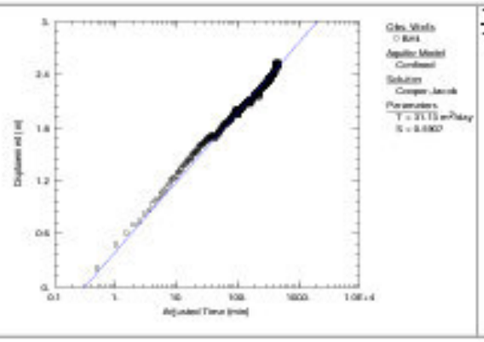
CONSTANT-RATE TEST AND RECOVERY CURVES



SUSTAINABLE YIELD CALCULATION

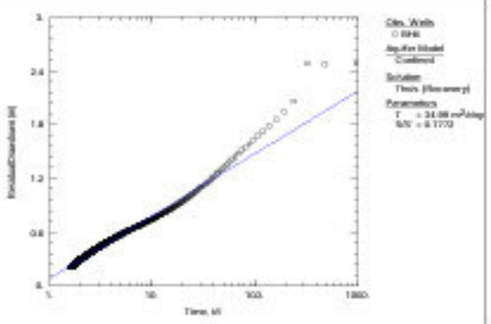
Cooper-Jacob

Transmissivity = 31.13 m^2/d



Theis Residual Drawdown

Transmissivity = 34.99 m^2/d



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m^3/d]
Sustainable Abstraction Rate [24 hour per day schedule]	7.4	639.36
Sustainable Abstraction Rate [12 hour per day schedule]	10.5	452.304

Assumptions:

- *12 hour per day abstraction.*
- *Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.*
- *No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.*

Limitation

- *The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.*
- *Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.*

BOREHOLE INFORMATION		
BOREHOLE ID:		BH4
COORDINATES	LATITUDE:	-27.92406
	LONGITUDE:	29.75607
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		-
BOREHOLE DEPTH [m]:		80.00
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	28 (12 000)
	WATER STRIKE NO 2:	39 (15 000)
	WATER STRIKE NO 3:	-
	WATER STRIKE NO 4:	-
	WATER STRIKE NO 5:	-
GEOLOGICAL DESCRIPTION:		-

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	-

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Thursday, June 27, 2019
STATIC WATER LEVEL [m bgl]:		8.92
AVAILABLE DRAWDOWN [m]:		30.18
CRT	RATE [L/s]:	1.54
	DURATION [min]:	480.00
	DRAWDOWN [m]:	2.50
RECOVERY MONITORING:	DURATION [min]:	195.00
	RECOVERY PERCENTAGE [%]	95.00

Note/s:

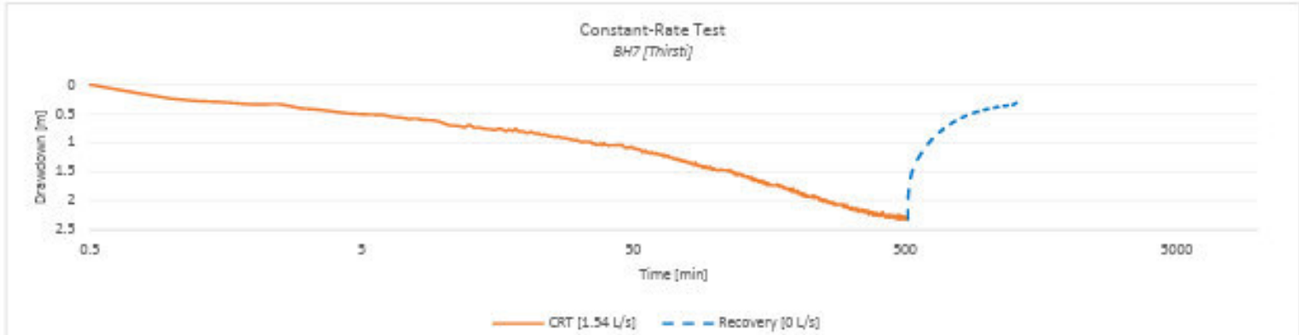
- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m^3/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B5
CLIENT:	THIRSTI™

GCS Water & Environmental Consultants

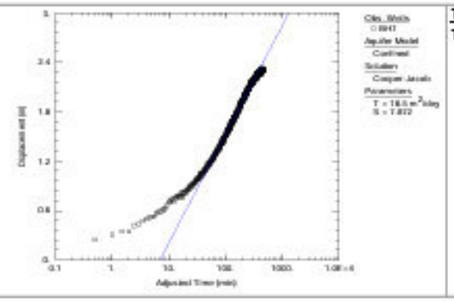
63 Wessel Road Woodmead
PO Box 2597 Rivonia 2128, South Africa
Tel: +27 (0) 11 803 5726
Fax: +27 (0) 11 803 5745

CONSTANT-RATE TEST AND RECOVERY CURVES

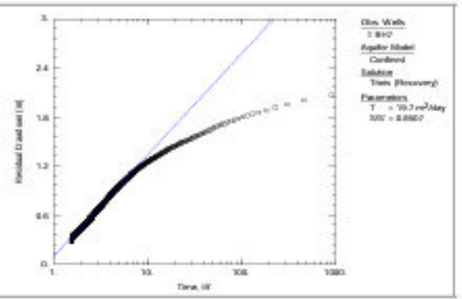


SUSTAINABLE YIELD CALCULATION

Cooper-Jacob
Transmissivity = 18.5 m^2/d



Theis Residual Drawdown
Transmissivity = 19.7 m^2/d



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m^3/d]
Sustainable Abstraction Rate [24 hour per day schedule]	4.7	406.08
Sustainable Abstraction Rate [12 hour per day schedule]	6.7	287.28

Assumptions:
- *12 hour per day abstraction.*
- *Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.*
- *No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.*

Limitation
- *The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.*
- *Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.*

BOREHOLE INFORMATION		
BOREHOLE ID:		BH7
COORDINATES	LATITUDE:	-27.9272
	LONGITUDE:	29.75194
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		-
BOREHOLE DEPTH [m]:		-
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	-
	WATER STRIKE NO 2:	-
	WATER STRIKE NO 3:	-
	WATER STRIKE NO 4:	-
	WATER STRIKE NO 5:	-
GEOLOGICAL DESCRIPTION:		-

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	-

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Friday, May 31, 2019
STATIC WATER LEVEL [m bgl]:		5.80
AVAILABLE DRAWDOWN [m]:		31.20
CRT	RATE [L/s]:	1.54
	DURATION [min]:	480.00
	DRAWDOWN [m]:	2.34
RECOVERY MONITORING:	DURATION [min]:	791.00
	RECOVERY PERCENTAGE [%]	95.00

Note/s:
- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m^3/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

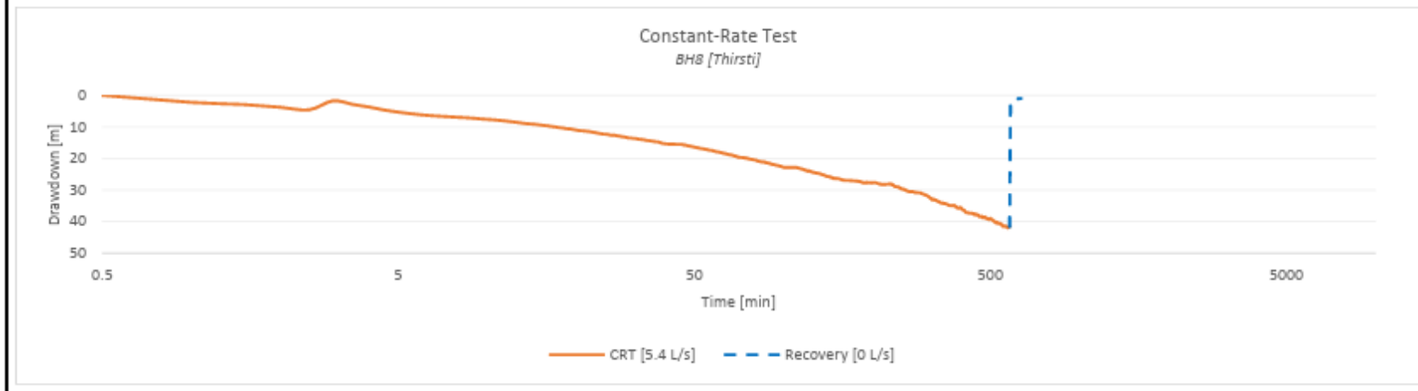
PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B6
CLIENT:	

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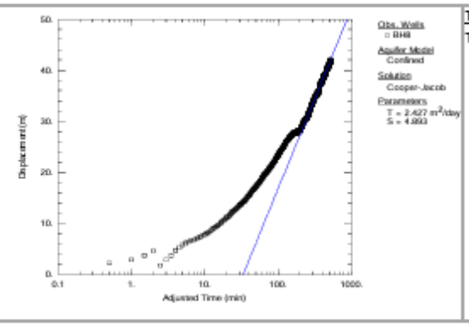
CONSTANT-RATE TEST AND RECOVERY CURVES



SUSTAINABLE YIELD CALCULATION

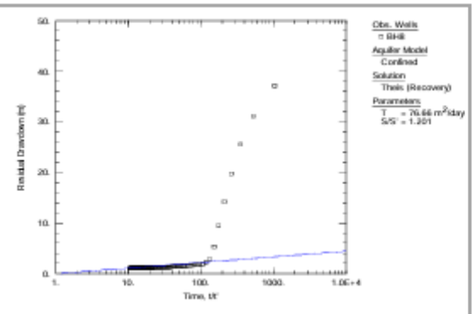
Cooper-Jacob

Transmissivity = 2.43 m^2/d



Theis Residual Drawdown

Transmissivity = 76.66 m^2/d



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m^3/d]
Sustainable Abstraction Rate [24 hour per day schedule]	2.6	224.64
Sustainable Abstraction Rate [12 hour per day schedule]	3.7	158.976

Assumptions:

- 12 hour per day abstraction.

- Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.

- No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.

Limitation

- The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.

- Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.

- No borehole and / or formation skin effects were taken into account.

BOREHOLE INFORMATION		
BOREHOLE ID:		BH8
COORDINATES	LATITUDE:	-27.9188
	LONGITUDE:	29.75715
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		-
BOREHOLE DEPTH [m]:		-
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	-
	WATER STRIKE NO 2:	-
	WATER STRIKE NO 3:	-
	WATER STRIKE NO 4:	-
	WATER STRIKE NO 5:	-
GEOLOGICAL DESCRIPTION:		-

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	-

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Thursday, May 30, 2019
STATIC WATER LEVEL [m bgl]:		11.10
AVAILABLE DRAWDOWN [m]:		43.90
CRT	RATE [L/s]:	5.40
	DURATION [min]:	530.00
	DRAWDOWN [m]:	42.00
RECOVERY MONITORING:	DURATION [min]:	49.00
	RECOVERY PERCENTAGE [%]	90.00

Note/s:

- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m^3/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B7

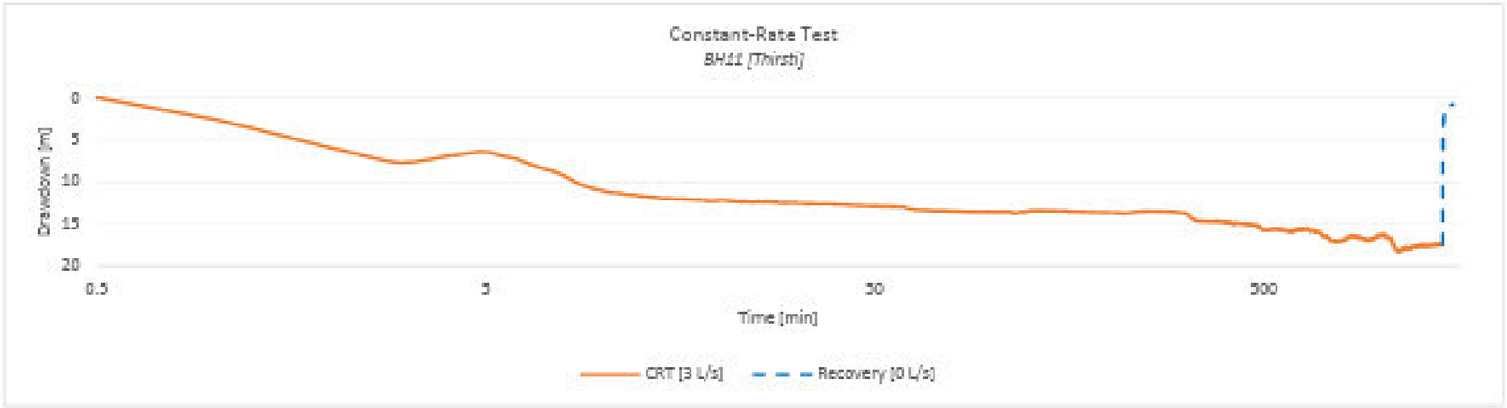
CLIENT:

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GCS Water & Environmental Consultants

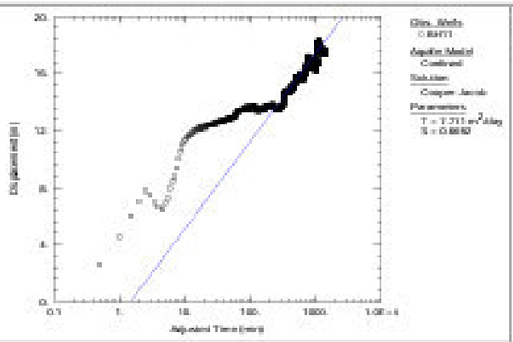
63 Wessel Road Woodmead
PO Box 2597 Rivonia 2128, South Africa
Tel: +27 (0) 11 803 5726
Fax: +27 (0) 11 803 5745

CONSTANT-RATE TEST AND RECOVERY CURVES

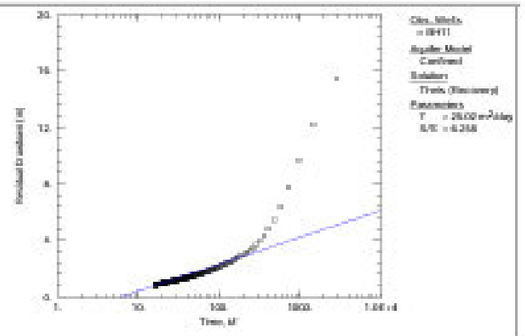


SUSTAINABLE YIELD CALCULATION

Cooper-Jacob
Transmissivity = 7.71 m^2/d



Theis Residual Drawdown
Transmissivity = 25.02 m^2/d



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m^3/d]
Sustainable Abstraction Rate [24 hour per day schedule]	2.7	233.28
Sustainable Abstraction Rate [12 hour per day schedule]	3.8	165.024

Assumptions:
- *12 hour per day abstraction.*
- *Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.*
- *No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.*

Limitation
- *The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.*
- *Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.*

BOREHOLE INFORMATION		
BOREHOLE ID:		BH11
COORDINATES	LATITUDE:	-27.931865
	LONGITUDE:	29.74876
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		Wednesday, June 12, 2019
BOREHOLE DEPTH [m]:		54.00
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	9 (Seepage)
	WATER STRIKE NO 2:	14 (5 000)
	WATER STRIKE NO 3:	33 (12 000)
	WATER STRIKE NO 4:	-
	WATER STRIKE NO 5:	-
GEOLOGICAL DESCRIPTION:		Refer to Drill Log

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	40.00

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Friday, June 21, 2019
STATIC WATER LEVEL [m bgl]:		2.19
AVAILABLE DRAWDOWN [m]:		32.81
CRT	RATE [L/s]:	3.00
	DURATION [min]:	1440.00
	DRAWDOWN [m]:	18.80
RECOVERY MONITORING:	DURATION [min]:	95.00
	RECOVERY PERCENTAGE [%]	90.00

Note's:
- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m^3/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

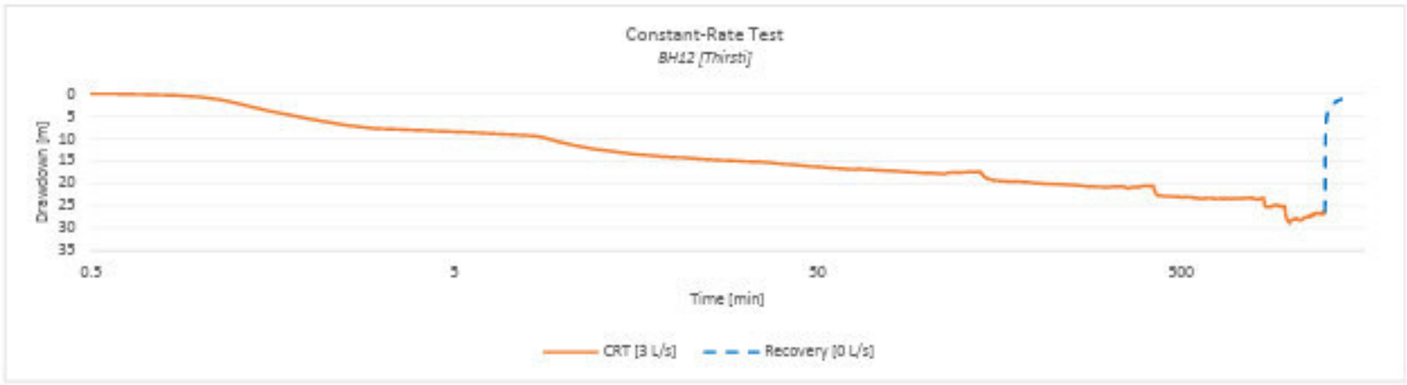
PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B1
CLIENT:	

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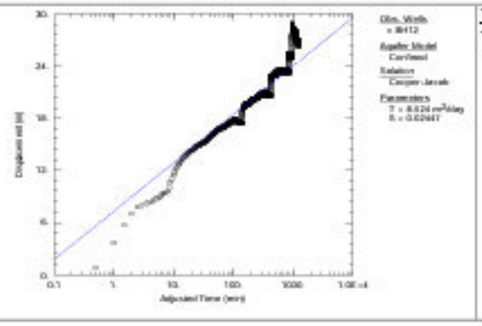
CONSTANT-RATE TEST AND RECOVERY CURVES



SUSTAINABLE YIELD CALCULATION

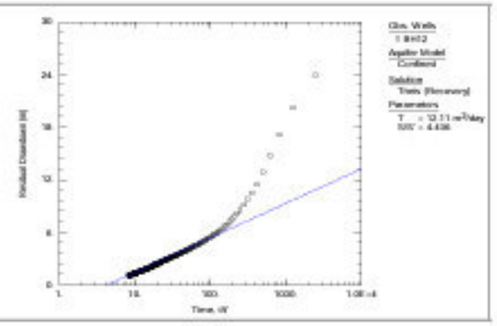
Cooper-Jacob

Transmissivity = 8.52 m^2/d



Theis Residual Drawdown

Transmissivity = 12.11 m^2/d



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m^3/d]
Sustainable Abstraction Rate [24 hour per day schedule]	2.7	233.28
Sustainable Abstraction Rate [12 hour per day schedule]	3.8	165.024

Assumptions:

- 12 hour per day abstraction.
- Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.
- No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.

Limitation

- The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.
- Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.
- No borehole and / or formation skin effects were taken into account.

BOREHOLE INFORMATION		
BOREHOLE ID:		BH12
COORDINATES	LATITUDE:	-27.942212
	LONGITUDE:	29.743712
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		Thursday, June 13, 2019
BOREHOLE DEPTH [m]:		78.00
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	6 (Seepage)
	WATER STRIKE NO 2:	11 (2 000)
	WATER STRIKE NO 3:	25 (7 000)
	WATER STRIKE NO 4:	35 (11 000)
	WATER STRIKE NO 5:	49 (14 000)
GEOLOGICAL DESCRIPTION:		Refer to Drill Log

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	67.00

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Sunday, June 23, 2019
STATIC WATER LEVEL [m bgl]:		9.45
AVAILABLE DRAWDOWN [m]:		44.55
CRT	RATE [L/s]:	3.00
	DURATION [min]:	1440.00
	DRAWDOWN [m]:	26.65
RECOVERY MONITORING:	DURATION [min]:	167.00
	RECOVERY PERCENTAGE [%]	90.00

Note/s:

- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m^3/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B2
CLIENT:	

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CONSTANT-RATE TEST AND RECOVERY CURVES



Abstraction Rate Scenario Summary

Scenarios	Abstraction Rate (12 Hour Abstracion Schedule)	
	[L/s]	[m³/d]
Sustainable Abstraction Rate [24 hour per day schedule]	**5.9**	**509.76**
Sustainable Abstraction Rate [12 hour per day schedule]	**8.4**	**360.72**

Assumptions:
- *12 hour per day abstraction.*
- *Groundwater level during pumping should not reach the depth of pump inlet / main water strike depth.*
- *No groundwater recharge was accounted for in the analytical calculation to allow for a more conservative approach.*

Limitation
- *The groundwater sustainble calculation does not take account any other abstractions in the surrounding area.*
- *Little information is available in terms of groundwater boundaries, including aquifer limits, low permeable barriers and recharge flux boundaries.*
- *No borehole and / or formation skin effects were taken into account.*

BOREHOLE INFORMATION		
BOREHOLE ID:		BH13
COORDINATES	LATITUDE:	-27.928825
	LONGITUDE:	-27.928825
	COORDINATE SYSTEM	Geographic (Latitude and Longitude)
BOREHOLE INSTALLATION DATE:		Thursday, July 4, 2019
BOREHOLE DEPTH [m]:		54.00
WATER STRIKE DEPTH [m] (CUMULATIVE YIELD [L/h])	WATER STRIKE NO 1:	6 (Seepage)
	WATER STRIKE NO 2:	12 (3 000)
	WATER STRIKE NO 3:	21 (6 000)
	WATER STRIKE NO 4:	24 (30 000)
	WATER STRIKE NO 5:	-
GEOLOGICAL DESCRIPTION:		Refer to Drill Log

PUMP SYSTEM INFORMATION	
PUMP SYSTEM:	-
PUMP INLET DEPTH [m]:	30.00

CONSTANT-RATE TEST INFORMATION		
TEST DATE:		Friday, July 5, 2019
STATIC WATER LEVEL [m bgl]:		9.02
AVAILABLE DRAWDOWN [m]:		21.00
CRT	RATE [L/s]:	6.00
	DURATION [min]:	1440.00
	DRAWDOWN [m]:	5.43
RECOVERY MONITORING:	DURATION [min]:	880.00
	RECOVERY PERCENTAGE [%]	92.00

Note/s:
- *m - metres*
- *m bgl - metres below ground level*
- *L/s - Litres per second*
- *L/h - Litres per hour*
- *m³/d - cubic metres per day*
- *min - minutes*
- *% - percentage*

PREPARED BY:	Mr. D. Bosman
DATE:	Monday, July 15, 2019
PROJECT NAME:	Thirti Bottling Plant Water Supply
PROJECT CODE:	19-0320
FIGURE NUMBER:	B3
CLIENT:	THIRSTI™

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APPENDIX B: LABORATORY CERTIFICATE

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Tel: +27 (0) 33 346 1444 • Fax: +27 (0) 33 346 1445 • E-mail: talbot@talbot.co.za • http://www.talbot.co.za

2015/12/04

ANALYTICAL REPORT

OUR REF: NORMANDIEN FARMS (PTY) LTD 19937/15
QU102669 (O/N: PO0080084)
COMPANY NAME: NORMANDIEN FARMS (PTY) LTD
CONTACT ADDRESS: CORNER OF UMLAAS & RICHMOND ROAD, THORNVILLE, 3760
CONTACT PERSON: ROSEMARY MTSHALI
SAMPLE TYPE: WATER SAMPLES
DATE SUBMITTED: 2015/11/27

Determinand	Units	Method No	SANS 241-1:2015 RECOMMENDED LIMITS	Results	
				19937/15	19938/15
				BOREHOLE 1 26.11.15	BOREHOLE 2 26.11.15
Chloride	mg Cl/l	16	< 300	<5	<5
Colour	mg Pt-Co/l	48	< 15	<1	<1
Copper	µg Cu/l	83	< 2000	<1	11.2
Dissolved calcium	mg Ca/l	8A	Not specified	2.8	5.7
Dissolved magnesium	mg Mg/l	9A	Not specified	1.2	0.9
E. coli	colonies per 100ml	31	0	0	0
Electrical conductivity at 25°C	mS/m	2	< 170	34	21
Fluoride	µg F/l	18A	< 1500	240	300
Iron	µg Fe/l	83	Chronic ≤2000 Aesthetic ≤300	132	137
Lead	µg Pb/l	83	< 10	<1	<1
Manganese	µg Mn/l	83	Chronic ≤400 Aesthetic ≤100	3.60	3.29
Nitrate*	mg N/l	Calc.	< 11	<0.1	<0.1
Nitrite*	mg N/l	65	< 0.9	0.11	<0.1
Combined Nitrate + Nitrite (sum of Ratios)*	-	-	<1	0.12	<0.1
pH at 25°C	pH units	1A	5.0 - 9.7	9.9	9.7
Sodium	mg Na/l	6A	< 200	60	38
Standard plate count	colonies per ml	31	<1000	**3 680**	108
Sulphate	mg SO_4/l	67	Acute Health ≤500 Aesthetic ≤250	2.67	4.02
Total alkalinity	mg $CaCO_3$/l	10	Not specified	151	68
Total coliforms	colonies per 100ml	31	<10	0	0
Total hardness*	mg $CaCO_3$/l	Calc.	Not specified	12	18
Turbidity	NTU	4	Operational ≤1 Aesthetic ≤5	0.6	2.5

Directors: Dr MMJ-F Talbot, Mr FD Urbaniak-Hedley (British), Mrs VR Talbot
Talbot & Talbot (Pty) Ltd - Company Registration Number 2000/021732/07

Talbot ENGINEERING Talbot GREEN ENERGY Talbot OPERATIONS

Amended Certificate Of Analysis

Company: Swift Silliker Pty Ltd T/A Mérieux NutriSciences - Gauteng
Address: Stellenryk Building
Contantia Square Office Park
16th Street
Midrand
Gauteng, 1685

Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 3 (Normadien Farms T/A Thirsti)			
Sample Number:	WW-22-11283	Sample Condition:	Chilled	Remark:	
WW	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		167	2022-02-28
Colour (True)*		Pt-Co-true	<15	36.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	44.0	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.53	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	295	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		346	2022-03-02
Turbidity	M12	NTU	<5	1.41	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		30.4	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.20	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.11	2022-03-07
Magnesium as Mg	M18	mg/L		9.60	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	<0.10	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.99	2022-02-28
Sulphate as SO_4^{2-}	M44	mg/L	<250	58.1	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.07	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	27.7	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	241	2022-02-25

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16th Street
Midrand
Gauteng, 1685

Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.17	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	64.3	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	384	2022-03-11

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Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 4 (Normadien Farms T/A Thirst)			
Sample Number:	WW-22-11284	Sample Condition:	Chilled	Remark:	
WW	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		157	2022-02-28
Colour (True)*		Pt-Co-true	<15	28.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	41.0	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.38	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	275	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		312	2022-03-02
Turbidity	M12	NTU	<5	0.93	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		31.8	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.87	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.12	2022-03-07
Magnesium as Mg	M18	mg/L		9.41	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	<0.10	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.98	2022-02-28
Sulphate as SO4²-	M44	mg/L	<250	48.4	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.06	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	23.8	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	223	2022-02-25

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Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.15	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	<10.0	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	326	2022-03-11

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Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 6 (Normadien Farms T/A Thirsti)			
Sample Number:	WW-22-11285	Sample Condition:	Chilled	Remark:	
WW	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		164	2022-02-28
Colour (True)*		Pt-Co-true	<15	30.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	41.6	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.35	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	279	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		300	2022-03-02
Turbidity	M12	NTU	<5	1.72	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		27.3	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.20	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.14	2022-03-07
Magnesium as Mg	M18	mg/L		8.37	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	<0.10	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.95	2022-02-28
Sulphate as SO4²-	M44	mg/L	<250	49.0	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.10	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	<10.0	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	226	2022-02-25

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Contact: Phindile Masuku

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Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.19	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	129	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25

Organic Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Total Organic Carbon	M20	mg/L	<10	273	2022-03-11

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Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 7 (Normadien Farms T/A Thirst)			
Sample Number:	WW-22-11286	Sample Condition:	Chilled	Remark:	

WW	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		156	2022-02-28
Colour (True)*		Pt-Co-true	<15	29.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	39.9	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.37	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	287	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		316	2022-03-02
Turbidity	M12	NTU	<5	0.98	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		30.7	2022-02-28
Chloride as Cl-	M44	mg/L	<300	5.13	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.15	2022-03-07
Magnesium as Mg	M18	mg/L		9.33	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	0.38	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.98	2022-02-28
Sulphate as SO4²-	M44	mg/L	<250	44.5	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.05	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	30.8	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	214	2022-02-25

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Service Request Number: WW-2022-04362-A
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Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.14	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	<10.0	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	373	2022-03-11

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Date of Receival at Lab: 23-February-2022

Sample Identification	OMS-22-01365: Borehole 8 (Normadien Farms T/A Thirsti)		
Sample Number: WW-22-11287	Sample Condition: Chilled		Remark:

WW	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		167	2022-02-28
Colour (True)*		Pt-Co-true	<15	39.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	43.4	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.38	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	291	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		316	2022-03-02
Turbidity	M12	NTU	<5	1.05	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		31.7	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.11	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.10	2022-03-07
Magnesium as Mg	M18	mg/L		9.24	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	0.47	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.99	2022-02-28
Sulphate as SO_4^{2-}	M44	mg/L	<250	53.3	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.08	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	30.6	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	232	2022-02-25

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Contact: Phindile Masuku

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Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.18	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	27.5	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	267	2022-03-11

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Amended Certificate Of Analysis

Company: Swift Slilker Pty Ltd T/A Mérieux NutriSciences - Gauteng
Address: Stellenryk Building
Contantia Square Office Park
16th Street
Midrand
Gauteng, 1685

Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01366: Borehole 11 (Normadien Farms T/A Thirsti)			
Sample Number:	WW-22-11288	Sample Condition:	Chilled	Remark:	
WW	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		168	2022-02-28
Colour (True)*		Pt-Co-true	<15	34.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	44.2	2022-02-28
pH @ 25°C	M5	pH units	5 - 9.7	7.44	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	298	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		302	2022-03-02
Turbidity	M12	NTU	<5	0.80	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		32.0	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.11	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.13	2022-03-07
Magnesium as Mg	M18	mg/L		9.57	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	<0.10	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.99	2022-02-28
Sulphate as SO4²-	M44	mg/L	<250	57.0	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.10	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	19.4	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	227	2022-02-25

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Contact: Phindile Masuku

Service Request Number: WW-2022-04382-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.19	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	19.6	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	341	2022-03-11

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Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 12 (Normadien Farms T/A Thirsti)			
Sample Number:	WW-22-11289	Sample Condition:	Chilled	Remark:	

WW	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		156	2022-02-28
Colour (True)*		Pt-Co-true	<15	62.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	39.8	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.41	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	267	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		338	2022-03-02
Turbidity	M12	NTU	<5	1.30	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		32.0	2022-02-28
Chloride as Cl-	M44	mg/L	<300	5.04	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.10	2022-03-07
Magnesium as Mg	M18	mg/L		9.29	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	0.34	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.98	2022-02-28
Sulphate as SO_4^{2-}	M44	mg/L	<250	44.6	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.06	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	<10.0	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	226	2022-02-25

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Gauteng, 1685
Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.19	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	<10.0	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	320	2022-03-11

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Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification		OMS-22-01365: Borehole 13 (Normadien Farms T/A Thirsti)			
Sample Number:	WW-22-11290	Sample Condition:	Chilled	Remark:	

WW	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		184	2022-02-28
Colour (True)*		Pt-Co-true	<15	98.0	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	41.7	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.30	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	279	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		304	2022-03-02
Turbidity	M12	NTU	<5	2.77	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		27.6	2022-02-28
Chloride as Cl-	M44	mg/L	<300	3.80	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.12	2022-03-07
Magnesium as Mg	M18	mg/L		8.46	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	<0.10	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		1.99	2022-02-28
Sulphate as SO4*-	M44	mg/L	<250	49.4	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-03-11
Total Chlorine*	M15	mg/L		0.08	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	15.2	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	220	2022-02-25

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Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 21-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.18	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	120	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	264	2022-03-11

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Contact: Phindile Masuku

Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 20-February-2022
Date of Receival at Lab: 23-February-2022

Sample Identification	OMS-22-01365: 5L Still Water (TB12079) (Normadien Farms T/A Thirsti)		
Sample Number: WW-22-11291	Sample Condition: Chilled	Remark:	

WW	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Odour*		TON		Inoffensive	2022-03-01
Physical / Aesthetic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Alkalinity - Total as CaCO3	M7	mg/L		173	2022-02-28
Colour (True)*		Pt-Co-true	<15	8.00	2022-02-24
Electrical Conductivity @ 25°C	M4	mS/m	<170	46.7	2022-02-28
pH @ 25°C	M6	pH units	5 - 9.7	7.88	2022-02-28
Total Dissolved Solids*	Calc	mg/L	<1 200	313	2022-02-28
Total Dissolved Solids @ 105°C*	M112	mg/L		330	2022-03-02
Turbidity	M12	NTU	<5	<0.30	2022-02-24
Chemistry (Macro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Calcium as Ca	M18	mg/L		37.3	2022-02-28
Chloride as Cl-	M44	mg/L	<300	4.20	2022-03-07
Fluoride as F-	M44	mg/L	<1.5	0.10	2022-03-07
Magnesium as Mg	M18	mg/L		10.6	2022-02-28
Nitrate as Nitrogen	M44	mg/L	<11	0.19	2022-03-07
Nitrite as N	M44	mg/L	<0.9	<0.05	2022-03-07
Potassium as K	M18	mg/L		2.01	2022-02-28
Sulphate as SO_4^{2-}	M44	mg/L	<250	67.0	2022-03-07
Sulphide (as S)*	M18	mg/L		<0.10	2022-02-25
Total Chlorine*	M15	mg/L		0.07	2022-02-24
Zinc as Zn	M16	mg/L	<5	<0.05	2022-02-25
Chemistry (Micro) Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Aluminium as Al	M16	µg/L	<300	23.0	2022-02-25
Antimony as Sb*	M16	µg/L	<20	<5.00	2022-02-25
Arsenic as As*	M16	µg/L	<10	<3.00	2022-02-25
Barium as Ba	M16	µg/L	<700	235	2022-02-25

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Service Request Number: WW-2022-04362-A
Date of Certificate: 14-March-2022
Date Completed:
Date of Sampling: 20-February-2022
Date of Receival at Lab: 23-February-2022

Chemistry (Micro) Parameters	Method	Unit	Limits - SANS 241 2015	Result	Analysis Date
Boron as B	M16	µg/L	<2 400	<100	2022-02-25
Bromine as Br2*	M48	mg/L		0.17	2022-03-10
Cadmium as Cd	M16	µg/L	<3	<1.00	2022-02-25
Chromium as Cr	M16	µg/L	<50	<5.00	2022-02-25
Copper as Cu	M16	µg/L	<2 000	<20.0	2022-02-25
Cyanide as CN-*	M55	µg/L	<200	<10.0	2022-02-25
Iron as Fe	M16	µg/L	<300	<20.0	2022-02-25
Lead as Pb*	M16	µg/L	<10	<2.00	2022-02-25
Manganese as Mn	M16	µg/L	<100	<10.0	2022-02-25
Mercury as Hg*	M16	µg/L	<6	<1.00	2022-02-25
Molybdenum as Mo	M16	µg/L		<20.0	2022-02-25
Nickel as Ni	M16	µg/L	<70	<5.00	2022-02-25
Selenium as Se*	M16	µg/L	<40	<20.0	2022-02-25
Organic Parameters	**Method**	**Unit**	**Limits - SANS 241 2015**	**Result**	**Analysis Date**
Total Organic Carbon	M20	mg/L	<10	0.72	2022-03-11

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Address:	Stellenryk Building Contantia Square Office Park 16th Street Midrand Gauteng, 1685	Date of Certificate: Date Completed:	14-March-2022
		Date of Sampling:	20-February-2022
		Date of Receival at Lab:	23-February-2022
Contact:	Phindile Masuku		

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FINAL CERTIFICATE OF ANALYSIS

COA N°:	713144-0
COA Date:	06/10/2022
Page	1 / 9

Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231691
Client Reference N°:
Project N°: GT 22-025340

Analysed By Swift Sillker (Pty) Ltd t/a Mérieux NutriSciences
Constantia Office Park, 526 16th Street, Midrand, Gauteng, South Africa

Phone: +27118054310 Fax: +27118057930
E-mail: za.customercare@mxns.com

Received from Normandien Farms (Pty) Ltd - Johannesburg

P.O. Box 13559
Cascades, 3202

E-mail: hlengiwev@thirsti.co.za

To: Normandien Farms (Pty) Ltd
Hlengiwe Vilakazi
P.O. Box 13559
Cascades 3202

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-001
Sample N°: 4484310
Test Date: 29/09/2022
Category Detail: Water
Sample Condition: SEALED
Date Received: 29/09/2022
Product Description:** Water: 750ml still
Production Date:** 28/09/2022
COA Remark:** TS14134

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits (Target value)
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TMA** METHOD: SWJM 35	29/09/2022	No Growth	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No Growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

FINAL CERTIFICATE OF ANALYSIS

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Customer: Normandien Farms (Pty) Ltd - Johannesburg	
Order N°:	PO0231591
Client Reference N°:	
Project N°:	GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-002 **Sample N°:** 4484311 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 3

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *(Target value)*
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TMA** METHOD: SWJM 35	29/09/2022	38	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No Growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

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COA N°:	713144-0
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Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231581
Client Reference N°:
Project N°: GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-003 **Sample N°:** 4484312 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 4

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *[Target value]*
Clostridium species METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
Coliforms METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
Escherichia coli METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
Pseudomonas species METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
Intestinal Enterococci (Faecal Streptococci) METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
TMA METHOD: SWJM 35	29/09/2022	56	cfu/ml	
Yeast & Mould METHOD: SWJM 50	29/09/2022			
Mould		No growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

FINAL CERTIFICATE OF ANALYSIS

COA N°:	713144-0
COA Date:	06/10/2022
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Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231591
Client Reference N°:
Project N°: GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-004 **Sample N°:** 4484313 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 6

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *(Target value)*
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 40	29/09/2022	No growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TMA** METHOD: SWJM 35	29/09/2022	70	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

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FINAL CERTIFICATE OF ANALYSIS

COA N°:	713144-0
COA Date:	06/10/2022
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Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231591
Client Reference N°:
Project N°: GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-005 **Sample N°:** 4484314 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 7

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits [Target value]
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 48	29/09/2022	No growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TNA** METHOD: SWJM 35	29/09/2022	39	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

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Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231591
Client Reference N°:
Project N°: GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-006 **Sample N°:** 4484315 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole II

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits (Target value)
Clostridium species METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
Coliforms METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
Escherichia coli METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
Pseudomonas species METHOD: SWJM 46	29/09/2022	No growth	cfu/100ml	
Intestinal Enterococci (Faecal Streptococci) METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
TNA METHOD: SWJM 35	29/09/2022	76	cfu/ml	
Yeast & Mould METHOD: SWJM 50	29/09/2022			
Mould		No growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

FINAL CERTIFICATE OF ANALYSIS

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Customer: Normandien Farms (Pty) Ltd - Johannesburg
Order N°: PO0231591
Client Reference N°:
Project N°: GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-007 **Sample N°:** 4484318 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 11

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *[Target value]*
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 48	29/09/2022	No growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TMA** METHOD: SWJM 35	29/09/2022	30	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

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Customer: Normandien Farms (Pty) Ltd - Johannesburg	
Order N°:	PO0231591
Client Reference N°:	
Project N°:	GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-008 **Sample N°:** 4484317 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 12

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits *[Target value]*
Clostridium species METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
Coliforms METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
Escherichia coli METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
Pseudomonas species METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
Intestinal Enterococci (Faecal Streptococci) METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
TMA METHOD: SWJM 35	29/09/2022	68	cfu/ml	
Yeast & Mould METHOD: SWJM 50	29/09/2022			
Mould		No Growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

FINAL CERTIFICATE OF ANALYSIS

COA N°:	713144-0
COA Date:	06/10/2022
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Customer: Normandien Farms (Pty) Ltd - Johannesburg	
Order N°:	PO0231591
Client Reference N°:	
Project N°:	GT 22-025340

SAMPLE DESCRIPTION

Lab Sample Ref #: GT 22-025340-009 **Sample N°:** 4484318 **Test Date:** 29/09/2022
Category Detail: Water **Sample Condition:** SEALED **Date Received:** 29/09/2022
Product Description:** Water: Borehole 13

ANALYTICAL RESULTS

Tests	Analysis Start Date	Results	Units	Limits (Target value)
☑ **Clostridium species** METHOD: SWJM 60	29/09/2022	No Growth	cfu/100ml	
☑ **Coliforms** METHOD: SWJM 48	29/09/2022	No Growth	cfu/100ml	
☑ **Escherichia coli** METHOD: SWJM 45	29/09/2022	No Growth	cfu/100ml	
☑ **Pseudomonas species** METHOD: SWJM 46	29/09/2022	No Growth	cfu/100ml	
☑ **Intestinal Enterococci (Faecal Streptococci)** METHOD: SWJM 57	29/09/2022	No Growth	cfu/100ml	
☑ **TMA** METHOD: SWJM 35	29/09/2022	78	cfu/ml	
☑ **Yeast & Mould** METHOD: SWJM 50	29/09/2022			
Mould		No Growth	cfu/100ml	
Yeast		No Growth	cfu/100ml	

☑ Accredited analysis + Non Accredited analysis NC Non Conformance ↔ Customer provided data ✎ Changed Data

TMA = Total Microbial Activity / Total Viable Plate Count
No growth = Not detected / less than the lower detection limit of the test method, for the specified sample type / volume of sample tested.
Tests marked with a tick in this report are included in the SANAS Schedule of Accreditation for this laboratory T 0350.
Tests marked with a "-" in this report are not included in the SANAS Schedule of Accreditation for this laboratory T0350.
** Data provided by the customer
Tests marked with a plane in this report are Subcontracted Tests and are not included in the SANAS Schedule of Accreditation for this laboratory T0350
The test report relates only to the specific item submitted for testing. It furnishes or implies no guarantee whatsoever, in respect of a similar item that has not been tested.
The test report applies to the sample as received where the laboratory has not been responsible for the sampling stage.
Opinions and interpretations expressed in this report are not included in the SANAS Schedule of Accreditation for this laboratory T0350.
The test report shall not be reproduced except in full without written approval of Swift Stilker (Pty) Ltd t/a Mérieux NutriSciences.

Results validated on 06/10/2022
By: Samu Siyaya
Technical Signatory

Samu Siyaya
Digitally Signed By: Samukelisiwe Precious Siyaya
Reason: COA Digital Sign
Signed On: 06/10/2022 11:00:35

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APPENDIX C: DISCLAIMER

The opinions expressed in this Report have been based on-Site information made available to GCS Environment South Africa (Pty) Ltd and are based on public domain data, field data and data supplied to GCS by the client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the Site conditions, and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

APPENDIX D: DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

PROJECT TITLE

Thirst Bottling Plant - Hydrogeological Investigation for WULA

SPECIALIST INFORMATION

Specialist Company Name:	GCS Environment South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:	Andrew Johnstone			
Specialist Qualifications:	MSc Hydrogeology			
Professional affiliation/registration:	PR SCI NAT 400192/87			
Physical address:	63 Wessel Rd, Rivonia, Gauteng			
Postal address:	63 Wessel Rd, Rivonia, Gauteng			
Postal code:	2191	Cell:	083 654 5726	
Telephone:	+27 (0) 11 803 5726	Fax:		
E-mail:	andrewj@gcs-sa.biz			

DECLARATION BY THE SPECIALIST

I, Andrew Johnstone, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Water Act, its Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the relevant Regulations and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken concerning the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; and
- all the particulars furnished by me in this form are true and correct.

Signature of the Specialist

GCS

Name of Company:

20 February 2026

Date

APPENDIX E: CV OF SPECIALIST

Wian de Klerk
Hydrogeologist

CORE SKILLS

- Groundwater Numerical Modeling
- Field Work
- Processing and Interpreting Hydrogeological Data
- Spatial Analysis and GIS Application
- Python Scripting

DETAILS

Qualifications
BSc. Environmental Sciences with Geology & Geography

BSc. Honors in Hydrology & Geohydrology

Membership
Golden Key International Honors Society
International Mine Water Association

Languages
Afrikaans - Fluent
English - Fluent

Countries Worked In
South Africa
Zimbabwe

Projects Worked on:
South Africa
Zimbabwe
Zambia
Morocco

PROFILE

Wian de Klerk has 1 year experience as a hydrogeologist. His experience includes the undertaking of hydrogeological assessments, groundwater numerical modelling, GIS - based data handling, and hydrogeological field work (Hydrocensus, Aquifer Testing, Drilling Supervision, Geophysics). Wian is currently working for the Groundwater Unit within the GCS Johannesburg Office.

Professional Affiliations:

- SACNASP Status - Candidate

Areas of Expertise:

- Data visualization, creation of conceptual cross sections and maps.
- Groundwater numerical modelling using modflow (NWT & USG), flow and solute transport simulation using MT3DS.
- Spatial analysis with focus on geohydrological and topographical data.
- Web scraping and data postprocessing via Python and ChatGPT
- Hydrogeological Assessments

Melinda Nongqobo

Junior hydrogeologist

CORE SKILLS

- Excellent report writing and communication skills
- Proficient in PHREEQC, MS Word and MS Excel
- Aquifer testing and data interpretation
- Geophysical
- GIS
- Water quality sampling and data interpretation
- Environmental Assessment (EIA reports)

DETAILS

Academics

- MSc Environmental and Water Science (Cum laude) at University of the Western Cape
- BSc (Hons) Environmental and Water Science at University of the Western Cape
- BSc Environmental and Water Science at University of the Western Cape

Languages

- English (Fluent)
- IsiZulu (Fluent)

Countries Worked In

- South Africa

PROFILE

Melinda holds a MSc degree in Environmental and Water Science (Cum Ladue). She currently pursuing a career in the field of Hydrogeology at GCS (Pty) Ltd as a Junior hydrogeologist since January 2025.

Professional Affiliations:

Cand.Sci.Nat. (SACNASP Registration Number: 170114)

Areas of Expertise:

- Excellent report writing and communication skills
- Analytical skills with strong attention to detail
- Proficient in PHREEQC, MS Word and MS Excel
- Aquifer testing and data interpretation
- Geophysics
- GIS
- Water quality sampling and data interpretation
- Environmental Impact Assessment (EIA reports)



ANDREW CLIFFORD JOHNSTONE

CEO

Core Skills

- Project Management of water and environmental projects for mining, industrial and agriculture sectors
- Integrated Water and Environmental Investigations
- Integrated Water Resource Investigations
- Development of wellfields in fractured, karst and primary aquifers
- EIA's and EMP's
- Management of a scientific consultancy practice

Qualifications

Qualifications

MSc (Hydrogeology): Rhodes University, South Africa

BSc (Hons) (Geography/Geology): Rhodes University, South Africa

BSc (Geology/Geography): Rhodes University, South Africa

Memberships

Registered Natural Scientist S.A (Reg. No. 192/97)

International Mine Water Association

Institute of Directors South Africa

Groundwater Division of the Geological Society of RSA (President, 1993 – 1995)

Geological Society of South Africa

International Association of Hydrogeologists

Institute of Waste Management, South Africa

Borehole Water Association of Southern Africa (President, 1996 - 1997)

Languages

English – (speak & write)

Afrikaans – (speak & write)

seSotho – (speak only)

seTswana – (speak only)

PROFILE

Andrew is the founder and Managing Director of GCS (Pty) Ltd. He has over 40 years' experience in the water and environmental consulting for mining, industrial, waste, oil and agriculture sectors in Africa.

Andrew has undertaken and managed water and environmental investigations in 15 counties in Africa.

COUNTRIES WORKED IN

South Africa, Botswana, Burkina Faso, Mozambique, Namibia, Morocco, Zimbabwe, Lesotho, Swaziland, Malawi, Ghana, Tanzania, Uganda, Kenya, and Zambia.

PAPERS

Andrew has authored numerous papers regarding groundwater supplies, geochemistry and the hydrogeological impacts of mining.

1

APPENDIX D: FRESHWATER ECOSYSTEM ASSESSMENT

THIRSTI BOTTLING PLANT

FRESHWATER ECOSYSTEM ASSESSMENT UPDATE

FINAL V2

GroundTruth

SEPTEMBER 2025

GT1203/190925/03

GroundTruth
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Title	THIRSTI BOTTLING PLANT FRESHWATER ECOSYSTEM UPDATE
Report Issue	Final V2
Consultant Ref Number	GTW1203/190925/03
Prepared by:	GroundTruth environment & engineering
Authors	Caydon van Eck
	Zaniel April
Document Reviewer	Fiona Eggers (Pr. Sci. Nat.: Ecological Science)
Director	Craig Cowden (Pr. Sci. Nat.: Ecological Science)
Prepared for:	THIRSTI™

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The project deliverables, including the reported results, comments, recommendations, and conclusions, are based on the author's professional knowledge, as well as available information. The study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of survey undertaken. GroundTruth therefore reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice or pertaining to this study.

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VALIDITY PERIOD

It should be noted that the findings of these freshwater ecosystem studies, including the infield delineation of the systems, are considered to be valid for a period of five (5) years unless new/additional information warrants a change in project findings. This is based on the likelihood of changes within the systems (e.g. changes in vegetation composition or altered flow patterns) and the associated catchment areas (e.g. increased runoff or establishment of streamflow reduction activities.

EXECUTIVE SUMMARY

The following report provides an update on the freshwater ecosystem assessment for the Thirsti Bottling Plant, focusing on watercourses within 500 m of the plant's boreholes and septic tank. The purpose of the study was to identify, delineate and evaluate the condition of these ecosystems to ensure their protection in line with regulatory requirements.

The assessment confirmed the presence of three riparian streams, two channelled valley-bottom wetlands, and two seeps, all of which are considered to be Critically Endangered. It was found that the ecological condition of the wetland systems ranged from moderately to critically modified. Hydrology, geomorphology and vegetation showed clear signs of degradation caused by erosion, channel incision, dams altering flow regimes, the spread of invasive alien plants and land uses such as grazing, hay production and pine plantations. In contrast, water quality was relatively intact, falling between largely natural and moderately modified. Ecosystem services were limited, reflecting both the degraded state of the systems and low demand in the surrounding rural landscape. In terms of ecological importance and sensitivity, the channelled valley-bottom wetland (CVB) 1 was classified as Moderate, while CVB 2 and the two seeps were considered Low/Marginal. Riparian habitat integrity was generally better, with two streams in good condition and the third in fair condition, although invasive plants, plantations, and erosion remained significant pressures.

In evaluating the potential environmental impacts associated with the operations of the bottling facility, assessments indicate that the boreholes present a negligible risk to adjacent wetland ecosystems, based on the fact that groundwater abstraction occurs from deep, confined aquifers located at depths ranging between 50 m to 100 m. Provided the borehole infrastructure remains sealed, enclosed and regularly maintained, the likelihood of contamination is low. At the time of the fieldwork, the septic tank was observed to be overflowing and presenting a potential water quality risk to downstream systems, particularly CVB 1 and CVB 2, which would experience a decline in ecological condition if discharges were not managed. Upgrades to the septic tank have subsequently been undertaken, and as such the tanks are no longer overflowing and impacting on the receiving environment.

Overall, the boreholes and septic tank associated with the Thirsti Bottling Plant represent a low risk to the linked freshwater ecosystems, provided that mitigation measures are effectively implemented and maintained. Key actions include regular septic tank management, the establishment of a vegetated buffer zone, temporary containment during overflow events, and biannual water quality monitoring of the affected wetlands for at least three years.

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LIST OF ACRONYMS

Acronym	Explanation
BH	Borehole
CR	Critically Endangered
CVB	Channelled Valley-Bottom Wetland
DEP	Depression
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EIS	Ecological Importance and Sensitivity
EN	Endangered
ETS	Ecosystem Threat Status
FEPA	Freshwater Ecosystem Priority Area
GA	General Authorisation
GIS	Geographic Information System
GPS	Global Positioning System
Gs	Sub-Escarpment Grassland
Gs6	KwaZulu-Natal Highland Thornveld
HGM	Hydrogeomorphic
HSS	Hillslope Seep
IAPs	Invasive Alien Plants
IHI	Index of Habitat Integrity
KZN	KwaZulu-Natal
LT	Least Threatened
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NP	Not Protected
NWA	National Water Act (No. 36. 1998)
MAP	Mean Annual Precipitation
PES	Present Ecological State
PET	Potential Evapotranspiration
PGS	Present Geomorphology State
PHS	Present Hydrological State
PVS	Present Vegetation State
PWQS	Present Water Quality State
RIP	Riparian Area
SANBI	South African National Biodiversity Institute
UCVB	Unchannelled Valley-Bottom Wetland

VHS	Valley Head Seep Wetland
WUL	Water Use License
WT	Wetland Type

1. INTRODUCTION

Local, regional, and national regulatory bodies, such as the Departments of Water and Sanitation (DWS) and Economic Development, Tourism and Environmental Affairs (EDTEA), have adopted legislation, policies and guidelines that regulate the use of freshwater ecosystems (wetland and riverine) to protect and maintain these systems' benefits and services to society and the natural environment. To be regulated, these systems must first be identified, delineated and assessed.

The objective of the delineation procedure is to identify the boundary between the freshwater ecosystems and adjacent terrestrial areas. The process of freshwater ecosystem delineation identifies the extent of these ecosystems based on the following legal definitions:

- "Wetland means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."
- "Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

Hydrology is considered to be the primary biophysical driver of wetland ecosystems, but due to its variability, it is not possible to efficiently and accurately delineate these systems based on water levels (Richardson and Vepraskas, 2001). The delineation of freshwater systems, therefore, relies on indirect indicators, such as vegetation, topography, and soils.

This study was undertaken to inform the potential risks posed by activities linked to the Thirsti bottling facilities, including eight existing boreholes[1] and septic tanks, on the freshwater ecosystems on the Normandien Farms, located Southwest of the town Newcastle in the KwaZulu-Natal (KZN). As such, a wetland verification process was conducted to verify and delineate any freshwater ecosystems associated with the said boreholes (**Figure 1-1**). The freshwater ecosystems hydrologically linked and within 500m of the boreholes and septic tank were then suitably assessed, and appropriate mitigation measures proposed.

[1] The boreholes that were assessed within this study includes boreholes 3, 4, 6, 7, 8, 11, 12, and 13.

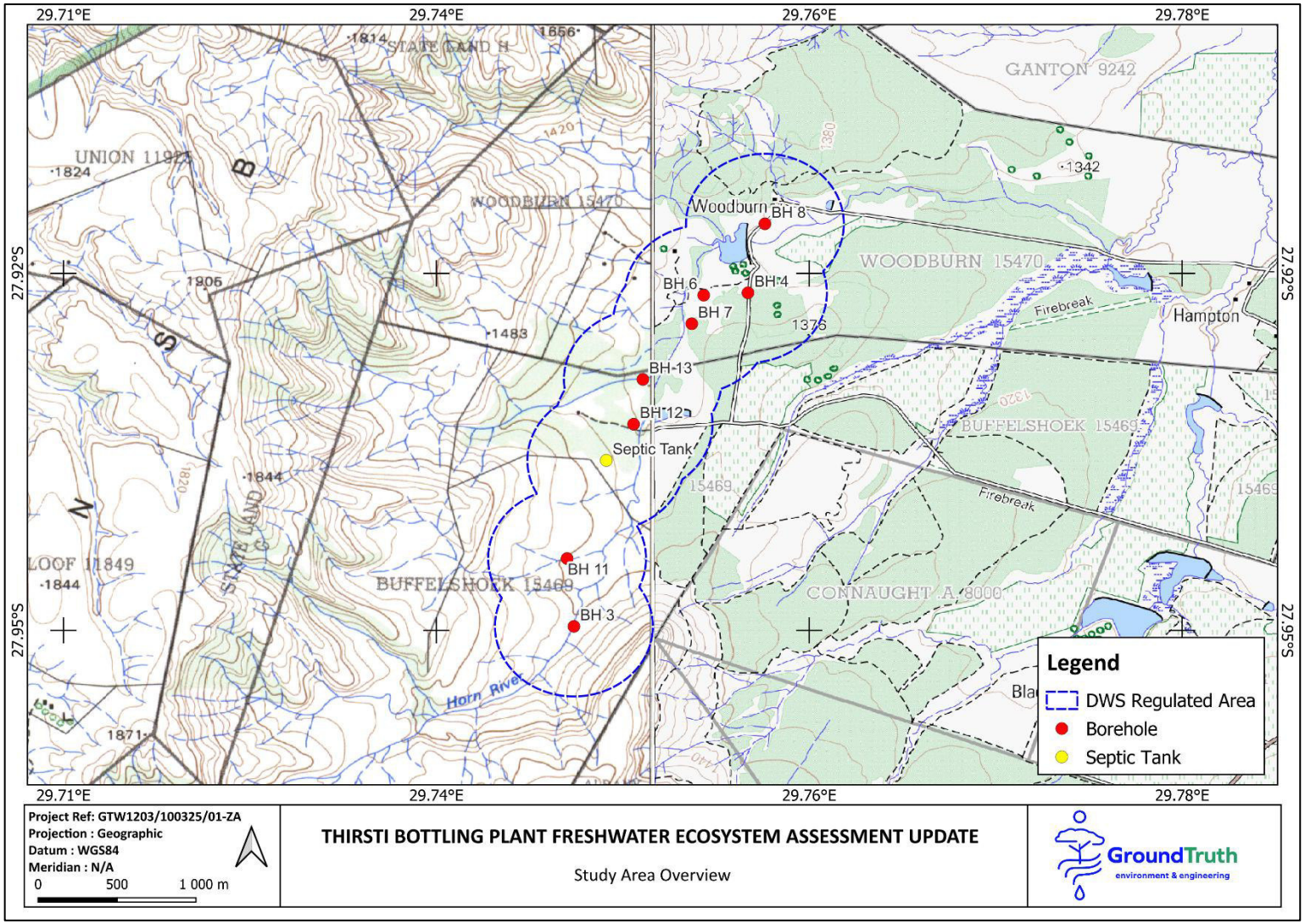


Figure 1-1 Borehole and septic tank locations

2. TERMS OF REFERENCE

This study area is located on Normandien Farms in the KZN, near the town of Newcastle, and falls within the Amajuba District Municipality, specifically the Newcastle local municipality. Currently, the Thirsti bottling plant is looking to upgrade their facilities to meet the growing demand for its product line. As such, boreholes were installed to increase the size of the bottling plant's capacity to provide water. In addition, the septic tank system associated with the bottling facilities were to be upgraded to accommodate the increased effluent produced by the growing facility. As such, the following is the terms of reference for the study:

- In field verification of the freshwater ecosystems originally delineated by GCS (2023a) and Wet-Earth (2019). The verification focused on the areas located within 500 m of the boreholes and septic tank. It should be noted that only hydrologically linked freshwater ecosystems were verified. This was done to ascertain whether there have been any significant changes to the freshwater ecosystems since the original delineation of the systems.
- Functional and integrity assessments of the wetland habitat hydrologically linked to the boreholes and septic tank.
- Description of the pre-development (i.e. pre-borehole and septic tank) and post-development (i.e. current) state of the wetland systems hydrologically linked to the proposed developments.
- Update of freshwater ecosystems boundaries where necessary.
- Description of the likely impacts and risks associated with the boreholes and septic tank and appropriate mitigation measures to avoid unnecessary impacts to the freshwater ecosystems.
- Identification of other sensitivities and important issues not identified within the assessment process, if applicable.

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3. KNOWLEDGE GAPS

The following sections highlight the assumptions and limitations associated with this study that may influence the type of information collected and the accuracy of the data.

3.1 Assumptions

Studies relating to natural ecosystems and understanding historical conditions rely on various assumptions, with the following assumptions being made during the assessment of these particular systems:

- The reference benchmark vegetation within much of the study site is considered to be the Southern KwaZulu-Natal Moist Grassland (Gs4) and has been classified as 'Vulnerable' while a small portion of the southern side of the consists of Low Escarpment Moist Grassland (Gs3), which is considered to be 'Least Threatened' (Mucina and Rutherford, 2006).
- The site similarly falls across two bioregions, namely the Sub-Escarpment Grassland Bioregion group 4 and the Sub-Escarpment Grassland Bioregion, group 3 (Nel *et al.*, 2011).
- When undertaking a wetland delineation, three environmental indicators are generally considered namely, landscape position, soil properties and vegetation indicators. Wetlands seldom form on hill sides and scarp slopes and as such, assessing the landscape position can often preclude the need to assess the soil and vegetation indicators. As such, areas where there is a high chance that wetland conditions may exist were assessed in detail, whereas areas precluded by their position in the landscape were only briefly assessed for wetland conditions.
- Previous studies by GCS (2023a) and Wet-Earth (2019) were used as the basis for the infield verification of the freshwater ecosystems.
- Information pertaining to borehole depth was obtained from previous reports by GCS (2021, 2023b) and Levin (2016). It is assumed that these reported depths remain accurate and reflective of the current infrastructure.
- The potential impacts of stormwater management and discharge associated with the plant, did not form part of the scope of work for this study. It is however, understood that this component was being reviewed by GCS.
- The hectare equivalent calculations relating to the functional wetland area in the study site accounts for the entire extent of the hydrogeomorphic (HGM) unit in the landscape (i.e., including the wetland areas that extend beyond the study site and/or property boundary).
- An appropriate maintenance and management plan will be compiled and implemented, to ensure the effectiveness of the proposed activities are sustained into the future.

3.2 Limitations

The following limitations apply to the studies undertaken for this report:

- Due to time constraints, soil descriptions are based on moist conditions, rather than the dry conditions stipulated in the DWS guidelines (DWAF, 2005). Generally, the recorded Munsell colour values would increase as soil is dried. This was taken into consideration during the infield studies.

- The freshwater assessment techniques are considered to be the most appropriate at the time of the compilation of the report, however in some instances, such as for systems that have been highly modified/transformed, they may have shortfalls. These techniques, however, has been compiled based on international best practice, to apply to South African conditions, having undergone a peer-review process during their development. These assessment techniques should, therefore, be seen as the most appropriate tool for freshwater assessments at this time.
- The assessments of the identified freshwater systems were based on an individual site visit, i.e., a 'snap-shot' in time, due to budgetary and time constraints. As such, changes in the recorded features and/or characteristics within the freshwater ecosystems and their catchments, which may be subject to the influences of seasonality and/or land use changes, may not be accounted for in the assessments.
- The assessment of the wetland systems' ecological integrity includes catchment conditions, and it should be noted that changes in the hydrogeomorphic (HGM) units' catchments may have an adverse effect on the systems' integrity.
- WET-EcoServices assists in identifying the importance and sensitivity of specific wetlands but is recognised as having limitations in terms of quantifying specific impacts linked to development or changes within the landscape; and accounting for the size of the wetland and ecosystem services strongly associated with the size of the systems.
- Mapping and classification of the freshwater ecosystems that are hydrologically isolated from the boreholes and septic tank and within the 500 m radius were mapped based on desktop indicators and limited infield verification. Therefore, the mapping of these systems would not be appropriate for the authorisation of any future unrelated developments within the study area.
- The pipelines associated with the boreholes and the bottling plant did not form part of the scope of work of this study.
- Identification of grass species was hindered by seasonality and the area having already received its first frost.
- Limited availability of historical imagery for the area the study did not allow for the review of historical imagery to determine the extent of wetlands in the area prior to the construction of the dam. As such, these areas were mapped based on contour data and the professional opinion of the specialists involved in the compilation of this report.
- All assessments undertaken were based on the impacts that were noted during the time of the site visit. Should conditions onsite change, the assessments may not necessarily reflect such changes.
- It is necessary to note that the calculation of the buffer zone, although based on onsite observations, was undertaken from an ecological point of view. As such, this assessment should not be used as a basis for authorising development or activities with a potential impact on biodiversity as it does not cater for biodiversity considerations or other site factors (Macfarlane *et al.*, 2015).
- This study does not consider freshwater ecosystems beyond the 500m study site radius.

The project deliverables, including the reported results, comments, recommendations, and conclusions, are based on the authors' professional knowledge as well as available information. This study is based on assessment techniques and investigations that are limited by time and

budgetary constraints applicable to the type and level of survey undertaken. This study is, however, considered to be the most accurate and up-to-date assessment of the freshwater habitat associated with the study area, and should be used to inform the decision-making processes of the relevant authorities.

4. STUDY SITE

This section serves to provide a brief outline of the study area. Additional information, including soil types, geology, etc., can be found in existing studies carried out by GCS (2021, 2023a, 2023b) and Wet-Earth (2019), among others.

4.1 Regional context

South Africa is a semi-arid country, and thus freshwater ecosystems are important features within the landscape as they provide ecosystem services directly related to water quantity and quality. Approximately 300'000 ha of wetlands or 2.4% of South Africa's surface area remain. It is estimated that there has been a loss of between 35% and 60% of wetlands across the major catchments in South Africa, and of the remaining systems, 48% are classified as critically endangered making these systems the most threatened ecosystems (Nel and Driver, 2011). Similarly, wetlands, rivers and riparian systems provide important ecological functions that benefit the surrounding environment and society. Within South Africa, approximately 55% of river ecosystems are classified as threatened as a result of human-mediated disturbances which have negatively impacted the health of these ecosystems (Richardson *et al.*, 2007; Nel and Driver, 2011). Taking into consideration the above-mentioned degradation of wetland and river ecosystems, it is important that the developments attempt to maintain the current levels of integrity and ecosystem service delivery, and where possible, enhance the systems' ability to supply these benefits and services.

Within the KwaZulu-Natal region, wetlands and rivers have been subjected to high levels of modification and destruction (Kotze *et al.*, 1995; Macfarlane *et al.*, 2012). The factors contributing towards the degradation of the systems vary greatly, but the predominant impacts include urbanisation, abstraction, dams, cultivation, drainage, and overgrazing (Macfarlane *et al.*, 2012). The loss of freshwater habitat within KwaZulu-Natal is considered to be of concern due to the value of wetlands in terms of contributions to water quantity and quality, supporting unique biological diversity and other ecosystem services (Kotze *et al.*, 2021). Taking into consideration the above-mentioned degradation of wetland ecosystems, it is important that the operation and maintenance of the development attempts to maintain the current levels of ecosystem service delivery, and where possible, enhance the systems' ability to supply these benefits and services.

4.2 Climate

The study area falls under one quaternary catchment namely V31F as defined by Midgley et al. (1994). The mean annual precipitation (MAP) is for V31F is 910.3 mm and Potential Evapotranspiration (PET) is 1857.4 mm (Schulze, 2007), which suggests that the freshwater ecosystems within the catchment would have a **Moderate** sensitivity (Macfarlane *et al.*, 2008) to hydrological impacts within the catchment.

4.3 Vegetation types

Under natural conditions the surrounding landscape and study site would have been characterised by particular vegetation types. The historical vegetation type that would have been dominant in the northern portions of the study site is the Northern KwaZulu-Natal Moist Grassland (Gs4), under the Sub-escarpment Grassland Bioregion group 4. The southern portion of the study site would have been dominated Low Escarpment Moist Grassland (Gs3), forming part of the Sub-Escarpment Grassland Bioregion, group 3 (Nel *et al.*, 2011; Mucina and Rutherford, 2006). Brief descriptions of the relevant vegetation types, as defined by Mucina and Rutherford (2006), are provided in the following two paragraphs.

Northern KwaZulu-Natal Moist Grassland is considered vulnerable, with only around 2% currently under statutory conservation. More than a quarter of this ecosystem has been transformed due to various land use activities, including cultivation, plantations, urban sprawl, and dam construction. In addition, alien vegetation contributes to ongoing habitat degradation. It is confined to the northern and northwestern parts of KwaZulu-Natal, forming a patchy rim around the upper Thukela Basin found with the Thukela River Catchment. It is found to occur mainly near Winterton, Bergville, Dundee, Dannhauser, north of Ladysmith, and west of Newcastle, at altitudes between 1040 and 1440 m above sea level (asl).

The Low Escarpment Moist Grassland is considered least threatened, although only around 2% is currently under statutory conservation, mainly within Sterkfontein Dam Nature Reserve (Free State) and Ncandu Nature Reserve (KwaZulu-Natal). Approximately 6% has been transformed due to plantations and cultivation, while alien *Acacia dealbata* is present in some areas. This grassland type is found along the slopes of the Drakensberg in KwaZulu-Natal, Free State, and Mpumalanga, extending from Oliviershoek near Harrismith to Volksrust. It occurs at altitudes between 1300 and 2000 m asl.

4.4 Wetland classification

To allow for the differentiation between wetland systems and the prioritisation of systems either for conservation or management purposes, the wetlands were classified in accordance with the South African National Biodiversity Institute's (SANBI) wetland classification system (**Table 4-1**) (Ollis *et al.* 2013). However, for the purpose of assessing each hydrogeomorphic (HGM) unit, Kotze *et al.* (2007) was used to classify the wetland systems as particular HGM units rather than Level 4 of the SANBI system. The HGM unit types defined by Kotze *et al.* (2007) differ from Ollis *et al.* (2013), with the river classification being excluded and flat wetlands being grouped with the depression wetlands. The HGM units identified within the study site are classified as channelled and hillslope seep linked to a stream channel.

Table 4-1 A description of the onsite wetland based on the SANBI classification

System (Level 1)	Bioregion (Level 2)	Landscape Unit (Level 3)	HGM Unit (Level 4)	Description of HGM Units (Ollis *et al.* 2013)
Inland systems	Sub-Escarpment Grassland, Gs3 and Sub-Escarpment	Valley Floor landscape unit	Channelled-valley-bottom (CVB)	Valley-bottom areas with a clearly defined stream channel but lacking characteristic floodplain features. May be gently sloped

System (Level 1)	Bioregion (Level 2)	Landscape Unit (Level 3)	HGM Unit (Level 4)	Description of HGM Units (Ollis *et al.* 2013)
	Grassland, Gs4			and characterised by the net accumulation of alluvial deposits, or may have steeper slopes and be characterised by the net loss of sediment. Water inputs from the main channel (when channel banks overspill) and from adjacent slopes.
	Sub-Escarpment Grassland, Gs4	Hillslope landscape unit	Hillslope seep (HSS)	A wetland area located on gently to steeply sloping land and dominated by colluvial (i.e., gravity-driven), unidirectional movement of water and material downslope. Seeps are often located on the side slopes of a valley, but they do not typically extend onto a valley floor.

As described above, two unchannelled valley-bottom (UVB) and two hillslope seepage (HSS) wetlands were identified within the study site that are hydrologically linked to the proposed development.

4.5 National wetland mapping (National Wetland Map 5) and the threat status of wetlands

Mapping of all wetlands within South Africa has been an ongoing exercise for many years, as data has been collated and improved upon over time. SANBI has recently released the latest National Wetland Map 5 (NWM5_AEA) in an attempt to improve the wetland inventory available to users at a national level (Van Deventer *et al.*, 2018). This layer includes inland wetlands and estuaries and has been determined through extensive consultation with many other datasets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) 2018.

For the sake of this report, the development sites have been contextualised within the broader landscape (**Figure 4-1**). Two distinct wetland types have been classified within the DWS 500 m regulated area, namely (shown as UVB on the map), and seeps (shown as SEEP on the map). A third type was identified outside of the 500 m buffer, which is a channelled valley-bottom. For the identified wetland vegetation group, the ecosystem threat status for the wetland types is considered to be Critically Endangered. This is mostly related to the minimal protection this vegetation group receives and the level of transformation that has occurred. Deterioration in condition of the remaining healthy examples of these ecosystem types must be avoided, and the remaining healthy examples should be the focus of urgent conservation action.

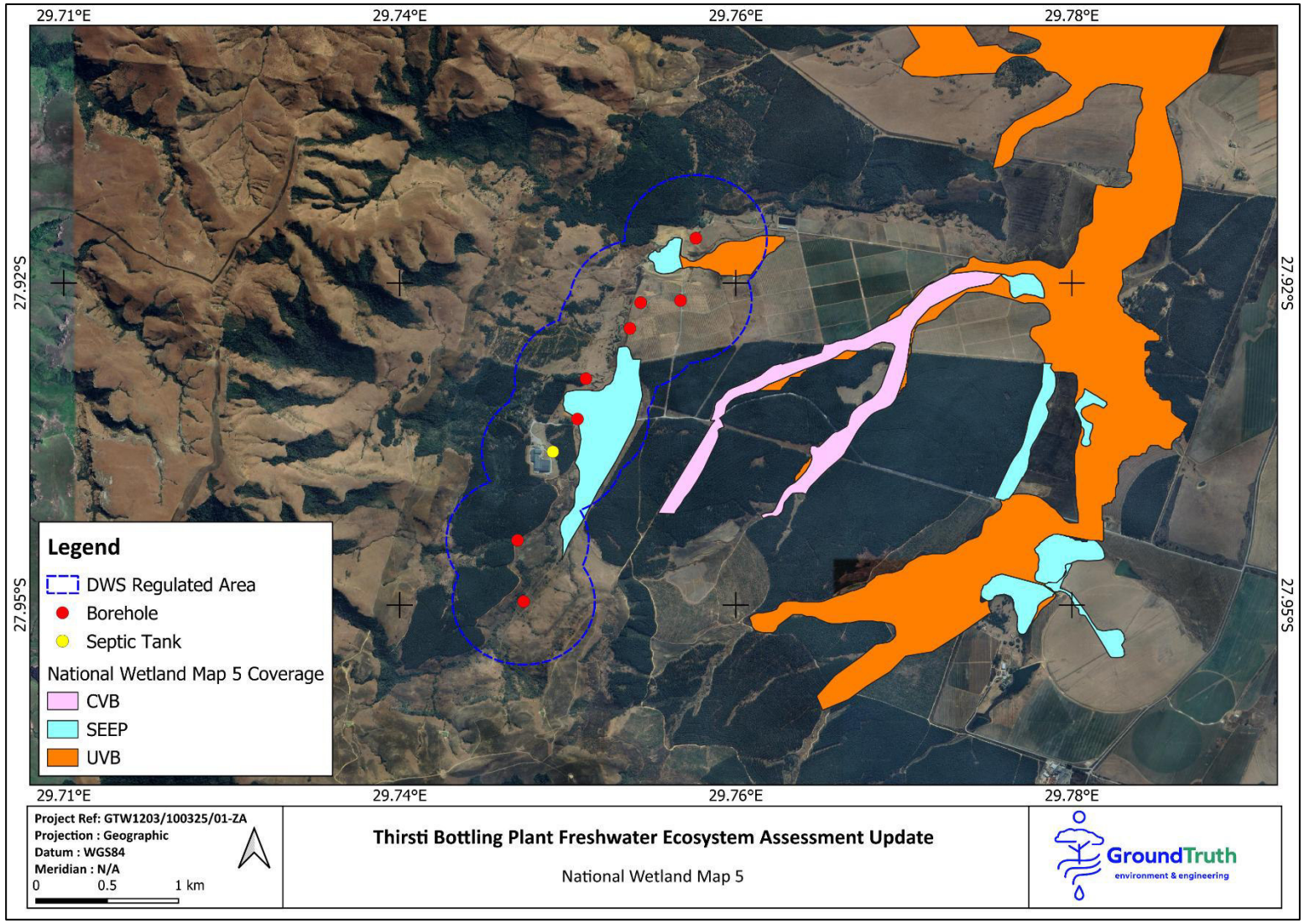


Figure 4-1 The study site in relation to wetlands as per the National Wetland Map 5.

5. EXPERTISE OF SPECIALISTS

Due to the nature of the study, the project team included personnel with experience in mapping, delineation, and assessment of freshwater ecosystems in KwaZulu-Natal (**Table 5-1**).

Table 5-1 Team members, roles, experience levels and qualifications

Wetland Practitioner	Role in the Study	Experience Levels	Qualifications
Fiona Eggers	• Infield verification • Review of the project report	14 years' experience, with input into various wetland studies, including: • Delineation; • Assessments; • Rehabilitation planning; • Monitoring and evaluation of wetland rehabilitation projects; • Mitigation & offset studies; and • Wetland creation.	M.Sc. (Botany) Pr.Sci.Nat - Ecology
Lindelani Hlongwane	• Conducting an infield wetland delineation	11 years' experience with infield delineation of freshwater ecosystems • Delineation and • Assessments • Desktop processing • Conducting wetland assessments	SASS 5 Accreditation
Caydon van Eck	• Desktop processing • Conducting infield delineation • Conducting wetland assessments • Compilation of the project report	~1 year's experience, with input into various wetland studies, including: • Delineation and • Assessments	MSc (Geography)
Zaniel April	• Conducting infield delineation	~1 years' experience, with input into various wetland studies, including: • Delineation and • Assessments	Ndip (Nature Conservation)

6. STUDY METHODOLOGY

This section of the report provides an overview of the methods adopted to delineate and assess the identified freshwater ecosystems located within the study area.

6.1 Site visit

A site visit was conducted from the 28th to 29th May 2025 to verify the extent of the freshwater ecosystems within the study area and assess the current level of ecological integrity and ecosystem services provided by the freshwater ecosystems.

6.2 Freshwater ecosystem system identification and mapping

The preliminary identification and mapping of all freshwater ecosystems within a 500m radius of the boreholes and septic tank was undertaken at a desktop level utilising available spatial data from previous studies, aerial imagery, and contour data. Only those freshwater ecosystems that will be primarily impacted upon by the boreholes and septic tank were verified infield in accordance with the DWS guideline document. The derived boundaries were determined at appropriate intervals within the refined study area and recorded using a mapping-grade Global Positioning System (GPS)[2]. The subsequent information was used to inform the production of a Geographic Information System (GIS) spatial coverage of the boundaries of the freshwater ecosystems. In accordance with the preferences of the regional DWS, the study also attempted to:

- Identify and/or describe the zones of wetness within the study site (**Figure 6-1**); and
- Classify the stream channel (refer to **Section 4.5** and **Figure 6-2**).

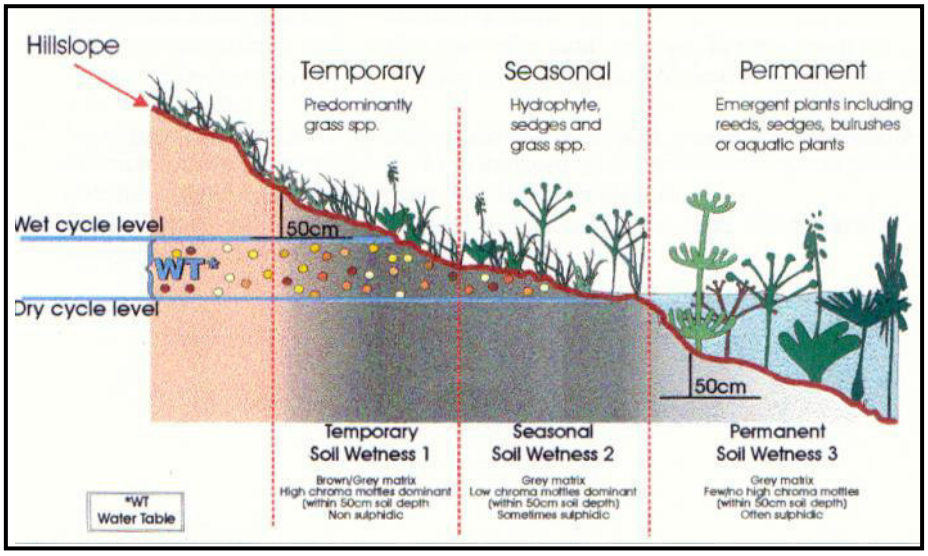


Figure 6-1 **Wetness zones within wetland ecosystems**
(DWAF, 2005, p.6)

2Ashtech Mobile Mapper 50 handheld unit and a Trimble D1 Catalyst handheld unit.

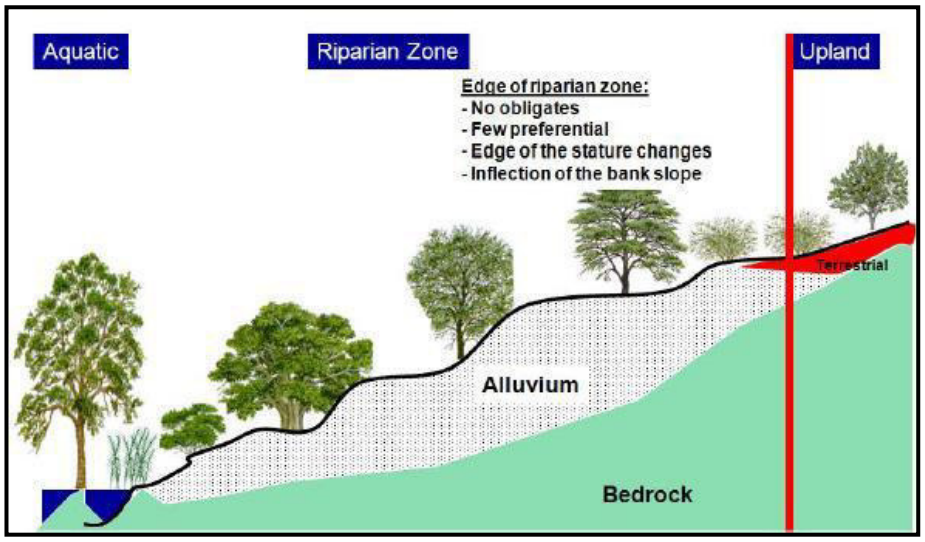


Figure 6-2 **A schematic diagram illustrating the edge of the riparian zone on one bank of a large river**

(DWAF, 2008, p.54)

6.3 Assessment of wetland functioning and condition

The assessments of the HGM units were derived by evaluating the level of ecosystem functioning and ecological integrity/condition of the identified hydrologically linked wetlands for the pre-borehole and septic tank (hereafter pre-borehole) and post-borehole and septic tank (hereafter post-borehole) scenarios as outlined in the following sections.

6.3.1 *Assessment of wetland functioning*

To quantify the level of functioning of the wetland systems, and to highlight their relative importance in providing ecosystem benefits and services at a landscape level, a WET-EcoServices Version 2 (Kotze *et al.*, 2021) assessment was performed for the wetland systems associated with proposed developments on the Nomandien Farms. The assessment provides a method to measure the ability of a wetland to provide sixteen (16) ecosystem services (**Table 6-1**).

The WET-EcoServices assessment technique focuses on assessing the extent to which a benefit is being supplied by each freshwater ecosystem, based on both:

- The supply of the wetland to provide the benefits; and
- The demand of the particular wetland in providing the benefit.

The above-mentioned ecosystem services, which include direct and indirect benefits to society and the surrounding landscape, were assessed by rating various characteristics of the wetlands and their surrounding catchments based on the categories shown in **Table 6-2** as presented within Kotze *et al.* (2021).

Table 6-1 Ecosystem services supplied by wetland/riparian areas

(Kotze *et al.*, 2021, p3)

Services contributing to indirect benefits	**Regulating and supporting services**	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland/riparian area, thereby reducing the severity of floods downstream
		Stream flow regulation		Sustaining streamflow during low flow periods
		Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland/riparian area of sediment carried by runoff waters
			Phosphate assimilation	Removal by the wetland/riparian area of phosphates carried by runoff water, thereby enhancing water quality
			Nitrate assimilation	Removal by the wetland/riparian area of nitrates carried by runoff water, thereby enhancing water quality
			Toxicant assimilation	Removal by the wetland/riparian area of toxicants (e.g. metals, biocides and salts) carried by runoff water, thereby enhancing water quality
			Erosion control	Controlling of erosion at the wetland/riparian area, principally through the protection provided by vegetation
		Carbon storage		The trapping of carbon by the wetland/riparian area, principally as soil organic matter
Services contributing to direct benefits	**Biodiversity maintenance**[3]			Through the provision of habitat and maintenance of natural process by the wetland/riparian area, a contribution is made to maintaining biodiversity
	Provisioning services	Provision of water for human use		The provision of water which is taken directly from the wetland/riparian area for domestic, agricultural or other purposes
		Provision of harvestable resources		The provision of natural resources from the wetland/riparian area - including craft plants, fish, wood etc.
		Food for livestock		The provision of grazing for livestock
		Provision of cultivated foods		The provision of cultivated foods from within the wetland/riparian area
	Cultural (non-material) benefits	Cultural heritage		Places of special cultural significance in the wetland/riparian area - e.g. for baptisms or gathering of culturally significant plants
		Tourism and recreation		Sites of value for tourism and recreation in the wetland/riparian area, often associated with scenic beauty and abundant birdlife[4]
		Education and research		Sites of value in the wetland/riparian area for education or research

In addition to providing individual scores for each ecosystem service provided by the individual wetland and riparian areas, the WET-EcoServices Version 2 (Kotze *et al.*, 2021) assessment technique also allows for the derivation of a consolidated/integrated overall importance score (**Table 6-2**), by combining the supply and demand scores for each of the ecosystem services.

[3] It is recognised that biodiversity maintenance is not an ecosystem service in the strict sense and is framed in less anthropocentric terms than all of the other services, but it underpins many other services and is widely acknowledged as having high value to society broadly, even in the absence of any local or downstream beneficiaries.
[4] WET-EcoServices focuses on recreational services which are specifically nature-based, e.g. bird watching. It does not account specifically for recreational services from wetland/riparian areas that have been converted into sports grounds, children's playgrounds, or other built infrastructure.

Table 6-2 Categories used for reporting the overall importance of ecosystem services (Kotze *et al.,* 2021, p. 27)

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8-1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately Low	1.3-1.69	The importance of services supplied is moderately low relative to that supplied by other wetlands.
Moderate	1.7-2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately High	2.3-2.69	The importance of services supplied is moderately high relative to that supplied by other wetlands.
High	2.7-3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2-4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

It should be noted that WET-EcoServices assists in identifying the importance and sensitivity of specific wetlands, but is recognised as having limitations in terms of:

- The scores obtained cannot be used to deduce the economic value of the wetland/riparian area.
- Fine-scale differentiation of ecosystem service provisions cannot be made.
- The demand of ecosystem services by users is considered at a coarse scale.
- The level of dependency and level of diversity of dependency does not necessarily correlate to one another, nor does it account for the socio-economic factors contributing to the dependency or differing levels of dependency among users.
- Quantifying specific impacts linked to development or changes within the landscape.
- Accounting for the size of the wetland and ecosystem services strongly associated with the size of the systems.

Although the opportunity exists to present an Ecological Importance and Sensitivity (EIS) rating for wetland systems from the updated assessment technique, this approach is currently not adopted by the relevant authorities and as such the EIS technique (DWA, 2013) described in **Section 6.3.2** below is still utilised.

6.3.2 *Ecological Importance and Sensitivity*

In accordance with (Rountree *et al.*, 2013), the ecological importance of a water resource provides an expression of its importance to the maintenance of ecological diversity and functioning at local and wider scales. As WET-EcoServices does not provide a consolidated score that can be used as a target, the assessment scores were incorporated into the EIS assessment framework to provide an EIS score based on scores for ecological importance and sensitivity, hydro-functional importance, and direct human benefits (Rountree *et al.*, 2013). It should be noted that the EIS categories have been slightly modified in accordance with approach adopted by the Department of Water and Sanitation (2023a), in which all the categories now reflect a range of scores. This was described as a crucial amendment, as only systems scoring a 4 and/or 100% could be classified as being of 'Very High' importance, which is considered to be largely impossible to attain thereby, excluding systems of significance from scoring in the 'Very

Important' category despite their high importance. Allowing for range in this upper category means that some systems that did not score a 4 on all indicators of the EI/ES rating system are now considered to be of 'Very High' importance. Additionally, including a range for the EIS scores is consistent with the Present Ecological State (PES) scoring range (Department of Water and Sanitation, 2023a). **Table 6-3** provides an overview of the ratings used to interpret the derived EIS scores.

Table 6-3 Ecological Importance and Sensitivity Classes

(DWA, 2013, p43)

Category	EIS Description	Range of EIS Score
A	Very High Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers	≥3.5
B	High Wetlands that are ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quality and quantity of water in major rivers.	>2.5 and <3.5
C	Moderate Wetlands that are ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major river	>1.5 and ≤2.5
D	Low/Marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers	>0.5 and ≤1.5
E	None Wetlands that are rarely sensitive to changes in water quality/hydrological regime	≤0.5

Assessment of wetland condition/integrity

The assessment of ecosystem integrity was undertaken using the assessment framework, WET-Health Version 2 (Macfarlane *et al.*, 2020)[5], which was performed for the HGM units primarily affected by the boreholes and septic tank. The WET-Health assessment technique gives an indication of the deviation of the systems from the wetlands' natural reference condition for the following biophysical drivers:

- **Hydrology** - defined as the supply of water to wetland and the distribution and movement of water through a wetland.
- **Water quality** – defined as the condition of the water according to the chemical, physical and biological characteristics.

[5] The assessment technique was developed for southern African wetlands.

- **Geomorphology** - defined as the distribution and retention patterns of sediment within the wetland.
- **Vegetation** - defined as the vegetation structural and compositional state.

The impacts on the wetlands, determined by features of the wetlands and its catchments, were scored based on the extent and intensity of the disturbance units. These disturbance units, derived for each of the afore-mentioned components, were scored based on a suite of sub-categories using a scale of 0-10, prior to being combined to determine the overall magnitude-of-impact scores. From these scores, the overall impact score and Ecological Categories (**Table 6-4**) were determined, which reflects the extent to which anthropogenic changes have impacted the wetland from the benchmark/desired state.

Table 6-4 Description of the Ecological Categories typically used for PES assessments of inland aquatic ecosystems in South Africa, together with the applicable range of Impact Scores and PES Scores for each category (after Kleynhans, 1996, Macfarlane *et al.*, 2008).

(MacFarlane *et al.*, 2020)

Impact Category	Description	Impact Score Range (0-10)	PES Score	Ecological Category
None	Unmodified, natural.	0-0.9	**90-100**	**A**
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	**80-89**	**B**
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	**60-79**	**C**
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	**40-59**	**D**
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.	6-7.9	**20-39**	**E**
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	**0-19**	**F**

6.4 Index of Habitat Integrity (IHI)

The Index of Habitat Integrity (IHI) assessment was used to establish the condition of the riparian habitat's integrity (**Table 6-5**). The IHI assessment forms part of the published methods for the eco-classification of South African rivers (Kleynhans *et al.*, 2009). The rapid version of the IHI method based on Kleynhans (1996) was applied, which considers impacts within river buffer areas (500m) associated with the upstream quaternary catchment.

Table 6-5 Scores used to define river health class boundaries for IHI

(Kleynhans *et al.*, 2009)

River Health	Instream and Riparian IHI
Natural	> 90
Good	> 80
Fair	> 60
Poor	> 40
Seriously Modified	< 40

6.5 Freshwater ecosystem risk assessment

The risk assessment matrix (Department of Water and Sanitation, 2023b) assesses the likely impact the proposed development may have on the aquatic ecosystems hydrologically linked to the broiler houses. A broad outline of the criteria considered are as follows:

- Nature of the impact;
- Scale/extent of the impact;
- Duration of the impact;
- Intensity/severity of the impact; and
- Probability/likelihood of the impact occurring.

Identified risks were evaluated according to the above-mentioned criteria. The significance of impacts was derived through a synthesis of ratings of all criteria in the following calculations:

Intensity + Spatial Scale + Duration = Severity
Severity x Importance Rating (i.e. EIS rating) = Consequence
(Consequence x Probability) x (100/75) = Significance or Risk

The significance of a potential risk on decision-making was indicated through significance points, which are described in **Table 6-6.**

Table 6-6 List of descriptors for the significance score of an impact.

(DWS, 2023a)

Rating	Class	Management description	Authorisation
1 – 29	(L) Low Risk OR (+) Positive	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.	General Authorisation (GA)
30 – 60	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and requires specialist input.	Water Use Licence (WUL)
61-100	(H) High Risk	Watercourse(s) impacted by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.	Water Use Licence (WUL)

7. STUDY RESULTS

The results of the freshwater ecosystems delineation and assessments within the study area are outlined in the following sections.

7.1 Freshwater ecosystem delineation and verification

The delineation and verification of the freshwater ecosystems that are hydrologically linked to the boreholes and the septic tank included three riparian streams (Riparian 1, 2 and 3), two channelled valley-bottom wetlands (CVB 1 and 2) and two seeps (Seep 1 and 2) (**Figure 7-2**). Several hydrologically isolated inflowing watercourses and one seep were identified within the 500m DWS radius.

7.1.1 *Riparian 1*

Riparian 1, associated with borehole (BH) 13, is a riparian B channel approximately 250 m in length that decants into the lower channelled valley-bottom wetland (CVB 1). The channel is heavily eroded in places, with steep, incised banks. Much of the channel's banks and adjacent catchment is invaded by invasive alien plants (IAPs), notably *Solanum mauritianum* (bugweed) and *Acacia mearnsii* (black wattle). Cattle grazing was also observed along the channel margins. Semi-natural grasslands, pine plantations, invasive alien plant infestations, and patches of natural mistbelt forest characterise the upstream catchment.



Figure 7-1 Photographs showing a portion of the channel where the banks have been heavily incised and the dense infestations of alien vegetation.

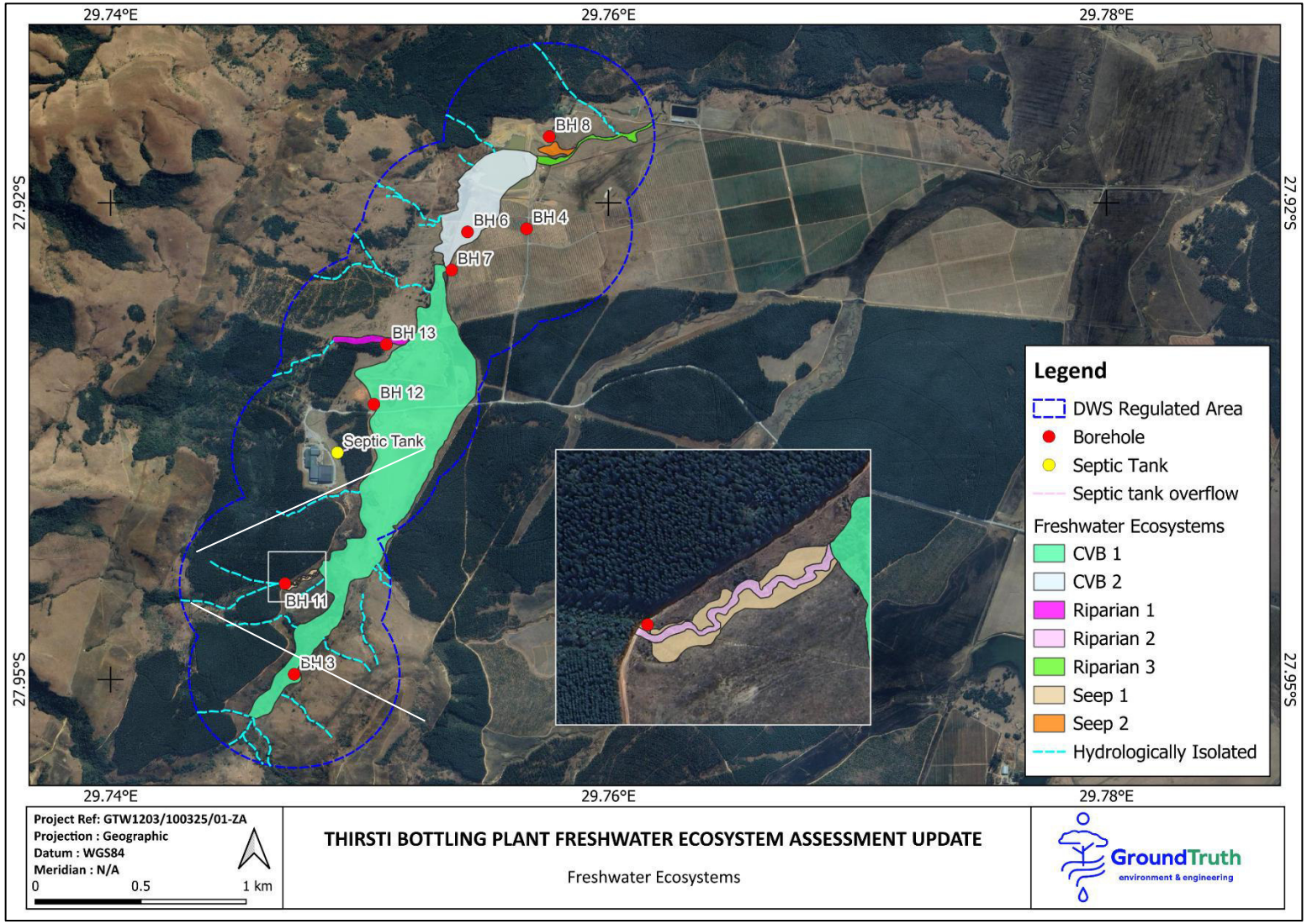


Figure 7-2 An overview of the onsite freshwater ecosystem overview

7.1.2 *Riparian 2*

Riparian 2, which is associated with BH 11 and is a riparian B channel and is characterised by a relatively steep incised channel that emerges from under a service road, where it discharges roughly 250 m downstream into the channel associated with CVB 1. The channel is less steep than the densely vegetated portions upstream of the road, however it is considered to be heavily eroded. Parts of the banks in the upper portions of the system appear to have recently collapsed, and parts of the road have eroded to expose the culvert outlet. A second headcut was noted immediately south of the channel, which was also relatively deep (>1 m in depth). IAPs were again noted along the channel margins, which included *Xanthium strumarium* (cocklebur), *Verbena bonariensis* (tall verbena), *Rubus sp.* (bramble), *Acacia mearnsii* (black wattle), and *Solanum mauritianum* (bugweed), while some of the native plants observed included *Leucosidea sericea* (ouhout), S*porobolous africanus* (rat's tail grass), and *Paspallum urvillei* (vasey grass), amongst others.



Figure 7-3 Images showing the pipe out of which Riparian 2 emerges, and the heavily incised and eroded characteristics of the channel.

7.1.3 *Riparian 3*

Riparian 3 occurs below the large water supply dam associated with CVB 2 and is a riparian C channel. It receives water from the dam's baseflow outlet pipe, which discharges onto the bedrock within the channel (**Figure 7-4**). The upper portions of the channel were observed to be heavily eroded and infested with *Populus sp.* (poplar), *Melia azedarach* (Syringa) and *A. mearnsii*. The current spillway from the dam is directing flows along the northern banks of the system. The channel associated with the spillway is approximately 670 m in length and has been directed

through a large seepage system before decanting into the riparian system. Historical images on Google Earth depict riparian vegetation all along the channel, however this was cleared around 2018, which coincides with the time that the southern spillway (which has since been decommissioned) was created. The channel flows out under a road to the east.



Figure 7-4 A photograph showing the general channel characteristics at the location of the baseflow discharge point.

7.1.4 *Channelled valley-bottom wetland 1 (CVB 1)*

Channelled valley-bottom wetland 1 (CVB 1) is the southernmost and largest of the two CVB wetlands, with a total area of approximately 54.28 ha. It receives inflow from several channels originating in the steep, mountainous catchment to the southwest and west, while smaller channels also enter the system from the eastern hills. The catchment is largely characterised by grasslands, patches of IAPs, pine plantations, and pockets of mist belt forest that tend to occur on the south-facing slopes. A small patch of pecan nut farming borders the system to the northeast.

CVB 1 was observed to have a largely incised channel running along the length of the valley bottom. The incision, particularly in the upper portions of the system, is likely a result of the wetland's relatively steep longitudinal slope of 3.80%, which, given its size, makes the system susceptible to erosion. Although the incision has lowered the water table, lateral inputs still appear to contribute to flow within the wetland. This is evident in the central valley-bottom area, where seasonal soils appeared light brown to yellow-grey (10YR 4/2) with extensive mottling and a relatively high clay content. In contrast, non-wetland areas exhibited darker brown soils (10YR 4/4) with lower clay content.

The central valley bottom is currently utilised by local farmers for cattle grazing. Downstream of the road crossing, the channel discharges into a dam. East of the dam, the spillway has become heavily eroded and now appears to function as the primary channel. Water was noted to be flowing out of an area to the west of the dam wall, which is thought to be associated with the old channel. The dam wall is heavily invaded by IAPs including *Persicara sp.* (knotweed)*, A. mearnsii* and *S. mauritianum*, and an area to the west of the dam has been substantially modified through the movement of soil and the creation of an earthen platform.

IAPs were observed throughout the system, particularly along the upper channel and the western slopes of the central wetland area. A relatively deep excavated trench (> 50 cm) was noted in the upper portions, running perpendicular to the valley floor. This appears to be associated with a

pipeline from Borehole 3 (BH 3) to the Thirsti bottling plant. The channel shows signs of erosion due to animal trampling. This area is considered to pose a significant risk to wildlife.

Vegetation within the system included grasses such as *Sporobolus* spp., *Cymbopogon* sp., *P. urvillei*, and *Melinis repens* (Natal red top), among others. Along the riparian areas and wetland margins, species such as *Searsia dentata* (nana-berry), *Podocarpus latifolius* (real yellowwood), *Cliffortia linearifolia* (River Rice-bush), and *Helichrysum aureonitens* (imphepho) were observed and others.



Figure 7-5 Images showing the eroded channel in the upper portions of the system, the deep excavated trench that appears to be associated with the pipeline running from BH 3 to the bottling plant, and the old channel behind the dam where water was noted.

7.1.5 *Channelled valley-bottom wetland 2 (CVB 2)*

CVB 2 is a smaller (12.86 ha) system that occurs immediately downstream of CVB 1. With a slope of 2.10%, it is less steep than CVB 1, however it is still considered moderately vulnerable to erosion. It shares much of the same catchment characteristics as CVB 1, which falls within its catchment. Much of its eastern slope has been converted to pecan nut orchards, which are irrigated.

The channel is well incised and heavily infested with *A. mearnsii*. Much of the western boundary upslope of the wetland has dense *A. mearnsii* infestations. Like CVB 1, it is believed that lateral seep inputs contribute to maintaining hydrophytic conditions in parts of the valley-bottom area. In contrast, areas immediately adjacent to the channel were not characterised by hydromorphic soils (soil colours ranged from 10YR 3/4 to 10YR 4/4), likely due to the significant incision depth (approximately 3 m) from the valley floor to the channel bed.

Much of the valley-bottom area has been transformed due to a combination of hay production and cattle grazing. At the base of the system is a large water supply dam at the bottom of the system, which is likely being used for agricultural purposes. *S. africanus* and *P. urvillei* were recorded in parts of the system.



Figure 7-6 Photographs showing the incised channel where a road passes through it, the flat valley-bottom area utilised for hay production and the pecan nut trees along the eastern bank, and the large water supply dam downstream with a dense infestation of wattle in the catchment.

7.1.6 *Seep 1*

Seep 1 is a small seep that flanks Riparian 2 on both the northwestern and southeastern sides, wherein it laterally drains (0.38 ha). Its catchment is comprised of both grassland and natural

mistbelt forests, however its immediate upstream area is dominated by pine plantations. Small areas of erosion were noted, which are associated with the eroding Riparian 2 channel, however much of the system was intact.

7.1.7 *Seep 2*

Seep 2 occurs immediately downstream of CVB 2. It has a total size of 0.67 ha and is considered heavily modified due to the water supply dam wall and spillway that passes directly through the system. Soil samples revealed a heavily disturbed system, with hard imported material being found throughout much of the soil profile. The northeastern portions of the system had some *V. bonariensis, Cymbopogon sp.* and *P. urvillei*, amongst other grasses, while the southwestern portion of the system had short, mowed grass. The area below the spillway was observed to be heavily eroded, with a broad headcut present, which has left various pipes exposed as a result. *A. mearnsii* was also observed to be establishing along the edges of the spillway.



Figure 7-7 Photographs showing the vegetation characteristics of the northeastern portion of the seep, the short mowed grass on the southwestern side of the seep, and the heavily eroded area associated with the spillway.

7.2 Assessment of wetland functioning

The assessment of wetland functioning, and condition/integrity assessments of the wetlands are detailed in the following sections.

7.2.1 *Wetland ecosystem functioning*

The general features of the HGM units were assessed in terms of their ecosystem functioning at a landscape level for the **pre-borehole** and **post-borehole** scenarios using a Level 2 WET-EcoServices assessment (see **Table 7-1** to **Table 7-4**). The score for each ecosystem service represents the likely extent to which that benefit is being supplied by the wetlands, based on the supply and demand scores, rated from 0-4, which informs the overall importance score, based on the following categories as presented within Kotze *et al*. (2020):

- **0-0.79** Very Low;
- **0.8-1.29** Low;
- **1.3-1.69** Moderately Low;
- **1.7-2.29** Moderate;
- **2.3-2.69** Moderately High;
- **2.7-3 .19** High; and
- **3.2-4.0** Very High.

7.2.1.1 *CVB 1*

The values recorded for the regulating and supporting ecosystem services in CVB 1 for both the pre- and post-borehole scenarios ranged from ***Very Low*** to ***Moderate***. Overall, the wetland delivers a relatively low level of ecosystem service benefits, largely due to limited demand for many of these services within the rural and sparsely populated catchment. For example, although the supply of streamflow regulation is ***High***, the associated demand is ***Low***, resulting in a ***Moderate*** importance score. Most other regulating services, including flood attenuation, erosion control, and nutrient and toxicant assimilation, were rated ***Very Low*** in importance due to both low supply and demand. The low erosion control rating is related to the presence of erosion features throughout the assessment unit, particularly within channel and the excavated trench near BH 3 and poor vegetation cover in some areas.

The biodiversity maintenance and carbon storage services remained of ***Very Low*** and ***Low*** importance, respectively, in both scenarios. This is despite relatively high demand scores, as the area is identified as an important bird area, and it falls upstream of an NFEPA area.

Provisioning services showed a variable range of importance. The supply of water for human use and food for livestock was ***High***, which is due to the dam and perennial flow, as well as the grazable plant species within the valley-bottom area. However, demand for these services was negligible, resulting in only ***Moderately Low*** importance scores. Other provisioning services, such as cultivated foods and harvestable resources, were rated ***Very Low*** in importance due to a lack of current use in the surrounding area.

Cultural services were consistently rated ***Very Low*** in both scenarios. This is due to the limited recreational, educational, or spiritual use of the wetland, compounded by its rural setting and private landownership.

7.2.1.2 *CVB 2*

No changes were noted under pre- and post-borehole scenarios. The regulating and supporting ecosystem services in CVB 2 ranged from ***Very Low*** to ***Moderate*** in both the pre- and post-borehole scenarios. Overall, the wetland provides a relatively low level of ecosystem service benefits, mainly due to limited demand in the rural setting. While streamflow regulation showed relatively high supply, most other services, including flood attenuation, erosion control, and nutrient assimilation, were rated ***Very Low*** due to low supply and demand. The low erosion control rating is associated with the relatively steep slope that characterises the system, deep channel incision and dense wattle infestation along the channel, which reduce soil and vegetation stability.

Biodiversity maintenance and carbon storage remained of ***Very Low*** importance despite a high demand for it, which is due to degradation to the system from channel incision, IAPs, and land use impacts such as grazing and hay production. This is despite relatively high demand scores, as the area is identified as an important bird area and it falls upstream of an NFEPA area.

Provisioning services showed greater variability. Food for livestock scored ***High*** supply, which is due to the presence of palatable grass species observed (and indication of grazing due to the presence of cattle manure), and hay production, though importance remained ***Low*** due to limited current demand.

Water for human use was rated ***Moderate***, linked to the downstream dam, while cultivated foods were of ***Low*** importance. Other provisioning services had ***Very Low*** importance. Cultural services were rated ***Very Low***, with this being attributed to the fact that area is rural and private, and due to the absence of recreational or spiritual use.

7.2.1.3 *Seep 1*

Again, no changes were registered under pre- and post-borehole scenarios. The ecosystem services delivered by Seep 1 are generally limited, reflecting its small size and the low demand for most services. Regulating and supporting services ranged from ***Very Low*** to ***Moderate***. While the supply of streamflow regulation and nutrient assimilation was relatively high, their overall importance was ***Moderately low*** to ***Moderate*** due to limited downstream demand. Sediment trapping also scored ***Moderate*** in importance, which due to the relatively intact vegetation and low levels of disturbance within the seep itself.

Erosion control was rated ***Very Low*** in importance, despite the ability of the wetland to supply these services, which is likely due to presence of minor erosion features associated with the adjacent Riparian 2 channel. Biodiversity maintenance and carbon storage were rated as ***Moderately Low*** and ***Very Low*** in importance respectively, despite relatively high demand scores due to area being identified as an important bird area and occurring upstream of an NFEPA area.

Provisioning and cultural services were consistently rated ***Very Low***, except for food for livestock, which showed high supply but low demand, resulting in a ***Moderately Low*** importance score. No use of the system for water supply, harvestable resources, or cultivation was observed.

7.2.1.4 *Seep 2*

Both pre- and post- borehole scenarios registered no change. The values recorded for the regulating and supporting ecosystem services in Seep 2 ranged from ***Very Low*** to ***Low***. Overall, the wetland delivers a low level of ecosystem service benefits, primarily due to its small size and the fact that the system has been heavily modified by the water supply dam wall and spillway. These disturbances have resulted in a degraded soil profile and a large headcut through the centre of the system, limiting its capacity to provide services such as erosion control, sediment trapping, and nutrient assimilation.

The supply of streamflow regulation is ***Moderate***, but due to low demand, it holds a **Very Low** importance score. Similarly, services related to phosphate, nitrate, and toxicant assimilation were rated ***Very Low*** in importance, reflecting both low demand and the wetland's compromised condition. Slightly higher importance scores were recorded for carbon storage and cultivated foods, possibly due to residual vegetation and adjacent agricultural use.

Provisioning and cultural services were consistently rated ***Very Low***, indicating minimal use of the site for water abstraction, grazing, recreational, or cultural purposes.

Table 7-1 Summary of the ecosystem services scores for CVB 1 for the pre-borehole and post-borehole scenarios[6]

		CVB 1 pre-borehole				CVB 1 post-borehole			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.3	0.4	0.0	Very Low	1.3	0.4	0.0	Very Low
	Stream flow regulation	3.0	1.3	2.2	Moderate	3.0	1.3	2.2	Moderate
	Sediment trapping	1.3	1.0	0.3	Very Low	1.3	1.0	0.3	Very Low
	Erosion control	1.4	0.2	0.0	Very Low	1.4	0.2	0.0	Very Low
	Phosphate assimilation	1.2	0.5	0.0	Very Low	1.2	0.5	0.0	Very Low
	Nitrate assimilation	1.0	0.5	0.0	Very Low	1.0	0.5	0.0	Very Low
	Toxicant assimilation	1.0	0.5	0.0	Very Low	1.0	0.5	0.0	Very Low
	Carbon storage	1.1	2.7	0.9	Low	1.1	2.7	0.9	Low
	Biodiversity maintenance	0.8	3.0	0.8	Very Low	0.8	3.0	0.8	Very Low
PROVISIONING SERVICES	Water for human use	3.0	0.0	1.5	Moderately Low	3.0	0.0	1.5	Moderately Low
	Harvestable resources	1.5	0.0	0.0	Very Low	1.5	0.0	0.0	Very Low
	Food for livestock	3.0	0.0	1.5	Moderately Low	3.0	0.0	1.5	Moderately Low
	Cultivated foods	2.3	0.0	0.8	Very Low	2.3	0.0	0.8	Very Low
CULTURAL SERVICES	Tourism and Recreation	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Education and Research	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Cultural and Spiritual	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low

6 Please note that **Table 7-1** to **Table 7-4** form summary tables developed for reporting purposes. Full data is available upon request.

Table 7-2 Summary of the ecosystem services scores for CVB 2 for the pre-borehole and post-borehole scenarios

		CVB 2 pre-borehole				CVB 2 post-borehole			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.4	0.4	0.1	Very Low	1.4	0.4	0.1	Very Low
	Stream flow regulation	2.7	1.3	1.8	Moderate	2.7	1.3	1.8	Moderate
	Sediment trapping	1.4	1.0	0.4	Very Low	1.4	1.0	0.4	Very Low
	Erosion control	1.4	0.2	0.0	Very Low	1.4	0.2	0.0	Very Low
	Phosphate assimilation	1.3	0.5	0.0	Very Low	1.3	0.5	0.0	Very Low
	Nitrate assimilation	0.8	0.5	0.0	Very Low	0.8	0.5	0.0	Very Low
	Toxicant assimilation	1.0	0.5	0.0	Very Low	1.0	0.5	0.0	Very Low
	Carbon storage	0.8	2.7	0.7	Very Low	0.8	2.7	0.7	Very Low
	Biodiversity maintenance	0.5	3.0	0.5	Very Low	0.5	3.0	0.5	Very Low
PROVISIONING SERVICES	Water for human use	3.0	1.3	2.2	Moderate	3.0	1.3	2.2	Moderate
	Harvestable resources	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low
	Food for livestock	3.0	0.0	1.5	Moderately Low	3.0	0.0	1.5	Moderately Low
	Cultivated foods	2.8	0.0	1.3	Low	2.8	0.0	1.3	Low
CULTURAL SERVICES	Tourism and Recreation	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low
	Education and Research	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Cultural and Spiritual	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low

Table 7-3 Summary of the ecosystem services scores for Seep 1 for the pre-borehole and post-borehole scenarios

		Seep 1 pre-borehole				Seep 1post-borehole			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.9	0.0	0.0	Very Low	0.9	0.0	0.0	Very Low
	Stream flow regulation	3.0	0.3	1.7	Moderately Low	3.0	0.3	1.7	Moderately Low
	Sediment trapping	3.0	0.8	1.9	Moderate	3.0	0.8	1.9	Moderate
	Erosion control	1.4	0.3	0.1	Very Low	1.4	0.3	0.1	Very Low
	Phosphate assimilation	3.2	0.8	2.1	Moderate	3.2	0.8	2.1	Moderate
	Nitrate assimilation	2.8	0.8	1.7	Moderate	2.8	0.8	1.7	Moderate
	Toxicant assimilation	3.3	0.0	1.8	Moderate	3.3	0.0	1.8	Moderate
	Carbon storage	0.7	2.7	0.6	Very Low	0.7	2.7	0.6	Very Low
	Biodiversity maintenance	1.9	2.0	1.4	Moderately Low	1.9	2.0	1.4	Moderately Low
PROVISIONING SERVICES	Water for human use	0.0	0.0	0.0	Very Low	0.0	0.0	0.0	Very Low
	Harvestable resources	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Food for livestock	3.0	0.0	1.5	Moderately Low	3.0	0.0	1.5	Moderately Low
	Cultivated foods	2.1	0.0	0.6	Very Low	2.1	0.0	0.6	Very Low
CULTURAL SERVICES	Tourism and Recreation	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Education and Research	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Cultural and Spiritual	0.0	0.0	0.0	Very Low	0.0	0.0	0.0	Very Low

Table 7-4 Summary of the ecosystem services scores for Seep 2 for the pre-borehole and post-borehole scenarios

		Seep 2 pre-borehole				Seep 2 post-borehole			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.9	0.2	0.0	Very Low	0.9	0.2	0.0	Very Low
	Stream flow regulation	2.0	0.0	0.5	Very Low	2.0	0.0	0.5	Very Low
	Sediment trapping	1.3	1.5	0.6	Very Low	1.3	1.5	0.6	Very Low
	Erosion control	1.1	0.0	0.0	Very Low	1.1	0.0	0.0	Very Low
	Phosphate assimilation	1.4	0.8	0.3	Very Low	1.4	0.8	0.3	Very Low
	Nitrate assimilation	1.1	0.8	0.0	Very Low	1.1	0.8	0.0	Very Low
	Toxicant assimilation	1.3	0.0	0.0	Very Low	1.3	0.0	0.0	Very Low
	Carbon storage	0.9	2.7	0.7	Very Low	0.9	2.7	0.7	Very Low
	Biodiversity maintenance	0.5	2.0	0.0	Very Low	0.5	2.0	0.0	Very Low
PROVISIONING SERVICES	Water for human use	1.5	0.0	0.0	Very Low	1.5	0.0	0.0	Very Low
	Harvestable resources	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low
	Food for livestock	1.0	0.0	0.0	Very Low	1.0	0.0	0.0	Very Low
	Cultivated foods	2.5	0.0	1.0	Low	2.5	0.0	1.0	Low
CULTURAL SERVICES	Tourism and Recreation	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Education and Research	0.5	0.0	0.0	Very Low	0.5	0.0	0.0	Very Low
	Cultural and Spiritual	2.0	0.0	0.5	Very Low	2.0	0.0	0.5	Very Low

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7.2.2 *Ecological importance and sensitivity*

According to the DWA (2013) Manual for Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0), the current EIS categories for the six systems are derived from the ecological importance and sensitivity score for all the assessed freshwater ecosystems. Of the systems linked to the boreholes, CVB 1 is considered to be a **C** category for the pre-borehole and post-borehole scenarios, while CVB 2 and the two seeps are considered to be **D** (**Table 7-5**). The EIS score for the two channelled valley-bottom system was predominantly derived from the protection status afforded to the wetland due to it being on private property, as well as its size. While CVB 2 has scored similar scores, but scored a lower category, its smaller size was enough to see it drop from a **C** to a **D**. The EIS category for the seeps were largely derived from the fact that they are on the same private property, which affords them protection status, however Seep 1's score is also partially derived from its hydro-functional importance as the score is highly linked to these systems' ability to provide regulating and support ecosystem services.

Table 7-5 Ecological Importance and Sensitivity Score for the wetland systems for the pre- and post- borehole (BH) scenario15 for CVB 1, CVB 2, Seep 1 and Seep 2[7].

Ecological Importance and Sensitivity Categories	CVB 1		CVB 2		Seep 1		Seep 2	
	Pre-BH	Post-BH	Pre-BH	Post-BH	Pre-BH	Post-BH	Pre-BH	Post-BH
Ecological Importance and Sensitivity	2.0	2.0	2.0	2.0	1.6	1.6	1.4	1.4
Hydro-functional Importance	0.4	0.4	0.4	0.4	1.2	1.2	0.2	0.2
Direct Human Benefits	0.4	0.4	0.6	0.6	0.4	0.4	0.2	0.2
Overall Importance and Sensitivity Score	2.0	2.0	2.0	2.0	1.6	1.6	1.4	1.4
Overall Importance and Sensitivity Category	**C**	**C**	**D**	**D**	**D**	**D**	**D**	**D**

7.2.3 *Wetland ecological condition*

The ecological integrity or PES of the channelled valley-bottom and seepage wetlands were assessed for the hydrology, geomorphology, water quality and vegetation components comprising wetland health for the **pre-** and **post-borehole** scenarios (**Table 7-6**).

7 Please note that **Table 7-5** forms a summary table developed for reporting purposes. Full data is available upon request.

Table 7-6 Summary of the overall ecological integrity of the wetlands for the pre-borehole scenarios[8]

		Hydrology	Geomorphology	Water Quality	Vegetation	Overall Score
CVB1	Impact Score	4.5	2.9	0.8	5.1	2.5
	PES Category	D	C	A	D	C
CVB2	Impact Score	7.5	4.7	1.1	7.6	6.0
	PES Category	E	D	B	E	E
Seep 1	Impact Score	3.1	2.6	0.7	4.3	2.7
	PES Category	C	C	A	D	C
Seep 2	Impact Score	10.0	7.3	1.1	8.1	7.7
	PES Category	F	E	B	F	F

*Refer to **Table 6-4** for details pertaining to the specific categories.

7.2.3.1 *Pre-borehole scenario*

Assessment of impacts on hydrology

The impact scores recorded for the hydrological component of the channelled valley-bottoms and seepage wetlands ranged from **3.1** to **10,** indicating a broad range of impacts to hydrology across the wetlands. CVB 1 scored an overall score of **D**, CVB 2 scored an overall **E**, while Seep 1 scored a **C** and a Seep 2 a **F**. The modifications to the wetland's Present Hydrological State (PHS) are primarily linked to the following factors:

- The heavy erosion that characterises both the channels in CVB 1 and CVB 2 contributes to the lowering of the wetlands' hydrology scores. This incision has likely contributed to a lowered table, while the depth of the channel has also led to a reduction in flood flows reaching the adjacent valley bottom. The historical drains and deep excavated trench within CVB 1 further compound these issues. While lateral flows from seeps or shallow subsurface flows still enter the system and contribute towards maintaining its wetness, the incision offsets these contributions.
- The dams within both CVB 1 and CVB 2 have further contributed to the lowering of hydrology scores by altering the natural flow regimes within the systems. In CVB 1, the large erosion gully associated with the dam's spillway has further affected water retention times, contributing to faster drainage and reduced saturation in that portion of the wetland. In Seep 2, the hydrological score is significantly impacted by the dam spillway. The associated infilling of more than 50% of the wetland has significantly altered natural flow patterns.
- Across all these systems and their catchments, plantations, irrigation from pecan nut trees and invasive alien vegetation have altered the natural hydrological regime. In particular, the presence of pine plantations on slopes and dense infestations of invasive species such as wattle have likely increased water uptake and reduced baseflow contributions to the wetlands.

8 Please note that **Table 7-6** forms a summary table developed for reporting purposes. Full data is available upon request.

Assessment of impacts on geomorphology

The impact scores recorded for the geomorphological component of the channelled valley-bottom and seep wetlands ranged from **2.6** to **7.3**, indicating varying levels of alteration to geomorphic processes across the wetlands. CVB 1 was assigned a Present Geomorphology State (PGS) category of **C**, CVB 2 a **D**, while Seep 1 was rated **C** and Seep 2 and **E**. The modifications to the wetlands' present geomorphic condition are primarily linked to the following factors:

- The dams in CVB 1, CVB 2 and Seep 2 have contributed to infilled areas that have buried portions of the wetlands, with more than half of Seep 2 comprising of fill material. Furthermore, dams act as sediment sinks, which have fundamentally changed the natural level of sediment flux through the wetland.
- The large erosion gully to the east of the dam in CVB 1, associated with the spillway, has significantly altered the natural sedimentation processes within the system. This effect is likely exacerbated by the deep incised channels, which facilitate rapid transport of sediments downstream, thereby depriving critical areas along the valley bottom of sediment deposition.

Assessment of impacts on water quality

The impact scores recorded for the water quality component of the channelled valley-bottom and seep wetlands were relatively low across all systems, ranging from **0.7** to **1.1**. This corresponds to Present Water Quality State (PWQS) categories of **A** or **B**, suggesting that water quality impacts are currently limited. CVB 1 and Seep 1 were rated **A**, while CVB 2 and Seep 2 were rated **B**. The limited level of degradation to water quality can be attributed to the following factors:

- Catchment land uses have partially contributed to a lowering of the water quality scores across all the systems, which include plantations and IAPs, however these impacts are minimal.
- CVB 2 has seen a further reduction in water quality due to the pecan nut farming in the catchment as well as within a small portion of the wetland, while Seep 2 has been impacted by infilling and the eroded areas within the system.

Assessment of impacts on vegetation

The impact scores recorded for the vegetation component of the channelled valley-bottom and seep wetlands ranged from **4.3** to **8.1**, indicating moderate to severe levels of degradation across the sites. CVB 1and Seep 1 were assigned a Present Vegetation State (PVS) category of **D**, CVB 2 an **E,** and Seep 2 scored an **F**. The following factors were considered to contribute to the current state of vegetation across these wetlands:

- IAPs within the channelled valley-bottom wetlands have impacted the native vegetation of the systems. In addition, the areas are used for grazing and are thought to be semi-natural rather than natural due to this historical and ongoing land use.
- In Seep 2, much of the natural vegetation has been removed or altered due to infilling associated with the dam spillway. The remaining vegetation is fragmented, with grasses in certain portion of the system being kept artificially short.

- Hay production in CVB 2 has resulted in near-complete transformation of the vegetation composition in these areas.
- The deep and permanent flooding associated with the dams in both CVB 1 and CVB 2 has limited the ability of wetland vegetation to establish in affected areas. Zones that might previously have supported hydrophytic vegetation are now submerged or disturbed, contributing to the overall vegetation degradation.
- Channel incision in parts of CVB 1 and CVB 2 has resulted in a lowering of the local water table and a disconnection from regular overbank flooding. This hydrological alteration can lead to shifts in vegetation composition, with species better adapted to drier conditions replacing native wetland species.
- Moderately degraded areas associated with Seep 1 and the eroding adjacent riparian channel have also contributed to a lower vegetation score. While indigenous vegetation remains, bare areas were evident.

7.2.3.2 *Post-borehole scenario*

Table 7-7 Summary of the overall ecological integrity of the wetlands for the post-borehole scenarios[9]

		Hydrology	Geomorphology	Water Quality	Vegetation	Overall Score
CVB1	Impact Score	4.5	2.9	0.8	5.1	2.5
	PES Category	D	C	C	D	C
CVB2	Impact Score	7.5	4.7	1.1	7.6	6.0
	PES Category	E	D	C	E	E
Seep 1	Impact Score	3.1	2.6	0.7	4.3	2.7
	PES Category	C	C	A	D	C
Seep 2	Impact Score	10.0	7.3	1.1	8.1	7.7
	PES Category	F	E	B	F	F

The PES scores of the channelled valley-bottom and seep wetlands assessed for the hydrology, geomorphology, water quality, and vegetation components comprising wetland health under the post-borehole scenario are presented in **Table 7-7.** The only change in this scenario is the decline in the PES categories for the water quality component, which is attributed to the presence of a leaking septic tank located upstream of the wetland systems.

The leaking septic tank is situated within the catchment of CVB 1 and CVB 2 and is likely contributing to elevated nutrient and organic loads, resulting in a decrease in water quality scores for CVB 1 and CVB 2. These impacts are likely to be transported downstream via overland or shallow subsurface flow, particularly during rainfall events. The extent of change is limited to water quality, with no changes to hydrology, geomorphology, or vegetation in this scenario. It is important to note that impacts to water quality are considered transient, as appropriate mitigation measures help to ensure that any leaks are infrequent and limited in extent.

9 Please note that **Table 7-7** forms a summary table developed for reporting purposes. Full data is available upon request.

WATER QUALITY IMPACTS ASSOCIATED WITH THE OVERFLOWING SEPTIC TANK:

During the original assessment, the septic tank was found to be overflowing, which impacted the receiving environment (i.e. water quality component). GroundTruth has since been informed that the septic tank has been upgraded and is no longer leaking. As a result, the impact on water quality is no longer considered a concern.

7.3 Index of habitat integrity (IHI)

The IHI assessment result summaries of the riparian B and C channels that will be impacted by the boreholes are presented in **Table 7-8** with a discussion on the impacts to both the instream and riparian habitats to follow.

Table 7-8 IHI assessment summary of ecological categories for the identified riparian ecosystems[10].

Watercourse	Instream Habitat		Riparian Habitat	
	Score	Class	Score	Class
Riparian 1	98	A	86	B
Riparian 2	97	A	87	B
Riparian 3	88	B	68	C

Instream impacts across the systems were minimal, with condition scores ranging from natural (**A**) to good (**B**). The primary contributor to instream alteration was the dam affecting Riparian 3, which has regulated natural flow regimes and led to unnatural morphological changes within the channel. Invasive alien vegetation was also noted to negatively affect instream habitats across all systems.

Riparian habitat condition for Riparian 1 and 2 was rated as good (**B**), with relatively minor disturbances. Riparian 3 is considered to be in fair condition (**C**) and is considered to be slightly more modified. All riparian zones have been negatively affected by IAPs and plantations within their immediate catchments. These disturbances have reduced the natural buffering capacity of the riparian zones and contributed to reduced water availability and quality. While bank erosion and channel modification were noted across all three systems, Riparian 1 and 3 were particularly affected by severe bank erosion, as observed during the field assessment. Furthermore, the dam has altered the riparian habitat in Riparian 3 by regulating flow patterns and disrupting natural flood pulses that typically sustain riparian vegetation and sediment dynamics, while the culvert that channels water into the Riparian 2 has also contributed towards some minor disruption of natural flows through the system.

10 Please note that and **Table 7-8** forms a summary table developed for reporting purposes. Full data is available upon request.

7.4 Potential impacts associated with the boreholes and septic tanks

It is essential to understand the potential impacts on the freshwater ecosystems associated with any form of development to provide appropriate mitigation recommendations. Based on the reports by Levin (2016) and GCS (2021, 2023b), the boreholes are drawing from confined aquifers deep below the surface of the wetlands, with the borehole depths range between 50 – 100 m. Given this, the impacts to the wetlands from an abstraction point of view is negligible.

Given that the boreholes and the septic tank are already installed, the following impacts are anticipated:

- **Pollution from discharges** – there is a potential for the water quality to be negatively affected in downstream areas if the septic tank or hydrocarbons from the boreholes leak. These impacts could, over time, result in eutrophic conditions, altering aquatic flora and fauna dynamics and may even impact downstream users of the water resources.

7.5 Watercourse risk assessment

Consideration of the principles and approach described in the DWS Risk Matrix (Gazette No. 49833, Notice 4167 of 2023), highlighted that the boreholes and septic tank associated with the Thirsti bottling plant pose a ***Low*** risk of negative impacts to the downstream hydrologically linked watercourses under mitigated conditions.

While the boreholes present a potential risk of hydrocarbon contamination to groundwater, this risk is considered to be ***low***, as the borehole infrastructure is housed within sealed and enclosed pump houses that minimise the likelihood of leaks or spills reaching the subsurface. Proper containment and infrastructure design significantly reduce the potential for contamination. However, it is important that infrastructure is regularly inspected and maintained as needed to prevent any potential for contamination.

While the septic tank is anticipated to overflow (it was observed to be overflowing while onsite,however this has since been rectified), proper management and regular maintenance of the facility will mitigate the risk of contamination to nearby water resources. Mitigation measures include:

- Strong messages to staff and guests of Thirsti should include the appropriate use of septic tanks and French drains.
- The system should be inspected for sludge buildup in the main tank chamber, and the inflow and outflow pipes should be checked for any blockages. This will not only reduce the risk of failure but will also ensure that the septic tanks are operating optimally to reduce their overall operational-related risks to the downstream watercourses.
- An appropriate buffer zone should be maintained between the septic tank and the downstream freshwater ecosystem (CVB 1). This buffer should be vegetated with indigenous plant species, which can assist in intercepting and slowing down overland flow, thereby enhancing infiltration and reducing the direct transport of nutrients, pathogens, and other pollutants into the wetland. The vegetation within the buffer zone also contributes to phytoremediation, where plants take up and metabolise certain contaminants, further improving water quality before it reaches sensitive aquatic habitats.

- In the event of a system failure, sandbags should be strategically placed immediately downstream of the septic tank to divert any overflow and promote infiltration into the surrounding soil. This measure will help reduce the likelihood of overland flow reaching nearby freshwater ecosystems.
- Bi-annual water quality monitoring of CVB 1 and CVB 2 should be undertaken by an independent specialist using a simple in-situ water quality test to determine temperature, electrical conductivity, dissolved oxygen, pH, and salinity. In addition, it is recommended that individual ammonia, total nitrate, total phosphate, and *E. coli* water quality tests are taken. These tests should be undertaken twice a year (one test in the dry season and one in the wet season) to ensure that the septic tank systems are not having an overall cumulative impact on the resource quality of the CVB 1 and CVB 2. This monitoring should occur for at least three years from the date of authorisation.

Table 7-9 Wetland risk assessment activities, impacts and risk ratings for the operation phase[11]

Phase	Activity	Impact	Potentially affected watercourses		Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating
			Name/s	Ecological Importance						
OPERATIONAL (mitigated)	Operations of septic tank	Overflowing septic tank upstream of CVB1 and CVB2 due to improper management.	CVB 1	Moderate	8.0	3.0	1.0	80.0%	28.8	L
			CVB 2	Moderate	6.0	2.0	1.0	80.0%	21.6	L
	Operations of boreholes tank	Potential hydrocarbon contamination of wetlands through fuel leaks from borehole pumps.	CVB 1	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			CVB 2	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Seep 1	Low/ Very low	2.0	1.0	1.0	20.0%	1.6	L
			Seep 2	Low/ Very low	2.0	1.0	1.0	20.0%	1.6	L
			Riparian 1	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Riparian 2	Moderate	2.0	1.0	1.0	20.0%	2.4	L
			Riparian 3	Moderate	2.0	3.0	1.0	20.0%	3.6	L

11 Please note that **Table 7-9** forms a summary table developed for reporting purposes. Full data is available upon request.

8. CONCLUSION

The freshwater ecosystems identified as being hydrologically linked to the Thirsti bottling plant boreholes and septic tank included two channelled valley-bottom and two seep wetlands, as well as three riparian channels. In terms of the wetland ecological condition, systems ranged from moderately modified (**C**) to critically modified (**F**). Most of the systems' catchments were considered to be semi-natural, with some being more heavily altered due to plantations and dense wattle infestation. In terms of in-system impacts, the channelled valley-bottom wetlands suffered from various impacts, including erosion, infilling associated with water supply dams and alteration to the natural vegetation dynamics from farming and IAPs.

Impacts from the boreholes and septic tank are considered to be Low, provided that appropriate mitigation measures are in place. The boreholes pose minimal risk to groundwater resources due to the depth from which they abstract, which limits interaction with near-surface water-dependent ecosystems. Additionally, potential impacts from the septic tank are expected to remain low, as any overflows are likely to be short-lived and localised, assuming the system is appropriately managed and maintained.

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10. APPENDICES

Appendix 1

Sample plot descriptions and photographs collected during the field component of the study using a data collection sheet adapted from Job (2009).

Project/Site: GTW1203
Sample Plot No.:1
Date: 29/05/25
Lat: 29° 45′ 10.62″ E
Long: 27° 55′ 26.68″ S

Do normal circumstances exist on the site? Yes ~~No~~
Is the site significantly disturbed (difficult site)? ~~Yes~~ No
Is the area a Specific Case per Appendix A of the delineation manual? ~~Yes~~ No

TERRAIN UNIT INDICATOR

Position in the landscape:
☐ crest ☐ footslope
☐ scarp ☒ valley bottom
☐ midslope
Local relief:
☐ flat
☒ concave
☐ convex

VEGETATION INDICATOR

The location of the sample plot within a mowed natural grassland area precluded the use of vegetation as an indicator in this instance

SOIL WETNESS INDICATORS

Soil Profile Description:

Depth (cm)	Matrix Colour (Munsell)	Mottle Colours (Munsell)	Texture, Concretions, Rhizospheres, etc.
0 –15cm	10YR 4/3		
15 – 40cm	10YR 4/3	10YR 5/6	
40- 50cm	10YR 5/4	10YR 4/4	
50-70cm	10YR 6/4	10YR 6/8	

Zone of Wetness:
☐ Permanent Wetness Zone
☐ Seasonal Wetness Zone
☒ Temporary Wetness Zone
☐ Non-Wetland or Dryland

Features present within 50cm of the soil surface:
☐ Organic soil ☐ High organic content in surface layer
☐ Grey/gleyed matrix ☒ Mottle / concretions
☐ Organic streaking ☐ Sulfidic odour
☐ Other

Munsell colour one of the following? Yes ~~No~~
Gley 1:
☐
Gley 2:
☐
Hue 5YR:
☐value 5 or more/chroma 2 or less OR
☐value 6 or more/chroma 4 or less
Hue 7.5YR:
☐ value 5 or more/chroma 2 or less OR
☐ value 6 or more/chroma 4 or less.
Hue l0YR:
☐value 4 or more/chroma 2 or less OR
☐ value 5 or more/chroma 3 or less OR
☒ value 6 or more/chroma 4 or less
Hue 2.5Y:
☐value 5 or more/chroma 2 or less OR
☐value 6 or more/chroma 4 or less
Hue 5Y:
☐value 5 or more/chroma 2 or less

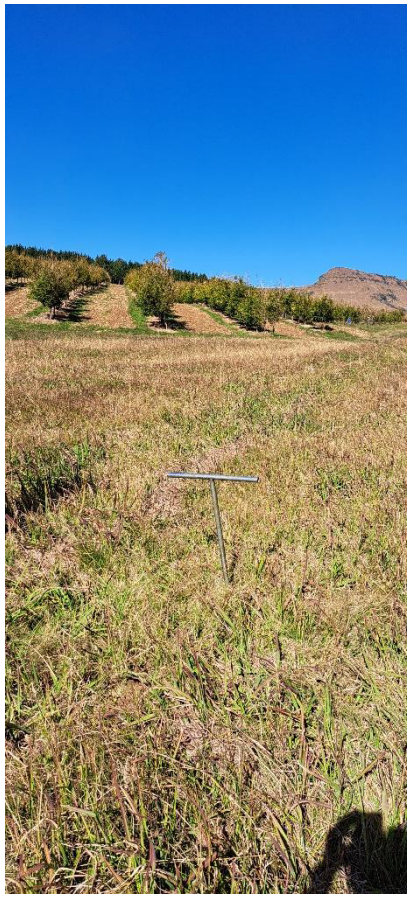
HYDROLOGY INDICATORS (Generally applicable to Permanent/Seasonal Zones of Wetness)
☐ Inundated
Depth of Surface Water:
☐ Evidence of bedrock or other impermeable layer within 30-50 cm of the soil surface.
☐ Saturated within 50 cm of surface
Depth to Saturated Soil:
☐ Sediment Deposits
☐ Aquatic invertebrates
☐ Salt Crust
☐ Oxidised Root Channels
☐ Water-Stained Leaves
☐ Water Marks

WETLAND DETERMINATION

Terrain unit indicators present?	Yes	~~No~~
Vegetation indicators present?	~~Yes~~	No
Soil wetness indicators present?	Yes	~~No~~
Hydrology indicators present?	Yes	~~No~~
Is this sampling plot within wetland?	Yes	~~No~~

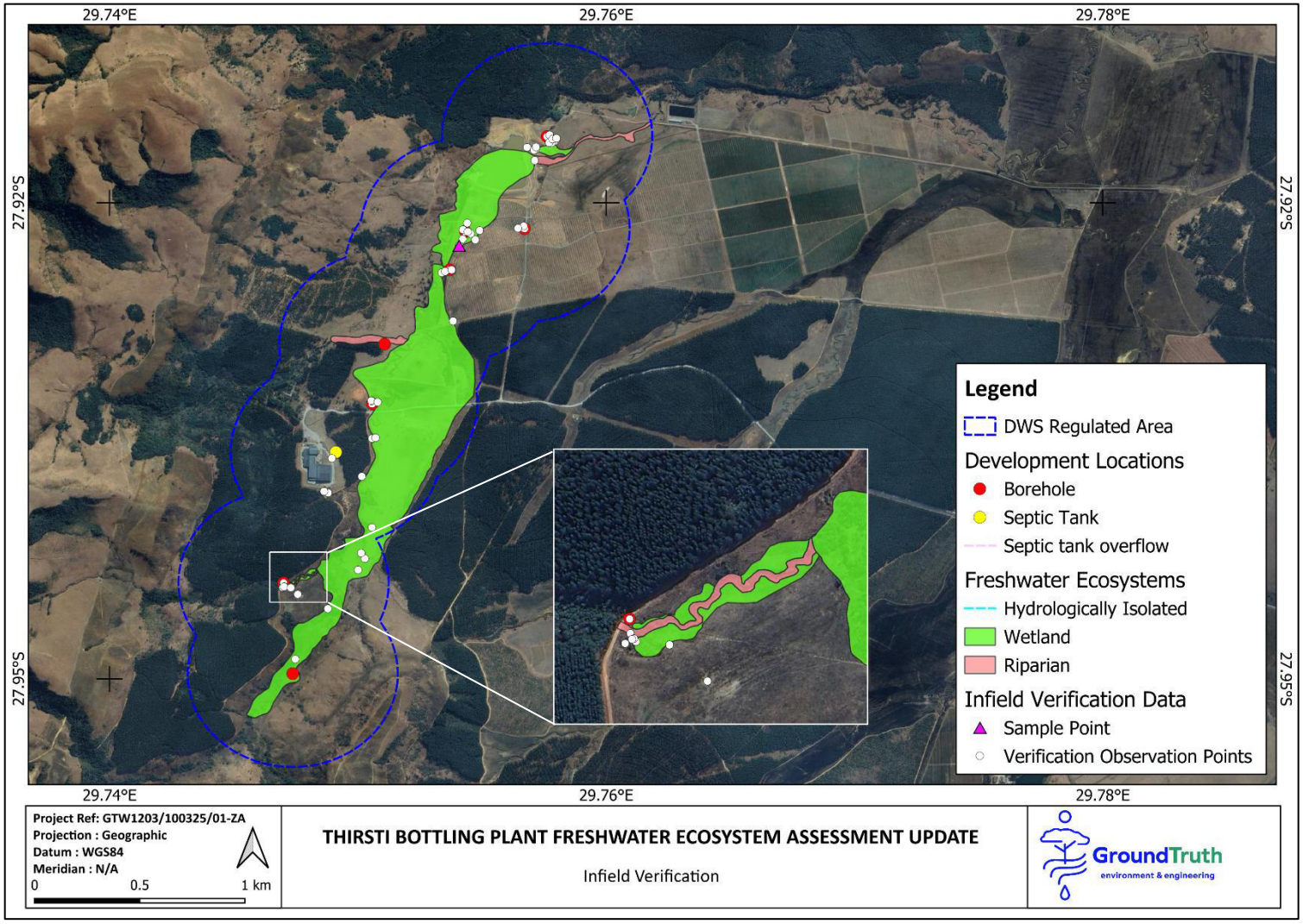
© GroundTruth

Sample plot photographs

Overview of soil profile	Location of soil profile
	

Appendix 2

Infield verification



APPENDIX E: HYDROPEDOLOGY ASSESSMENT

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Hydropedology Assessment for the Thirsti Bottling Plant

Report

Version - Final V1

01 July 2021

Thirsti

GCS Project Number: 21-0336

Client Reference: 21-0336



HYDROPEDOLOGY ASSESSMENT FOR THE THIRSTI BOTTLING PLANT

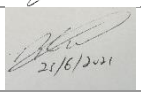
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Thirsti

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DECLARATION OF INDEPENDENCE

GCS (Pty) Ltd was appointed to conduct this specialist study and to act as the independent hydropedological specialist. GCS objectively performed the work, even if this results in views and findings that are not favourable. GCS has the expertise in conducting the specialist investigation and does not have a conflict of interest in the undertaking of this study. This report presents the findings of the investigations which include the activities set out in the scope of work.

EXECUTIVE SUMMARY

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Thirsti (Pty) Ltd to undertake a hydropedological assessment for the Thirsti Bottling Plant, situated near Normandien, KwaZulu-Natal Province (refer to Figure 1-2). The project area falls within quaternary catchment V31F of the Pongola-Mtamvuna Management Area (DWS, 2016).

Thirsti is busy undertaking their water use license application (WULA) for the bottling plant operated near Normandien, KwaZulu-Natal. The Department of Water and Sanitation (DWS) requested that a hydropedology assessment be undertaken to supplement the WULA. Moreover, the hydropedology assessment needs to evaluate the likely impact on wetlands as a result of the establishment of the facility.

The hydropedological assessment is required to evaluate hydropedological flow drivers to watercourses and wetlands, identified in the area. The hydropedological report will supplement the WULA for the site and evaluated the potential existing impacts on hydropedological flow drivers.

This report investigated the sub-soil conditions at the site and focused on soil-water transfer functions and classification of hydrological soil types (HST) which include:

Hydrological soil type	Description
Recharge	The soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.
Interflow (A/B)	The soils have a textural discontinuity which facilitates the build-up of water in the topsoil, the water that sits on the upper layer then flows laterally into the stream on the A/B horizon interface. The flow path is predominantly downslope in a lateral direction.
Interflow (Soil/Bedrock) **Or** **Interflow (A/ Bedrock)**	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.
Responsive (Shallow)	The soils are shallow, and they are over a relatively less permeable weathered rock or bedrock. They have limited storage capacity which results in the generation of overland flow after rainfall events.
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.

Recharge soils are dominant across the site. These soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.

Moving towards the higher topography areas (the headwaters of the sub-catchment delineated) exposed rock and shallow responsive (soil/bedrock) type soils occur. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction of overland runoff in areas where bedrock is exposed. vertical flow through and out of the profile into the underlying soil zones (or hard rock) is the dominant flow path.

The area associated with the Horn River flood plain (also identified as a channelled valley bottom wetland) is associated with hydrogeomorphic soil types (such as the Katspruit soil form encountered) and will primarily be responsive (saturated). These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.

Several hydropedological risks were identified for the operational phase of the project (refer to Section 4). Based on the HSTs identified and existing site activities, marginal impacts on the diversion and suppression of primary flow processes (i.e. lateral and vertical recharge and interflow) are anticipated. However, after accounting for released back into the environment (i.e. stormwater attenuation as proposed) a limited change in PES and EIS category is anticipated.

The estimated impact radius for the abstraction boreholes at the site ranges from 30 to 600m around the borehole (cone of depression). The dewatering impact is estimated to be limited to the confined fractured aquifer system, with limited drawdown expected in the weathered zone (which primarily supplied baseflow towards streams in the project area). Considering that water is drawn from a confined aquifer system, marginal to zero impacts are anticipated in term of reduced baseflow from the unconfined weathered zone towards watercourses and wetlands in the area.

It is important to note that the bottling facility is an existing operation that cannot be re-zoned. Therefore, no avoidance areas are proposed, as the PES and EIS impact is considered low-moderate and wetland buffers and stormwater attenuation measures will offset negative impacts. Recommendations to further limit the impact on soil/water processes are available in Section 5.1.

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STANDARD LIST OF ACRONYMS FOR HYDROPEDOLOGY

Acronym	Description
A	Diagnostic A horizon
A/B	Interflow soil type A/B
A/Bedrock	Interflow soil type A/Bedrock
B (B1, B2, B3 etc.)	Diagnostic B horizon
BA	Basic Assessment
BOD	Biological oxygen demand
COD	Chemical oxygen demand
CSWMP	A conceptual stormwater management plan
CVB	Channelled valley bottom wetland
DEM	Digital Elevation Model
DWS	Department of Water and Sanitation
E	Diagnostic E horizon
EIS	Ecological importance and Sensitivity
G	G Horizon/soil
GCS	GCS Water and Environment (Pty) Ltd.
GN704	General Notice 704
ha	Hectare
HOSASH	Hydrology of South African Soils and Hillslopes
HRU	Hydrological Response Unit
HST	Hydrological Soil Type
IWULA	Integrated Water Use Licence Application
m^3	Cubic Metres
MAE	Mean annual evaporation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman (runoff calculation method)
Ml	megalitre
NEMA	National Environmental Management Agency
n-Value	Manning's Roughness Coefficients
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O	Orthic Horizon/soil
PCD	Pollution Control Dam
PES	Present Ecological State
PFD	Process flow diagram
RP	Riparian zone / wetland
S	Seepage wetland
SDF	Standard design flood
SW	Surface Water
TDS	Total dissolved solids
TIN	Triangulated Irregular Network
UCVB	Unchanneled valley bottom wetland
UVB	un-channelled valley bottom
V	Vertic Horizon/soil
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012
WTW	Water Treatment Works

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Thirsti (Pty) Ltd to undertake a hydropedological assessment for the Thirsti Bottling Plant, situated near Normandien, KwaZulu-Natal Province (refer to Figure 1-2). The project area falls within quaternary catchment V31F of the Pongola-Mtamvuna Management Area (DWS, 2016).

1.1 Project background

Thirsti is busy undertaking their water use license application (WULA) for the bottling plant operated near Normandien, KwaZulu-Natal. The Department of Water and Sanitation (DWS) requested that a hydropedology assessment be undertaken to supplement the WULA. Moreover, the hydropedology assessment needs to evaluate the likely impact on wetlands as a result of the establishment of the facility.

1.2 Study approach and methodology

Soils develop over time under the influence of chemical, physical, and biological processes (refer to Figure 1-1). Soils are predominantly the result of in-situ weathering of the host rock (i.e. has characteristics associated with the parent geological occurrence/rock). Soil has an interactive relationship with hydrology (i.e. climate, rainfall duration, runoff patterns, groundwater contribution to baseflow, evaporation etc.). It is a product of water-related processes (physical and chemical) and a first-order control of the destiny of rainwater. Though hydrological processes change seasonally, soil characteristics and water transfer capabilities tend to change very slowly (i.e. may only be subjected to quick changes due to anthropogenic processes or advanced climate change patterns). The study is not seasonally bound and is a once-off evaluation of the study area (i.e. there is no need to re-assess the study area in the winter or summer months, as soil flow conditions will remain mostly unchanged).

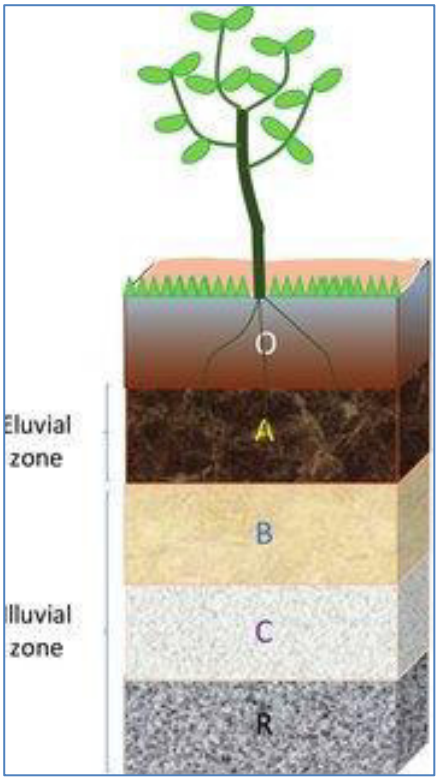


Figure 1-1: Typical soil genesis Invalid source specified.

The following general approach was followed:

1. Evaluate the soils in the study area:
    - Soils were classified per the taxonomic system for South Africa (Department of Agricultural Development, 1991) and natural and anthropogenic systems for South Africa - Soil Classification Working Group (SCWG, 2018) guidelines.
    - Soil permeability was estimated based on available data (i.e. public soil data) and according to best practice guidelines (FAO, 1980); and (DWS, 2011).

2. Derive hydropedological flow regimes and interaction areas:
    - In the determination of Hydrological Soil Types (HST), soils were divided into classes based on their expected hydrological responses (Van Tol, et al., 2013).
3. Conceptualise the water flow dynamics and derive hydropedological flow buffer areas (if required) for wetlands identified in the area:
    - Hydrological processes were perceived from traceable signatures in the soil matrix resulting from the soil's ability to transmit, store and react with water (Le Roux, et al., 2011).
4. Identify potential hydropedological impacts per standard DWS & EIA impact criteria and risk rating (refer to **Appendix A**).
5. Evaluate the potential impact on the wetlands downstream of the site, based on the existing activities and proposed activities.

The above-mentioned objectives coincide with DWS guidelines for Hydropedology Studies (Van Tol; Bouwer, J.J, 2021).

1.3 Objectives

The main objective of this study is to:

- Evaluate the hydropedological regime and determine the dominant soil flow drivers associated with the site;
- Estimate the likely impact on the hydropedological flow regime as a result of the construction of the bottling plant and the abstraction of groundwater;
- Evaluate the likely impact on the wetlands downstream of the bottling plant and abstraction activities; and
- Comply with DWS requirements for WULAs/EIAs.

1.4 Scope of work

The scope of work completed was as follows:

1. **Desktop study:**
    a. Evaluation of soils in the study area, on a desktop level, based on available Land Types of South Africa (2006) data was completed.
    b. Available public hydrological and wetland data was assessed. Moreover, specialist reports relating to the site (wetland and geohydrology reports) were also assessed.

2. **Field investigation:**

    a. A soil survey was undertaken of the project area, targeting hillslope, crest, and foot slope topographical areas – identified hillslopes from desktop evaluation.

    b. Auger boreholes were drilled to the confining layer of the material or as per the maximum depth of the auger equipment.

    c. The soils identified in the study area were classified according to Soil Classification guidelines (SCWG, 2018); and (Department of Agricultural Development, 1991), and a soil distribution map was generated.

3. **Hydropedological assessment:**

    a. Meteorological evaluation;

    b. Catchment delineation;

    c. Soil classification and characterisation; and

    d. HOSASH (Hydrology of South African Soils and Hillslopes) index.

4. **Data assessment:**

    a. All data obtained for the area was assessed in terms of suitable practices and screening protocols.

5. **Risk assessment:**

    a. The risk and impact criteria (Refer to **Appendix A**) was applied to the study area, to evaluate hydropedological risks.

    b. Natural flow losses were estimated using a water balance, spreadsheet analytical model approach.

    c. The impact of dewatering on the local wetlands were evaluated by incorporating the Cooper-Jacob equation for constant drawdown and borehole interference.

6. **Mapping and report:**

    a. Several hydrological hillslope profiles, soil distribution and hydrological soil type maps were produced.

    b. This report was compiled.

1.5 Study limitations

The following study limitations are recognised:

- The concepts presented are simplifications of the temporal variability of water transfer functions. Realistically, water transfer functions, such as throughflow and groundwater sources, may take a few months up to several years to recharge streams (Le Roux, et al., 2011) However, hydropedology hillslopes have been effectively applied to simulate runoff response mechanisms (Van Tol, et al., 2013).

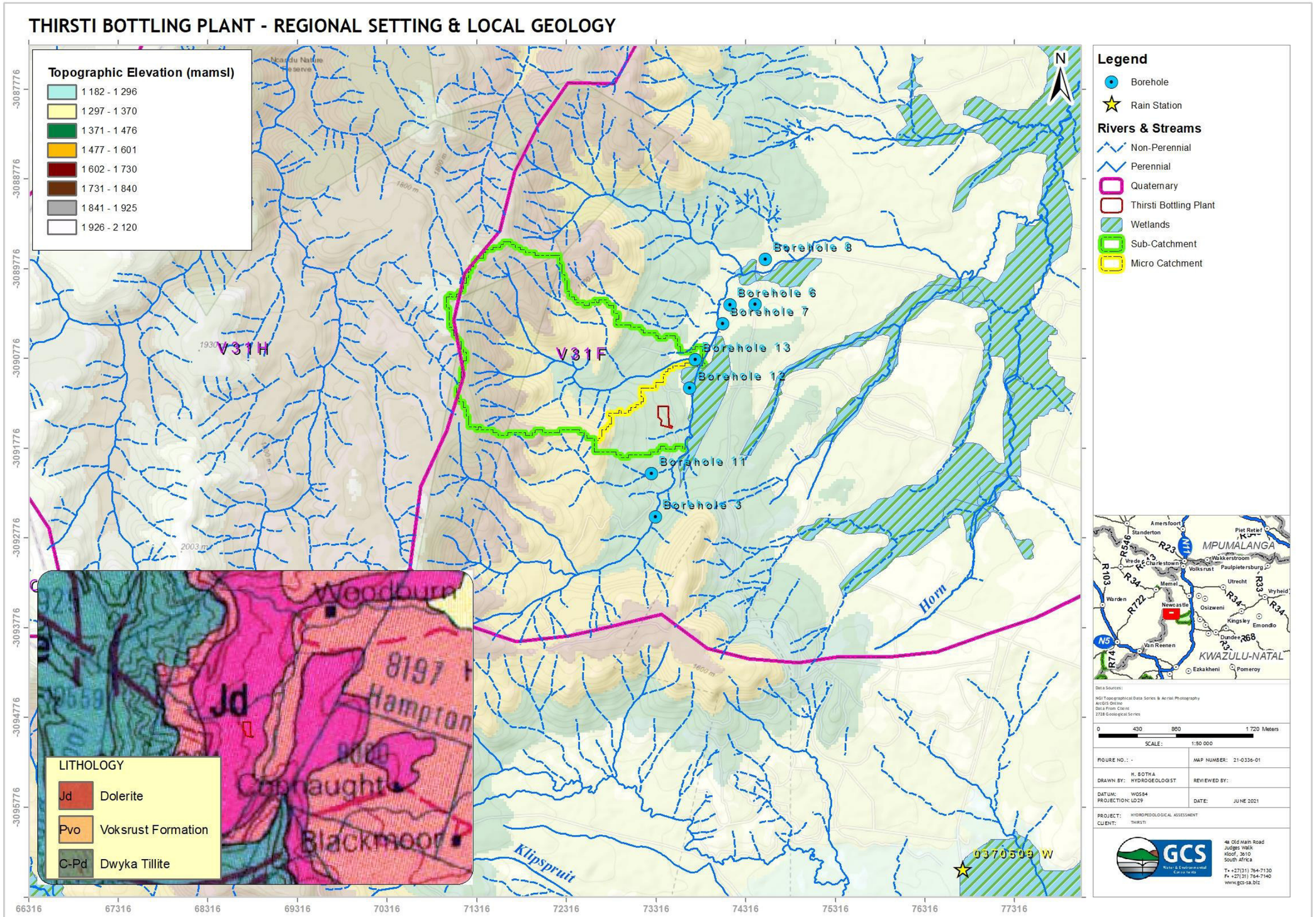


Figure 1-2: Site locality & local geology

2 SITE OVERVIEW

The following section supplies a brief overview of the regional setting, topography, climate, geological and soil occurrences in the project area. The information in this section was obtained from the public domain and reports for the project.

2.1 Regional setting and topography

The Thirsti bottling plant is situated in Quaternary Catchment V31F of the Pongola - Mtamvuna Water Management Area (WMA 4) (DWS, 2016). Elevations for the area range from 1050 metres above mean sea level (mamsl) to 1450 mamsl.

Based on a 30m digital elevation model (DTM) for the project area, the bottling plant is situated in a sub-catchment (named HRU1) generally draining towards the northeast. The sub-catchment drains towards the Horn River, which is situated approximately 290 m downstream of the plant (refer to Figure 1-2). There is a non-perennial drainage line associated with the southern portion of the sub-catchment which also confluences with the Horn River.

Indigenous planted forest plantations (woodlands), sparsely woodland grasslands, thickets, cultivated, low shrubs, bush, grass, industrial areas and residential land types dominate the sub-catchment (DEA, 2019).

2.2 Climate

Climate, amongst other factors, influences soil-water processes and peak flows. The most influential climatic parameter is rainfall. Rainfall intensity, duration, evaporative demand and runoff were considered in this study to indicate rainfall partitioning within the project area.

2.2.1 Temperature

The average yearly temperature (refer to Figure 2-1) for the Thirsti area (Normandien used as a reference site) ranges from 19 to 33 °C (high) and -3 to 15 °C (Low). The study area is situated in a sub-tropical climate area, as per the Köppen Climate Classification (Kottek, et al., 2006).

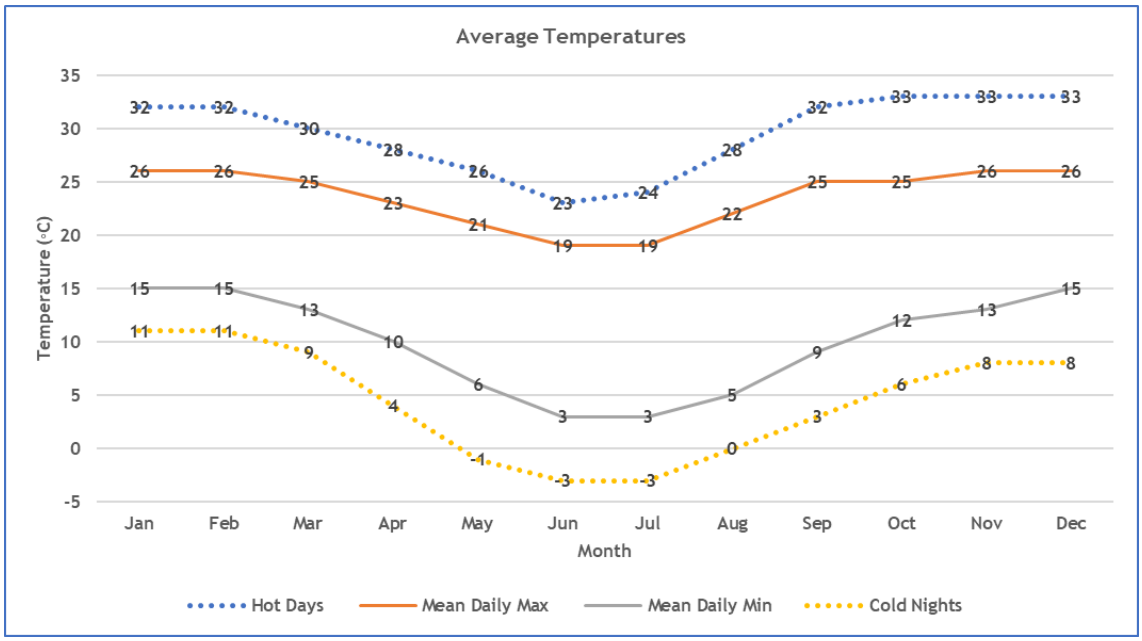


Figure 2-1: Average yearly temperatures (Meteoblue, 2021)

2.2.2 Wind speed and direction

Figure 2-2 shows the wind rose for the project area and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows from WNW, W, ENE, E, NW, ESE and NNE. Precipitation intensity during wind will likely cause intensity changes on slopes perpendicular to the wind direction, throughout the year.

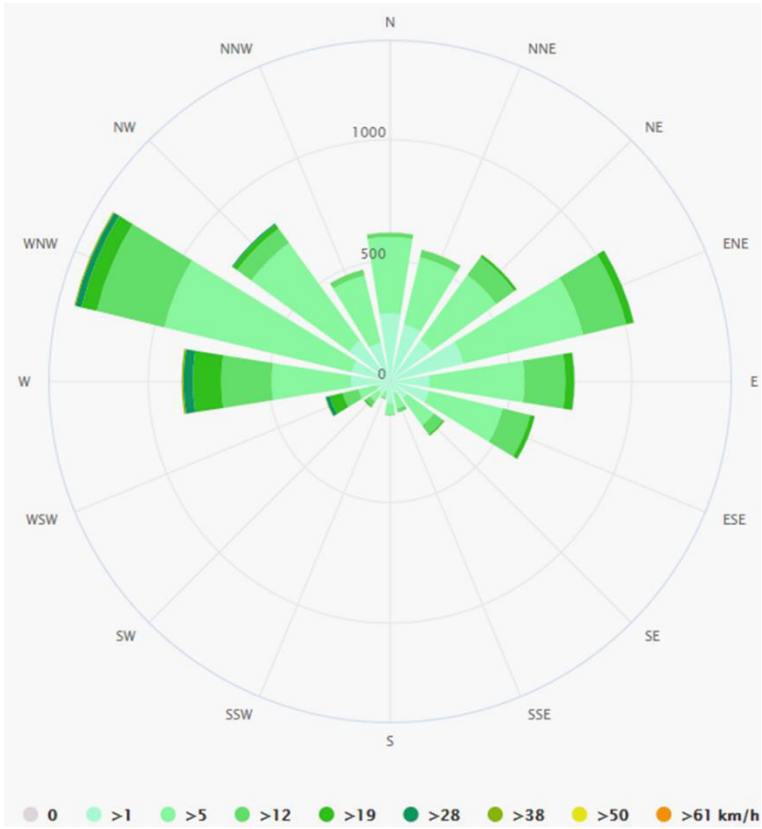


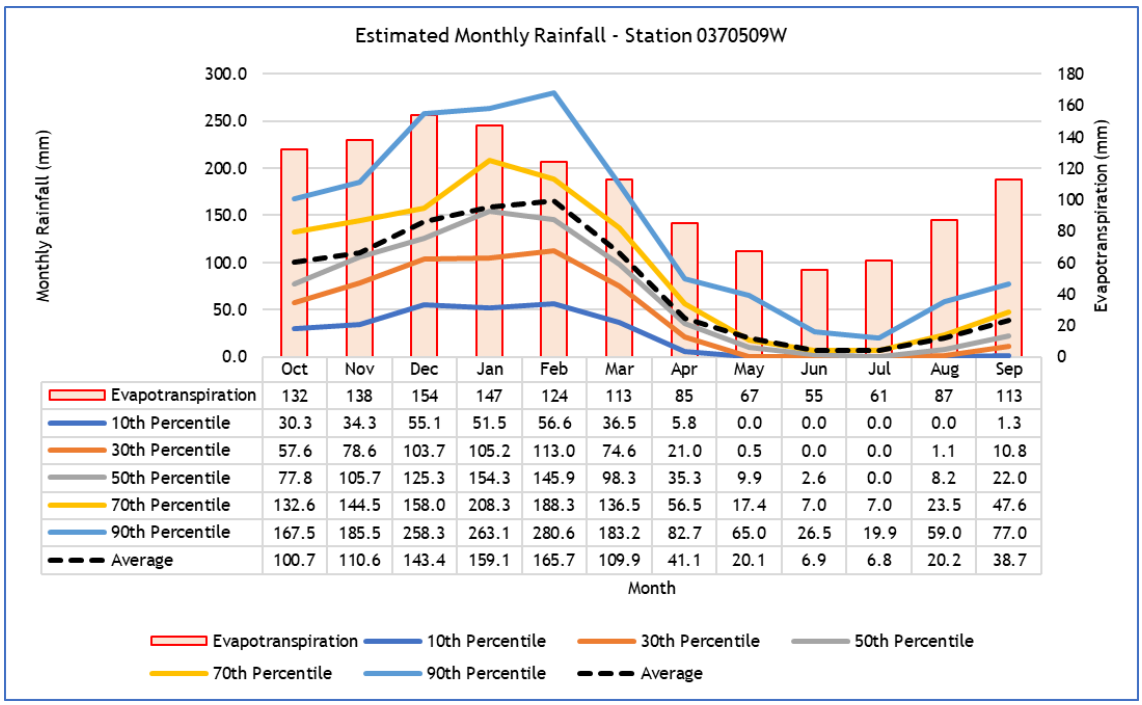
Figure 2-2: Wind rose (Meteoblue, 2021)

2.2.3 Rainfall and evaporation

The rainfall data used to calculate Mean Annual Precipitation (MAP) was obtained from rainfall station 0370509W, situated approximately 6km southeast (near Normandien). Available rainfall data suggest a MAP ranging from 566 (30th percentile) to 1668 (90th percentile) mm/yr., based on a historical record of 35 years (i.e. 1968 to 2003).

Monthly rainfall for the site is likely to be distributed as shown in Figure 2-3, below. WR2012 data suggest a MAP for catchment V31F in the order of 920 mm/yr. (WRC, 2015).

Catchment V31F falls within evaporation zone 21A, of which Mean Annual Evaporation (MAE) ranges from 1 300 to 1 450 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed as shown in Figure 2-3, below.

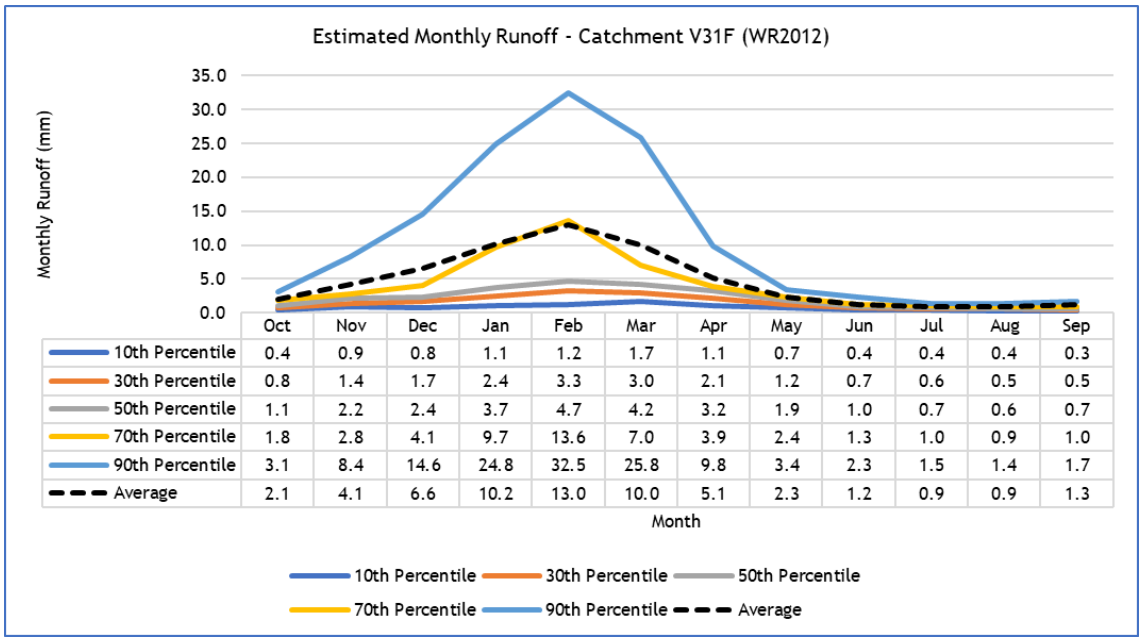


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evapotranspiration	132	138	154	147	124	113	85	67	55	61	87	113
10th Percentile	30.3	34.3	55.1	51.5	56.6	36.5	5.8	0.0	0.0	0.0	0.0	1.3
30th Percentile	57.6	78.6	103.7	105.2	113.0	74.6	21.0	0.5	0.0	0.0	1.1	10.8
50th Percentile	77.8	105.7	125.3	154.3	145.9	98.3	35.3	9.9	2.6	0.0	8.2	22.0
70th Percentile	132.6	144.5	158.0	208.3	188.3	136.5	56.5	17.4	7.0	7.0	23.5	47.6
90th Percentile	167.5	185.5	258.3	263.1	280.6	183.2	82.7	65.0	26.5	19.9	59.0	77.0
Average	100.7	110.6	143.4	159.1	165.7	109.9	41.1	20.1	6.9	6.8	20.2	38.7

Figure 2-3: Rainfall distribution and evaporation (station 0370509W)

2.2.4 Runoff

Runoff from natural (unmodified) catchments in Catchment V31F is simulated in WR2012 as being equivalent to 57.8 mm/yr over the surface area (WRC, 2015). This is equal to approximately 6% of the MAP. Monthly runoff is distributed as shown in Figure 2-4, below.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	0.4	0.9	0.8	1.1	1.2	1.7	1.1	0.7	0.4	0.4	0.4	0.3
30th Percentile	0.8	1.4	1.7	2.4	3.3	3.0	2.1	1.2	0.7	0.6	0.5	0.5
50th Percentile	1.1	2.2	2.4	3.7	4.7	4.2	3.2	1.9	1.0	0.7	0.6	0.7
70th Percentile	1.8	2.8	4.1	9.7	13.6	7.0	3.9	2.4	1.3	1.0	0.9	1.0
90th Percentile	3.1	8.4	14.6	24.8	32.5	25.8	9.8	3.4	2.3	1.5	1.4	1.7
Average	2.1	4.1	6.6	10.2	13.0	10.0	5.1	2.3	1.2	0.9	0.9	1.3

Figure 2-4: Simulated runoff for quaternary catchment V31F (WRC, 2015)

2.3 Depth to groundwater

Literature suggests an average groundwater level in the order of 16.5 mgbl (metres below ground level), for the greater quaternary catchment V31F (DWAF, 2006). Available groundwater level data for water supply boreholes at Thirsti suggest that water levels vary from 3 to 17 mbgl. Moreover, there is a good Bayesian correlation (R ≈ 95%) between the topographic elevation (collar of the borehole) and the groundwater elevations, which suggest that the groundwater table mimics the topography (refer to Figure 2-5). No shallow groundwater ingress was observed in any of the auger test holes.

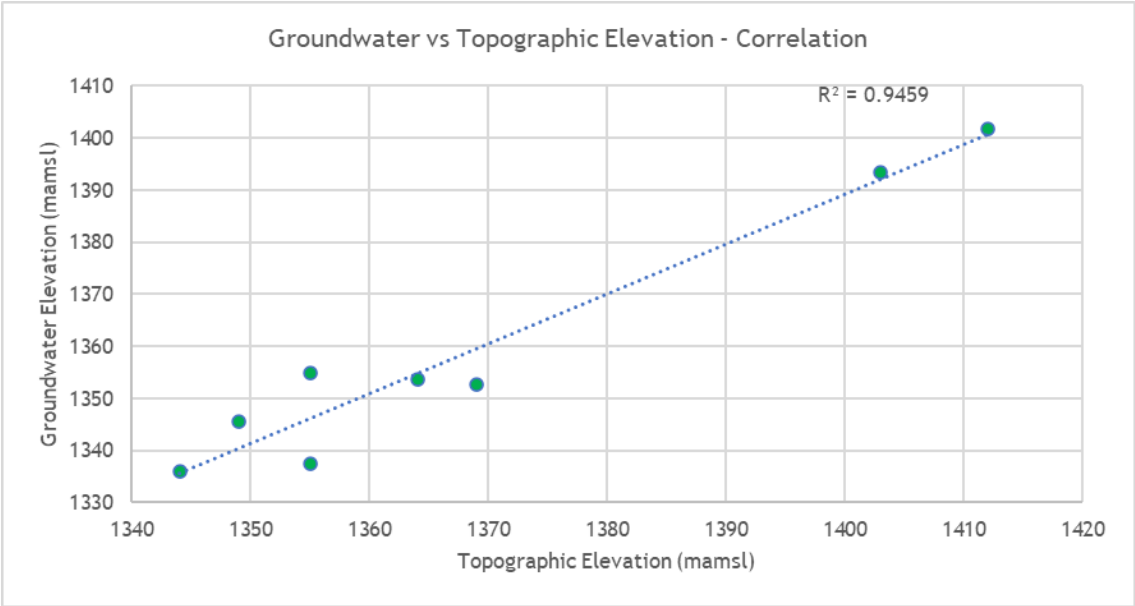


Figure 2-5: Topography vs Groundwater Elevation - Correlation

2.4 Wetland areas

Based on the NFEPA 2018 National Wetland Map 5 (Van Deventer, 2018) the flood plains associated with the Horn River is classified as a seepage (SEEP) wetland system – refer to Figure 1-2. However, based on the wetland report for Thirsti (Wet-Earth, 2019) the SEEP wetland as per the NFEPA NWMP5 was re-classified (called W1) as a channelled valley bottom wetland (CVB), and another CVB wetland is associated with the non-perennial drainage line towards the north of the Thirsti Plant (called W3). On the eastern side of the wetland associated with the Horn River, a hillslope seepage wetland (HSeep) area was also identified (called W3).

In terms of wetland hydrology, channelled valley bottom wetlands are maintained either permanently, seasonally, or temporarily via groundwater baseflow.

Baseflow (refer to Figure 2-6) is a non-process related term to signify low amplitude high-frequency flow in a river during dry or fair-weather periods. Baseflow is not a measure of the volume of groundwater discharged into a river or wetland, but it is recognised that groundwater contributes to the baseflow component of river or wetland flow.

Available literature (WRC, 2015; and DWAF, 2006) suggest groundwater contribution to baseflow ranging from 8.81 mm/yr (PITMAN MODEL) to 51.67 mm/yr (HUGHES MODEL). This relates to approximately 0.9 to 5.6% of rainfall.

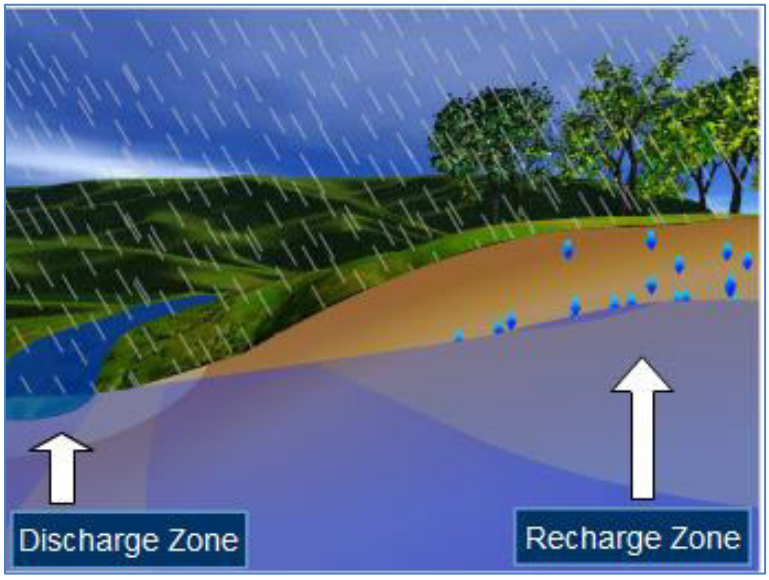


Figure 2-6: Groundwater baseflow concept (DWS, 2011)

2.5 Present ecological state (PES) and ecological importance and sensitivity (EIS)

The PES for quaternary catchment V31F is classified as Class C: Modified (SANBI, 2011), and the EIS is classified as moderate. The wetlands within proximity to the site are considered poorly protected (Van Deventer, 2018).

Wet-Earth (2019) suggest a PES of D (largely modified) and the EIS is D (marginal) for W1 to W3.

2.6 Local geology

According to the 2728 Frankfort– 1:250 000 Geological map series (DMEA, 1998) the site is predominantly underlain by a dolerite sill as well as sandstone from the Volksrust Formation of the Ecca Group of the Karoo Supergroup. Dwyka tillite occurs further upstream of the site, towards the mountain areas.

2.7 Soils and land morphology

Different soil types are encountered within shoulder, mid-slope and valley positions of the project area (referred to as soil hillslope) and are mainly due to sub-surface geology, products of weathering, degree of saturation, soil texture and slope position (refer to Figure 2-7). The terrain is classified as D2 and D3 (steep to moderate sloping with soil depts range 300mm to 600mm).

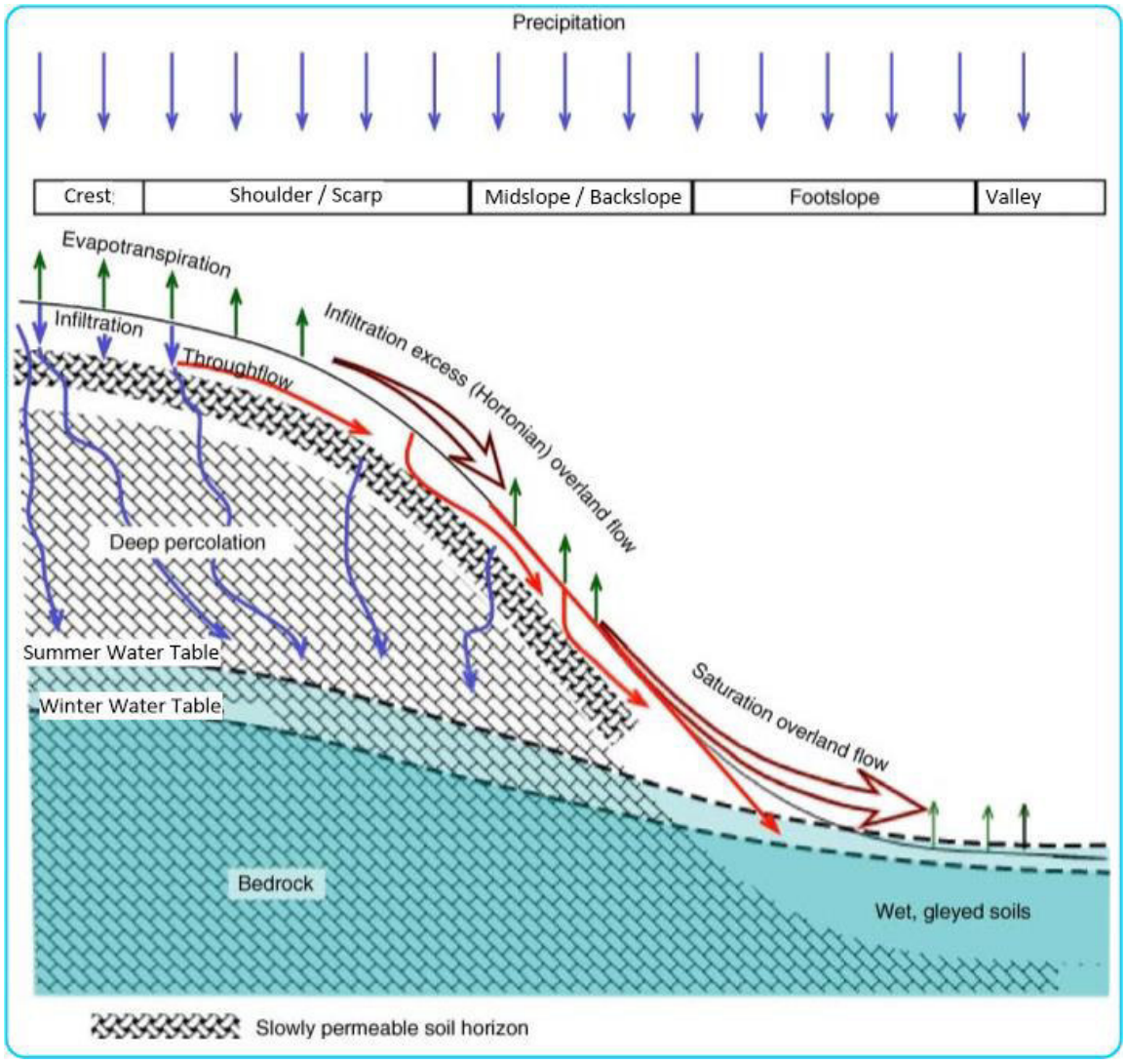


Figure 2-7: Land morphology concept (Almond, 2016)

According to the Land types of South Africa databases (ARC, 2006), the soils in the project area fall within:

- Land type Ad3 [Freely drained, red and yellow, dystrophic/mesotrophic, apedal soils comprise >40% of the land type (red soils comprise <10%)] – refer to Figure 2-8.
    - The dominant soil moisture regime in these soils is one of free drainage and leaching from the profiles. In the more arid areas, the leaching of salts is hindered by low precipitation (and subsequent evaporation of water from the profile) rather than poor drainage.
    - The consequence is that these soils invariably don't exhibit mottling or redox morphology that would result from perched and/or fluctuating water tables. Wetland soils do occur in these landscapes but are generally limited to the immediate watercourse areas in depressions (Der Waals, 2019).

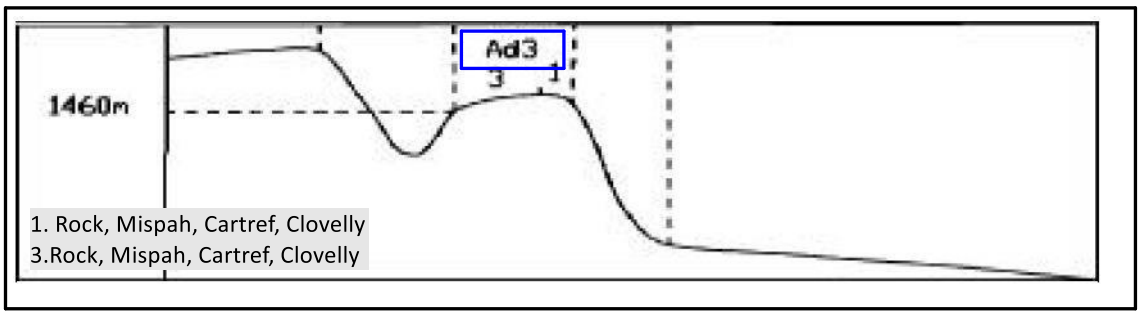


Figure 2-8: Ad3

- Land type Fa28 [Shallow soils predominate; little or no lime in landscape] – refer to Figure 2-9.
    - The dominant soil moisture regime in these soils is one of free drainage and recharge of lower fractured rock layers. The degree of recharge depends on the extent and connectedness of fracturing in the underlying geology.
    - Due to the dominance of rapid percolation through the fractured rock material signs of redox morphology are generally lacking except in cases where climate and the flow regime conspire to yield prolonged periods of wetness and saturation. Under such conditions, the presence of redox morphology is accommodated at the family level in the Glenrosa form.

- Therefore, these landscapes do not have a clear expression of wetland conditions as a rule but specific cases may prove otherwise during detailed investigations. However, due to the "water capturing" function that rocky and shallow soils play they invariably contribute to the expression of wetness and wetlands further down the slope. In this regard in arid landscapes, the accumulation of lime in lower-lying landscape positions may indicate the preferential flow paths and hydrology even though these signatures do not qualify as wetlands per se (Der Waals, 2019).

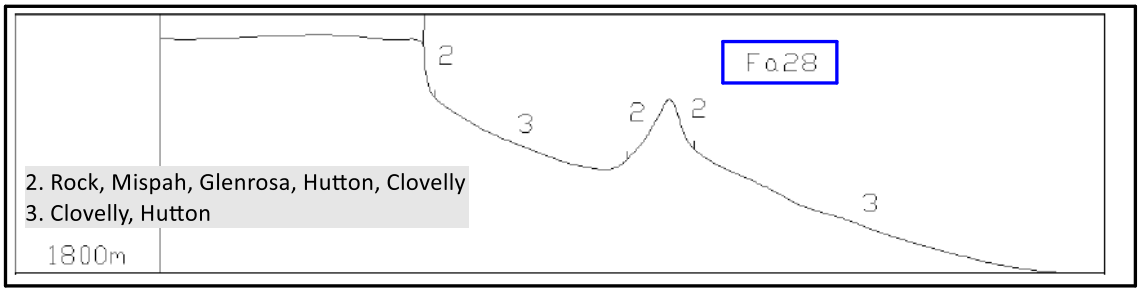


Figure 2-9: Fa28

- Land type AC5 [freely drained, red and yellow, dystrophic/mesotrophic, apedal soils comprise >40% of the land type (red and yellow soils each >10%)] – refer to Figure 2-10.

  - The dominant soil moisture regime in these soils is one of free drainage and leaching from the profiles. In the more arid areas, the leaching of salts is hindered by low precipitation (and subsequent evaporation of water from the profile) rather than poor drainage. The consequence is that these soils invariably don't exhibit mottling or redox morphology that would result from perched and/or fluctuating water tables. Wetland soils do occur in these landscapes but are generally limited to the immediate watercourse areas in depressions (Der Waals, 2019).

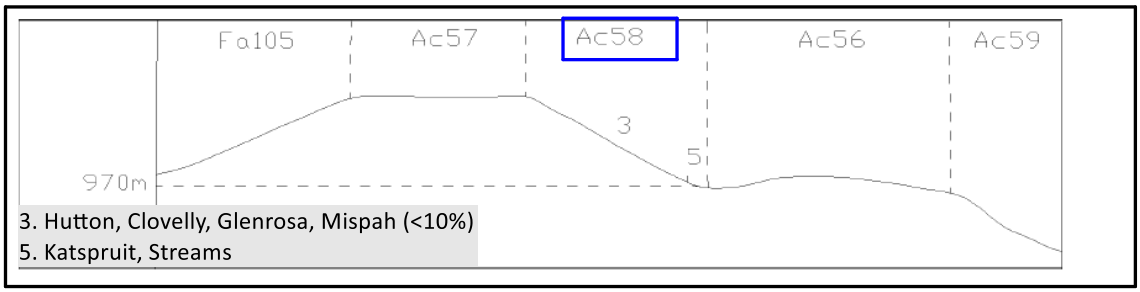


Figure 2-10: Ac5

Available desktop data suggest that rock and shallow soils (Ad3 types) are associated with the hilltops and headwaters of the sub-catchments associated with the Thirsti development site. Freely drained and shallow soils (Fa28 types) occur at the bottling plant and changes to leached / free drainage soils towards the Horn River and the identified wetlands in the study area. The soils range from medium-grained sand to fine-grained clay loam, and average clay content within the A and B horizons range from 10 to 40% for freely drained soils to 15% for shallow rocky soils.

2.7.1 Site-specific

A soil survey took place on 15 May 2021. Soil profile logs are available in **Appendix B**. The following is noted in terms of sub-surface soil conditions:

- Ten (10) hand auger holes were conducted, targeting the dominant soil hillslope identified in the desktop phase. Moreover, a visual survey was undertaken in the study area targeting erosion gullies, rock outcrops where soil formation is visible and stream eroded banks. The positions of the auger holes and the soils identified are shown in Figure 2-11.
- Clovelly and Hutton soils were encountered in 9 test auger holes, upstream, downstream and at the bottling plant. The soil profile is characterised by an oxidised or less oxidised unstructured B horizon, underlain by saprolite / unspecified material with signs of wetness.
- Towards the Horn River flood plain (also identified as wetland units), darker hydrotropic soils were observed associated with the Katspruit soil form. These soil types exhibited gleying with abundant clay (G horizon) which suggest responsive hydrological soil function. These soils tend to be saturated for long periods. The Katspruit soil form was encountered in 1 auger holes and was observed along the erosion gullies associated with the Horn River.

2.7.2 Soil distribution

Figure 2-13 provides an estimate of the soil distribution for the study area. Soil occurrences were derived from available field data and extrapolated to areas based on available land type data and Google Earth Imagery (i.e. similar vegetation types relative to land morphology will likely have similar soils as investigated areas).

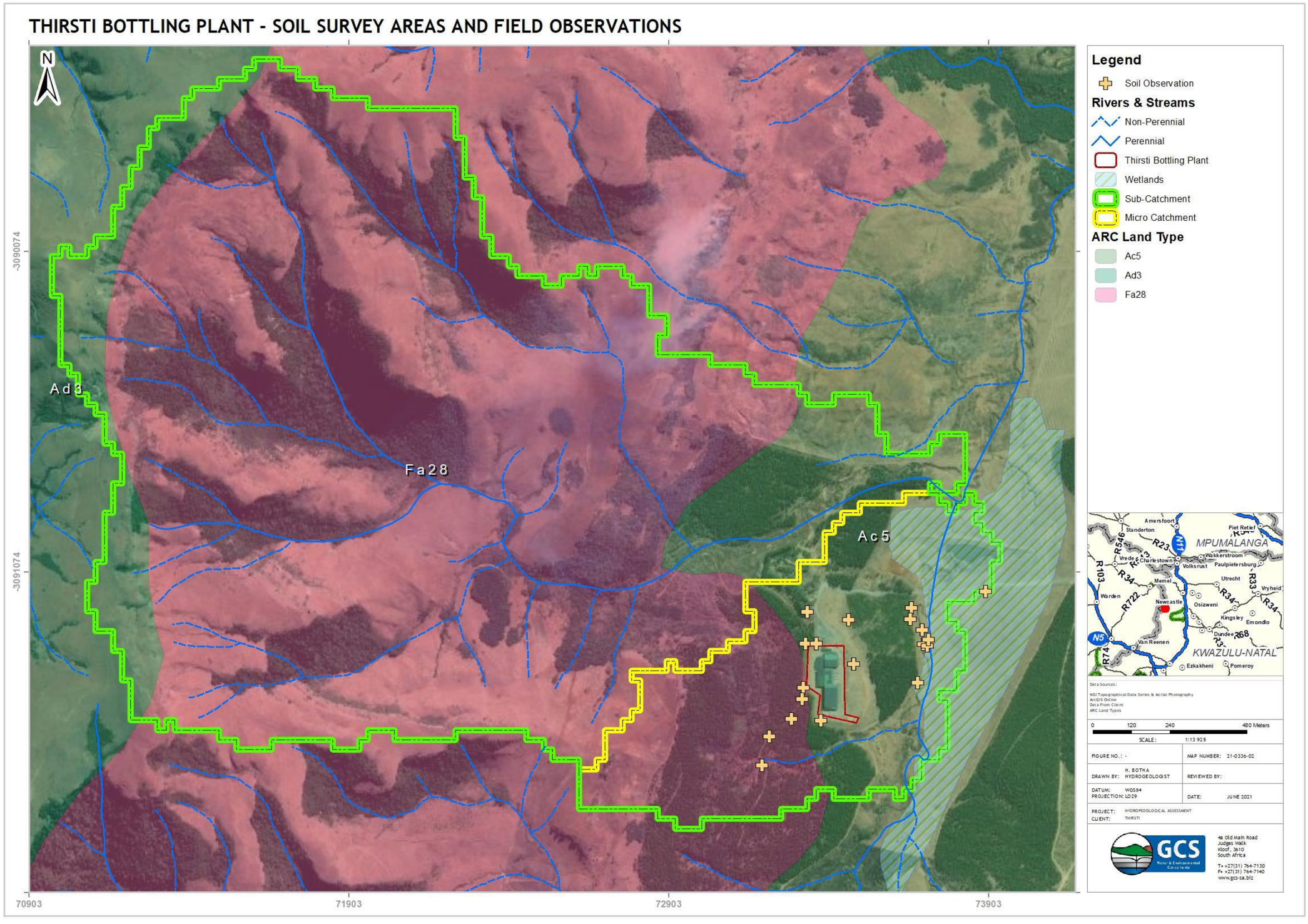


Figure 2-11: Soil survey areas

PROJECT:
THIRSTI™

DRAWING TITLE:
Site Observations

Drawn By:	H. Botha (MSc, PriSciNat)
Project No.	21-0336-PED01
Date	22/06/2021
Projection	WGS84 - LO29
Scale	As indicated
Drawing No.	Report Figure

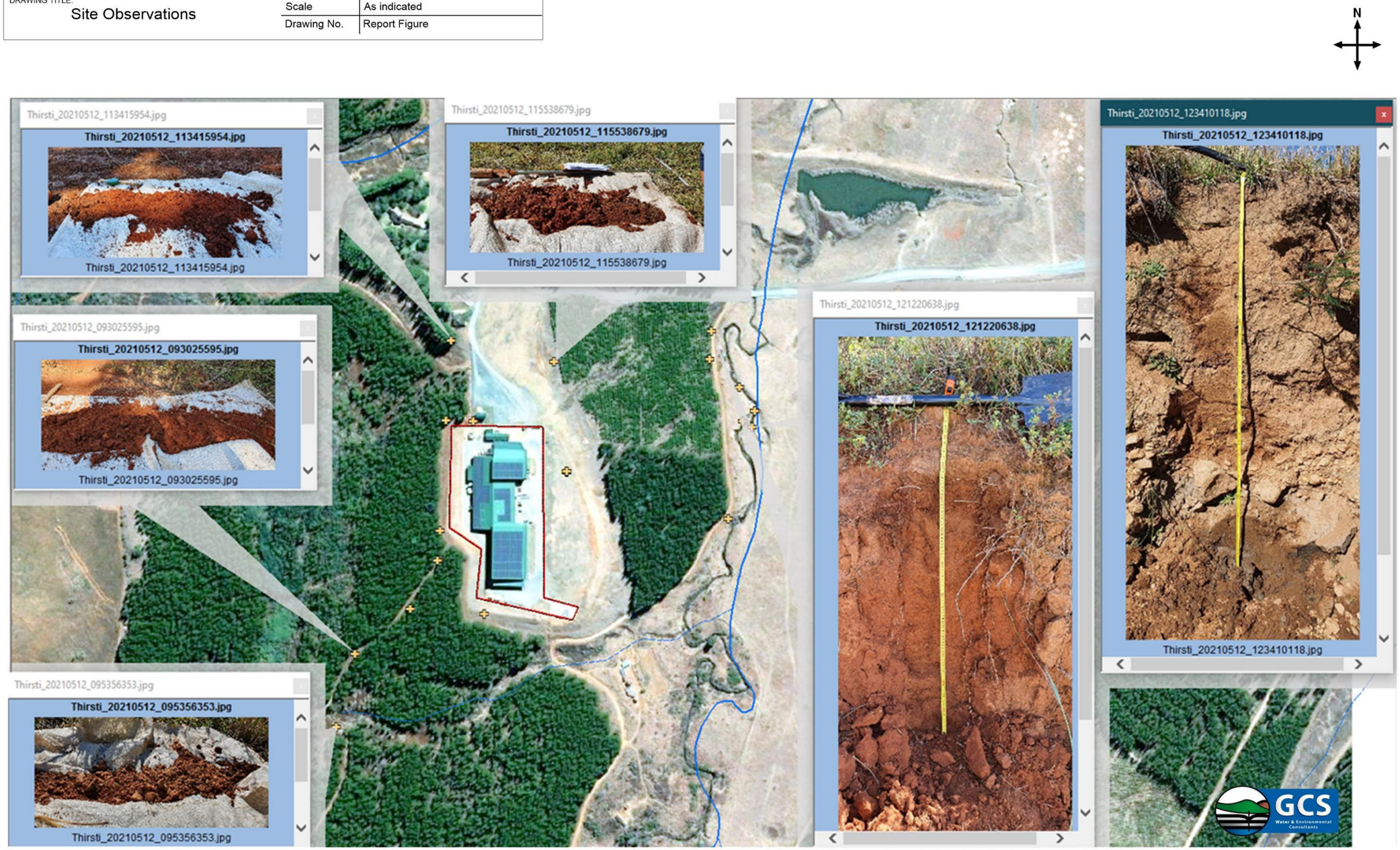


Figure 2-12: Field observations

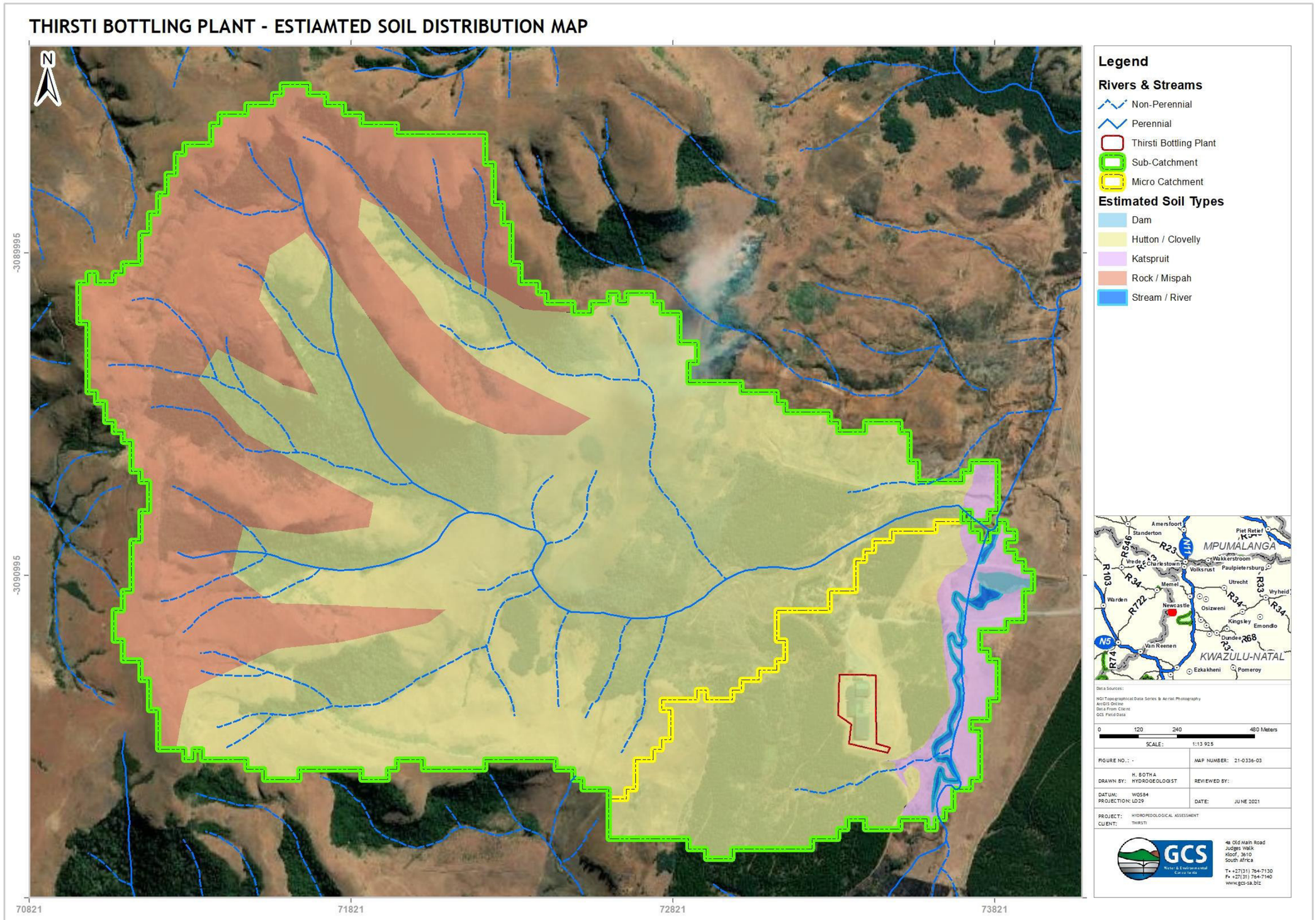


Figure 2-13: Estimated soil distribution map

3 HYDROPEDOLOGICAL ASSESSMENT

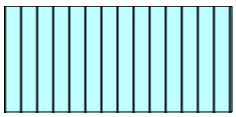
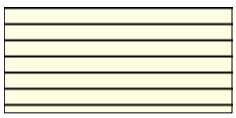
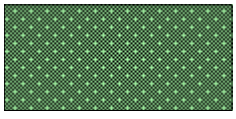
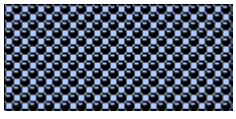
Soil genesis is influenced by physical and chemical water-related processes and soils are, therefore, the first-order control of hydrological processes. The water transfer function of soils varies with several factors including soil properties, topography, and climate.

Characteristic soil properties make it possible to conceptualise hillslope hydrological responses within catchments. The approach followed in this study includes the classification of hillslopes for the site, the development of a soil map (refer to Section 2.7), which were used to determine the HST. Finally, a conceptualization of hydrological processes that occur on the various hillslopes, based on HST was undertaken.

3.1 Hydrological Soil Types (HST)

In the determination of Hydrological Soil Types (HST), soils were divided into classes based on their expected hydrological responses (Van Tol, et al., 2013). Hydrological processes were perceived from traceable signatures in the soil matrix resulting from the soil's ability to transmit, store and react with water (Le Roux, et al., 2011). The HST descriptions and representative symbols are presented in Table 3-1, below. HSTs identified in the project area is shown in Figure 3-1.

Table 3-1: Hydrological soil types

Hydrological soil type	Description	Symbol
Recharge	The soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.	
Interflow (A/B)	The soils have a textural discontinuity which facilitates the build-up of water in the topsoil, the water that sits on the upper layer then flows laterally into the stream on the A/B horizon interface. The flow path is predominantly downslope in a lateral direction.	
Interflow (Soil/Bedrock) Or Interflow (A/ Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.	
Responsive (Shallow)	The soils are shallow, and they are over a relatively less permeable weathered rock or bedrock. They have limited storage capacity which results in the generation of overland flow after rainfall events.	
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.	

*Adapted from (Van Tol, et al., 2013)

3.2 Hillslopes and hillslope hydrology

Hillslopes and preferential soil flow paths were evaluated based on a 30m ALOS digital terrain model (DTM) (JAXA, 2021), and can be seen in Figure 3-1. The hillslopes generally feed into responsive or interflow soil types or streams/rivers. The Thirsti bottling plant is situated in a micro-catchment draining towards the northeast but is situated in a large catchment predominantly feeding into the wetland system associated with the Horn River. Based on the soil data for the project area, one (1) hillslope (from crest to valley) is sufficient to describe the hillslope hydrological processes. However, a 2nd hillslope is presented for the micro catchment associated with the bottling plant, to illustrate hydropedological processes.

3.3 Conceptual hydrological flow processes

The hydrological processes associated with the land types and associated soils in the project area are discussed concerning the numbered arrows in Figure 3-2, below:

1. Soils associated with hilltops and crests (headwaters of the catchment) in the study area are highly likely to act as shallow responsive soils (shallow A horizon underlain by intact and relatively impermeable bedrock). These soils would act as interflow soil/bedrock soil types.
    a. In interflow (A/B) soils the flow path is predominantly downslope in a lateral direction. If interflow (A/B) soils occur upstream of responsive (shallow or wet) HSTs, overland flow at the soil interface may occur (this will depend on the soil characteristics and clay content).
    b. Minor deep secondary flow towards the saturated zone is expected.
2. The portion of the hillslope which characterises the midslope to footslope position is characterised by freely drained deep recharge soils of the Clovelly and Hutton soil groups.
    a. Shallow vertical and lateral recharge to sub-soils and lateral discharge towards responsive and interflow soil types are expected.
    b. Deep percolation into the sub-soils / hard rock and subsequent aquifers towards the lower topography areas is expected. This deep percolation water contributes to surface water streams as groundwater baseflow.
3. The area associated with the Horn River flood plain (also identified as a channelled valley bottom wetland) is associated with hydrogeomorphic soil types (such as the Katspruit soil form encountered) and will primarily be responsive (saturated).
    a. In responsive soils, the build-up of water is expected in the B and upper A horizons after rain and overland discharge and minor lateral seepage are expected (due to saturation excess). Secondary vertical seepage to deeper soil zones from the saturated B horizon is expected.

b. The release of water from the gleyic horizons will be somewhat slow, and can still contribute to vertical and lateral water movement during dry periods.

4. Due to the likely presence of interconnected fractures within the bedrock, deep lateral movement of water is anticipated from high to low topography areas. However, this will depend on the degree of fracturing and interconnectivity between the vadose and saturated zones.

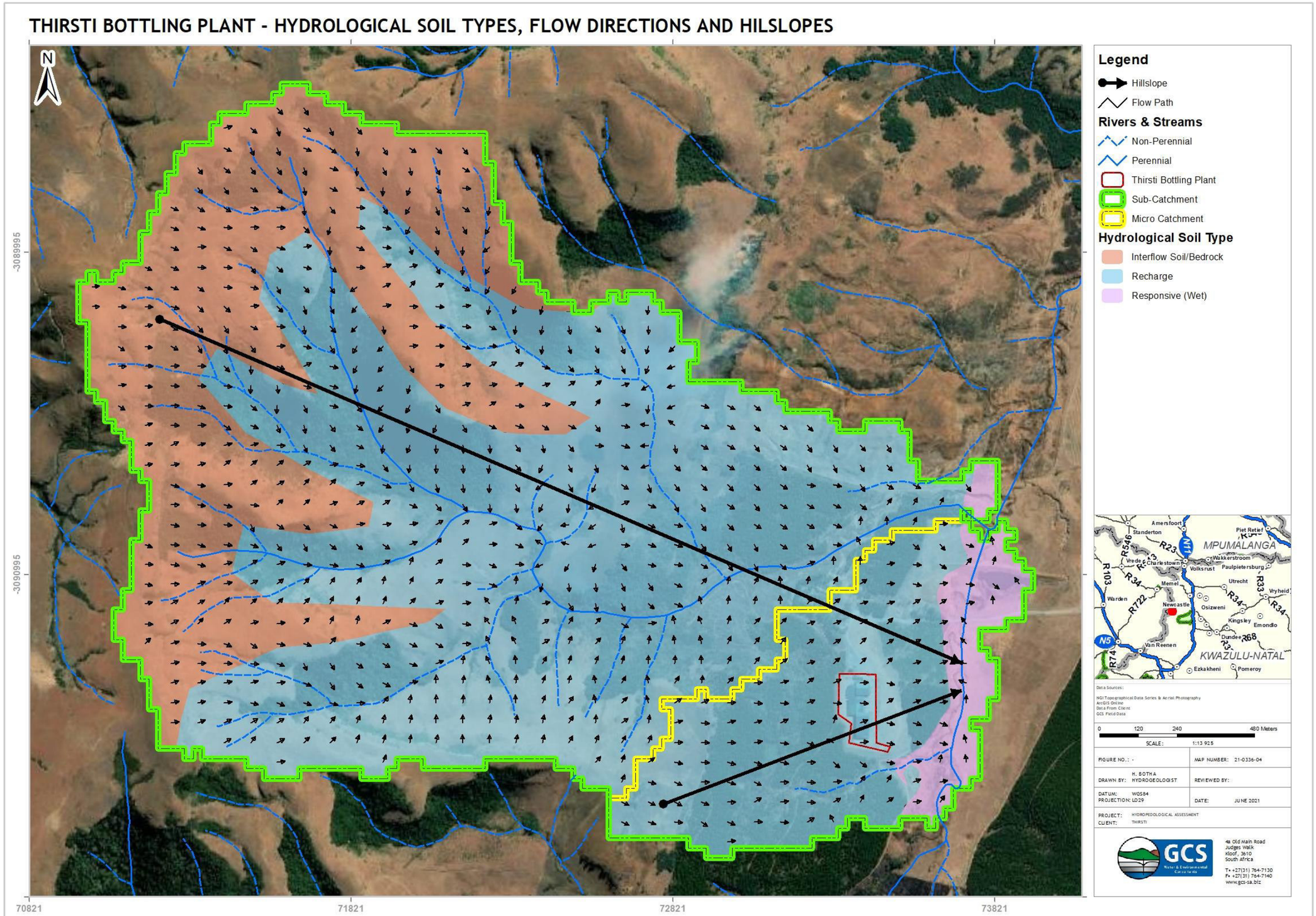


Figure 3-1: Est. flow directions and hydrological soil types

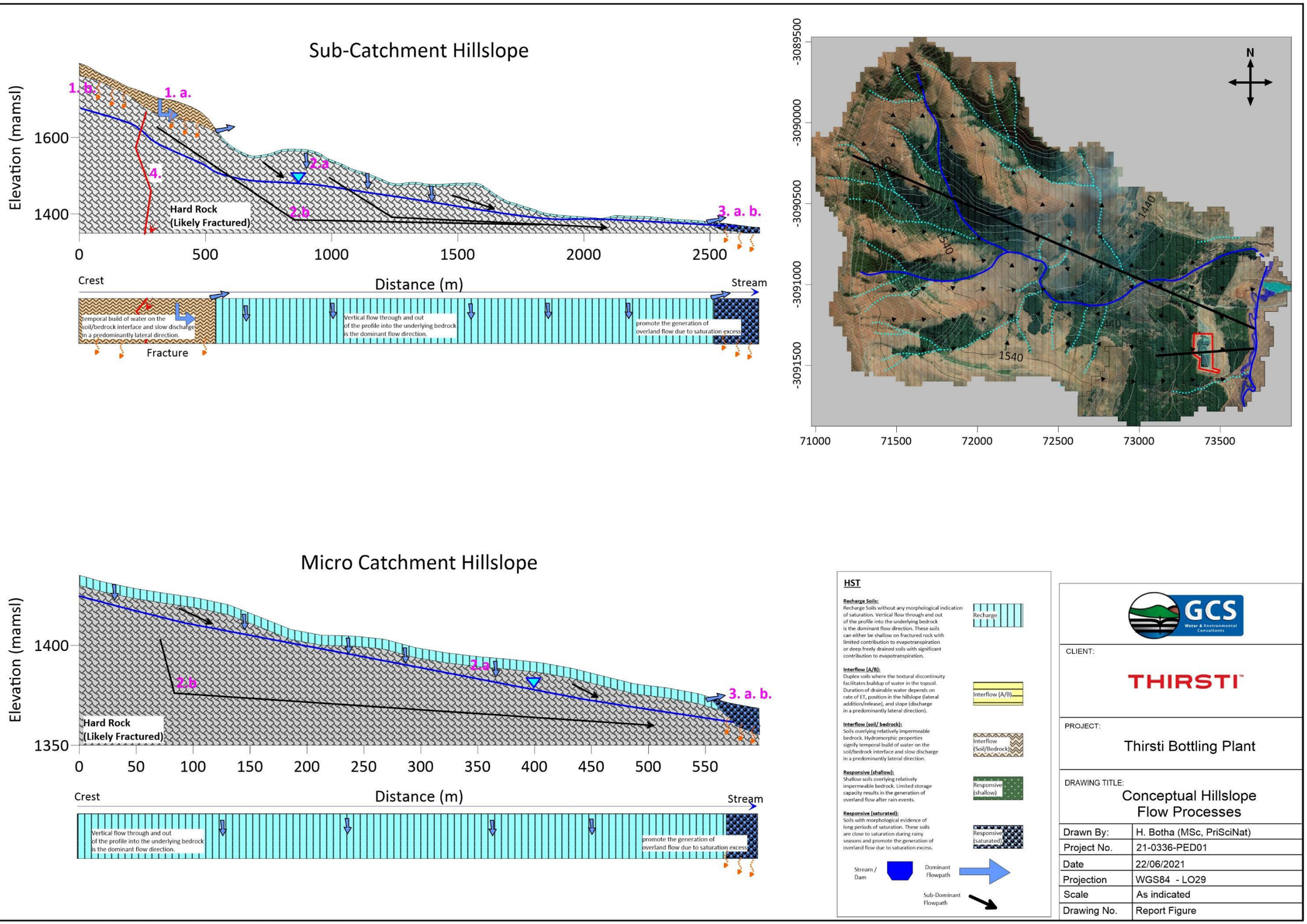


Figure 3-2: Hillslope hydropedological behaviours and flow zones

4 IMPACT AND RISK ASSESSMENT

The anticipated hydropedological risks and impacts with regards to the operational setting were assessed (i.e. because the bottling plant is already operational and was constructed by cutting and filling the landscape).

The source-pathway-receiver (SPR) model (DWAF, 2008) was used to evaluate potential pollution sources and primary receptors within the study area (suppression of soil flow processes to the underlying soils, watercourse and groundwater table). The risk assessment methodology and ratings applied is available in **Appendix A**.

The potential impacts identified and environmental significance for the **operational phase** of the site is presented in Table 4-2. It is anticipated that the closure phase risks/impacts will be like operational risks – with the possibility of the hydropedology drivers returning the pre-development conditions if all infrastructure is removed.

Based on available site activities, the following will likely contribute to impacts of hydropedological flow drivers, soil quality and may compromise surface water quality in the nearby watercourse:

- Reduced rainfall infiltration associated with the factory laydown area, and likely future expansion areas. Reduced rainfall infiltration for the factory footprint area may have already impacted some of the vertical and horizontal soil interflows.
- Compacting the topsoils associated with haul roads will likely reduce rainfall infiltration and increase runoff. Hence, during the storm event, there may be a risk for soil erosion and degradation of the shallow vertical and lateral soil flow processes.
- Placing excavated soils on top of existing soil formations (i.e. during any factory expansion or future developments associated with the site) may impact the hydropedological flow drivers feeding into the downstream wetland areas.
- It was observed that there are several pine tree plantations associated with the site and project area. Though not directly relating to the Thirsti Bottling Plant, the plantations may be having an impact on recharge through the soil profiles, as well as suppressing lateral flow out of the soil profiles (i.e. as the trees will take up much of the soil water). The impact of forestation on unsaturated water flow is well studied in South Africa. It is anticipated that the impact of forestation at the site may be several orders greater than that of the bottling facility.
- Soil quality could be compromised if leakages from waste storage and handling facilities at the facility occur. Moreover, oil & fuel spills from vehicles can cause soil contamination.

The potential impact on hydropedological flow drivers and risk associated with the activities mentioned above were further investigated in the sub-sections below.

4.1 Risk of wetland dewatering, as a result of groundwater abstraction activities

Thirsti abstracts groundwater from 8 boreholes spread across the project area (not within the delineated sub-catchment) – refer to Table 4-1. From available data, the following is noted:

- Groundwater is obtained from the confined fractured aquifer network, as all boreholes target the deep aquifer zone and dolerite contacts (GCS, 2019); and
- The confined aquifer system is under pressure;
- Borehole depths range from 50 to 100 metres below ground level (mbgl); and
- Groundwater levels range from 2 to 16 mbgl and mimic the topography.

4.2 Impact radius

The potential radius of influence of pumping for each borehole was determined by applying the Cooper-Jacob equation (1):

$$\boldsymbol{Radius\ of\ Influence}\ (r_e) = \mathbf{1.5}\sqrt{\frac{Tt}{s}} \qquad \textbf{Equation 1}$$

Where:

T = aquifer transmissivity (m^2/day)

t = exploitation time / pumping time (days); and

S = aquifer storativity.

The radius of influence based on available geohydrological data (GCS, 2019) is summarised in Table 4-1. The estimated impact radius for the boreholes ranges from 30 to 600m around the borehole (cone of depression). The dewatering impact is estimated to be limited to the confined fractured aquifer system, with limited drawdown expected in the weathered zone (which primarily supplied baseflow towards streams in the project area).

Considering that water is drawn from a confined aquifer system, marginal to zero impacts are anticipated in term of reduced baseflow from the unconfined weathered zone towards watercourses and wetlands in the area.

Table 4-1: Summary of the radius of influence for each borehole

Parameter	T	t	s	*Radius of Influence*	*Radius impact zone*	*Estimated drawdown within the influence area*
Units	m^2/day	days		*m*		
Borehole 3	1	121 (based on 8 hours pumping per day)	0.19	*37.9*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 4	31	121 (based on 8 hours pumping per day)	0.5	*129.9*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 6	18.5	121 (based on 8 hours pumping per day)	0.8	*79.3*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 7	18.5	121 (based on 8 hours pumping per day)	0.5	*100.4*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 8	2.4	121 (based on 8 hours pumping per day)	0.01	*255.6*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 11	7	121 (based on 8 hours pumping per day)	0.6	*56.4*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 12	12	121 (based on 8 hours pumping per day)	0.02	*404.2*	*Fractured Aquifer*	*1 to 0.001 m*
Borehole 13	15	121 (based on 8 hours pumping per day)	0.01	*639.0*	*Fractured Aquifer*	*1 to 0.001 m*

Table 4-2: Estimated hydropedological risk (operational phase)

COMPONENT BEING IMPACTED ON	ACTIVITY THAT MAY CAUSE THE IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
	Impermeable areas (bottling plant footprint area) may decrease rainfall infiltration into recharge soils, and hence reduce interflow (A/B) and recharge (Re) process to downstream watercourses and wetland areas. Compaction along haul roads may further reduce rainfall infiltration, and promote soil erosion.	The net result of the operation of the bottling facility.	2	5	1	3	24	-	L	Ensure stormwater is conveyed to the natural environment. The aim is to capture water during rain events and to slowly release water to the environment. Ensure haul roads are constructed with stormwater drains and erosion control systems (i.e. road gravel instead of exposed soils) to minimize rainfall-runoff and erosion.	2	5	1	2	16	-	Marginal
<u>Soil interflow processes (vadose zone processes):</u> • Alteration to natural hydropedological flow paths (i.e. interception of rainfall and increased runoff). • Impacts on the lateral and vertical hydropedological processes supporting the watercourses. • Soil erosion.	Improve wetland functionality by diverting any stormwater to the nearest drainage line, to introduce the water back into the environment. Long term soil diagenetic impacts may be associated with the activity, even though this may improve the wetland functionality. This may cause new soil flow processes. However, the outcome is deemed favourable to maintain the PES of wetland systems.	The net result of the operation of the bottling facility.	2	5	1	2	16	+	L	Ensure a wetland rehabilitation plan is implemented if severe stormwater discharge takes place.	2	5	1	5	40	+	M
	Temporary soil stockpiles or construction pads may be prone to cause erosion and sedimentation. It may take some time for these areas to stabilise (i.e. to establish new soil flow dynamics).	The net result of the operation of the bottling facility.	1	2	2	4	20	-	L	Retain as much indigenous vegetation as possible if the bottling plant is expanded. Re-vegetate eroded areas. Ensure erosion control measures are implemented at the site. Ensure clean stormwater is conveyed to the natural environment.	1	2	1	4	16	-	Marginal
	Reduced vertical recharge, and interflow into and out of areas associated with pine tree plantations.	The net result of existing land use.	2	5	1	4	32	-	M	No mitigation is possible. Reducing plantation areas is the only way to reduce impact. However, may not be economically feasible for the landowner.							

COMPONENT BEING IMPACTED ON	ACTIVITY THAT MAY CAUSE THE IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Soil pollution/impacts on soil quality	Oil or fuel leakages from vehicles and machines at the site. Prolonged pollution may impact soil quality, and lateral flow to nearby watercourses may occur (under severe pollution circumstances)	Mechanised machinery & vehicles parked at the site	2	1	1	5	20	-	L	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Have hydrocarbon spill kits on site.	0	1	1	2	4	-	Marginal
Shallow groundwater occurrences and interflow between the vadose zone and weathered aquifer system	In areas where shallow groundwater / perched groundwater occurs (specifically near wetland areas and river systems), dewatering activities may impact natural soil-flow processes. However, available geohydrological reports (Thirsti Bottling Plant Water Supply Investigation, GCS, 2019) suggest that groundwater is drawn from a confined and fractured aquifer network. Hence, marginal impacts on hydropedological flow drivers are expected.	Pumping from boreholes	2	2	1	4	20	-	Marginal	No mitigation required.							

4.3 Flow driver impact categories

Table 4-3 summarises the criteria used for the hydropedological flow driver impact assessment.

The flow driver impact assessment aims to characterise the likely impacts post-development (i.e. what is the likely impacts of land development/dewatering/mining on the hydropedological flow drivers sustaining a wetland or stream after the development has taken place).

Table 4-3: Impact categories for describing the impact on the wetlands and associated hydropedological drivers

Severity	Flow Driver Reduction	Change Class	Description
No Impact	0 – 2.5 %	No change	The hydropedological process is predicted to be unmodified and the functionality of the wetland will remain unchanged
Low	2.5 – 5 %	No Significant change	A small effect on the hydropedological process is predicted, however, the functionality of the wetland remains unchanged and no change in resource class is expected.
Low to Moderate	5 – 10 %	Limited change with a change in the PES category possible	A slight change in hydropedological processes is predicted and a small change in the wetland may have taken place but is changed to the (present ecological state) PES, EIS (ecological importance and sensitivity) or wetland functionality and eco service provision is limited with no more than one PES class predicted.
Moderate	10 – 15 %	A significant change with a change in PES Category definite and possibly a change of more than one category	A moderate change in the hydropedological processes is predicted to occur, the change in PES may exceed one category but no change in EIS takes place. No loss of important eco-services is predicted to occur
High	15 – 22.5 %	A very significant change with a change in PES of more than two categories	Modifications have reached a very significant level and the hydropedological processes are predicted to be largely modified with a large change in the PES, EIS of the wetland feature as well as a significant loss in eco service provision.
Very High	22.5 -60%	Serious to Critical change with a change in PES of more than three categories or a permanent complete loss of wetland resource	Modifications have reached a serious level and the hydropedological processes have been seriously modified with an almost complete loss of wetland integrity, functionality, and service provision.

4.4 Flow driver loss calculation/impact estimation

A water balance approach was adopted to estimate the potential impacts on the flow drivers. The equation used was as follows:

$$\text{Flow Loss \%} = \frac{FN\ (\text{m}^3/\text{yr.})}{\text{WT}\ (\text{m}^3/\text{yr.})} \text{ x } 100 \text{ (convert to \%)} \qquad \text{Equation 1}$$

Where:

- FN = Sum of Total Negative flow driver impacts in a given sub-catchment.
- WT = Total water in the system.

And:

$$FN = RRI + GBR + AII + NRF \qquad \text{Equation 2}$$

- RRI = Est. direct rainfall runoff intercepted by the development ($m^3/yr.$).
- GBR = Est. reduced groundwater contribution to flow drivers / GW dewatering ($m^3/yr.$).
- AII = Est. aquifer and soil interflow intercepted by the development/activity ($m^3/yr.$); and
- NRF = Est. surface runoff intercepted which would naturally flow from upper catchments to the downstream environment ($m^3/yr.$) – estimated at 30% of the MAP.

Adding positive water releases to the flow driver system (i.e. diverting rainwater to the environment via stormwater systems) may offset the negative. The equation used, was as follows:

$$\text{Net Flow loss impact (\%)} = [\textbf{ΣTotal Negative} \text{ flow driver impacts } (\text{m}^3/\text{yr.}) - \textbf{Positive Adjustments } (\text{m}^3/\text{yr.})] \text{ / Total water in the system } (\text{m}^3/\text{yr.}) \text{ x } 100 \text{ (convert to \%)} \qquad \text{Equation 3}$$

Where:

Sum of Positive Adjustments ($m^3/yr.$) are:

- Est. positive flow releases previously impacted ($m^3/yr.$); and
- Est. new positive flow releases not impacted on ($m^3/yr.$).

4.4.1 Assumptions

The following assumptions were made:

- Constant evaporation of 30% is assumed for the sub-catchments.
- No groundwater dewatering takes place at the bottling plant. Dewatering of boreholes in other drainage areas is not considered.
- Groundwater contribution to baseflow is assumed to be in the order of 8.1 mm/yr (DWAF, 2006) – Pitman Model.
- No interception of upstream catchment overland flow paths is assumed (i.e. stormwater is conveyed around the plant). It is assumed that 80% of all direct rainfall at the site will be conveyed back to the natural environment via stormwater systems. The Thirsti bottling plant is an existing facility that has stormwater measures in place.
- Interflow from the upper regions of the sub-catchments is assumed to not be intercepted and passes underneath the plant (i.e. no open-pit activities which can potentially prevent/intercept interflow in the soil zones).
- No artificial recharge, other than in the case of a mitigation measure, is accounted for.
- The impact of forestation is not accounted for.
- The existing setting and activities are evaluated. Built-up areas are assessed as being impermeable or no-flow boundaries. was done to evaluate the likely impacts of PES / EIS.

4.5 Estimated flow losses and risk rating

Based on the sub-catchments delineated and proposed activities, the overall impacts on the sub-surface natural flow systems were estimated. Table 4-4 summarises the estimated % loss ratings for the sub-catchments – pre- and post-mitigation.

The footprint areas of the bottling plant may suppress natural soil flow processes, and increase runoff. Hence, there may be a reduction of water available to sustain interflow processes. The likely impact on the hydropedological flow drivers was assessed on a sub-catchment (hillslope) and micro-catchment (drainage catchment for the plant) scale.

The predicted impact on the wetlands and watercourses fed by the hydropedological process ranges from 0.56% (sub-catchment scale) to 3.2% (micro catchment scale) which equates to no-impact and low impact. The change in PES and EIS as a result of the establishment of the bottling facility is negligible. After considering likely stormwater attenuation discharge back to the environment (as part of mitigation measures proposed); the impact on PES and EIS change to no impact.

Table 4-4: Estimated % Loss rating for sub-catchments

Sub-Catchment / Hillslope	Est. Flow Driver Impact (No Mitigation)	**Severity**	Est. Flow Driver Impact (Mitigation)	**Severity**
Sub-Catchment	0.56%	No Impact	0.13%	No Impact
Micro-Catchment	3.20%	Low	0.73%	No Impact

5 CONCLUSION

Soil data were evaluated for the project area to produce a soil distribution map. The soil map was used to categorize the hydrological soil types (HST), into the following categories:

- Recharge.
- Responsive (shallow).
- Responsive (saturated).
- Interflow (A/B); and
- Interflow (soil/bedrock).

Generally, recharge soils are dominant across the site. These soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.

Moving towards the higher topography areas (the headwaters of the sub-catchment delineated) exposed rock and shallow responsive (soil/bedrock) type soils occur. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction of overland runoff in areas where bedrock is exposed. vertical flow through and out of the profile into the underlying soil zones (or hard rock) is the dominant flow path.

The area associated with the Horn River flood plain (also identified as a channelled valley bottom wetland) is associated with hydrogeomorphic soil types (such as the Katspruit soil form encountered) and will primarily be responsive (saturated). These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.

Several hydropedological risks were identified for the operational phase of the project (refer to Section 4). Based on the HSTs identified and existing site activities, marginal impacts on the diversion and suppression of primary flow processes (i.e. lateral and vertical recharge and interflow) are anticipated. However, after accounting for released back into the environment (i.e. stormwater attenuation as proposed) a limited change in PES and EIS category is anticipated.

It is important to note that the bottling facility is an existing operation that cannot be re-zoned. Therefore, no avoidance areas are proposed, as the PES and EIS impact is considered low-moderate and wetland buffers and stormwater attenuation measures will offset negative impacts. Recommendations to further limit the impact on soil/water processes are available in Section 5.1.

5.1 Recommendations

The following recommendations are made:

- Ensure clean stormwater is conveyed to the natural environment. An attenuation pond can be used to ensure steady seepage of accumulated stormwater into the soils upstream of wetland areas.
- It is recommended that mitigation measures, as described in Section 4 be implemented during the operational phase of this project.

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APPENDIX A: RISK ASSESSMENT METHODOLOGY

Each impact identified (for the commissioning, operational and decommissioning phases) was assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value is linked to each rating scale.

The following criteria were applied:

- **Occurrence:**
    - Probability of occurrence (how likely is it that the impact may occur?); and
    - Duration of occurrence (how long the impact may last).
- **Severity:**
    - Magnitude (severity) of impact (will the impact be of high, moderate, or low severity?); and
    - Scale/extent of impact (will the impact affect the national, regional, or local environment or only that of the site?).

The impact assessment rankings used are listed in Table 1. The significance of the impact was determined by the formula below and was screened according to Table 2.

SP (significance of impact) = (magnitude + duration + scale) x probability

Table 1: Impact assessment rankings

Status of Impact	
+: Positive (A benefit to the receiving environment)	
N: Neutral (No cost or benefit to the receiving environment)	
-: Negative (A cost to the receiving environment)	
Magnitude: =M	**Duration: =D**
10: Very high/do not know	5: Permanent
8: High	4: Long-term (ceases with the operational life)
6: Moderate	3: Medium-term (5-15 years)
4: Low	2: Short-term (0-5 years)
2: Minor	1: Immediate
0: Not applicable/none/negligible	0: Not applicable/none/negligible
Scale: =S	**Probability: =P**
5: International	5: Definite/do not know
4: National	4: Highly probable
3: Regional	3: Medium probability
2: Local	2: Low probability
1: Site only	1: Improbable
0: Not applicable/none/negligible	0: Not applicable/none/negligible

Table 2: Impact significance ratings

Significance	Environmental Significance Points	Colour Code
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	15 to 30	L
Low-Marginal (positive)	0 to 15	L-Marginal
Neutral	0	N
Low-Marginal (Negative)	0 to -15	L-Marginal
Low (negative)	-15 to -30	L
Medium (negative)	-30 to -60	M
High (negative)	<-60	H

APPENDIX B: FIELD DATA

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93481434	• Moisture
Date:	12/05/2021	Longitude:	29.74498817	• Colour
Log ID:	A1	Depth (m):	0.46	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

A

mosture 20%

Red Apedol B

0.46m

Hard Rock Boulder?

Depth (m)

Bottom

0-0.46 Moist, Reddish brown, (Syr/4).

Stiff, very clay, medium to fine grain, Red Apedal B, Hutton



Notes:

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93565106	• Moisture
Date:	12/05/2021	Longitude:	29.74469312	• Colour
Log ID:	A2	Depth (m):	0.39	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

Ortic A

mosture 20%

0.12m

Red Apedal B

0.39m

Hard Rock Boulder

Depth (m)

Bottom

Dry, Redish brown, loose, stiff, fine - medium grained, top-soil

Dry, Redish brown, clay, no structure, no peds, Red Apedal B

Hutton



Notes:_____

_____

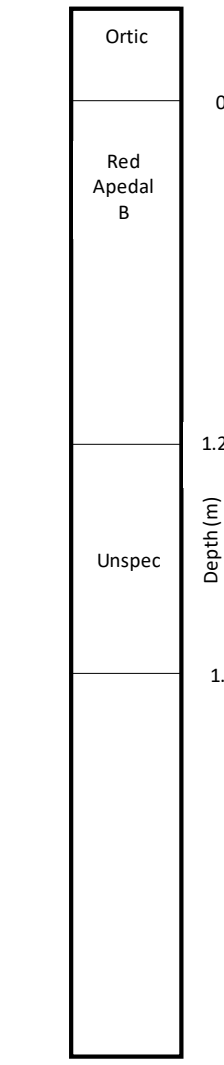
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Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93610358	• Moisture
Date:	12/05/2021	Longitude	29.74392399	• Colour
Log ID:	A3	Depth (m)	1.41m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO



Dry, sandy-clay, Red-brown, loose-stiff, no distinct structure , Ortic A

Dry, Red-brown, lots of clay (sandy clay laom?), no structure, no peds, Red Apedal B

Redish coloured soil, Dry, lots of clay



N

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93696312	• Moisture
Date:	12/05/2021	Longitude	29.74366944	• Colour
Log ID:	A4	Depth (m)	0.97 m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

Ortic

20%

10 cm

40cm

Depth (m)

85 cm

97cm

Bottom

Dry, brown, sandy-clay, no structure, top-soil

Dry, Redish-brown, no structure, no slick and slides, slightly yellow mottles, yellow brown, / red apedal

Dry, Brown-yellow, clay, some intact shale, yellow brown Apedal, firm

Dry, Dark brown - red, high clay, firm, fine grained

Clovelly



Notes:

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93572731	• Moisture
Date:	12/05/2021	Longitude	29.7453748	• Colour
Log ID:	A5	Depth (m)	1.40m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

Orthic A

0.1m

Yellow red A-B

Depth (m)

Bottom

Ortic A, dry, dark brown, medium grained, loose top-soil

Dry, Red 5/5YR,Sandy clay, loose,
no distinct structure, yellow red Apedal B

Clovelly



Notes:___ No seepage

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93350998	• Moisture
Date:	12/05/2021	Longitude	29.74508303	• Colour
Log ID:	A6	Depth (m)	0.50m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

Ortic A

0.1m

Red Apedal B

0.50m

Rock boulder

Depth (m)

Bottom

Moist (50%), sandy-clay, Redish-brown, stiff, Top-soil

Moist (50%), Redish brown, sandy clay, medium-fine grained, small intact shail fragments, red apedal B

Rock and/or Refuge

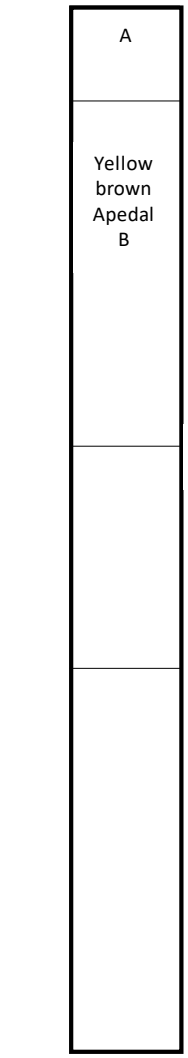


Notes:_____
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Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.93353023	• Moisture
Date:	12/05/2021	Longitude	29.74536813	• Colour
Log ID:	A7	Depth (m)	0.94m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO



pH:7, moist (70%), yellow-brown (orange), medium-fine grained, intact SND SHL, Top-soil

moist (70%), redish-yellow to brown, intact SND, fine - medium grained, firm, clay-sand, yellow-brown A, no distinct structure

Moist, >70%, redish brown - yellow, yellow and black mottles,
fine-medium grained, clay sand - loam, unspecified or sapralite

clovelly



Notes:___Sampled

Field Soil Classification Chart

Project:	21-0336		Latitude:	-27.93267092	• Moisture
Date:	12/05/2021		Longitude	29.74505546	• Colour
Log ID:	A8		Depth (m)	1.04m	• Consistency
					• Structure
					• Origin

Please classify according to MCCSO

Top

Ortic A

0.1m

Roots

0.49m

Red Apedal B

1.04m

Depth (m)

Bottom

60% Moist, 0 - 10cm moist, brown, sandy clay, top-soil 5/10R

Moist consistancy, firm, fine grained - very fine, clay loam, Apedal B

Hutton



Notes:___ 0.49m roots

_____

_____Sampled_____

_____

Field Soil Classification Chart

Project:	21-0336	Latitude:	-27.9328446	• Moisture
Date:	12/05/2021	Longitude	29.74645874	• Colour
Log ID:	A9	Depth (m)	1.24m	• Consistency
				• Structure
				• Origin

Please classify according to MCCSO

Top

Top-soil	0.05m	5 cm grass roots
Ortic	0.20m	0-20cm 20% moist, dry, brown, fine - medium grained Some roots, ortic A top-soil
Red Apedal B	0.80m	20-80cm 5/10YR, fine grained, slightly clay, no structure, red apedal B
	1.24m	0.80 - 1m Moist, yellow brown 5/10YR, presence of weathered sandstone, fine - medium grain, stiff, unspec

Depth (m)

Bottom

Hutton

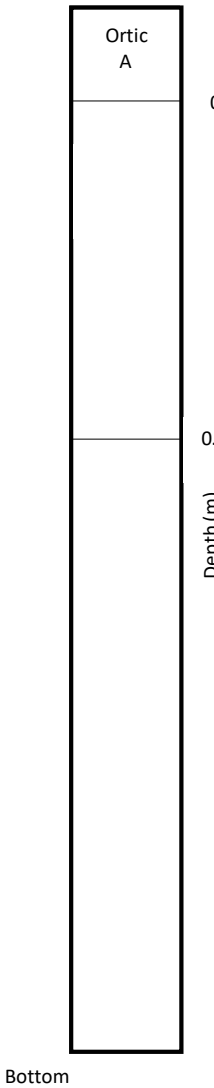


Notes:___ 5cm grass roots

Field Soil Classification Chart

Project:	21-0336		Latitude:	-27.93201683	• Moisture
Date:	12/05/2021		Longitude	29.75074089	• Colour
Log ID:	A10		Depth (m)	0.90m	• Consistency
					• Structure
					• Origin

Please classify according to MCCSO



Moist, Dark brown, sandy clay, firm, Ortic A top-soil, A-horizon

Moist, grey colour - light olive brown, mottled-colours of mottles orange, red, black, sandy clay loab, G-horizon katspruit (hydromorphic soil)



Notes:_____

APPENDIX C: DISCLAIMER

The opinions expressed in this Report have been based on site /project information supplied to GCS (Pty) Ltd by Thirsti and is based on public domain data, field data and data supplied to GCS by the client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the site conditions, and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

APPENDIX F: FOOD SAFETY MANAGEMENT SYSTEM POLICY

Approval: General Manager	**Food Safety Management System**	**Doc No: POL -01**
		Ref: SANBWA cl 1.1.4
		Ref:ISO22000 cl 5.2.2a
	Food Safety and Quality Policy	**Rev: 10**
		Page 1 of 1
		Issue Date: 12/03/2025

It is the primary concern of **Thirsti Water**, to provide safe and high-quality products that meet and succeed customer and consumer expectations. The following quality and food safety principles are the foundation of **Thirsti Water's** commitment to quality and food safety:

- At the very minimum we will comply with all relevant legislation and approved codes of practice.
- Meet mutually agreed customer requirements related to quality and food safety.
- Manufacture and deliver products that meet the highest quality and food safety standards, assuring product and process integrity.
- Ensure a sustainable quality and food safety culture through communication and developing employees' competencies and technical skills.
- Include quality and food safety strategies in the annual business planning process to ensure that food safety and quality remains an integral part of operations.
- Management ensures that the appropriate resources, including human and financial resources, are committed towards implementing this policy across all our operations and communicating the policies, behaviours and standards to all employees.
- Set clear measurable food safety and quality objectives and targets against which performance will be measured.
- Establish, implement and maintain effective arrangements for communicating with suppliers and contractors, customers and statutory and regulatory authorities.
- Maintain a food safety and quality management system conforming to FSSC 22000.
- Validate the effectiveness of the quality and food safety management systems through internal and external audit processes.
- We will regularly measure compliance with these behaviours and implement performance objectives to help assure our clients and consumers that we are providing products that are safe while meeting their quality expectations. at **Thirsti Water.**
- Review the food safety quality policy annually to ensure that it continues to reflect the aims and aspirations of **Thirsti Water.**

SIGNED			
General Manager:		**Date:**	

Approved by: Managing Director	**Food Safety Management System**	Doc No: SR-PRP 01
		Ref: ISO22000 Cl 8.2; ISO22002-100:2025 & ISO22002-1:2025 Cl 14
		Rev: 04
	14. Personal Hygiene Code of Conduct	Page 1 of 1
		Issue Date: 25/09/2025

All staff will adhere to the following personal hygiene practices:

- Eating or drinking is not permitted in any processing area, toilets or changing rooms. The canteen is the only area available for this purpose and provided dustbins must be used for refuse.
- Smoking is not allowed within the facility and is to be kept confined to designated areas outside the facility.
- Spitting is not allowed anywhere on the premises, especially in areas where products are handled.
- Overalls worn in the production areas are changed daily.
- Suitable footwear must be worn in product handling areas, i.e. no open shoes or slop-slops.
- Protective clothing including microbiology laboratory may not be worn outside the production area or taken off the premises for any reason.
- All staff that handles final products will ensure that their personal hygiene includes a daily bath, shower or wash.
- For safety, no loose clothing will be worn near moving machinery. This includes scarves, towels and blankets.
- Jewellery must not be worn by employees in food handling areas. Religious, ethnic, medical and cultural imperatives that pose a risk to food safety must be controlled by measures to minimize contamination.
- Nail polish and any nail art must not be used on fingernails, and fingernails must be kept short and clean. Artificial fingernails must not be worn.
- Artificial eyelashes must not be worn. Hair nets and beards mask must be worn when entering the factory.
- Civilian clothing must be neat and clean, and ironed on a regular basis.
- Hands and forearms must be washed with warm water and anti-bacterial soap and dried with paper towel:
    - ❖ after visiting the toilet
    - ❖ after blowing the nose
    - ❖ after smoking and/or eating
    - ❖ after handling any soiled object.
- Hand washbasins are only available for the cleaning of hands and are not to be used for the cleaning of equipment or utensils.
- Any skin infections, irritations, illness or disease that could influence product safety must be reported to the First Aider when arriving at work.
- Any cuts, scratches, open wounds or abrasions must be covered with a plaster, bandage and glove, which will be issued by the First Aider.
- Any loss of plasters and spillage of blood near to product and equipment must be immediately reported to the Supervisor.
- Gloves will only be issued in circumstances where hands need to be protected against physical or chemical injuries. They may also be worn to cover plasters and bandages where necessary. Visitors and finance will be allowed to wear gloves and shall be recorded on glove issue register.
- Before coughing or sneezing turn away from products and turn head into shoulder when working in the production area.

General Manager: …… Date: ……..

APPENDIX G: PUBLIC PARTICIPATION REPORT

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Thirsti Bottling Plant Water Use Licence Application

Public Participation Report

Version – Final

3 June 2026

GCS Project Number: 25-0109

Client Reference: Thirsti Bottling Plant WULA



GCS Environment South Africa (Pty) Ltd **Reg No:** 2002/028494/07
Offices: **Johannesburg**
Directors: DA Kriel (Managing) | AC Johnstone | W Sherriff | T Isaac | A Theunissen

Thirsti Bottling Plant Water Use Licence Application

Public Participation Report

Version – Final

THIRSTI™

3 June 2026

DOCUMENT ISSUE STATUS

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Client Reference	Thirsti Bottling Plant WULA		
Title	Thirsti Bottling Plant Water Use Licence Application Public Participation Report		
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LIST OF ABBREVIATIONS

Abbreviation	Description
BID	Background Information Document
CIP	Clean-in-Place
CO_2	Carbon Dioxide
CRR	Comments and Responses Report
DWS	Department of Water and Sanitation
e-WULAAS	Electronic Water Use Licence Application and Authorisation System
GA	General Authorisation
GCS	GCS Environment South Africa (Pty) Ltd
GNR	Government Notice Regulation
I&AP	Interested and Affected Party
NGOs	Non-Governmental Organisations
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PET	Polyethylene Terephthalate
PPP	Public Participation Process
SAPS	South African Police Service
WULA	Water Use Licence Application

UNITS OF MEASUREMENT

Unit	Description
m	metre
km	kilometre
ha	hectare
m^2	square metre
km^2	square kilometre
m^3	cubic metre
m^3/a	cubic metres per annum

1 INTRODUCTION

Normandien Farms (Pty) Ltd (Normandien) owns and operates the Thirsti Bottling Plant (Thirsti), located on farms Buffelshoek 15469 and Woodburn 15470, approximately 28 kilometres (km) southwest of Newcastle and 6 km northwest of the settlement of Normandien in the province of KwaZulu-Natal (Figure 1-1). The facility commenced operations in 2015 and has subsequently expanded.

Thirsti has operated the facility under a General Authorisation (GA) issued by the Department of Water and Sanitation (DWS) under reference 27/2/1/V31F/1. Up to and including 2018, groundwater abstraction and production volumes remained within the limits authorised under the GA. As production requirements increased and future growth became evident, Thirsti appointed GCS Environment South Africa (Pty) Ltd (GCS) in 2019 to undertake a Water Use Licence Application (WULA) process to secure the necessary water use authorisations for the continued operation and future expansion of the facility.

The WULA seeks authorisation for groundwater abstraction from eight operational boreholes, infrastructure located within the regulated area of watercourses, and the operation of existing wastewater disposal infrastructure. To support the application, a range of specialist investigations have been undertaken, including hydrogeological, freshwater ecological, hydropedological, hydrological and groundwater vulnerability assessments. These studies have informed the assessment of potential impacts associated with the proposed water uses and the development of appropriate management measures.

Importantly, the WULA process was initiated prior to the expansion of the facility. Since its commencement, the application has progressed through specialist investigations, public participation processes, site inspections, requests for additional information, and the submission of updated technical documentation. While the COVID-19 pandemic and associated restrictions contributed to delays during 2020 and 2021, the application process continued to progress, with updated technical information being compiled and submitted as required.

A previous WULA was submitted to the DWS via the electronic Water Use Licence Application and Authorisation System (e-WULAAS), and a comprehensive public participation process was undertaken during 2021 in support of that application. During the review and refinement of the project, the proposed abstraction infrastructure was reduced from ten boreholes to eight operational boreholes, reflecting the boreholes currently utilised to supply the facility. The original WULA was subsequently closed prior to completion of the licensing process. Consequently, the current application constitutes a re-application and incorporates updated project information, revised specialist studies, refined abstraction requirements, and additional technical assessments undertaken since the original submission.

The purpose of this Public Participation Report is to document the stakeholder engagement undertaken in support of the WULA and to demonstrate compliance with the public participation requirements of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) and associated regulatory requirements. The report provides a record of the public participation activities undertaken during both the original application process and the current re-application process, including stakeholder identification, notification, consultation, comments received, and responses provided.

1.1 Project Description

The Thirsti bottling facility sources groundwater from boreholes on the property and transfers it to the treatment facility, where it undergoes multi-stage preparation. The process includes sand and activated carbon filtration, microfiltration, ultraviolet sterilisation, and ozonation, all supported by a Clean-in-Place system to maintain hygiene and operational efficiency. This ensures the water retains its natural mineral balance while meeting potable water and food safety standards.

Packaging is prepared on site. Polyethylene Terephthalate (PET) preforms are blow-moulded into bottles of various sizes using high-pressure compressed air, while closures, labels, shrink-wrap, and trays are staged and fed into the filling lines.

The plant operates three main production lines:

- Three still water lines: Bottles are rinsed, filled under hygienic conditions, capped, labelled, coded, and shrink-wrapped.
- Two flavoured water lines: Syrups and concentrates are blended with base water under controlled ratios and inline quality checks before bottling and canning.
- One sparkling water line: Carbon Dioxide (CO_2) is injected under pressure, with isobaric filling technology used to retain carbonation before capping and packaging.

Supporting utilities include compressed air for bottle blowing and rinsing, chillers for process cooling, boilers for steam and hot water, and process water systems for rinsing and Clean-in-Place (CIP) cycles. These utilities are closely monitored to ensure safe and efficient operation.

Once packaged, products are shrink-wrapped into multipacks, palletised, and stored in temperature-stable warehouses before national distribution.

Waste is managed through controlled disposal and recycling systems. Wastewater from CIP and cleaning cycles, rejected packaging and bottles, and CO_2 or boiler emissions are treated or disposed of in accordance with environmental requirements.

1.2 Project Location

Thirsti is situated on the farm Buffelshoek 15469 and Woodburn 15470 in the province of

KwaZulu-Natal. The site lies approximately 28 km southwest of Newcastle and 6 km northwest of the settlement of Normandien. Access to the property is via the P39-1 provincial road leading from Newcastle. Thirsti is located in the Newcastle Local Municipality which falls under the jurisdiction of the Amajuba District Municipality.

Thirsti covers an area of approximately 2 413.92 hectares (ha) and is located on farms Buffelshoek 15469 and Woodburn 15470. The property details are provided in Table 1-1, and the property map is shown in Figure 1-2.

Table 1-1: Property Details of the Farms

Farm Name	Portion	Landowner	Title Deed
Buffelshoek Farm	Erf 15469	Normandien Farms (Pty) Ltd	000011131/2002
Woodburn Farm	15470 Ptn 1	Normandien Farms (Pty) Ltd	000015271/2016
Woodburn Farm	15470 RE	Normandien Farms (Pty) Ltd	000015271/2016

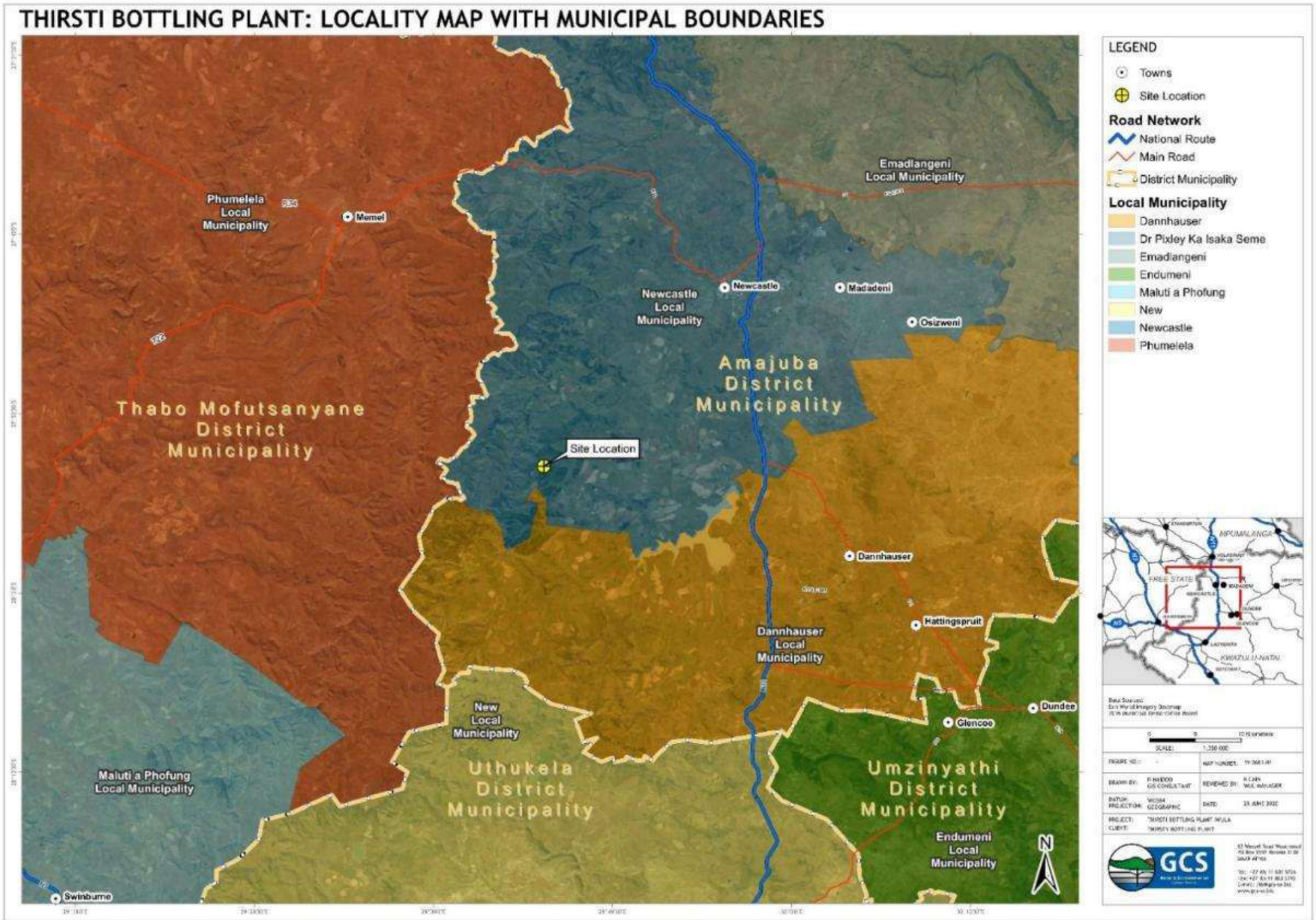


Figure 1-1: Regional Locality of the Thirsti Bottling Plant

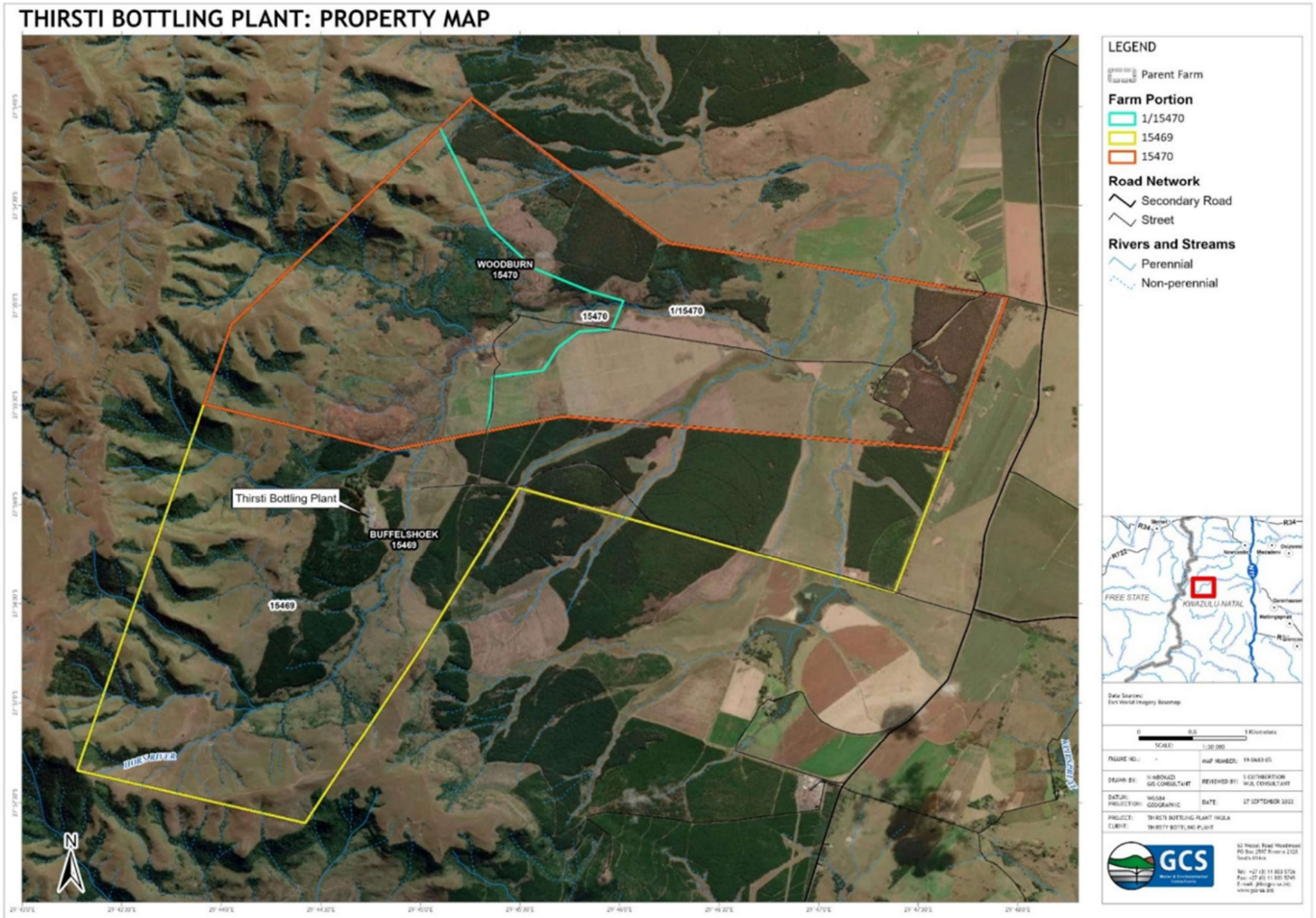


Figure 1-2: Properties that form the Thirsti Bottling Plant

1.3 Required Authorisations

In terms of Section 21 of the NWA, the proposed activities trigger the following water uses and therefore require authorisation through a WULA:

- (a) taking water from a resource.
- (c) Impeding or diverting the flow of water in a watercourse.
- (g) Disposing of waste in a manner likely to negatively impact a water resource.
- (i) Altering the bed, banks, course, or characteristics of a watercourse.

1.4 The Purpose of the Report

This Public Participation Report documents the stakeholder engagement undertaken in support of the WULA in accordance with Section 41(4) of NWA, read together with the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals (Government Notice Regulation (GNR) 267).

The report provides a record of the public participation activities undertaken, including stakeholder identification, notification, consultation, comments received, and responses provided. It demonstrates compliance with the applicable legislative requirements and provides evidence that Interested and Affected Parties (I&APs) were afforded a reasonable opportunity to participate in the WULA process.

1.5 Objectives of Public Participation Process

The objective of the public participation process (PPP) is to ensure that all relevant stakeholders are informed of the proposed water uses and provided with a meaningful opportunity to participate in the WULA process. The key objectives of the PPP are to:

- Identify and register I&APs;
- Provide stakeholders with accurate and accessible information regarding the proposed water uses;
- Facilitate consultation with stakeholders throughout the application process;
- Identify and record stakeholder concerns, issues, and recommendations;
- Ensure that comments received are considered and addressed by the Applicant and / or specialist team;
- Document stakeholder inputs within a Comment and Response Report (CRR); and
- Demonstrate compliance with the requirements of the NWA.

1.6 Legal Framework

The PPP was undertaken in accordance with the Regulations Regarding the Procedural

Requirements for Water Use Licence Applications and Appeals (GNR 267). To ensure compliance with the applicable regulatory requirements, the following activities were undertaken:

- Identification of relevant stakeholders, including organs of state, landowners, lawful occupiers, community representatives, and I&APs;
- Distribution of project information through a Background Information Document (BID), stakeholder notifications, and direct correspondence;
- Placement of newspaper advertisements and site notices;
- Provision of opportunities for stakeholders to review and comment on the application documentation; and
- Compilation of a CRR documenting issues raised and responses provided.

2 PUBLIC PARTICIPATION ACTIVITIES

I&APs were informed of the proposed WULA and afforded opportunities to participate throughout the application process. Public participation was undertaken to identify issues and concerns requiring consideration as part of the specialist assessments and decision making process.

2.1 Development of Stakeholder Database

A stakeholder database was initially developed as part of the original WULA process undertaken and was subsequently reviewed and updated for the current WULA re-application process undertaken during 2025 and 2026. The purpose of the database was to identify and record I&APs who may have an interest in, or be affected by, the proposed water uses, and to ensure that stakeholders were provided with information and opportunities to participate throughout the licensing process.

The database was compiled using information obtained from previous stakeholder engagement activities, landowner records, municipal and government contact databases, environmental organisations, community representatives, and stakeholder registrations received during the PPP. Stakeholders included national and provincial government departments, district and local municipalities, environmental non-governmental organisations (NGOs), adjacent and surrounding landowners and occupiers, host communities, and other interested organisations and individuals.

The stakeholder database developed during the original WULA process was utilised for the 2026 re-application process to ensure continuity of stakeholder engagement. Registered stakeholders from the previous process were notified of the updated application through direct email and SMS communications issued on 25 February 2026 and were provided with

details regarding the availability of the Draft WULA Technical Report and the associated 60-day public review period.

The stakeholder database was maintained as a living document throughout both the original and current WULA processes. Additional stakeholders who registered during the public participation period or requested inclusion on the database were added and included in subsequent project communications. The final stakeholder database is provided in APPENDIX A.

2.2 Public Participation Process Undertaken During the Original WULA Application

2.2.1 Publication of Newspaper Advertisement

Newspaper advertisements were published in the Newcastle Advertiser to notify stakeholders of the proposed WULA, the availability of draft report, and opportunities to participate in the PPP.

The first advertisement was published in English on 19 March 2021 and informed stakeholders of the commencement of the PPP, the availability of draft reports for review, and the process for registering as an I&AP and submitting comments.

Following delays associated with the COVID-19 pandemic and the implementation of an additional public review period, a second advertisement was published in the Newcastle Advertiser on 4 June 2021 in both English and isiZulu. The advertisement notified stakeholders of the additional 60-day public review period and invited interested parties to review the application documentation and submit comments for consideration as part of the WULA process. Refer to APPENDIX B.

2.2.2 Site Notices

Site notices were erected on 19 March 2021 at strategically selected public locations within and surrounding the project area to notify stakeholders of the proposed WULA, the availability of draft reports, and the opportunity to register as I&APs and submit comments. The notices were displayed in English and placed at the following locations:

- Normandien: 27°59'8.75"S; 29°46'49.24"E;
- Thirsti Entrance: 27°56'32.90"S; 29°47'45.60"E;
- Intersection on the P39-1: 27°52'28.98"S; 29°48'43.83"E; and
- Near Scott Street Mall, Newcastle: 27°45'27.92"S; 29°55'47.24"E.

Following delays associated with the COVID-19 pandemic and to ensure stakeholders were provided with a further opportunity to participate in the process, a second round of site notices was erected on 4 June 2021 at the same locations. These notices were displayed in

English, Afrikaans and isiZulu and informed stakeholders of the additional 60-day public review period for the draft reports. Refer to APPENDIX C.

2.2.3 Background Information Document and Stakeholder Notification

A BID and Registration and Comment Form (APPENDIX D) were prepared and distributed to identified stakeholders, including government authorities, local municipalities, surrounding landowners, environmental organisations, and registered I&APs. The BID provided an overview of the project, the proposed water uses, the regulatory approval process, and opportunities for stakeholder participation.

The distribution of the BID served as the primary mechanism for introducing stakeholders to the project and notifying them of the commencement of the PPP. Stakeholders were invited to register as I&APs and to submit comments, concerns, and recommendations for consideration as part of the WULA assessment.

2.2.4 Availability of the Draft WULA Technical Report

Draft reports were made available for public review and comment for a period of 60 days from 19 March 2021 to 17 May 2021. Stakeholders were notified of the availability of the report and provided with an opportunity to review the application documentation and submit comments for consideration as part of the WULA process.

Following delays associated with the COVID-19 pandemic and to ensure that stakeholders were afforded an additional opportunity to participate, a second 60-day public review period was undertaken from 4 June 2021 to 2 August 2021. During both review periods, stakeholders were invited to review draft reports and submit comments, concerns, and recommendations regarding the proposed water uses.

Electronic copies of draft reports were made available on the GCS website throughout the review periods to facilitate access to the application documentation and supporting information.

2.2.5 Public Meeting

A public meeting was held at the Normandien Farmers Hall (Normandien Sale Yard) on Wednesday, 23 June 2021, from 17:00 to 19:00 as part of the PPP for the WULA. The meeting provided stakeholders and I&APs with an opportunity to engage directly with the project team and specialist consultants.

The purpose of the meeting was to present the proposed water uses, explain the WULA process, provide an overview of the findings of draft reports, and respond to questions raised by attendees. Stakeholders were afforded an opportunity to raise concerns, seek clarification on aspects of the application, and provide comments for consideration as part of the assessment process.

Comments, concerns, and issues raised during the meeting were recorded and incorporated into the CRR (APPENDIX M), where responses were provided by the Applicant and specialist team. A copy of the presentation delivered during the public meeting is included in APPENDIX E, while the meeting attendance register is provided in APPENDIX F.

2.3 Public Participation Media - Water Use Licence (WU41899)

As part of the current WULA re-application process, a PPP was undertaken in accordance with the requirements of the NWA and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals (GNR 267). The purpose of the process was to inform stakeholders of the updated application, provide access to the revised application documentation, and afford I&APs an opportunity to review and comment on the proposed water uses.

2.3.1 Publication of Newspaper Advertisement

A newspaper advertisement was published in the Newcastle Advertiser on 19 February 2026. The Newcastle Advertiser is a local newspaper circulated within Newcastle, Normandien, and the surrounding areas. The advertisement notified stakeholders of the WULA re-application, informed them of the availability of the Draft WULA Technical Report for review, and invited them to register as I&APs and submit comments on the application. A copy of the advertisement is provided in APPENDIX G.

2.3.2 Site Notices

Site notices were erected on 25 February 2026 at prominent public locations within and surrounding the project area to notify stakeholders of the WULA re-application and the availability of the Draft WULA Technical Report for review. The notices provided information regarding the proposed water uses, the public review period, and the process for registering as an I&AP and submitting comments.

The notices were placed at the following locations:

- Newcastle Library, 66 Scott Street, Newcastle, 2940 - 27°45'27.58"S; 29°55'51.49"E.
- Thirsti Security Gate, Buffelshoek Farm Erf 15469 - 27°56'22.24"S; 29°47'09.02"E.
- Thirsti Entrance, P39 Road - 27°56'33.32"S; 29°47'45.60"E.
- SAPS Normandien Police Station, P39 Road, Normandien, 2940 - 27°59'09.82"S; 29°46'49.30"E.

A table indicating the locations of site notices, along with a map illustrating each site notice's position in relation to the project, are provided in APPENDIX H.

2.3.3 Distribution of a Background Information Document and Registration and Comment Form

A BID and Registration and Comment Form were distributed via email to stakeholders on 25 February 2026 using the project stakeholder database. The BID provided an overview of the project, the proposed water uses, the regulatory process, and opportunities for stakeholder participation.

The Registration and Comment Form enabled stakeholders to formally register as I&APs and provide comments, concerns, and recommendations for consideration during the assessment process. A copy of the BID and Registration and Comment Form is included in APPENDIX I.

2.3.4 Availability of the Draft WULA Technical Report

Stakeholders were notified on 25 February 2026 of the availability of the Draft WULA Technical Report for public review and comment. The report was made available for a 60-day public review period from 26 February 2026 to 30 April 2026, thereby providing stakeholders with an opportunity to review the application documentation and submit comments on the proposed water uses.

To facilitate access to the application documentation, copies of the Draft WULA Technical Report were made available at a number of publicly accessible locations, including Newcastle Library, the Thirsti Security Gate, and electronically via the GCS website. Proof of placement and delivery of the documentation is provided in APPENDIX J.

In addition to the newspaper advertisement and site notices, registered stakeholders were notified directly of the availability of the Draft WULA Technical Report and the associated public review period through email and SMS communications. Copies of the stakeholder notification emails are included in APPENDIX L, while records of the SMS notifications are provided in APPENDIX K.

2.3.5 Availability of the Final WULA Technical Report

Following the close of the public review period, all comments received from stakeholders were reviewed and considered by the Applicant and specialist team. The CRR was updated to record the comments received and the corresponding responses provided.

Where necessary, the Draft WULA Technical Report was revised to address comments and issues raised during the PPP. Upon completion of this process, the Final WULA Technical Report and updated CRR were made available to stakeholders via the GCS website prior to submission of the application to the DWS for consideration.

3 COMMENTS AND RESPONSE REPORT

Throughout the WULA process, stakeholders were afforded opportunities to review the application documentation and provide comments, raise concerns, and submit

recommendations regarding the proposed water uses. Comments were received through various public participation mechanisms, including written submissions, email correspondence, stakeholder consultations, and the public meeting.

All comments received during both the original WULA process and the current re-application process were recorded and considered by the Applicant and specialist team. Responses were prepared to address the issues raised and, where appropriate, amendments were made to the application documentation and supporting specialist reports.

The CRR provides a comprehensive record of the comments received, together with the corresponding responses provided by the Applicant and project team. The CRR is included in APPENDIX M.

4 CONCLUSION

A comprehensive PPP was undertaken in support of the WULA for the Thirsti Bottling Plant. The process was implemented over two phases, comprising the original WULA process undertaken during 2021 and the current WULA re-application process undertaken during 2026. Collectively, these processes provided stakeholders and I&APs with multiple opportunities to obtain information regarding the proposed water uses, review application documentation, and submit comments for consideration.

A range of public participation mechanisms were employed, including newspaper advertisements, site notices, distribution of BIDs, direct stakeholder notifications, public review periods, and a public meeting. The stakeholder database was maintained and updated throughout the process to ensure ongoing communication with registered stakeholders and to facilitate meaningful participation.

Comments, concerns, and recommendations received during the PPP were documented within the CRR and considered by the Applicant and specialist team. Where appropriate, comments informed refinements to the application documentation and supporting specialist assessments.

It is considered that the PPP has satisfied the requirements of the NWA and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals (GNR 267). Stakeholders were provided with reasonable access to information and afforded adequate opportunity to participate throughout the WULA process.

The outcomes of the PPP, together with the Final WULA Technical Report, specialist studies, and supporting documentation, have submitted to the DWS for consideration as part of its assessment of the application.

APPENDIX A: STAKEHOLDER DATABASE

Stakeholder Category	Name	Surname	Organisation / Role
Neighbour	Isabelle	Pitout	Farming
Neighbour	Anton	Pitout	Farming
Neighbour	Stoffel	Van Rooyen	Farming
Neighbour	Lize	Berry	Farming
Neighbour	Andre	Berry	Farming
Neighbour	Ann	Mc Kenzie	Farming
Neighbour	Steven	Walsh	Farming
Neighbour	Henk	Rouwenhorst	Farming
Neighbour	Stefan	Lombard	Farming
Neighbour	Cheryl	Gibbs	Farming
Neighbour	Luke	Gibbs	Farming
Neighbour	Francois	Woest	Farming
Newcastle Local Municipality	B.E	Mswane	Municipal Manager
Newcastle Local Municipality	Simphiwe	Mzila	PA to Manager
Newcastle Local Municipality	Dumisani	Thabethe	Water
Amajuba District Municipality	Sipho	Zwane	Municipal Manager
Amajuba District Municipality	Mpume	Sibiya	PA to Manager
Amajuba District Municipality	Thembelihle	Mthembu	Mayor
Newcastle Local Municipality	Xolani	Dube	Mayor
I&AP	Bradley	Gibbons	Highland Grassland Field Officer
I&AP	Nkosikhona	Shabalala	Environmental activist and community human rights defender
I&AP	Z.K Mncube (Mazibuko)	Mncube	Mbuzelenikonke Trading Enterprise – Director
Newcastle Local Municipality	MT	Nkosi	Corporate Services Department
DWS	Shaun Oeveshen	Naidoo	WULA Manager
DWS	Zamashenge Phiilisiwe Magnificent	Hadebe	WUA Administrator
I&AP	B	Lauterbach	SE Lauterbach & Associates NN Land Survey Office Inc
Amafa AmaKZN	Bernadette	Pawandiwa	
Amafa AmaKZN	Sibusiso	Khumalo	Heritage Officer
KZN Department of Economic Development, Tourism and Environmental Affairs	Nonkuh	Mabaso	
KZN Department of Economic Development, Tourism and Environmental Affairs	Musa	Dlamini	Environmental Compliance
WWF South Africa Ecosystems	Melusi	Mthembu	Grassland Programme
WWF South Africa Ecosystems	Bronwyn	Maree	Sustainable Agriculture
South African National Biodiversity Institute	Dr Sibusiso	Mnguni	Biodiversity Planning
South African National Biodiversity Institute	Khanyisile	Mkhize	Ecosystem Guideline
BirdLife South Africa	Dan	Parker	KZN Conservation
BirdLife South Africa	Tanya	Smith	KZN Conservation
Endangered Wildlife Trust	Gareth	Tate	Species Conservation
Endangered Wildlife Trust	Jacques	Marais	Species Conservation
Department of Rural Development and Land Reform	Siboniso	Dladla	KZN Provincial Land Use
Amajuba District Municipality	Sbonelo	Cebekhulu	Head of Communications
Amajuba District Municipality	Celani	Myeza	Planning & Development
Newcastle Farmers Association	Jaco	van der Merwe	Chairperson
Ezemvelo KZN	Sizwe	Mkhize	Biodiversity Conservation

APPENDIX B: NEWSPAPER ADVERTISEMENT MARCH AND JUNE 2021



Friday March 19, 2021 CLASSIFIEDS | Newcastle Advertiser | 13

NOTICES / TENDERS

DANNHAUSER LOCAL MUNICIPALITY

NOTICE NO. 18/03/2021

APPLICATION IS MADE IN TERMS OF SPATIAL PLANNING AND LAND USE MANAGEMENT ACT 16 OF 2013 READ WITH IN CONJUCTION WITH SECTION 46 (a) OF DANNHAUSER SPATIAL PLANNING AND LAND USE MANAGEMENT BY-LAW FOR PURPOSE OF ESTABLISHING A MICRO LIQUOR MANUFACTURING ON REMAINDER OF FARM NO. 8493 DONDOLA A.

Notice is hereby given that the Dannhauser Municipality has received an application in terms of the Spatial Planning and Land Use Management Act 16 of 2013 read in conjunction with Dannhauser Spatial Planning and Land use management By-Law No 1624.

A copy of the application and its accompanying documents will lie for inspection at the Dannhauser Municipality Technical Building, 8 Church Street Dannhauser between 08:00 and 16:00 weekdays.

Any person with interest therein may lodge or post written objections or make representations relating thereto with the Municipal Manager, 8 Church Street, Private Bag X1011, Dannhauser 3080 by no later than 30 days from the publication date.

Any person who fails to lodge written objections or make representation within 30 days from the date of this letter, in response to this notice by the aforementioned date shall be precluded from further participation in the process with regard to the application.

Enquiries heron may be lodged with Mr. SS Nkabinde, Manager Land Use Management Telephone number 034 621 2666 during normal office hours or by email to sibusison@dannhauser.gov.za

W.B. NKOSI NOTICE NO. 18/03/2021
MUNICIPAL MANAGER

APPLICATION IN TERMS OF THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT, NO. 16 OF 2013 REGULATIONS AND BY-LAWS:

APPLICATION FOR REZONING

NEWCASTLE TOWN PLANNING SCHEME:

Notice is hereby given that on application has been lodged with the Newcastle Municipality for amendment of the Town Planning Scheme by rezoning of land.

- Rezoning of Portion 7 of Erf 787 Newcastle from DETACHED RESIDENTIAL to MEDIUM DENSITY RESIDENTIAL

Property is located at No. 80 Coronation Road, Newcastle.

Documentation relating to the proposed development is available for inspection between 07:30 to 16:00, Monday to Friday at the municipal offices, Development Planning & Human Settlements (Town Planning, 4th floor) e.o. 37 Murchison Street, Newcastle, for a period of not less than 30 days from **18th March 2021 to 20th April 2021.**

Any person having sufficient interest herein may lodge written objections or representations relating hereto with the undersigned within 30 days commencing from 18th March 2021. Failure to do so will disqualify you from participating further in the application process.

Ms. Xoliswa Madela
Tel: 034 328 7600
Email: Xoliswa.Madela@newcastle.gov.za/townplanning@newcastle.gov.za
Newcastle Municipality: Town Planning Directorate
Private Bag X6621, Newcastle, 2940

GCS

NOTIFICATION OF AN INTEGRATED WATER USE LICENCE APPLICATION (IWULA) PROCESS IN TERMS OF SECTION 21 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) (NWA) FOR WATER USE ACTIVITIES TAKING PLACE AT THE THIRSTI BOTTLING PLANT, SOUTH-WEST OF NEWCASTLE, KWAZULU-NATAL PROVINCE

DEPARTMENT OF HUMAN SETTLEMENTS, WATER AND SANITATION (DSHWS)
GCS REFERENCE NO: 19-0483
DHSWS REFERENCE NO: WU1863/5

Notice is hereby given in terms of Chapter 4, Section 41(4) of the National Water Act, 1998 (Act No.36 of 1998) (NWA), of the Integrated Water Use Licences Application (IWULA) process being undertaken by GCS Water and Environment (Pty) Ltd (GCS). The process is being undertaken on behalf of Normandien Farms (Pty) Ltd for the activities identified in terms of Section 21 of the NWA at the Thirsti Bottling Plant (Thirsti).

Thirsti is located south-west of Newcastle in the KwaZulu-Natal Province of South Africa. The bottling plant is located within the V31F quaternary catchment of the Buffalo Water Management Area (WMA). Government Notice Regulation 267 'Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals' published in Government Gazette No. 40713 on 24 March 2017 states that the competent authority, the Department of Human Settlements, Water and Sanitation (DHSWS), requires the applicant to place a suitable notice in newspapers and other media, and to take other reasonable steps as directed by Government Notice Regulation (GNR) No.267 to bring the application to the attention of relevant organs of state, interested persons and the general public.

The following water uses require authorisation for the Integrated Water Use Licence Application (IWULA) being applied for in terms of Section 21 of the NWA:

WATER USE	DESCRIPTION	TRIGGERED BY
Section 21 of the NWA		
21 (a)	Taking of water from a water resource	Abstraction of groundwater from boreholes
21 (c) and (i)	Impeding or diverting the flow of water in a watercourse; and Altering the bed, banks, course or characteristics of a watercourse	Infrastructure:boreholes within 500m of a wetland (Channelled valley-bottom wetland)

You are hereby invited to register as an Interested and Affected Party (I&AP), to participate in the stakeholder engagement process, as well as to raise any issues or concerns about the project, or to submit suggestions regarding the project. As a registered I&AP, you will receive further information and will be kept informed of the decisions taken by the competent authorities. **Please note that due to COVID-19 regulations, a public meeting will not be held. All information will be made available electronically and comments can be made via e-mail, telephone or post using the contact details provided below.**

Should you wish to register as an I&AP or to receive a background information document, with additional details on the project, please contact Kate Cain via Tel: 011 803 5726, Fax: 011 803 5745, E-mail: kate@gcs-sa.biz or Post: PO Box 2597, Rivonia, 2128 on/before **17th May 2021.** Please note that this date includes time for comments to be received by registered I&APs. The IWULA report is accessible for download and comment from http://www.gcs-sa.biz/

NEWCASTLE MUNICIPALITY

NOTICE NO. CS 7/2021

APPLICATION IN TERMS OF THE SPATIAL PLANNING AND LAND USE MANAGEMENT, ACT NO. 16 OF 2013, REGULATIONS AND BY-LAWS.

Notice is hereby given in terms of the Spatial Planning and Land Use Management Regulations and Bylaws that the Newcastle Municipality is considering a proposal for the following:

1. Subdivision of Erf 29 Newcastle to form Portion 1 of Erf 29 Newcastle and Remainder of Erf 29 Newcastle
2. Rezoning of Portion 1 of Erf 29 Newcastle from "Detached Residential" to "Road".

Erf 29 Newcastle is located at No. 1 Finnemore Street, Paradise.

Documentation relating to the proposed development is available for inspection between 07:30 to 16:00, Monday-Friday at the Municipal Offices, Development Planning and Human Settlements (Town Planning Directorate) located at No. 37 Murchison Street, Newcastle, for a period not less than 30 days from **18 March 2021 to 21 April 2021.**

Any person having sufficient interest herein may lodge written objections or representations relating hereto with the undersigned within **30 days** commencing from **18 March 2021.** Any person who fails to respond to this notice by either submitting comments or representations during the advertising period as specified above will be disqualified to participate further in the application process.

Representations or objections can be directed to: Ms X. Madela (Xoliswa.Madela@newcastle.gov.za) and/or Mr. Siphephelo Cindi (Siphephelo.Cindi@newcastle.gov.za) on 034 328 3300.

V GOVENDER
ACTING MUNICIPAL MANAGER

Newcastle Municipality
Private Bag X 6621
NEWCASTLE
2940

AMAJUBA DISTRICT MUNICIPALITY

INVITATION TO BID

BID No.: T2021/05

PROVISION AND SET UP OF SECURITY SOFTWARE

Bids are hereby invited from Sophos partners for the provision, set up and configuration of the provided security software. Bidders must be registered on the Central Supplier Database. Bid documents with detailed information can be downloaded from the website www.amajuba.gov.za / e-tender website.

NB: This bid will be evaluated on price in terms of the 80/20 preference point system as prescribed in the Preferential Procurement Policy Framework Act (No 5 of 2000) and for this purpose the enclosed forms must scrutinized, completed and submitted together with your bid. The bid validity period is 90 days after tender closing date.

Bidders are required to submit original tax clearance certificate/ Tax Compliance Status Pin or CSD number and valid B-BBEE Status Level Verification Certificates or certified copies thereof together with their bids, to substantiate their B-BBEE rating claims. Failure to submit the proof of B-BBEE Certificate will result in forfeiting the points.

Completed bid documents in sealed envelopes endorsed **"Bid number: T2021/05: PROVISION AND SET UP OF SECURITY SOFTWARE"** must be deposited in the Municipality's tender box located in the reception of the Amajuba District Municipality 89/96 Amajuba Road Section 1 Madadeni on or before the closing date, whereby bids will be opened in public. Bid envelopes that are not sealed and numbered will not be considered. Late bids will not be accepted. The Amajuba DM is not obliged to award the lowest or any bid.

All technical enquiries should be directed to **Mr Wonder Madi** on 034 329 7202 or by email: **wonderm@amajuba.gov.za** and regarding the bidding procedures, kindly contact **Mr Henry Mthembu** on 034 329 7200 or by email **henrym@amajuba.gov.za**

Closing date: Wednesday, 07 April 2021 at 12h00 noon

ADV N.N KHAMBULE
ACTING MUNICIPAL MANAGER

NEWCASTLE MUNICIPALITY

NOTICE NUMBER CS 8/2021

APPLICATION IN TERMS OF THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT, 16 OF 2013 (SPLUMA):
PROPOSED REZONING OF ERF 9890 NEWCASTLE AND ERF 13648 NEWCASTLE FROM DETACHED RESIDENTIAL (SINGLE RESIDENTIAL) TO INSTITUTION

Notice is hereby given that it is the intention of the Newcastle Municipality to rezone the following properties:

- Erf 9890 Newcastle;
- Erf 13648 Newcastle.

From Detached Residential (Single Residential) to Institution for its subsequent sale.

The properties are located at the corner Bird and Hospital Street within the Newcastle Medical Precinct.

A copy of the application and its accompanying documents will be lying for inspection at the offices of the BED Development Planning and Human Settlements, 37 Murchison Street, Newcastle between 07:30 am to 16:00 p.m. weekdays. Any person having sufficient interest therein may lodge or post written objections or representations relating thereto with the Municipal Manager, 37 Murchison Street, Private Bag X 6621, Newcastle, 2940 by no later than the 14th of April 2021.

Any person who fails to lodge written objections or representations in response to this notice by the aforementioned date shall be precluded from further participating in the process with regard to the application.

Contact Person: Shahil Singh
Tel: 034 328 3300
Fax: 034 328 3464
E-mail: Shahil.singh@newcastle.gov.za

Acting Municipal Manager: M. J. Mayiela
Newcastle Municipality
(Town Planning)
Private Bag X6621
Newcastle
2940

NOTICES

EMADLANGENI MUNICIPALITY

PUBLIC NOTICE



NEWCASTLE MUNICIPALITY

NOTICE NO. CS 22/2021

THE 2019/2020 OVERSIGHT REPORT FOR NEWCASTLE MUNICIPALITY

The public is hereby informed that the 2019/2020 Oversight Report for Newcastle Municipality has been adopted by Council on the 25th of May 2021.

Notice is hereby given in terms of Section 21A of The Local Government Municipal Systems Act 32 of 2000, read with Section 129 (3) of The Local Government Municipal Finance Management Act 56 of 2003. The 2019/2020 Oversight Report for Newcastle Municipality is available for perusal at all Newcastle Municipality Offices and libraries.

The Oversight Report is also accessible on the municipal website at www.newcastle.gov.za

Enquiries can be directed to Miss Sholina Patel on (034) 328 7570 or via email on Sholina.Patel@newcastle.gov.za

MR V GOVENDER
ACTING MUNICIPAL MANAGER
NEWCASTLE MUNICIPALITY
PRIVATE BAG X6662
NEWCASTLE
2940

NEWCASTLE MUNICIPALITY

NOTICE NO.: CS 23/2021

PUBLIC NOTICE

PUBLIC NOTICE: ADOPTION OF THE FINAL IDP/BUDGET/PMS FOR THE 2021/22 FINANCIAL YEAR

Public notice is hereby given that Newcastle Local Municipality, at its Virtual Special Council meeting held on the 25th of May 2021, has adopted the Final Integrated Development Plan (IDP), Budget and Performance Management System (PMS) as prescribed by the Municipal Systems Act 32 of 2000 Chapter 4, Section 25 (1) (b) (i), (c) read in conjunction with the Municipal Finance Management Act (No.56 of 2003) Chapter 4 Section 16 (1), (2).

Copies of the Final IDP, Budget and PMS documents for 2021/2022 are available on the municipal website: www.newcastle.gov.za as from Monday, 31st of May 2021, libraries and the reception at Newcastle Civic Centre, 37 Murchison Street as well as at all office number 8656 from Tuesday, 08 June 2021.

His Worship the Mayor of Newcastle Cllr. Dr. N.N.G. Mahlabe, in his capacity as the Chairperson of the IDP Representative Forum takes this opportunity to thank everyone who participated during the review process and he hopes to see the same robust debates during the future engagement processes.

For enquiries please contact Mr V. Govender on 034 328 7600 ext. 7665.

V. GOVENDER
ACTING MUNICIPAL MANAGER
Newcastle Municipality
37 Murchison Street, Civic Centre
www.newcastle.gov.za

NEWCASTLE MUNICIPALITY

NOTICE NO.: CS 23/2021

ISAZISO SOMPHAKATHI WASENYUKHASELA

ISAZISO SOKWAMUKELWA KOMQULU WOHLAKA LWENTUTHUKO OLUDIDIYELWE, UHLAHLOLWASIWO NALI OLUBUYEKEZIWE LWESABELO SEZIMALI KANYE NOKUQAPHA KWEMISEBENZI WANGONYAKA KA 2021/2022 YOMKHANDLU WASE NYUKHASELA

Isaziso sikhanyisa wuMengcibi wase Nyukhasela mayelana nesingqumo esathathwa kumkhangiso weMengcibi ekhishwe le nyanga yezwe ngomhla ziNhlolanja 06 May 2021, futhi nesiMemezelo Sokuhlaziywa kwesiKhwishozwe, kanye nohlelo lokwakhiwa kanzulu olubuyekeziwe lwenyanga yokuhlaziywa kwe Nyukhasela ka wonyaka wezimali ka 2021/2022. Ikopi yalo lonke lolu lwazi lungatholakala ngokuvakashela uMkhandlu ongenzeni (37 Murchison Street) ngo 2000 osekuhlosiwe (ezinkundleni zonke) ngaphezu kwalokho ungavakashela iwebhusayithi yoMkhandlu ku www.newcastle.gov.za. Umkhandlu ungamukela izimbono zakho ngokubhala ku: 31 May 2021 ekhonjwa kwiwebhusayithi www.newcastle.gov.za, nangomhla ka 08 June 2021 ethunyelwa ekheli lokuthi isekela@newcastle.gov.za 37 Murchison (Civic Centre) kanye nakuyo yonke amalaga yakwa Nyukhasela, eMadadeni kanye nase Ekuvukeni.

Umkhandlu uthanda ukwazisa uZiki Dr. N.N.G. Mahlabe ukuthi ukuhlonga okukhulu ngqamile kwiv wonke amalungu omphakathi abenzanda nokwenke kjhuza ekuthungeniswei kwemigidu esulu lwe ngemba (IDP Budget and PMS).

V. GOVENDER
ISAMBELA LIKA MENEJA KAMASIPALA
Newcastle Municipality
37 Murchison Street, Civic Centre
www.newcastle.gov.za

GCS

UMNYANGO WEZOKUHLALISWA KWASEMAKHAYA, EZAMANZI NEZENHLANZEKO (UMNYANGO WEMIPHAKATHI YASEMAKHAYA)

INOMBOLO EYINKOMBA YE-GCS: 19-6653

INO. EYINKOMBA YE-DHSWS: WU19635

UKUSETSHENZISWA KWAMANZI	INCAZELO	KUGALISWA
yiSigaba 21 se-NWA		
21 (a)	Ukuthathwa kwamanzi emfuleni wendawo	Ukuthathwa kwamanzi kwiqiqabuso lomgodi
21 (c) and (i)	Ukuphazamiswa kwezindawo zamanzi engaphansi kwendawo kanye Ukuvuselelwa kwamanzi ezindaweni ezingaphansi kwendawo ezithinteka ukuthuthwa kwezinto ezikhiqizwa ngumsebenzi	Ingozi yokungcoliswa kwamanzi ayisemqoka kakhulu ngenxa yokuthi kuzoba nomsebenzi ogwadule kuphela

Ngokwe-Section 21 (c) and (i) of the NWA, the following water uses require authorisation for the integrated Water Use Licence Application (IWULA) being applied for in terms of Section 21 of the NWA:

WATER USE	DESCRIPTION	TRIGGERED BY
Section 21 of the NWA		
21 (a)	Taking of water from a water resource	Abstraction of groundwater from boreholes
21 (c) and (i)	Impeding or diverting the flow of water in a watercourse, and Altering the bed, banks, course or characteristics of a watercourse	Infrastructure/activities within 500m of a wetland (Channelled valley bottom wetland)

You are hereby invited to register as an Interested and Affected Party (IAP) to participate in the stakeholder engagement process, as well as to receive any relevant documentation about the project, as a natural or legal person representing the project. As a registered IAP, you will receive further information and will be kept informed of the documents taken by the competent authorities.

Should you wish to register as an IAP and receive a Background Information Document, with additional details on the project, please contact Shayla-Ann Dutt via the following: Tel: 27 (0) 31 205 5726; Fax: 27 (0) 31 205 4744; Email: shayla@gcs-sa.biz or Post: PO Box 2537, Riverhorse, 3135 on or before 02nd August 2021. Please note that this date includes time for comments to be received by registered IAPs. The IWULA report is accessible for download and comment from http://www.gcs-sa.biz.

A public meeting will be held on the 23rd June 2021 from 17:00 – 19:00 at the Normandien Farmers Hall (Normandien Sale Yard).

GCS

NOTIFICATION OF AN INTEGRATED WATER USE LICENCE APPLICATION (IWULA) PROCESS IN TERMS OF SECTION 21 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) (NWA), FOR WATER USE ACTIVITIES TAKING PLACE AT THE THISTLE BOTTLING PLANT, SOUTH-WEST OF NEWCASTLE, KWAZULU-NATAL PROVINCE

DEPARTMENT OF HUMAN SETTLEMENTS, WATER AND SANITATION (DHSWS)
GCS REFERENCE NO: 19-6653
DHSWS REFERENCE NO: WU19635

Notice is hereby given in terms of Chapter 4, Section 41(4) of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), of the intention of Water Use Licence Application (WULA) process being undertaken by GCS Water and Environment (Pty) Ltd (GCS). The process is being undertaken on behalf of Normandien Farms (Pty) Ltd for the activities described in terms of Section 21 of the NWA at the Thistle Bottling Plant in Newcastle.

Thistle is located southwest of Newcastle in the KwaZulu-Natal Province of South Africa. The bottling plant is located on the R621 roadway and is accessed off the R34. Water Management Areas (Water Use Licensing Application) Notice No. 40113 on 29 March 2017 states that the competent authority for Department of Human Settlements, Water and Sanitation (DHSWS) requires the applicant to obtain a suitable notice in newspapers and other media and to take other reasonable steps as directed by Government Notice Regulation (GNR) No 267 to bring the application to the attention of relevant organs of state, interested persons and the general public.

The following water uses require authorisation for the integrated Water Use Licence Application (IWULA) being applied for in terms of Section 21 of the NWA:

WATER USE	DESCRIPTION	TRIGGERED BY
Section 21 of the NWA		
21 (a)	Taking of water from a water resource	Abstraction of groundwater from boreholes
21 (c) and (i)	Impeding or diverting the flow of water in a watercourse, and Altering the bed, banks, course or characteristics of a watercourse	Infrastructure/activities within 500m of a wetland (Channelled valley bottom wetland)

You are hereby invited to register as an Interested and Affected Party (IAP) to participate in the stakeholder engagement process, as well as to receive any relevant documentation about the project, as a natural or legal person representing the project. As a registered IAP, you will receive further information and will be kept informed of the documents taken by the competent authorities.

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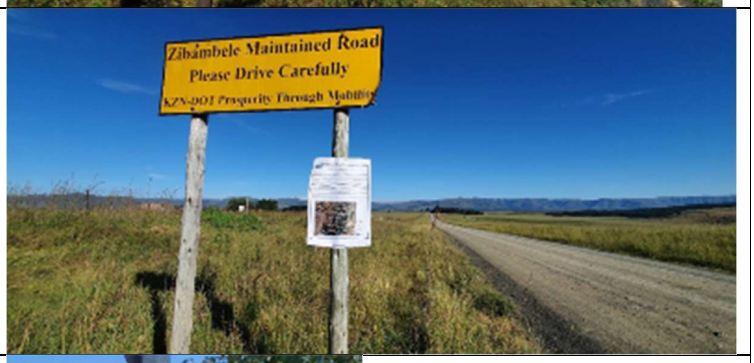
Deadline for all Advertising

Strictly 17:00 on Monday before publishing.

Cancellation of Legals

will only be accepted in writing before 12:00 on a Tuesday prior to printing. Email: newadv@caxton.co.za

APPENDIX C: SITE NOTICES 2021

	Place	Coordinates	Photo
Initial Site Notices			
1	Normandien	27°59'8.75"S 29°46'49.24"E	
2	Thirsti entrance	27°56'32.90"S 27°56'32.90"S	
3	Intersection on the P39-1	27°52'28.98"S 29°48'43.83"E	
4	Near Scott Street Mall	27°45'27.92"S 29°55'47.24"E	

	Place	Coordinates	Photo
Re-run			
5	Normandien	27°59'8.75"S 29°46'49.24"E	
6	Thirsti entrance	27°56'32.90"S 27°56'32.90"E	
7	Intersection on the P39-1	27°52'28.98"S 29°48'43.83"E	

	Place	Coordinates	Photo
8	Near Scott Street Mall	27°45'27.92"S 29°55'47.24"E	

APPENDIX D: BACKGROUND INFORMATION DOCUMENT 2021

63 Wessel Road Rivonia 2128 PO Box 2597 Rivonia 2128 South Africa

Telephone: +27 (0)11 803 5726 Facsimile: +27 (0)11 803 5745
Web: www.gcs-sa.biz

BACKGROUND INFORMATION DOCUMENT AND INVITATION TO COMMENT

NOTIFICATION OF AN INTEGRATED WATER USE LICENCE APPLICATION PROCESS IN TERMS OF SECTION 21 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) (NWA) FOR WATER USE ACTIVITIES TAKING PLACE AT THE THIRSTI BOTTLING PLANT, SOUTH-WEST OF NEWCASTLE, KWAZULU-NATAL PROVINCE.

Date of Publication: 19th March 2021
Client Name: Normandien Farms (Pty) Ltd
GCS Project Number: 19-0683
DHSWS Reference No: WU18635

Purpose of this Background Information Document

Purpose of this Background Information Document

The purpose of this document is to provide all interested and affected parties (I&APs) with information about the proposed application for an Integrated Water Use Licence Application (IWULA) for the Thirsti Bottling Plant:

- ☑ Introduce and explain the IWULA process;
- ☑ Introduce and explain the Public Participation Process related to the National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- ☑ Invite all I&APs to comment on:
  - Ecological, physical, socio-economic and any other issues of concern related to the IWULA;
  - The proposed public participation and IWULA assessment process; and
  - Any other suggestions.

What is an Integrated Water Use Licence Application (IWULA) and what does an IWULA contain?

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) prescribes the processes to be followed when compiling an Integrated Water Use License Application (IWULA), in respect of Section 21 activities that form the legal basis of this authorisation. The NWA also outlines the relevant competent authority, the Department of Human Settlements, Water and Sanitation (DHSWS), who will deal with the authorisation process.

The purpose of this IWULA is to assess all the required water uses for the Thirsti Bottling Plant (Thirsti). The surface water and groundwater aspects are determined, and all of the potential impacts assessed. Impacts are assessed in terms of their extent, duration, intensity and significance relating to the specific activity and to ensure that there is sufficient water resources available for the activity, while taking cognisance of other water users needs including the environment. The IWULA describes the goals and objectives for environmental management to minimise or eliminate the potential negative environmental impacts, the action plans to bring effect to those goals and objectives, the procedures to be implemented to ensure integration of environmental management into the daily operations, as well as a plan to raise awareness amongst employees and the surrounding community with regards to environmental management in terms of Chapter 4, Section 41(4) of the NWA.

The process aims to ensure that all relevant factors are considered when evaluating the potential impacts of a project on the water resource, as well as developing appropriate management measures to mitigate these impacts.

1 BACKGROUND AND PROJECT DESCRIPTION

Normandien Farms (Pty) Ltd owns and operates the Thirsti Bottling Plant (Thirsti). Thirsti is located on the farm Buffelshoek 5469, approximately 28km south west of Newcastle in Kwa-Zulu Natal, South Africa (Figure 1). The production of bottled water at Thirsti commenced during 2015 and included the bottling of natural and sparkling spring water. The water use for bottling is sourced from a natural spring / groundwater located on the property. Since the start of production, fruit flavoured water was also added to the list of products. Due to the growth of Thirsti (consumer demand and production capabilities), the bottling plant proposes to expand to increase production. In order to increase production, additional water will be required for bottling. This water is proposed to be abstracted from boreholes located on the property.

According to the quaternary catchments dataset for South Africa, the study area falls within the V31F quaternary catchments of the Thukela Water Management (WMA). Several tributaries/rivers run through the study area, including the perennial Horn River. The Horn River rises at approximately 1 800msl north of the Normandien Pass, between the Ncandu and Ngagane rivers. The Horn River joins the Ngagane River near Ballengeich. The Horn River is approximately 110m south-east of Thirsti.

Thirsti was issued with a General Authorisation (GA) (dated 17th June 2015) in terms of Section 39 of the National Water Act 1998 (Act 36 of 1998) for the taking of water from a water resources.

In addition to the GA issued, Thirsti currently triggers water uses in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) which requires authorisation from the Department of Human Settlements, Water and Sanitation (DHSWS) in the form of an Integrated Water Use License Application (IWULA). The following water uses have been identified for authorisation:

- Section 21(a) - Taking water from a water resource;
- Section 21(c) - Impeding or diverting the flow of water in a watercourse; and
- Section 21(i) - Altering the beds, banks, course or characteristics of a water course.

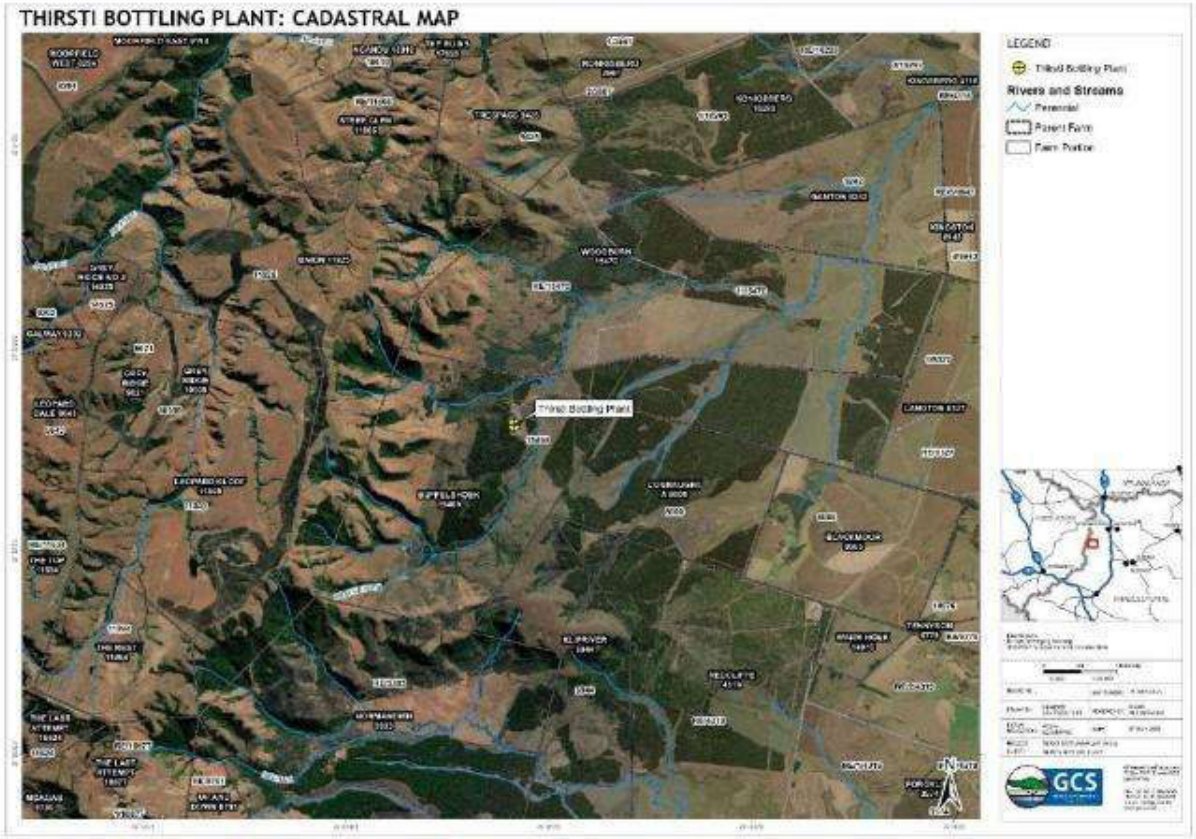


Figure 1: Locality Map - Thirsti

2 INTEGRATED WATER USE LICENCE APPLICATION

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

Water uses are identified in terms of Section 21 of the NWA. Any activity which is considered a water use may be undertaken if it is; a Schedule 1 use (e.g. abstracting groundwater for domestic use), a continuation of an existing lawful water use (a water use which took place between 1996 and 1998); which is permissible under the General Authorisation notices; or if an Integrated Water Use Licence Application (IWULA) is issued for that water use by the Department of Human Settlements, Water and Sanitation (DHSWS).

In order to apply for the water uses associated with the proposed project, an Integrated Water Use Licence Application (IWULA) needs to be compiled and submitted to the DHSWS. In this case, Thirsti has to apply for an Integrated Water Use License (IWUL) because of the Water uses that are triggered by the project.

The following water uses will require authorisation for the Integrated Water Use Licence Application IWULA in terms of Section 21 of the NWA:

WATER USE	DESCRIPTION	TRIGGERED BY
Section 21 of the NWA		
21 (a)	Taking of water from a water resource	Abstraction of groundwater from boreholes
21 (c) and (i)	Impeding or diverting the flow of water in a watercourse; and Altering the bed, banks, course or characteristics of a watercourse	Infrastructure/boreholes within 500m of a wetland (Channelled valley-bottom wetland)

National Government has the overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest. A person can only be entitled to use water if the use is permissible under the NWA. The purpose of the IWULA is to identify and assess the potential environmental and socio-economic impacts associated with the project, to develop measures to manage and/or mitigate the negative impacts, and to enhance any potential positive impacts. The application further enables the DHSWS to process and make an informed decision with regards to the water resource and management thereof in the area where the project is located.

3 PUBLIC PARTICIPATION PROCESS

The required Public Participation Process (PPP) is outlined in the Government Notice Regulation No. 267, Regulations Regarding the Procedural Requirements for Integrated Water Use Licence Applications and Appeals published in Government Gazette No. 40713 on 24 March 2017. The Public Participation Process (PPP) is an important part of the authorisation process:

The key objective of public participation is to assist stakeholders to identify issues of concern, to make suggestions for enhanced benefits, and to comment on the findings of the IWULA.

Proposed steps in and scheduling of the process are as follows:

Step 1: Notify I&APs and identify issues
Notify Interested and Affected Parties (I&APs) of the project;
Provide I&APs with a Background Information Document (BID) on the project, including a locality map and a Registration and Comment Sheet;
I&APS are required to register their interest in the project to receive further project information; and
Identify any issues/concerns and/or suggestions of I&APs with regards to the project (to be addressed and recorded in the Comment and Response Report).

Step 2: Public review of draft documentation
The draft IWULA will be placed for public review for a period of 60 days. All registered I&APs of the project will be invited to review and provide and comments or queries on the report.

Step 3: Final Integrated Water Use Licence Application IWULA
The Final IWULA, including the Comment and Responses Report and will be compiled for submission to the DHSWS for decision making.

Step 4: Notify I&APs of the Authorisation and Appeal Period
All registered I&APs will be notified in writing of the authorisation for the project and the appeal period, as well as the manner of appeal.

4 BE AN INTEGRAL PART OF THE ENVIRONMENTAL MANAGEMENT PROCESS

Public involvement is an essential part of any environmental assessment process. You have been identified as an I&AP who may want to receive information regarding the above-mentioned project and will be allowed to provide your input into the environmental assessment process. All comments will be recorded and presented to the project team and regulatory authorities. You will receive feedback on how your comments have been taken into account and the outcome of the assessment.

I&APs include any person who will be directly or indirectly involved and/or affected by the project. To be recognised as an I&AP you must register with GCS Water and Environment (Pty) Ltd to be added to the stakeholder database for the project. You may communicate via fax, email or telephone to obtain further information or comment on the proposed Thirsti IWULA (please see contact details below). All registered I&APs will be kept informed of the decision taken by the DHSWS.

How do you get involved?

You can get involved in the following ways:

- By registering your interest in the project with GCS as indicated below;
- By responding to our invitation for your involvement advertised in the local newspaper;
- By completing and forwarding the Registration and Comment Sheet to GCS if you have a query, comment, or require further project information;
- By telephonically contacting GCS; and
- By reviewing and commenting on the various reports within the stipulated comment period.

Please note that due to COVID-19 regulations, a public meeting will not be held. All information will be made available electronically and comments can be made via e-mail, telephone or post using the contact details provided below.

Public Notification

A major part of the PPP is to notify members of the public of the proposed activities, particularly those who may be directly or indirectly affected by the proposed project. This will be achieved via the following means:

- The placement of an advertisement in a local newspaper;
- Notices, which will be placed at and around the project area;
- Electronic distribution of BIDs to landowners and occupiers of land adjacent to the project area and to I&APs on request; and
- Written notifications to Local authorities, who will be automatically be registered as I&APs.

How to comment

Should you wish to register as an I&AP in order to be kept informed, please complete the registration form overleaf and submit to GCS via fax, post or email on/before **17th May 2021**. Any further enquiries can be directed to GCS telephonically, or via fax or email. It is important that you provide your contact details so that we may respond to your comments or questions.

Please note that should you require anyone else to be contacted, please provide their contact details as well. The IWULA report is accessible for download and comment from http://www.gcs-sa.biz/

Contact Us

Kate Cain

Tel:	011 803 5726
Fax:	011 803 5745
Email:	kate@gcs-sa.biz
Postal Address:	P.O. Box 2597 Rivonia Johannesburg 2128

Normandien Farms (Pty) Ltd - Thirsti

Integrated Water Use Licence Application IWULA

I&AP Comment and Registration Form

GCS Ref No: 19-0683

Name:		Surname:	
Organisation / interest:			
Postal / Residential address			
	Area:	Code:	
Contact details	Tel: ( )		
	Fax: ( )		
	Mobile: ( )		
	Email:		

Please mark with an X to indicate whether you would like to participate in the process:						
Yes, I would like to participate in this process and receive periodical updates						
No, I am not interested in participating and do not wish to receive further information						
Preferred method of communication	Email		Fax		Post	
Date commented	(DD / MM / YYYY)					

Please indicate any issues, comments and concerns with regards to the proposed project

Please indicate in which aspects you would require more information

Please indicate the contact details of any I&APs whom you think should be contacted

Name:		Surname:	
Tel:	( )	Fax:	( )
Mobile:	( )		
Email:			

In order to be registered as an I&AP for this project, fax, mail, or e-mail the completed registration form before **17th May 2021** to Kate Cain at:

Tel: (011) 803 5726
Fax: (011) 803 5745
Email: kate@gcs-sa.biz
Post: PO Box 2597, Rivonia, 2128

APPENDIX E: PUBLIC MEETING PRESENTATION JUNE 2021

THIRSTI™

Water Use Licence Application (WULA)
Public Meeting

23rd June 2021

GCS Water & Environmental Consultants

Agenda

1) Welcome and introduction
2) Background information
3) Project location
4) Water uses being applied for
5) Specialist studies conducted
6) Impact assessment
7) Public participation
8) Current project status
9) Conclusion and way forward
10) Question/Discussion Session

GCS THIRSTI 2

Background Information

- Normandien Farms (Pty) Ltd owns and operates the Thirsti Bottling Plant (Thirsti).
- The production of bottled water at Thirsti commenced during 2015 and included the bottling of natural and sparkling spring water.
- The water use for bottling is sourced from a natural spring / groundwater located on the property.
- Due to the growth of Thirsti (consumer demand and production capabilities), the bottling plant proposes to expand to increase production. In order to increase production, additional water will be required for bottling.

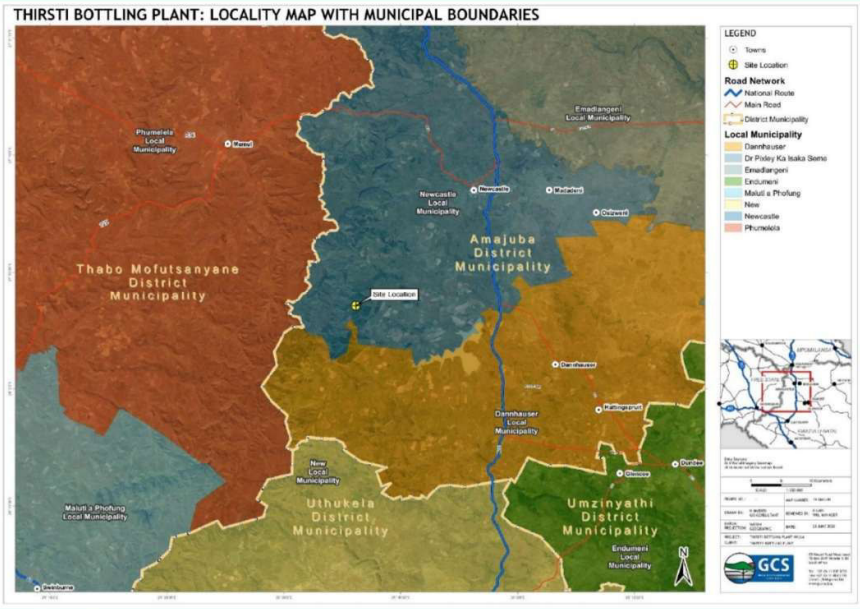
GCS THIRSTI 3

Project Location

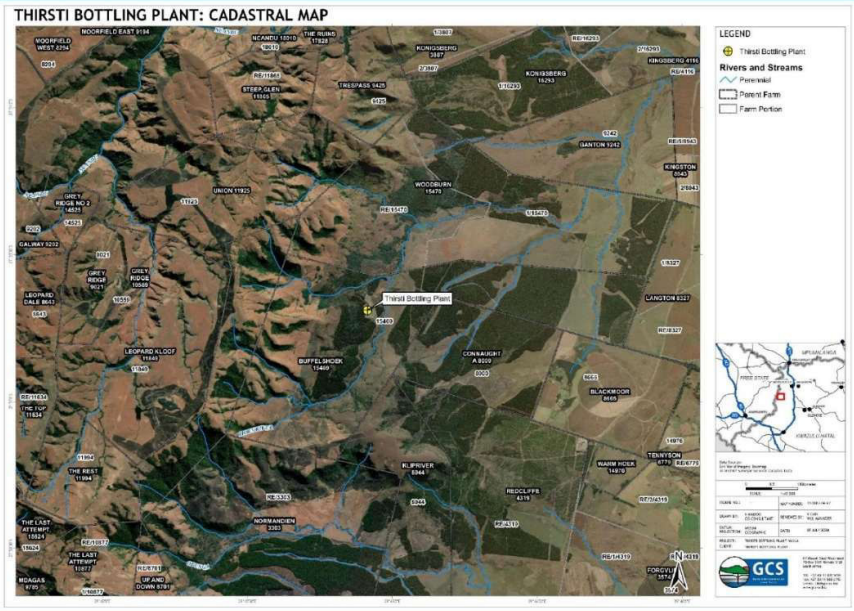
- Thirsti is located on the farm Buffelshoek 5469, approximately 28km south west of Newcastle in KwaZulu-Natal, South Africa.
- The farm is located in Newcastle Local Municipality within the Amajuba District Municipality.
- The project is situated within the the V31F quaternary catchment which forms part of the of the Thukela Water Management Area.

GCS THIRSTI 4

Locality



Locality

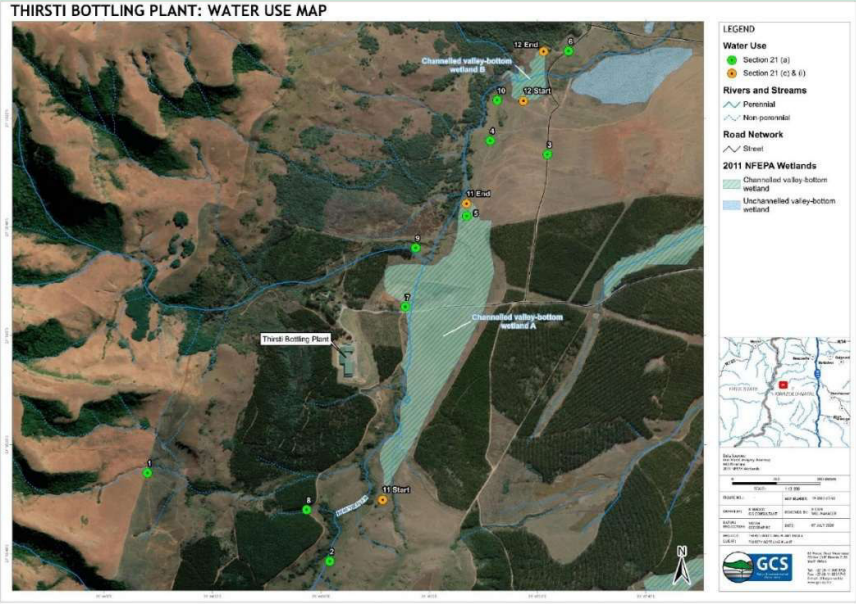


Water Uses Being Applied For

- **Normandien Farms (Pty) Ltd were issued with a General Authorisation (GA) (27/2/1/V31F/1) on the 17th June 2015 in terms of Section 39 of the National Water Act (NWA) for the taking of 36 000m³/a of groundwater for the purpose of bottling.**
- **As a result of the expansion, additional water uses are triggered in terms of Section 21 of the NWA.**
- **The water uses that have been identified include:**
  - **Section 21(a) -** Groundwater abstraction (boreholes) for operational use; and
  - **Section 21(c) and (i) -** Infrastructure/boreholes within 500m of a wetland.

GCS THIRSTI 7

Locality of Water Uses



GCS THIRSTI 8

Specialist Studies Conducted

- **The following studies have been conducted in support of this application:**
  - Water Supply Investigation (geohydrological assessment) was undertaken by GCS in 2019;
  - Hydropedology Assessment undertaken by GCS in 2021; and
  - A wetland assessment was undertaken by Wet-Earth Eco-Specs (Pty) Ltd in 2019.

- **The following studies have been done previously:**
  - Thirsti Bottled Water Groundwater Exploration (Aurecon);
  - Feasibility Geohydrological Investigation (Engeolab cc); and
  - Hydrogeological and Vulnerability Report (SANBWA).

GCS THIRSTI 9

Specialist Studies - Water Supply Investigation

- **Aquifer testing was completed to assess the hydraulic parameters of the encountered geology and selected structural feature for the newly installed production boreholes as well as the existing production boreholes.**

- **Sustainable abstraction rates were calculated for a 10 year operational life based on a twelve (12) hour per day abstraction schedule.**

- **The sustainable abstraction rate was determined for all of the boreholes to be used. No water will be abstracted in excess of these volumes.**

GCS THIRSTI 10

Specialist Studies - Water Supply Investigation

- As part of the water supply investigation undertaken, an impact assessment was done. The finding from the assessment indicated that the over-abstraction of the aquifer could result in decreasing water tables. This impact will be managed by the implementation of a sustainable abstraction programme which has been developed. Regular groundwater level monitoring will also be conducted.

GCS THIRSTI 11

Specialist Studies - Wetland Assessment

- A wetland assessment was undertaken by Wet-Earth Eco-Specs (Pty) Ltd in 2019.
- During this study three wetland areas have been identified namely:
  - Wetland 1(W1) is a Valley Bottom wetland with a channel and its Present Ecological Status (PES) (integrity of the wetlands) has been rated a **D**;
  - Wetland 2 (W2) a Hillslope seep connected to a wetland and its PES is a **D**; and
  - Wetland 3 (W3) also a Valley Bottom wetland with a channel and its PES is a **D**.
- D = Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.

GCS THIRSTI 12

Specialist Studies - Wetland Assessment

- The bottling facility is an existing operation. The PES and EIS (Ecological Importance & Sensitivity) impact is considered low-moderate and wetland buffers and stormwater attenuation measures will offset negative impacts.

- In relation to groundwater abstraction, and considering that water is drawn from a confined aquifer system, marginal to zero impacts are anticipated in term of reduced baseflow from the unconfined weathered zone towards watercourses and wetlands in the area.

GCS THIRSTI 13

Delineated wetlands in the study area



GCS THIRSTI 14

Public Participation

- **The following PPP has been undertaken for this WULA in accordance with GNR.267:**
  - Erecting of site notices (English, Afrikaans and isiZulu) on the 4th June 2021;
  - Distribution of Background Information Documents (BIDs) to adjacent landowners and any other Interested and Affected Party (I&AP) (via email); and
  - Placement of advertisements (English and isiZulu) in the local newspaper (Newcastle Advertiser) on the 4th June 2021.

- **The PPP commenced on the 4th June 2021 and will run for 60 days ending on the 02nd August 2021. A full PP report will be compiled to include all responses from the public after the 60 day period.**

GCS THIRSTI 15

Current Project Status

- **All specialist studies required by the Department of Water and Sanitation (DWS) have been undertaken.**
- **A pre-application meeting has been undertaken with the DWS to ensure all water uses are being applied for.**
- **The project is currently in public participation phase.**
- **The technical report for this application has been drafted and is available for public download on the GCS website.**
- **Comments from the public will be included in the final report for submission the DWS.**
- **Once the public participation is compete, the final report will be submitted to the DWS for authorisation.**

GCS THIRSTI 16

Conclusion

- **All water uses for Thirsti are being applied for as part of this application. After the implementation of mitigation measures, the specialists have determined that the impacts associated with the water uses are low to medium.**

- **Way forward:**
  - GCS to compile public participation report for inclusion into the application.
  - The public participation timeframe for comments ends on the 02nd August 2021.
  - The Application will be finalised and submitted to the DWS who will have 139 days to review the application and provide a decision.

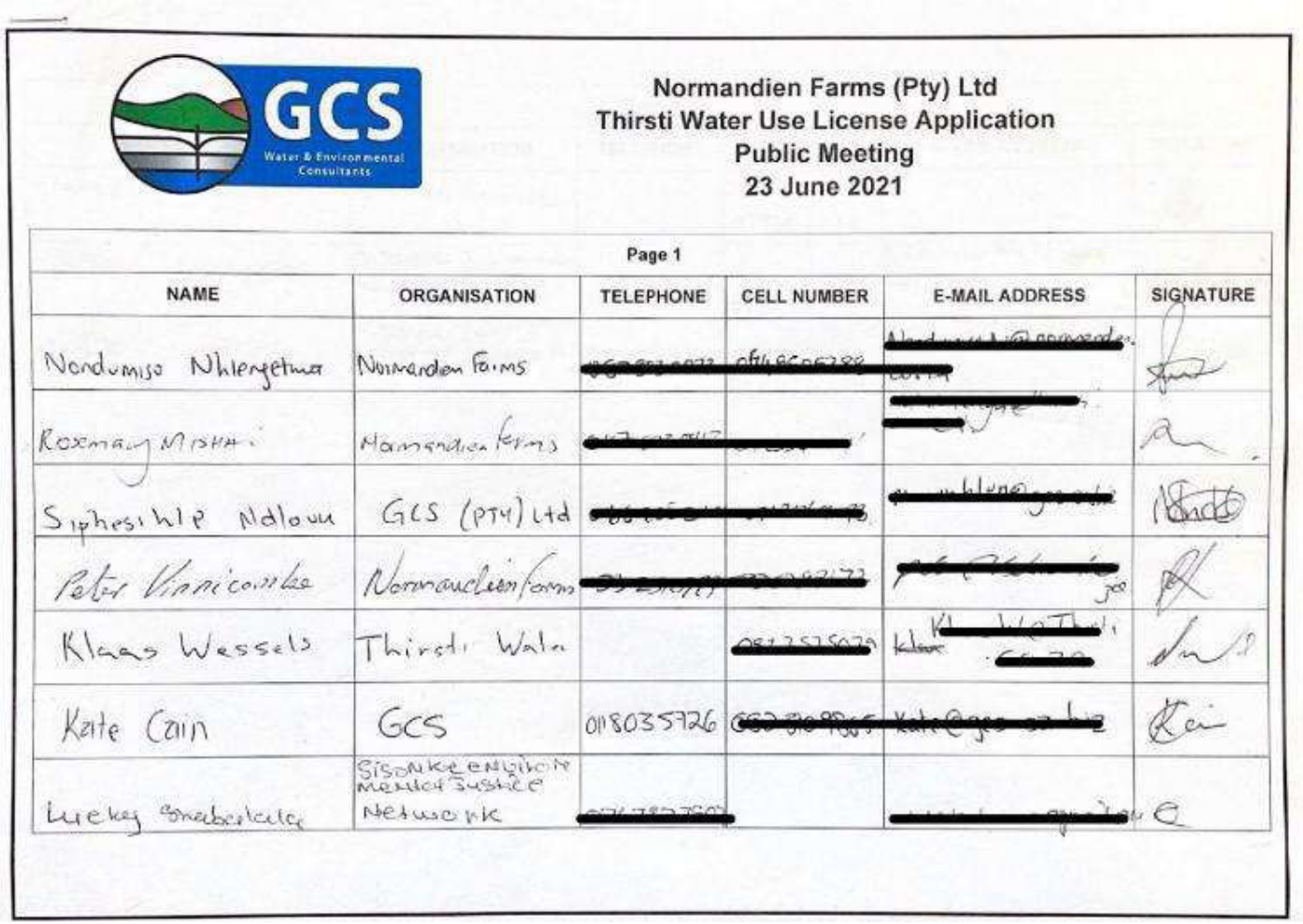
GCS THIRSTI 17

Thank You

Questions / Discussion

GCS THIRSTI 18

APPENDIX F: PUBLIC MEETING ATTENDANCE MEETING JUNE 2021

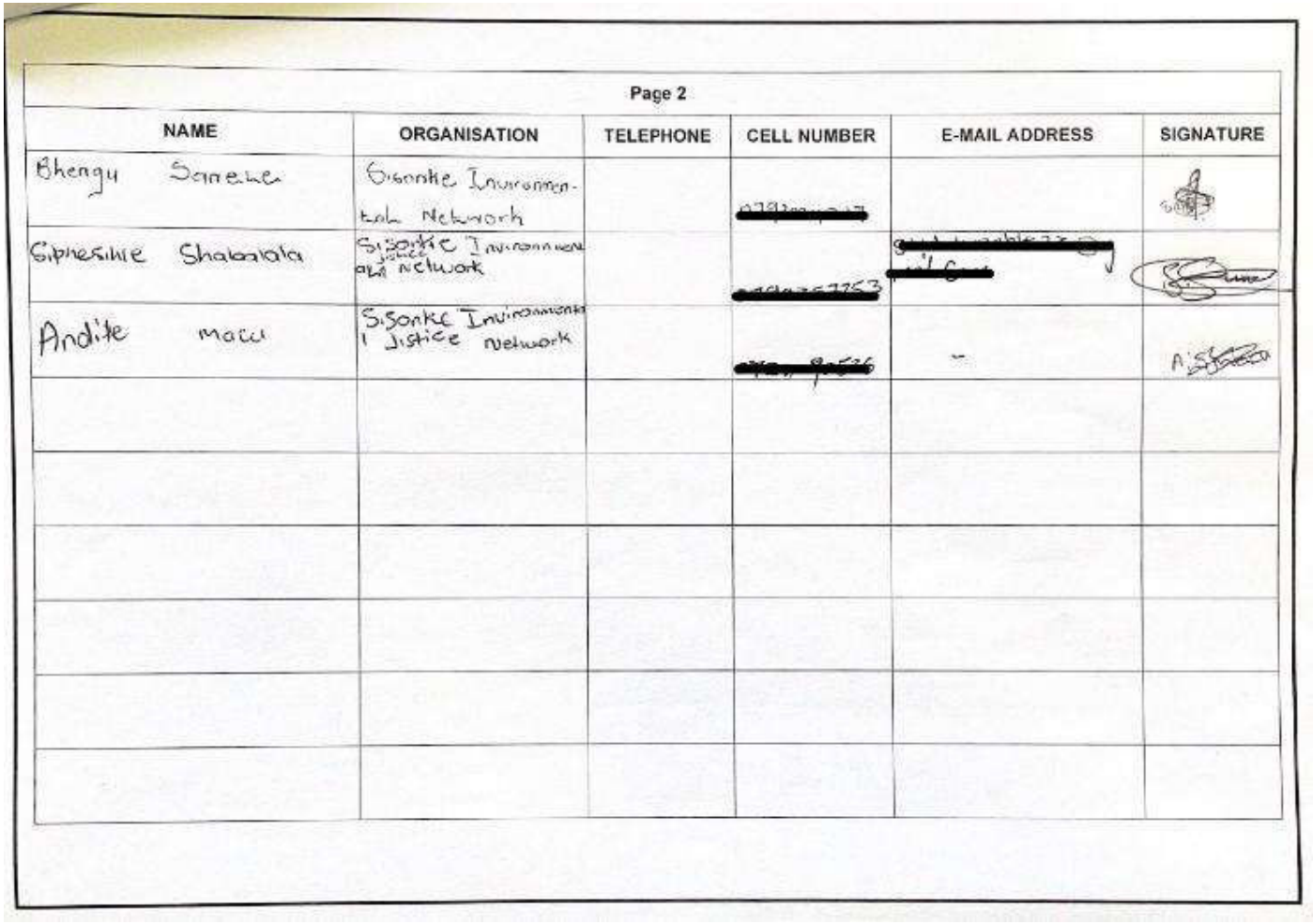


GCS Water & Environmental Consultants

Normandien Farms (Pty) Ltd
Thirsti Water Use License Application
Public Meeting
23 June 2021

Page 1

NAME	ORGANISATION	TELEPHONE	CELL NUMBER	E-MAIL ADDRESS	SIGNATURE
Nondumiso Nhlengetwa	Normandien Farms	[redacted]	[redacted]	[redacted]	
Roxmary Mishi	Normandien farms	[redacted]	[redacted]	[redacted]	
Siphesihle Ndlovu	GCS (PTY) Ltd	[redacted]	[redacted]	[redacted]	
Peter Vinnicombe	Normandien farms	[redacted]	[redacted]	[redacted]	
Klaas Wessels	Thirsti Wate		[redacted]	[redacted]	
Kate Cain	GCS	0118035726	[redacted]	[redacted]	
Lwekey Sonebesheke	Sisonke Environmental Justice Network	[redacted]		[redacted]	



Page 2

NAME	ORGANISATION	TELEPHONE	CELL NUMBER	E-MAIL ADDRESS	SIGNATURE
Bhengu Sanele	Sisonke Environmental Network		[redacted]		
Siphesihle Shabalala	Sisonke Environmental Justice Network		[redacted]	[redacted]	
Andile Mazi	Sisonke Environmental Justice Network		[redacted]	-	

APPENDIX G: NEWSPAPER ADVERTISEMENT FEBRUARY 2026



Public Works MEC Martin Meyer surveys the area.

Amajuba sees first confirmed case of Foot-and-Mouth in recorded history in 2025

The first confirmed case of Foot-and-Mouth Disease (FMD) in the Amajuba District was reported on February 25, 2025.

The infected animal was discovered at a communal dip tank in Osizweni, where animal health technicians, employed by the state, were assessing and treating the animals for disease.

Newcastle-based veterinary surgeon Dr Jason Blick explained that, at this dip tank, someone had reported a lame animal that was salivating as a result of sores in its mouth.

"The state vet examined the animal and said it definitely had Foot-and-Mouth. He then took blood samples, which he sent to the lab to confirm his diagnosis, and the results were positive for FMD," said Blick. "The state vet made the diagnosis and informed the department. He also managed to acquire vaccines and started vaccinating cattle in the area.

"Amajuba never had Foot-and Mouth Disease before. This was the first reported case," Blick confirmed.

During last week's public engagement with Amajuba's farming community, State Vet Wandile Ngwenya explained that he suspected some of the positive cases of FMD may have arisen at an auction that took place in Utrecht on February 13, 2025. The first clinical signs of FMD in the Amajuba District were reported to the state vet on February 17, 2025, four days after the auction was held.

Ngwenya later learned that a heifer purchased at the Utrecht auction showed clinical signs of FMD. The farm that purchased the heifer, located close to the R34, was placed under quarantine and all the livestock on that farm were vaccinated for FMD.

"We've had to do tracing from that auction. Most of the sellers came from the Amajuba District, but some of those cattle ended up in Winterton and Ladysmith," cautioned Ngwenya.

"The properties on the Normandien side and those to the north of the R34 are well-fenced-off. If we pick up FMD in a farm on those areas, we can treat that farm as a unit and deal with it without affecting trade on the neighbouring farms," explained Ngwenya. "However, this is impossible in the area which we included in the DMA. Here, it is village after village. There are no fences, so continual spread of the disease is a problem." Areas identified as high risk for illegal movement of animals out of and through the DMA are the intersection where the Osizweni road meets the R34 to Utrecht, as well as the border between Dannhauser and Dundee. "The intersection of the Osizweni road and the R34 is critical. Movement from this area is high risk and this intersection makes illegal movement possible to Emadlangeni, Vryheid and Ingogo," said Ngwenya.

Farmers fear that the biggest risk in terms of the illegal movement of livestock will present itself in the winter months when rivers are low enough to make crossing possible. "The only reason we are saying that the first case was that one was because we saw it. Chances are that many other animals were already infected in the area. That's why we went in there and instead of thinking of just one animal, we quarantined the whole area and began vaccinating. If you just focus on one animal when you are dealing with FMD, you've lost the battle. We had to think of the entire area. You can deal with one animal where a case of FMD is detected in an area where the animals are separated by fences. In the communal grazing areas in Osizweni and Madadeni, it is impossible. We would be wasting our time," he concluded.

Agriculture portfolio committee demands answers

The Department of Agriculture appeared before the national portfolio committee on February 7 to explain the causes of FMD's spread and what it has done to arrest its prevalence.

According to the report presented to the committee, buffaloes are the native carriers of FMD, and South Africa has a huge population of buffaloes in its game reserves.

The Department of Agriculture told the committee that although FMD is a state-controlled disease in terms of the Animal Diseases Act, 1984 (Act no 35 of 1984), section 11 of the same Act places an obligation on farmers to ensure that their animals are not infected; and if infected, to ensure that such a disease is prevented from spreading to their neighbours.

"To strengthen its intervention, the department has, among other things, come up with a strategy to interrupt virus transmission, reduce incidence to very low levels in two to three years, and create certified FMD-free zones through vaccination," the report claims.

These efforts would be supplemented by massive awareness campaigns on FMD.

The committee heard that in 12 months, the department seeks to reduce outbreak incidence by 70% in high-risk provinces through systematic vaccination.

The department also intends to reach 80% vaccination coverage of targeted cattle populations in priority districts.

The committee wanted to know how many vaccines have been distributed now.

In response, the department said that 1.2 million doses of vaccine had vaccinated 285,000 animals to date.

Another 12,000 doses of vaccine will be rolled out this month.

The committee heard that this amount was minimal, but nonetheless this roll-out would be based on a high-risk approach targeting the epicentres of FMD and would help to complement what is already out there in the field.

The department informed the committee that it has had information sessions with private veterinarians, and there will also be imbizos to communicate critical interventions regarding FMD.

But the priority now is animal health technicians and veterinarians so that they can spread the information on FMD.



Mass vaccinations are expected to be rolled out in KZN early next month.

APPLICATION FOR WATER USE LICENCE FOR THIRSTI BOTTLING PLANT

• Ref No. WU41899 • GCS Ref. No: 25-0109

NOTICE: Notice is hereby given in terms of the National Water Act, 1998 (Act No. 36 of 1998) and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals, 2017 (Government Notice R267 of 24 March 2017) (WULA Regulations), of the submission of a Water Use Licence Application (WULA) by Thirsti to the Department of Water and Sanitation.

LOCATION: The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa.

PROJECT DESCRIPTION: The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa. Established in 2015, the plant is situated at the foothills of the Kei Drakensberg Mountains, an area renowned for its natural springs. The water sourced is naturally filtered through ancient geological formations, resulting in a minerals-rich composition with a high pH of 8, making it both refreshing and alkaline.

Production began in 2015, focusing on the bottling of natural and sparkling spring water, and has since expanded to include fruit-flavoured water. Due to Thirsti's continued growth, the bottling plant now proposes an expansion, which will trigger additional water use requirements. Thirsti is applying for a Water Use Licence to authorise and expand groundwater use in line with legislation and long-term sustainability objectives.

ENVIRONMENTAL ASSESSMENT PRACTITIONER: GCS Environment South Africa (Pty) Ltd (GCS) has been appointed as the independent environmental consultant to manage the WULA process on behalf of Thirsti.

INVITATION TO PARTICIPATE AND COMMENT ON THE DRAFT WULA TECHNICAL REPORT: The Draft WULA Technical Report will be available for public review and comment from **23 February 2026 to 28 April 2026** at the following locations:

Place	Address	Telephone
Newcastle Library	86 Scott Street, Newcastle, 2940	+27 (0)34 328 7620
Thirsti Security Gate	Buffelscoek Farm Erf 15469 P250 Road)	+27 (0)87 805 0417
GCS Website	https://www.gcs-sa.biz/public-documents/	+27 (0)11 805 1726

Written comments and substantiated issues must be submitted to GCS by 28 April 2026. Early submissions are encouraged to allow the GCS sufficient time to address concerns comprehensively.

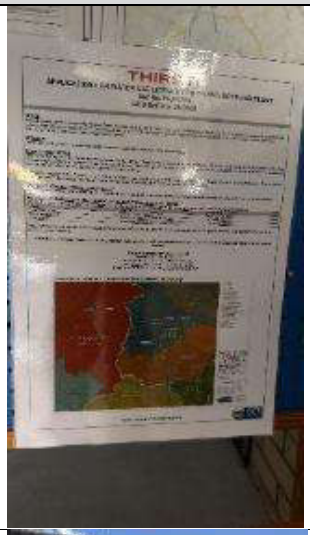
Interested and Affected Parties who wish to register, participate by contributing comments or who would like to obtain more information, should please contact:

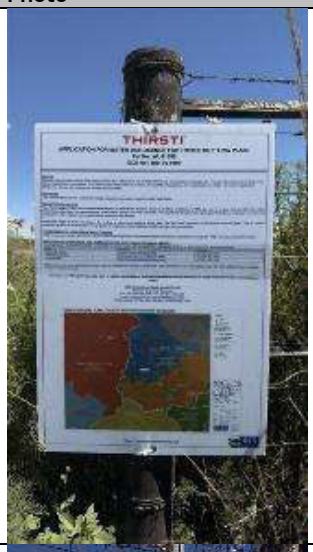
GCS Environment South Africa (Pty) Ltd, Attention: Morande a Mushambi
Tel: +27 (0)11 805 1726, Fax: +27 (0)11 805 1252
E-mail: ppp@gcs-sa.biz / MorandelaM@gcs-sa.biz
Postal Address: PO Box 2597, Rivonia, Johannesburg, 2128

THIRSTI GCS

APPENDIX H: SITE NOTICES FEBRUARY 2026

Site notices were placed at public places near Thirsti on 25 February 2026 at the following locations:

	Place	Coordinates	Photo
Re-application			
1	Newcastle Library 66 Scott Street, Newcastle	27°45'27.58"S 29°55'51.49"E	
2	Thirsti Security Gate Buffelshoek Farm Erf 15469	27°56'22.24"S 29°47'09.02"E	

	Place	Coordinates	Photo
3	Thirsti Entrance P39 Road	27°56'33.32"S 29°47'45.60"E	
4	SAPS Normandien Police Station P39 Road, Normandien, 2940	27°59'09.82"S 29°46'49.30"E	

APPENDIX I: BACKGROUND INFORMATION DOCUMENT 2026

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

APPLICATION FOR A WATER USE LICENCE FOR THIRSTI BOTTLING PLANT
Ref No. WU41899
GCS Ref. No: 25-0109

PURPOSE OF THE DOCUMENT

The purpose of this document is to provide Interested and Affected Parties (I&APs) with information regarding the Thirsti Bottling Plant Water Use Licence Application (WULA).

The aim of this document is thus to:
- Provide I&APs with background information about the WULA;
- Explain the application process followed; and
- Indicate how an I&AP can become involved in the process, receive information, raise issues, and make comments.

LOCATION

The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa. (Figure 2 and Figure 3).

PROJECT DESCRIPTION

The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa. Established in 2015, the plant is situated at the foothills of the Klein Drakensberg Mountains, an area renowned for its natural springs. The water sourced is naturally filtered through ancient geological formations, resulting in a mineral-rich composition with a high pH of 8, making it both refreshing and alkaline.

Production began in 2015, focusing on the bottling of natural and sparkling spring water, and has since expanded to include fruit-flavoured water. Due to Thirsti's continued growth, the bottling plant now proposes an expansion, which will trigger additional water use requirements

Although Thirsti currently uses several boreholes, these are not formally authorised. Thirsti is now applying for a Water Use Licence (WUL) to regularise and expand its groundwater use in line with national water legislation.

LEGISLATIVE CONTEXT

A WULA is being submitted by Thirsti to the Department of Water and Sanitation (DWS) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals, 2017 (Government Notice R267 of 24 March 2017) (WULA Regulations). The application is required for the following water use as defined in Section 21 of the NWA:
- **Section 21(a): Taking water from a water resource.**
  Applicability: This refers to the abstraction of groundwater from boreholes. As such, the abstraction qualifies as a regulated water use and must be formally authorised through a WULA process in accordance with the NWA and supporting regulations.
- **Section 21(c) - Impeding of diverting the flow of water in a watercourse.**
- **Section 21(i) - Altering the beds, banks, course and characteristics of a watercourse.**
  Applicability: Thirsti Bottling Plant is located within 500 m of a wetland, this activity qualifies as a regulated water use and must be formally authorised through a WULA process in accordance with the NWA and supporting regulations.
- **Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource.**

GCS Environment South Africa (Pty) Ltd Reg No: 2002/028494/07
Offices: Johannesburg
Directors: DA Krige (Managing) | AC Johnstone | W Sherriff | T Isaac | A Theunissen

THIRSTI

GCS

Applicability: The use of a septic tank at the Thirsti Bottling Plant constitutes the disposal of domestic waste in a manner that may detrimentally impact on a water resource, particularly given its proximity to a wetland. As such, this activity qualifies as a water use and must be formally authorised through a WULA process in accordance with the NWA and supporting regulations.

DELEGATED LEAD AUTHORITIES

The DWS is the delegated authority responsible for the administration and implementation of the NWA.

THE WATER USE LICENCE PROCESS

GCS Environment South Africa (Pty) Ltd (GCS) has been appointed as the independent environmental consultant to manage the WULA process on behalf of Thirsti.

A WULA is a legal requirement under the NWA to ensure the sustainable use and protection of South Africa's water resources. The process plays a critical role in:

- Promoting environmental stewardship;
- Preventing the degradation and pollution of water resources;
- Ensuring compliance with national legislation;
- Minimising the risk of legal penalties; and
- Enhancing transparency through stakeholder engagement.

The following key steps form part of the WULA process (Figure 1):

- Pre-application engagement with DWS: The applicant must meet with the DWS to confirm the need for a WUL, understand site-specific requirements, and obtain guidance on the application scope.
- Appointment of an independent environmental consultant: An independent environmental consultant is then appointed to manage the process, compile the WUL report, and coordinate public participation.
- Identification of Applicable Section 21 Water Uses: The independent environmental consultant and applicant identify which of the 11 water uses in Section 21 apply.
- Compilation of Technical and Specialist Studies: Relevant specialist studies are undertaken to assess the implications of the proposed water use.
- Public Participation Process (PPP):
    - A Draft WUL Report is made available for a minimum 60-day public comment period. A Comment and Response Report (CRR) is compiled to document and respond to stakeholder concerns.

You are hereby invited to review the Draft WUL Report and submit comments during the public comment period, which will run from 26 February 2026 to 30 April 2026 at the following locations:

- **Newcastle Library: 66 Scott Street, Newcastle, 2940, +27 (0)34 328 7620**
- **Thirsti Security Gate: Buffelshoek Farm Erf 15469 (P39 Road)**
- **GCS website: https://www.gcs-sa.biz/public-documents/**

Written comments and substantiated issues must be submitted to GCS by 30 April 2026. Early submissions are encouraged to allow the GCS sufficient time to address concerns comprehensively.

- Final Submission to DWS: The Final WUL Report, including technical documents, maps, and the CRR, is submitted to DWS for review and decision-making.
- DWS Review and Decision: DWS assesses the application against criteria such as water availability, environmental impact, alignment with the National Water Resource Strategy, and socio-economic benefits. A decision is typically made within 300 days (or longer for complex cases).
- Notification and Appeal: All registered I&APs are notified of the outcome. An appeal can be lodged within 30 days of the decision, in terms of the National Appeal Regulations, 2025.

THIRSTI



Figure 1: Key steps form part of the WULA process

REGISTERING AS AN INTERESTED AND AFFECTED PARTY

By registering as an I&AP, you will be included in the Project stakeholder database and receive further information in future for comment. Your comments will ensure that all relevant issues are incorporated and addressed.

Please complete and submit the enclosed registration / comment sheet or contact GCS if you wish to comment or register on the Project. I&APs who wish to participate by contributing comments, or who would like to obtain more information, should please contact:

GCS Environment South Africa (Pty) Ltd
Attention: Marandela Muzhambi
Tel: +27 (0)11 803 5726, Fax: +27 (0)11 803 5232
E-mail: ppp@gcs-sa.biz / MarandelaM@gcs-sa.biz
Postal Address: PO Box 2597, Rivonia, Johannesburg, 2128



Figure 2: Locality of Thirsti Bottling Plant

3

THIRSTI

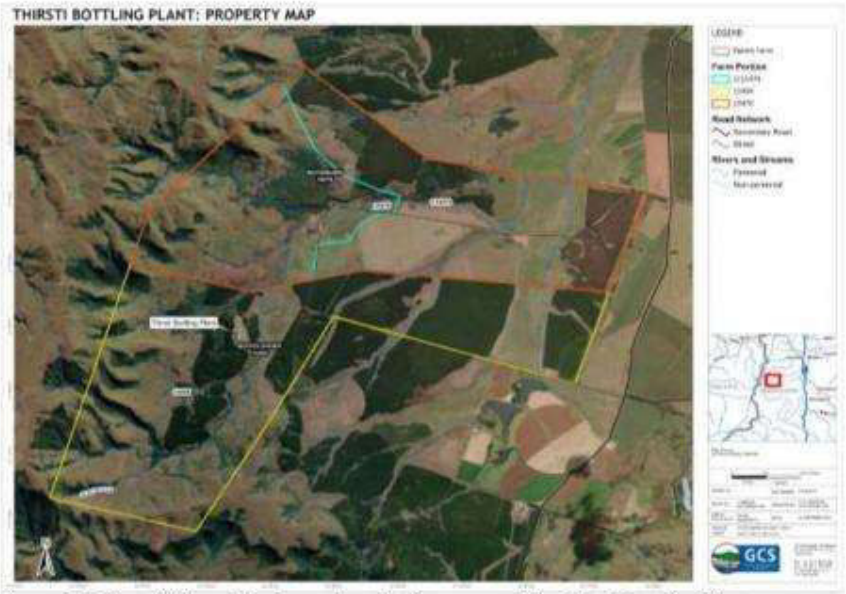


Figure 3: Cadastral Map of the Properties that form part of the Thirsti Bottling Plant

4

THIRSTI

GCS

APPLICATION FOR A WATER USE LICENCE FOR THIRSTI BOTTLING PLANT
Ref No. WU41899
GCS Ref. No: 25-0109

REGISTRATION AND COMMENT FORM

Registered Interested and Affected Party (I&AP) will be informed of ongoing developments via their preferred means of communication (SMS, e-mail, post or fax). Please register as an I&AP and provide comments by sending this form, or other written correspondence, to the contact details provided below:

GCS Environment South Africa (Pty) Ltd
Attention: Marandela Muzhambi
Tel: +27 (0)11 803 5726, Fax: +27 (0)11 803 5232
E-mail: ppp@gcs-sa.biz / MarandelaM@gcs-sa.biz
Postal Address: PO Box 2597, Rivonia, Johannesburg, 2128

Please formally register me as an Interested and Affected Party	Yes	No
I would like to receive my notifications by	E-mail	SMS

Please indicate which sector you represent and also provide a name

Government Department	
Municipality	
Community	
Non-Government Organisation	
Business	

If you are a *landowner* or *land occupier*, please indicate which farm(s) and portion(s) you reside on

Landowner	
Land occupier	

Please fill in your contact details below for the Project database

Title, Full Name					
Designation					
Cell phone		Fax		Tel	
E-mail					

5

THIRSTI

GCS

Postal Address	

Do you have any specific concerns, issues to raise or general comments that the Applicant or Environmental Assessment Practitioner should consider? Please state below:

In compliance with the Protection of Personal Information Act, 2013 (Act No. 4 of 2013) (POPI Act) you are requested to provide consent to GCS Environment South Africa (Pty) Ltd (GCS) in utilising your personal information throughout the process. GCS is obliged to use this information only for the purpose of this Project.

Kindly complete the following section, as permission to engage you in respect of the Public Participation Process that will be undertaken for the Project. If there are any other stakeholders, we should include onto the stakeholder database for the Project, please provide their contact details.

Title, Full Name	
Organisation	
Cell phone	
E-mail	

Signature _____ *Date* _____

6

APPENDIX J: PROOF OF DELIVERY 2026

DELIVERY NOTICE

Date:	25 February 2026	**Project Number:**	25-0109
Company / Organisation:	Newcastle Library: 66 Scott Street, Newcastle, 2940	**From:**	Paula Tolksdorff
Attention:	The Librarian		
RE:	**THIRSTI BOTTLING PLANT WATER USE LICENCE APPLICATION – DRAFT WULA TECHNICAL REPORT** **AVAILABILITY OF THE DRAFT WULA TECHNICAL REPORT FOR PUBLIC REVIEW**		

Quantity	Item	Description
1	Hard Copy	Draft WULA Technical Report

Please acknowledge receipt of documentation

NOMTHANDAZO
Print name

Signature

LIBRARIAN
Position

25/02/2026
Date

NEWCASTLE LIBRARY
2026 -02- 25
PRIVATE BAG X6606
2940

Please advise us if enclosures are not as described.

DELIVERY NOTICE

Date:	25 February 2026	**Project Number:**	25-0109
Company / Organisation:	Thirsti Security Gate: Buffelshoek Farm Erf 15469	**From:**	Paula Toksdorff
Attention:	Thirsti Security Officer		
RE:	**THIRSTI BOTTLING PLANT WATER USE LICENCE APPLICATION – DRAFT WULA TECHNICAL REPORT** **AVAILABILITY OF THE DRAFT WULA TECHNICAL REPORT FOR PUBLIC REVIEW**		

Quantity	Item	Description
1	Hard Copy	Draft WULA Technical Report

Please acknowledge receipt of documentation

P.N Shilubane
Print name

Signature

Security Officer
Position

25/02/26
Date

Please advise us if enclosures are not as described.

APPENDIX K: NOTIFICATION SMS 2026

Marandela Muzhambi

From: Vasie Naidoo
Sent: Monday, 13 April 2026 11:09
To: Marandela Muzhambi
Subject: FW: Bulk SMS: Dear Stakeholder, Please note the Draft Thirsti Bottling Plant WULA Technical Report (Re

-----Original Message-----
From: Vasie Naidoo [vasien@gcs-sa.biz]
Sent: Wednesday, 25 February 2026 4:41 PM
To: Copy of 25-0109 Thirsti Bulk SMSs.xlsx
Subject: Bulk SMS: Dear Stakeholder, Please note the Draft Thirsti Bottling Plant WULA Technical Report (Re

Dear Stakeholder, Please note the Draft Thirsti Bottling Plant WULA Technical Report (Review: 26 February - 30 April 2026) is available here: https://www.gcs-sa.biz/public-document from

1

APPENDIX L: NOTIFICATION EMAIL 2026

Marandela Muzhambi

From: Public Participation Processes
Sent: Wednesday, 25 February 2026 16:33
Cc: Paula Tolksdorff; Luyanda Macheke
Subject: WATER USE LICENCE APPLICATION FOR THE THIRSTI BOTTLING PLANT (Ref No. WU41899) (REVIEW: 26 February 2026 to 30 April 2026)
Attachments: 25-0109 Final BID 20.02.26.pdf

Bcc: [redacted]

Dear Stakeholder

APPLICATION FOR WATER USE LICENCE FOR THE THIRSTI BOTTLING PLANT (Ref No. WU41899) (REVIEW: 26 February 2026 to 30 April 2026)

NOTICE
Notice is hereby given in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), and the Regulations Regarding the Procedural Requirements for Water Use Licence Applications and Appeals, 2017 (Government Notice R267 of 24 March 2017) (WULA Regulations), of the submission of a Water Use Licence Application (WULA) by Thirsti to the Department of Water and Sanitation.

LOCATION
The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa.

PROJECT DESCRIPTION
The Thirsti Bottling Plant is a prominent facility located in Normandien, KwaZulu-Natal, South Africa. Established in 2015, the plant is situated at the foothills of the Klein Drakensberg Mountains, an area renowned for its natural springs. The water sourced is naturally filtered through ancient geological formations, resulting in a mineral-rich composition with a high pH of 8, making it both refreshing and alkaline.

Production began in 2015, focusing on the bottling of natural and sparkling spring water, and has since expanded to include fruit-flavoured water. Due to Thirsti's continued growth, the bottling plant now proposes an expansion, which will trigger additional water use requirements.

ENVIRONMENTAL ASSESSMENT PRACTITIONER

GCS Environment South Africa (Pty) Ltd (GCS) has been appointed as the independent environmental consultant to manage the WULA process on behalf of Thirsti.

INVITATION TO PARTICIPATE AND COMMENT ON THE DRAFT WULA TECHNICAL REPORT

The Draft WULA Technical Report will be available for public review and comment from 26 February 2026 to 30 April 2026 at the following locations:

Place	Address	Telephone
Newcastle Library	66 Scott Street, Newcastle, 2940	+27 (0)34 328 7620
Thirsti Security Gate	Buffelshoek Farm Erf 15489 (P39 Road)	+27 (0)87 803 0417
GCS Website	https://www.gcs-sa.biz/public-documents/	+27 (0)11 803 5726

Written comments and substantiated issues must be submitted to GCS by 30 April 2026. Early submissions are encouraged to allow the GCS sufficient time to address concerns comprehensively.

Interested and Affected Parties who wish to register, participate by contributing comments or who would like to obtain more information, should please contact:

GCS Environment South Africa (Pty) Ltd
Attention: Marandela Muzhembi
Tel: +27 (0)11 803 5726, Fax: +27 (0)11 803 5232
E-mail: ppp@gcs-sa.biz / MarandelaM@gcs-sa.biz
Postal Address: PO Box 2597, Rivonia, Johannesburg, 2128

APPENDIX M: COMMENTS AND RESPONSES REPORT

This CRR provides a record of the comments, questions and issues raised by stakeholders and responses provided.

Contributor	Date of Contribution	Means of Contribution	Comment	Response
Comments received during first 60 day period: 19 March 2021 to 17 May 2021				
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	10 April 2021	Email	I'm Nkosikhona Shabalala environmental activist and community human rights defender would like to register as interested and affected party to the application of your client regarding integrated water use licence also I wish to object the IWULA granting to your client Thirsti this are my reasons for objection: 1. The company itself is built on top of people's graves who were residing on Buffelshoek farm before your client company came to operate. 2. Your client company expansion would affect farm dwellers residing on that farm and they need to be consulted prior before the company applied for IWULA as they have an outstanding labour tenant claim on that farm and the consultation should be adequate and have their informed consent. 3. Your client company has been operating since 2015 and nowhere the community of Normandien were consulted about this project. 3.1 No EIA report was seen by the community. 3.2 No public participation meeting was held or advertised so we can attend in fact we were excluded from participating from decision making about previous granting of IWULA to your client if it was granted please note that the NWA act defined water as a scarce and precious resource that belongs to all people of south Africa that means a farm owner cannot do as he please with our natural resource without us being involved so this 1998 act substitute the old apartheid 1956 act which said water was a private property of farmers and they had to	Good morning Nkosikhona, Thank you for your comments. We will address your concerns after consultation with the client. Good afternoon Nkosikhona, Please find attached a letter from Thirsti addressing your concerns as well as the Background Information Document (BID) which contains additional information relating to the project and the public participation process being undertaken. We have added you to our database where all registered I&APs will be kept informed of the decision taken by the Department of Human Settlements, Water and Sanitation. Please note that your comments will be included in the Public Participation Report which will be submitted with the Integrated Water Use Licence Application (IWULA). In addition to the letter, please note the following: 1. In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), no listed activities were triggered, therefore no application for environmental authorisation in terms of an Environmental Impact Assessment was needed. 2. Prior to this IWULA, no water uses were triggered in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Thirsti was issued with a General Authorisation (GA) (dated 17th June 2015) in terms of Section 39 of the NWA for the taking of water from a water resource. In the case of a GA application, public participation is not required according to the NWA.

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			enjoy that privilege of doing as they want with water wetland underground water and waterfalls in fact my concern is that before we can move to the new application let's deal with the old water use licence if your client does have it and if your client does not have it let's get clarity as to how he decided to operate without it another issue or concern for you as a consultant please place your notices in all accessible Normandien areas and make sure that your notice is written in both isizulu which is an official language so that our people will be able to comment cause not all of us can read or speak English hope you understand my points of objection.	3. A total of 4 site notices were placed around the site area. These include: The entrance to Thirsti [along the main road(P39-1)], Normandien, Newcastle and on the P39-1 towards Thirsti. The site notices were done according to the NWA regulations. *Refer to APPENDIX N.
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	03 May 2021	Email	Follow-up Thank you very much for your respond and it has given just a light about your project but I'm having 3 remaining concerns 1. The applicant is Thirsti but on the other hand is Normandien Farms Pty Ltd of which you need to clarify about it. 2. The notice is written in English while you think you know that most of our people cannot write and read English and that makes them unable to comment which would be justified as if you are excluding them. 3. Public participation meeting I turn to disagree with you to say there would be no public participation in Normandien due to covid 19 I think you know better than me that we are on alert level.1 lockdown regulation which allows us to hold meetings in outdoors and outdoors meetings which have specific numbers for a meeting so I will request that you allow the public to come and attend the meeting and that would build a good relationship between ourselves that's my plea note	Good afternoon Nkosikhona, Thank you for your comments. We will address the three remaining concerns after consultation with the client. Note that while these concerns raised by Mr Shabalala were not directly responded to at the time, they were addressed in the following ways. *1. During the original public participation process, site notices were initially displayed in English on 19 March 2021 and a newspaper advertisement was published in the Newcastle Advertiser on the same date. Following concerns regarding accessibility and delays associated with the COVID-19 pandemic, a second round of public notification was undertaken on 4 June 2021. This included site notices and newspaper advertisements in English, Afrikaans and isiZulu, together with an additional 60-day public review period extending from 4 June 2021 to 2 August 2021.*

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			that I have read and understand section 39 of the NWA and I'm happy that you have tried to explain that another thing you mentioned is that you have 178 employees working for you but I would prefer that when you get this integrated water use licence you start by employing our local people before you go as far as Marsden osizweni and other outside areas while our people are unemployed that would build our relationship the other reason that would make us not to inject your application and support it it's because we as the Normandien community we are against oil and has extraction that is meant to happen on your farms by means of fracking which Rhino I will and has applied for concerning projects it's good you are supporting 3 schools but we would like you to put more support on community developments of which we can give them.to you also assist on bursaries as we have koda who wants to go to universities but they struggle financial let me assure you that as per hour communication with me we are fully supporting your project but as the community we need to part of you. Thank you.	2. *Issue 1: Request for a public meeting despite COVID-19 restrictions* *Response:* *During the original WULA process, the Applicant and its consultants sought to comply with the prevailing COVID-19 regulations and public health guidance. Notwithstanding these constraints, a public meeting was subsequently held at the Normandien Farmers Hall (Normandien Sale Yard) on 23 June 2021, providing stakeholders and I&APs with an opportunity to engage directly with the project team, obtain information regarding the application, and raise questions and concerns. In addition, stakeholders were afforded two separate 60-day public review periods and were able to submit comments through multiple communication channels.* 3. *Issue 2: Preference for local employment opportunities* *Response:* *The comment is noted and appreciated. Normandien Farms (Pty) Ltd recognises the importance of local employment opportunities and the positive contribution that local businesses can make to surrounding communities. The Thirsti facility currently sustains approximately 350 permanent jobs and contributes significantly to the local economy through employment, procurement of local services, and investment in the surrounding area. Employment practices and recruitment decisions do not form part of the WULA process and fall outside the scope of the National Water Act, 1998 (Act No. 36 of 1998). However, the comment has been recorded and brought to the attention of the Applicant.* 4. *Issue 3: Community support for the project* *Response:* *The Applicant welcomes the indication of support for the project and appreciates the willingness of community representatives to engage constructively*

Contributor	Date of Contribution	Means of Contribution	Comment	Response
				in the WULA process. Normandien Farms (Pty) Ltd remains committed to ongoing engagement with stakeholders and recognises the importance of maintaining positive relationships with neighbouring communities. 5. *Issue 4: Concerns regarding proposed oil and gas exploration and hydraulic fracturing* *Response:* *The current Water Use Licence Application relates solely to water uses associated with the operation of the Thirsti Bottling Plant and the abstraction of groundwater required to support the facility. Potential oil and gas exploration, extraction activities, or hydraulic fracturing applications do not form part of the current WULA assessment and fall outside the scope of this application. Notwithstanding the above, Normandien Farms (Pty) Ltd "successfully opposed the oil and gas exploration proposed by Rhino resources and has demonstrated its commitment to environmental stewardship and the long-term protection of the Normandien area through the establishment of the 1,230.6-hectare uMsonti Private Nature Reserve in terms of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003). The declaration of the nature reserve places the area under formal conservation management and includes a legal obligation to maintain the reserve in its natural state and undertake alien vegetation control. The reserve contributes to the protection of the upstream catchment and the biodiversity of the area.* 6. *Issue 5: Community development initiatives* *Response:* *The comment is noted and appreciated. In addition to sustaining employment in the region, Normandien Farms (Pty) Ltd supports a number of community initiatives within the Normandien and broader*

Contributor	Date of Contribution	Means of Contribution	Comment	Response
				Amajuba area. These initiatives include investment in school infrastructure, water supply systems, filtration systems, rainwater harvesting projects, pump replacements, sanitation improvements, and support provided during drought and water supply emergencies. The Applicant acknowledges the importance of community development. *7. Issue 6: Bursaries and educational support* *Response:* *The comment is noted. While bursary programmes and educational support initiatives fall outside the scope of the WULA process, the Applicant acknowledges the importance of educational development within local communities.*
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	17 May 2021	Email	Good afternoon, Shayna and Kate I have noticed that today is the last day for public comments on your client application and in the last email correspondence that was having some of the comments and request I have mentioned that there's a news for your client to have a public meeting with all the interested and affected parties of Normandien where the project is located because the lockdown rules allows us to hold outdoors and indoors meetings with certain limit of number of people attending that meeting, now in your respond you said you will liaise with your client and come back to me and today is the closing date for this application but you have not responded to me to address the public participation meeting concern and I do not understand why but please may you give me a respond on that one warm. Regards	Good morning Mr Shabalala, Thank you for your comment. Please note that we will be re-running the public participation phase and will place site notices as well as adverts in isiZulu.
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	02 June 2021	Email	Thank you for your correspondence respond please note that we will keep your respond for evidence and we will be waiting again for your 're public participation second phase which will accommodate Normandien community members who cannot speak	No further questions raised.

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			and write English as you said your notices who be in isizulu which is the first constitutional language majority of the people speaks in Normandien we have no objection to your application as long it will accommodate all of us and your project benefit Normandien communities as host communities all power to the people.	
Bradley Gibbons	16 April 2021	Email	Please can you register me as an interested and affected party for Water Use Licence for Normandien Farms (Pty) Ltd – Thirsti.	Good morning Bradley, Thank you for your email. We have added you to the I&AP database.
Comments received during second 60 day period (re-run): 04 June 2021 to 02 August 2021				
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	21 June 2021	Email	Afternoon may I have the agenda of the meeting so to prepare myself. Thank you.	Good morning, Mr Shabalala, The meeting agenda: • Introductions; • Water Use Licence Application (WULA) presentation; and • Questions/discussions pertaining to the WULA.
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	23 June 2021	Public Meeting	Thank you for the opportunity for people on the ground. I am the chairperson of the organisation called Sisonke Environmental Justice Network which deals with environmental and other issues. You have done a good job of interacting with the community even though not all can join. The notices that you have put a long the Normandien area, most of the people have been able to read them as some were in isiZulu and that is what most people speak in Normandien. So, one can say you have done a good job. The community has come to an agreement that there is no need for us as an organisation and a community; to say we object the application or the company being granted the water use licence. We have reasons for that.	Noted.
			We were confused at who was applying for the water use licence. Is it Normandien farms or is it Thirsti?	Normandien Farms has many different agricultural interests, nationally. They also process some of their projects. In terms of water, the brand/trademark is Thirsti which is owned by Normandien farms Pty Ltd (holding company).

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			Our other concern that we were having is that Thirsti which has been existing for more than 4/5 years; they are abstracting water from the ground and there is a waterfall on Buffelshoek Farm. The question was how it came about as operating as a business and having a bottling plant which is making money without consulting the community or without having a water use licence.	When the business started, they owned the farm Buffelshoek which came with water they are allowed to use. They have a General Authorisation (issued by the Department of Water and Sanitation) that allows them to use the water up to a certain limit. That is what they have been using up until now. Now, they want to expand with this project and they need a water use licence which is this project. As part of the General Authorisation process, public participation is not a legal requirement.
			As you say that public participation is not a legal requirement at time, when Thirsti started. But now that Thirsti is expanding, that is why you need to engage with the community in the form of a public participation to hear their views or if they do not want Thirsti to get the water use licence?	Correct.
			If you look at slide 9, my question is how the company going to mitigate the water table from decreasing.	As part of the study, pump tests are conducted to see how much water the boreholes can provide. As part of that test, they determine what is the sustainable abstraction. When abstracting, they need to ensure that the water underground can be replaced. Thirsti has done those tests and the pump tests indicated how much water Thirsti can abstract sustainably. Thirsti is not going to abstract more than that volume that each borehole can provide and they will do constant monitoring of the groundwater levels to ensure that the boreholes are not being adversely dewatered by the abstraction.
			Thirsti is a business and needs to make money. How can you give us assurance that Thirsti will monitor the levels so that they do not affect the environment and only worry about profit. You do not even mention the Department will come and monitor the water. So how can we trust you?	When Thirsti gets issued with a water use licence, it will come with a lot of conditions. Those conditions come from the Department of Water and Sanitation. The conditions are going to say Thirsti is going to need to do monitoring and the licence we list the points they will need to monitor and how often they will need to monitor those points. So all those monitoring results have to be submitted to the Department on annual or quarterly basis - whatever is stated in the licence. So the Department will keep an eye on Thirsti to ensure they are not over-abstracting. They also undertake site visits and every

Contributor	Date of Contribution	Means of Contribution	Comment	Response
				year, Thirsti will need to appoint an independent consultant to audit the conditions of that licence
			I do not hear you mention the waterfall supplying the Horn River. Is that river going to be affected by the project or is it not going to be affected by the project. As you know that river flows past the mining company and the prison.	As part of the project, we are only applying for groundwater abstraction - so only boreholes (so no surface water). Thirsti is not abstracting from the waterfall. So, water will run like it naturally runs. From the studies, it shows that the aquifer is a confined aquifer system, so it is one system and will not impact the wetlands or the river.
			For slide 12, you mention 3 wetlands. I'm not sure if they are close to your project or if they will be affected by the project. So, I'm very concerned about the wetlands because the wetlands play a role in our lives as communities. They wetlands also have small species in the wetlands. So, my concern is what is going to happen about those wetlands. Will we be able to see those wetlands once your project is operating or will we never see them again?	The wetlands will not be affected by the project. The infrastructure at Thirsti is already existing and the wetlands are existing around the infrastructure that is already established. Thirsti is not expanding any infrastructure. A study was also conducted to see if the groundwater abstraction impacts any of the wetlands. The study concluded that the impact was minimal-low.
			How far are the boreholes from the wetland?	There are a few boreholes that fall within 500m of wetland and that is why they are triggering a water use licence. So, the boreholes are in close proximity. We can send the map indication where the boreholes are in relation to the wetlands.
			One would like to know that once you apply for this water use licence and the result from the Department says that they are granting the water use licence; will it be accessible to us as an organisation/community to view it and see everything that is in it?	Yes, the public/interested and affected parties (I&APs) have 30 days to appeal the licence once it has been issued by the Department. The I&APs is entitled to see the conditions of the licence
			One of our main concerns were with the notices and that they were not in isiZulu. People sometimes feel that the company does not care about them. So, when the notices were put up in isiZulu, you accommodated the community and we thank you. The problem lies with the community. They saw the notices and they decided not to attend this meeting which is very important for them.	Noted.

<table>
<tr><th>Contributor</th><th>Date of Contribution</th><th>Means of Contribution</th><th>Comment</th><th>Response</th></tr>
<tr><td></td><td></td><td></td><td>Thank you for explaining the project to us and we have no need to object. We would like to be a part of the project as we should benefit from the project.</td><td>Noted.</td></tr>
<tr><td></td><td></td><td></td><td>Thirsti bought a bus, I saw that bus. But they are saying that the bus is transporting outsiders to come and work in Normandien. Why if we have the majority of the unemployed youth who have matric and some that do not. But we have a lot of them sitting at home not working. That is we ask why the company is spending money on diesel/petrol transporting from outside of Normandien. You see them by the sawmill gate looking for jobs. The company should accommodate us like it did today.</td><td>Noted. Thank you.</td></tr>
<tr><td></td><td></td><td></td><td>Another concern is that the company float that to the community in time. I know that everyone is struggling now but as time goes on and the economy is coming right, the company help the community with projects. We have kids that want to go to university and have passed matric. Their families are struggling, so they cannot go to university. We want them to go to university and study further. That is what we request.</td><td>Our consultants do not represent Normandien Farms in respect of the community investments as they are water use licence consultants. Your community concerns are noted and we take them seriously. I will let the executive know of these points raised</td></tr>
<tr><td colspan="5">Comments received during second 60 day period (re-application): 26 February 2026 to 30 April 2026</td></tr>
<tr><td>Noncedo Xulu
Newcastle Municipality</td><td>14 April 2026</td><td>Email</td><td>Good Day

I trust that you are well.

Upon review of the submitted document, it was noted that the erf number of the subject property has not been provided. In order for the Municipality to accurately assess and respond to the matter, we kindly request that you furnish the erf number.

Additionally, please provide a map clearly indicating the location and extent of the subject property. This will assist in ensuring that the Municipality responds appropriately and without delay.</td><td>Dear Noncedo,

I hope you are well.

Thank you for the comment.

Thirsti covers an area of approximately 2 413.92 hectares (ha) and is located on farms Buffelshoek 15469 and Woodburn 15470. The property details (Table 1-1 of the WULA Technical Report) and property map (Figure 1-2 of the WULA Technical Report) are provided below.

Table 1: Property Details
<table>
<tr><th>Farm Name</th><th>Portion</th><th>Landowner</th></tr>
<tr><td>Buffelshoek Farm</td><td>Erf 15469</td><td>Normandien Farms (Pty) Ltd</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Contributor</th><th>Date of Contribution</th><th>Means of Contribution</th><th>Comment</th><th>Response</th></tr>
<tr><td></td><td></td><td></td><td>Your prompt assistance in this regard will be highly appreciated.

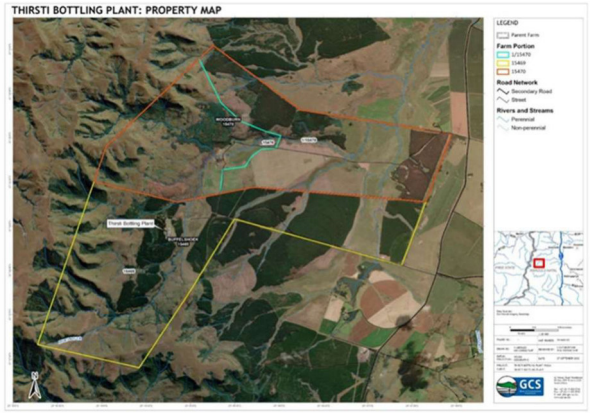
Regards
Noncedo Xulu</td><td>
<table>
<tr><td>Woodburn Farm</td><td>15470 Ptn 1</td><td>Normandien Farms (Pty) Ltd</td><td>000015271/2016</td></tr>
<tr><td>Woodburn Farm</td><td>15470 RE</td><td>Normandien Farms (Pty) Ltd</td><td>000015271/2016</td></tr>
</table>


Figure 1: Property Map

Kind regards,
Marandela</td></tr>
<tr><td>B. Lauterbach</td><td>21 February 2026</td><td>Email</td><td>Good day,

Water Use Licence Ref: WU41899 - GCS 25-0109

The abovementioned has reference.

We would like to register as an I&AP party.

Kind regards
B. Lauterbach</td><td>Noted. The stakeholder was added to the database.</td></tr>
<tr><td>Nkosikhona Lucky Shabalala</td><td>16 April 2026</td><td>Email</td><td>Refer to APPENDIX O, for communication received.

Good Day,</td><td>Dear Mr. Shabalala,

Thank you for your correspondence and for the submission</td></tr>
</table>

Contributor	Date of Contribution	Means of Contribution	Comment	Response
Sisonke Environmental Justice Network			Please find attached document(s) on behalf of our customer: Kind Regards The Team Postfast Newcastle	made on behalf of the Sisonke Environmental Justice Network regarding the above mentioned Water Use Licence Application. Please find attached GCS Environment South Africa (Pty) Ltd's formal response to the comments received on 18 March 2026. We would like to thank you for your participation in the public participation process and for taking the time to provide detailed comments and concerns for consideration as part of the assessment process. Should you require any further information or clarification, please do not hesitate to contact us. Kind regards, Paula Refer to APPENDIX P, for responding communication.
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	20 April 2026	Email	Sir or Madam I have registered and comment on this project application using internet café podcast Newcastle I have never received any feedback from you confirming receiving my comments objection and registration so please send me a proof of receiving so as Sisonke we can be able to plan ahead for your public participation meeting Regards Lucky Shabalala on behalf of Sisonke Environmental Justice Network	Dear Lucky, Thank you for your comment. We will review your comments and get back to you. Kind regards, Marandela
Nkosikhona Lucky Shabalala Sisonke Environmental Justice Network	28 April 2026	Email	Good day Ms Marandela please advise us as to what is going to happen cause your comment and objection period lapse on the 30 of this month which is Thursday this week.so we want to know as you do not have water use licence that you have now applied for and you have not yet granted it by water and sanitation department we want to know is it going to be business as usually that you are going to take our water illegally and sell it to your clients Woolworths and others so that if you	Dear Lucky, Thank you for your correspondence. We are currently reviewing the submission made by the Sisonke Environmental Justice Network (SEJN), dated 18 March 2026, with our client. Please note that the water use licence application will only

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			continue supplying them we can be able to tell them not buy from you cause you are selling to them water that you are not supposed to sell to them as you do not have water use licence and remember we have requested public participation meeting before the 30 but you ignored us so please give us an urgent response. Regards	be submitted once your comments, along with our responses, have been incorporated into the final report. We kindly request your patience while we prepare a comprehensive response to your submission. Kind regards, Paula
Z.K Mncube (Mazibuko) Mbuzelenikonke Trading Enterprise - Director	27 April 2026	Email	This email has reference; 1. I write this email as a beneficiary of the Mazibuko family under Isaac Mazibuko, who was born and bread in Koeningsberg. He and his family were forcefully removed in 1967 and relocated to Osizweni. The land was then reclaimed and given back to the Mazibuko family in 2016. We managed to move back to the farm under the chairperson, Mr R.M Zulu of the Koeningsberg Property Association. 2. We as the Mazibuko family run a food supply company called Mbuzelenikonke Trading Enterprise which feeds from the farm. We as the company acknowledge the request made by Thirsti Bottling for a Water Licence and have the following issues to be addressed; 2.1. If and when Thirsti Bottling equires their water use licence, will other surrounding farmers, companies also be able to acquire their own water licences. 2.2 This concern stems from the fact Thirsti is situated on a portion 3 of the Koeningsberg Property Association which is currently under claim by the association. 3. Mbuzelenikonke Trading is a company currently busy with a contract with McCain and also requires a water licence to continue operations.	Dear Mr Mncube, Thank you for your email dated 27 April 2026 and for sharing the background regarding the Mazibuko family and Mbuzelenikonke Trading Enterprise. We acknowledge your interest in the Water Use Licence Application currently being undertaken for the Thirsti Bottling Plant. In response to the matters raised in your correspondence, please note the following: 1. Water Use Licence Applications are regulated and assessed independently by the Department of Water and Sanitation in terms of the National Water Act, 1998 (Act No. 36 of 1998). Each application is considered on its own merits, based on the relevant technical, environmental, hydrological, and legal requirements applicable at the time of assessment. 2. Accordingly, the outcome of the Thirsti Water Use Licence Application does not determine or prevent other landowners, farmers, companies, or interested parties from submitting their own applications for consideration by the Department. 3. We note the statement regarding the location of the Thirsti Bottling Plant. For clarity, the Thirsti facility is situated on Erf 15469 Buffelshoek and associated properties in the Province of KwaZulu-Natal, as reflected in the Water Use Licence

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			4. We therefore request to meet with Thirsti Management for clarity and reassurance that their application will not clash with the company application. Your cooperation and response in the above mentioned regards will be highly anticipated and appreciated. Thank you Z.K Mncube (Mazibuko) Mbuzelenikonke Trading Enterprise - Director	Application Technical Report. 4. The current Water Use Licence Application relates specifically to the existing and proposed water uses associated with the Thirsti Bottling Plant and is being assessed through the prescribed regulatory process by the Department of Water and Sanitation. 5. While we appreciate your request for a meeting, we do not believe that a separate meeting is required at this stage, as the Department independently evaluates all applications on a case-by-case basis in accordance with the applicable legislative framework. Thirsti remains committed to engaging with stakeholders through the formal public participation and regulatory processes and values constructive engagement with neighbouring landowners, businesses, and community members. Thank you once again for your correspondence. Kind regards, Marandela
Janice Tooley All Rise	25 May 2026	Email	Refer to APPENDIX Q, for communication received. Dear Paula, All Rise will, from hereon, represent the Sisonke Environmental Justice Network in its objection to the Thirsti WULA. Please could you send me the contact details (full names and email addresses) of the DWS officials handling Thirsti's WULA application. Many thanks. Your sincerely,	Refer to APPENDIX R, for responding communication.

Contributor	Date of Contribution	Means of Contribution	Comment	Response
			Janice Tooley	

APPENDIX N: LETTER FROM THIRSTI 2021

Normandien Farms (Pty) Limited
Registration No. 2000/015374/07

Physical: Corner of Umlaas and Richmond roads, Thornville, Kwazulu-Natal, South Africa
Postal: P O Box 13559, Cascades, 3202
Contact: Tel +27 (33) 251 0977
Fax + 27 (33) 251 0708
Info: info@thirsti.co.za
www.thirsti.co.za

THIRSTI™
NATURAL SPRING WATER

14 April 2021

SHAYNA – ANNE CUTHBERTSON
WATER USE LICENCE CONSULTANT
GCS – SA

Via email: Shaynac@gcs-sa.biz

Dear Shayna,

Your email addressed to Esmeralda Pretorius and copied into Rosemary Mtshali and Klaas Wessels dated the 12th of April 2021 at 09h39 refers.

I have read the email from Shabalala and the contents of his mail are noted. I wish to state the following:

1. The Shabalala Homestead which is located on the Farm Buffelshoek is occupied by the following family heads:
    a) Patrick, Michael, Temba and Vincent. All of these people are employed by Normandien Farms (Pty) Ltd as farm workers and are presently on our payroll. As such, they do not qualify as labour tenants or ESTA tenants. There is also a homestead known as Kubheka Homestead where a Miss Kubheka is employed as a fire lookout by Normandien Farms (Pty) Ltd

2. There are no labour tenancy claims or ESTA rights claims and neither are there any land claims regarding the Farm Buffelshoek.

3. All of the gravesites are located within the proximity of the aforementioned homesteads and there have been no gravesites which have either been disturbed or otherwise to which Mr. Shabalala incorrectly refers.

4. With regard to the development of the water bottling plant, all due diligence and legal requirements have been complied with.

5. In closing, it seems that Mr. Nkosikhona Shabalala is a self-appointed environmental activist and community rights defender and as such, we do not know whether he has any formal qualifications which would enable him to make this claim. Furthermore, we do not know if he belongs to any recognised organisation with which to engage.

6. As such, we are unable to recognise this individual for the reasons stated. We have had no prior correspondence in this regard since we took ownership of the Farm Buffelshoek.

We trust that this clarifies any of the issues raised and confirm our instructions that the relevant water use licence applications continue.

Any interested and affected party has the rights afforded to that party within the legal framework.

Yours faithfully



Rob Hoatson

DIRECTOR

Directors: L J Hoatson, SC Hoatson, RA Hoatson, JM Hoatson, ML Hoatson, * OI Shongwe (Chairman), * DJJ Thomas
* Non-executive director

APPENDIX O: LETTER FROM SISONKE ENVIRONMENTAL JUSTICE NETWORK

From: Sisonke Environmental Justice Network

To: GCS Environment South Africa (Pty) Ltd

Email: MarandelaM@gcs-sa.biz; ppp@gcs-sa.biz

Subject: Comment on the Water Use Licence Application for the Thirsti Bottling Plant, Normandien, KwaZulu-Natal (WULA Ref: WU41899)

1. Introduction

We, the Sisonke Environmental Justice Network (SEJN), submit these comments as an Interested and Affected Party (I&AP) regarding the Water Use Licence Application (WULA) for the Thirsti Bottling Plant operated by Normandien Farms (Pty) Ltd, in the Newcastle Local Municipality, KwaZulu-Natal. Kindly register SEJN as an I&AP.

SEJN is an environmental justice organisation based in northern KwaZulu-Natal. Formed in 2015, it works with rural communities around Newcastle, advocating for environmental rights and supporting communities affected by environmental and resource-related impacts.

The National Water Act 36 of 1998 (NWA) requires that water resources be protected and used sustainably and equitably in the public interest. Section 27(1) of the NWA sets out the factors the licensing authority must consider when making a decision, including:

- equitable access to water;
- the need to redress past discrimination;
- the efficient and beneficial use of water in the public interest;
- the socio-economic impact of the proposed use;
- the probable effect on the water resource and other water users;
- any catchment management strategy;
- the likely effect on the resource directed measures; and
- investments already made by the applicant.

In addition, the Promotion of Administrative Justice Act 3 of 2000 (PAJA) requires that any administrative decision, including a licensing decision, must be procedurally fair. Affected parties must have a genuine opportunity to understand what is proposed, to access relevant information, and to make meaningful representations before the decision is made.

This objection is structured around the s27(1) factors and identifies the grounds on which the current application is insufficient for an informed and lawful licensing decision.

1

Grounds of Objection

SEJN formally objects to the granting of this Water Use Licence as currently applied for. Our objection rests on the following grounds, each developed in the sections below:

- The bottling plant has operated without a Water Use Licence for more than ten years. The compliance history of the applicant is a material factor that the Department must consider.
- The WULA does not cover all water uses on the relevant properties and is therefore incomplete.
- The aquifer is already under moderate stress (Category C) and the proposed abstraction, combined with other catchment pressures, risks increasing that stress.
- The Technical Report contains a material discrepancy between the abstraction volume applied for (281,371 m³/a) and the volume used in its stress index calculation (618,579 m³/a), which has not been explained.
- Neighbouring groundwater users have not been adequately identified, consulted, or protected.
- The cumulative groundwater impact of all uses in the catchment, including commercial forestry, has not been properly assessed.
- The proposed mitigation and monitoring measures lack enforceable trigger thresholds, independent oversight, and public transparency.
- Proximity to wetlands creates risks that have not been independently assessed, particularly regarding the untested assumption of hydraulic separation between the confined aquifer and shallow wetland systems.
- The application proposes large-scale abstraction in a nationally designated Strategic Water Source Area. The precautionary approach should be applied.
- The public participation process is conducted only in English, without community meetings, making it inaccessible to affected isiZulu-speaking residents.
- The main Technical Report was not prepared under the responsibility of appropriately registered Professional Natural Scientists in the relevant fields of practice and similar concerns exist for some of the specialist reports.

2. Historical Groundwater Abstraction Without Authorisation

The Technical Report indicates that groundwater has been abstracted from several boreholes since the bottling plant was established in 2015, in absence of a Water Use Licence. The application seeks authorisation for the abstraction of 281,371 m³/a from eight production boreholes.

This raises concerns about compliance with the NWA. Groundwater abstraction exceeding General Authorisation thresholds without a Water Use Licence is an offence under the NWA. Two prescribed thresholds are relevant:

- General Authorisation (Ref: 27/2/1/V31F/1) issued on 17 June 2015 permitting 36,000 m³/a from a single borehole on Portion 0, Buffelshoek Farm. The current abstraction of 281,371 m³/a from eight boreholes exceeds this by approximately 681%.
- Under GN 538 of 2016, Table 2, Appendix B, the V31F quaternary catchment falls within the 45 m³/ha/a abstraction rate category. For properties totalling approximately 2,413.92 ha, this yields a threshold subject to the statutory cap of 40,000 m³/a per property (maximum 80,000 m³/a across both properties). The applied-for volume exceeds this by a substantial margin.

In addition, the boreholes, septic tank, and French drains are located within 500 m of a wetland. Water uses within this proximity are specifically excluded from qualifying under the respective General Authorisation.

The applicant's compliance history is a relevant consideration under section 27 of the National Water Act, particularly in relation to the public interest, lawful use of water, and the protection of water resources. Full disclosure of the history of abstraction since 2015 is necessary for this purpose and to enable meaningful participation by I&APs.

SEJN requests that Normandien Farms and GCS publicly disclose:

- The date each borehole was installed and when abstraction commenced;
- Annual abstraction volumes from each borehole since 2015;
- Total annual wastewater volumes directed to the septic tank and French drains since 2015;
- When Normandien became aware its water uses may have been unlawful;
- A copy of the 2019 GCS report titled "Thirsti Bottling Plant Water Supply Investigation";
- Minutes of the pre-application meeting held on 24 March 2020 and records of any subsequent meetings with, or directives from, DWS; and
- Whether any enforcement action has been taken by DWS or any other government department.

3. The WULA Is Incomplete

The Technical Report discloses that several other water uses occur on Normandien's two farms (Buffelshoek 15469T and Woodburn 15470), including additional boreholes, storage/irrigation dams, and commercial forestry. All affect the same aquifer and catchment. Yet the application seeks a licence only for water uses connected to the bottling operation.

When multiple water uses occur on the same properties, they interact with and affect each other. The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This cannot be done without a complete picture of all water uses. Commercial forestry reduces groundwater recharge through interception and transpiration. According to data cited in the Technical Report itself, the V31F quaternary catchment loses approximately 1–5% of annual streamflow due to dense afforestation (Le Maitre et al., 2020). If forestry reduces recharge while the bottling plant

increases abstraction, the combined pressure on the aquifer is greater than either use alone would suggest.

The Technical Report references 11 boreholes (BH2, BH3, BH4, BH6, BH7, BH8, BH9, BH11, BH12, BH13, BH14). Boreholes 1, 5, and 10 are not mentioned. Their existence, location, status, and history of use are unknown. There is also insufficient information for the boreholes referenced as 34890, 0348992A, 35081, 35097 and 34891 which are also located on Normandien's farms.

- **Gap:** No explanation for the omission of boreholes 1, 5, and 10.
- **Gap:** No assessment of the combined impact of forestry, dams, and all boreholes on the aquifer.

As an aside, the Technical Report's executive summary refers to "the A91K quaternary catchment," while the body of the report consistently refers to V31F. A91K is located in Limpopo. This basic error needs to be corrected.

SEJN requests that the Department require a comprehensive, integrated WULA covering all water uses on these properties before making a licensing decision.

4. Aquifer Stress and the Volume Discrepancy

The Technical Report classifies the groundwater resource as Category C (moderate stress), based on a stress index of 0.23.

This calculation uses an abstraction figure of 618,579 m³/a — more than double the 281,371 m³/a applied for. The Technical Report explains that 618,579 m³/a is the "recommended sustainable abstraction rate" based on flow characteristics calculations for the eight boreholes on a 12-hour pumping schedule.

This raises important questions:

- If 618,579 m³/a is the recommended sustainable yield and the stress index is calculated on this basis, then the stress index reflects a much larger abstraction than is formally applied for. The Department must understand which figure drives the actual licensing decision.
- If the intended long-term abstraction is 618,579 m³/a, the application significantly understates the volume being sought.
- If the intended abstraction is 281,371 m³/a, then the stress index should be recalculated on the correct basis.
- **Uncertainty:** Whether the 618,579 m³/a figure represents future planned abstraction, a theoretical maximum, or a modelling input. The Technical Report does not clearly explain this.

The Technical Report's groundwater balance (Table 4-8) indicates that 2,918,072 m³/a of groundwater is available for abstraction at the sub-catchment scale, with a surplus of 2,299,493 m³/a remaining after the recommended abstraction of 618,579 m³/a. However, this balance appears to be calculated at sub-catchment scale and may not account for

localised drawdown effects, the concentrated nature of abstraction from eight boreholes in close proximity, or the cumulative impact of forestry and other land uses on recharge.

Category C stress indicates that the aquifer is already under moderate pressure. In fractured rock aquifers, where water moves through fractures rather than uniformly permeable material, responses to abstraction can be difficult to predict. Conservative management is particularly important.

- **Gap:** The Technical Report does not model aquifer stress under drought conditions. Groundwater that appears sustainable in average rainfall years can become critically depleted during droughts.
- **Gap:** The baseline stress assessment does not account for the decade of unlicensed abstraction already experienced.

SEJN requests that before the Department makes its decision, the applicant demonstrates through independent expert evidence that the proposed abstraction has been modelled under drought scenarios, that the total licensed volume will not push the aquifer from Category C to a higher stress category under any foreseeable conditions, and that the decade of unlicensed abstraction has been accounted for in any baseline assessment.

5. Impacts on Neighbouring Groundwater Users

When large volumes of water are pumped from boreholes, the water table drops. This drawdown can spread outward and affect neighbouring boreholes, springs, and streams. In a fractured rock aquifer, drawdown can be unpredictable and may extend over large distances.

Farms, smallholdings, and communities in the Normandien area depend on the same aquifer for drinking water, livestock, and food production. The Technical Report refers to a hydrocensus but the documentation does not demonstrate that all groundwater users within the potential radius of influence have been identified or consulted.

The Technical Report indicates that the radius of influence of individual boreholes ranges between 69 m and 496 m. Given that eight boreholes are proposed, the combined zone of influence may be substantially larger.

SEJN requests:

- A full borehole survey within at least a 5 km radius identifying all registered and unregistered boreholes and dependent users;
- Modelled drawdown effects under both current and proposed abstraction rates, including drought conditions; and
- Evidence that neighbouring landowners, communal water users, and communities have been directly consulted.

The Department should ensure that the NWA s27(1)(d) factor — the probable effect on the resource and on other water users — is fully assessed before making its decision.

6. Cumulative Groundwater Impacts

The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This necessarily includes cumulative effects when multiple uses draw on the same resource.

The Technical Report acknowledges that groundwater in the catchment is used by multiple sectors, including agriculture, commercial forestry, and domestic users. The report includes some catchment water balance data (Table 4-8) and references WARMS users (Table 4-2). However, the report does not provide a comprehensive catchment-scale model that accounts for all abstraction and all recharge-reducing activities, including commercial pine plantations.

This gap is significant because the Technical Report itself notes that the V31F catchment loses approximately 1–5% of annual streamflow to dense afforestation. Pine plantations intercept rainfall and transpire large volumes of water, reducing the recharge that sustains the aquifer. If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure may exceed what either use alone would suggest.

The applicant's own consultants acknowledge this gap. The Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." This is a significant admission that the current assessment is incomplete.

- **Gap:** No catchment-wide groundwater model accounting for forestry, irrigation, and all abstraction.
- **Gap:** No assessment of whether the aquifer is already in deficit from a decade of unlicensed abstraction.

The Department should not grant a licence on the basis of an assessment that the applicant's own experts acknowledge needs further work.

7. Monitoring, Mitigation, and Transparency

The Technical Report proposes mitigation measures including staggered pumping schedules, groundwater monitoring, septic system management, and stormwater controls. These are necessary tools. However, they reduce risk only if supported by enforceable monitoring requirements, defined trigger thresholds, and clear response protocols.

The proposed monitoring programme lacks clearly defined trigger levels — specific groundwater depth or quality thresholds that would require a management response. Without trigger thresholds and response protocols, monitoring becomes record-keeping with no meaningful management function.

The bottling plant has operated for more than a decade without a Water Use Licence and without any of the oversight conditions that a licence would have imposed.

SEJN requests that any licence granted include:

- Monthly monitoring of groundwater levels in all abstraction and dedicated monitoring boreholes;
- Quarterly water quality testing at the boreholes, the septic system outlet, and the nearest watercourse;
- Clearly defined trigger thresholds with documented response protocols;
- Annual compliance reports prepared by an independent Pr.Sci.Nat. not affiliated with GCS or the applicant;
- All monitoring data to be made publicly accessible within 30 days of collection;
- Annual compliance reports shared with registered I&APs; and
- Direct written notification to SEJN of any trigger-level exceedance, licence breach, or emergency event.

8. Potential Impacts on Wetlands

Wetlands are among the most valuable and fragile ecosystems. South African law restricts activities in their vicinity because they are easily damaged and difficult to restore. The boreholes, septic tank, and French drains are all located within 500 m of wetlands, which is why a Water Use Licence is required.

The Technical Report states that the proposed boreholes abstract water from a deeper confined aquifer that is assumed to be largely hydraulically separated from the shallow groundwater system that supports wetlands. On this basis, the report concludes that abstraction will have minimal direct impact on wetlands.

However, this conclusion rests on an assumption of hydraulic separation that has not been empirically tested. The documentation does not include a detailed numerical model specifically assessing how the proposed abstraction volumes could affect groundwater levels beneath nearby wetlands, or how this assumption has been verified.

- **Uncertainty:** Whether the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has been empirically tested.

An additional concern relates to the septic tank and French drain system. Leachate including chemical residues, excess nutrients, and pathogens can contaminate shallow groundwater feeding wetlands. The Technical Report acknowledges that the septic tank was previously observed to be overflowing. While the report states the system has since been upgraded, no independent verification of the upgrade's adequacy has been provided. The potential contamination from years of overflow has not been assessed, of if it has, has not been disclosed.

Several of the wetlands near the site are classified as Critically Endangered ecosystem types, with present ecological states assessed as moderately to largely modified (Categories C to D). Given their already degraded condition, any additional pressure could cause further irreversible harm.

SEJN requests that the Technical Report be amended to include:

- An assessment of the hydrological connectivity between the boreholes and nearby wetlands, including modelled analysis under average and dry-year conditions;
- A dedicated risk assessment of the septic tank and French drain system with respect to wetland water quality; and
- An investigation of historical contamination from years of septic tank overflow.

9. Protection of Water Resources in a Strategic Water Source Area

The Thirsti Bottling Plant is located within the Northern Drakensberg Strategic Water Source Area (SWSA). Although SWSAs cover only about 8% of South Africa's land area, they generate a disproportionately large share of the country's water resources. Water use decisions in these areas have implications that extend well beyond the immediate locality.

Section 2 of the National Environmental Management Act 107 of 1998 (NEMA) requires that, where there is uncertainty about the environmental consequences of an action, decision-makers should apply a risk-averse and cautious approach. While WUL decisions are made under the NWA, NEMA's environmental management principles bind all organs of state, and a precautionary approach is consistent with the Department's obligations under NWA s27(1) to consider the probable effect on the water resource.

Significant uncertainties remain about the true sustainable yield of the aquifer, the cumulative impact of all water uses, the impact on groundwater-fed wetlands, and the adequacy of the specialist assessments. Granting a licence in the face of these unresolved uncertainties would be inconsistent with a precautionary approach especially in a Strategic Water Resource Area which demands greater sensitivity and protection.

- **Uncertainty:** Whether the proposed abstraction is sustainable within the carrying capacity of the SWSA, given the cumulative pressures from forestry, agriculture, and bottling.

SEJN requests that the Department apply a precautionary approach and require robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security before granting any licence.

10. Inadequacy of Public Participation

Meaningful public participation is a legal right. The NWA and its regulations require that I&APs be given a genuine and reasonable opportunity to participate. PAJA requires that administrative decisions be procedurally fair. NEMA section 2 principles require that the participation of all I&APs must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

The public participation process conducted by GCS falls short in two respects:

- All WULA documents are in English and in highly technical language. Many community members in and around Normandien speak isiZulu as their first language and lack the technical background to understand the proposals and risks. Providing documents only in English to isiZulu-speaking communities is a form of exclusion.
- GCS has not arranged community meetings to explain the proposed water use, answer questions, or provide an accessible forum. A 60-day written comment period in English only, without meetings, plain-language summaries, or isiZulu materials, is not meaningful participation for communities facing literacy barriers and limited internet access.

SEJN requests that GCS:

- Prepare plain-language summaries translated into isiZulu and distribute them to affected communities;
- Arrange accessible community meetings conducted in isiZulu before the comment period closes; and
- Extend the comment period to allow meaningful participation after accessible information is provided.

The Department should not make a licensing decision until these procedural deficiencies have been remedied.

11. Technical Report, Specialist Reports and Professional Registration

Technical and specialist assessments form the evidentiary basis on which the Department must evaluate the impacts of the proposed water use. The Natural Scientific Professions Act 27 of 2003 requires that persons practising in the natural scientific professions must be registered with SACNASP in the appropriate category and field of practice.

SEJN's primary concern relates to the WULA Technical Report, which is the central document on which the licensing decision depends. The primary author (Luyanda Macheke) is not registered with SACNASP. The two co-authors (Marandela Muzhambi and Paula Tolksdorff) hold Pr.Sci.Nat. registration in Environmental Science, not in Earth Science or Water Resources Science — the fields relevant to a water use licence application. The director and signatory (Danielle Kriel) is also not registered.

This means the most important report in this application was not authored, supervised, or signed off by a Pr.Sci.Nat. registered in the relevant field of practice.

Similar concerns arise with the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D), where the primary authors are not registered as Pr.Sci.Nat. in the relevant fields. While directors holding full registration have signed off, it is not clear that sign-off alone constitutes the substantive supervision the Act requires. Only the Hydropedology Report (Appendix E) appears compliant.

The Department should not issue a licence until all professional qualification and registration deficiencies have been satisfactorily remedied and revised or re-certified reports have been made available to I&APs for comment.

12. Conclusion

SEJN acknowledges that the Thirsti Bottling Plant creates jobs in an area where employment opportunities are limited. This objection is not about opposing economic development. It is about ensuring that development dependent on a shared natural resource does so lawfully, responsibly, and with proper protection for communities and ecosystems.

The Department should not issue a Water Use Licence until:

- GCS and Normandien Farms have disclosed all compliance history information requested in Sections 2 and 3;
- A comprehensive, integrated WULA covering all water uses on the relevant properties has been submitted;
- Independent expert assessments have been provided addressing aquifer stress, cumulative impact, wetland connectivity, and neighbouring-user impacts (Sections 4–8);
- The material discrepancy between the applied-for volume (281,371 m³/a) and the volume used in the stress index (618,579 m³/a) has been explained and resolved;
- Meaningful multilingual community engagement, including isiZulu materials and community meetings, has been conducted;
- The SACNASP registration deficiencies identified in Section 11 have been remedied; and
- A robust, independent, and publicly accessible monitoring programme with enforceable trigger thresholds has been designed and put forward for approval.

If further information is provided by GCS and Normandien Farms during the 60-day comment period, the comment period must be extended and SEJN reserves the right to supplement its submission.

Please acknowledge receipt of this objection and confirm that SEJN has been registered as an Interested and Affected Party.

Yours faithfully,

Mr Lucky Shabalala

On behalf of the Sisonke Environmental Justice Network

Date: March 2026

APPENDIX P: RESPONSE TO SISONKE ENVIRONMENTAL JUSTICE NETWORK

GCS Environment South Africa

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

To: Sisonke Environmental Justice Network

Attention: Mr. Lucky Shabalala

13 May 2026

RESPONSE TO COMMENTS: WATER USE LICENCE APPLICATION (REF: WU41899) THIRSTI BOTTLING PLANT, NORMANDIEN, KWAZULU-NATAL

Dear Mr. Shabalala

GCS Environment South Africa (Pty) Ltd (GCS), acting on behalf of Normandien Farms (Pty) Ltd (the Applicant), hereby acknowledges receipt of the submission by the Sisonke Environmental Justice Network (SEJN) dated 18 March 2026.

The comments and concerns raised by SEJN have been carefully considered together with the findings of the Hydrogeological Investigation, Hydropedology Assessment, Freshwater Ecosystem Assessment, and supporting technical documentation prepared as part of the Water Use Licence Application (WULA) process.

Groundwater abstraction at the Thirsti Bottling Plant initially commenced under a valid General Authorisation (Ref: 27/2/1/V31F/1) issued by the Department of Water and Sanitation (DWS) on 17 June 2015 in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). It is acknowledged that operational expansion and increased production requirements subsequently resulted in abstraction volumes exceeding the applicable General Authorisation thresholds. In response, the Applicant initiated the WULA process in order to regularise and formally authorise the expanded water use through the prescribed statutory process under the NWA.

The WULA therefore does not represent an attempt to avoid regulation, but rather the mechanism through which the DWS is able to assess the abstraction, consider specialist investigations, evaluate impacts, and impose appropriate enforceable licence conditions.

The specialist investigations confirm that the proposed abstraction volume remains within the sustainable capacity of the aquifer system. The higher abstraction figure referenced in the Hydrogeological Investigation represents a conservative sustainable abstraction benchmark calculated for assessment purposes and not the applied-for abstraction volume. The proposed abstraction remains substantially lower than the calculated sustainable abstraction rate and is supported by aquifer testing, groundwater balance assessments, hydrocensus information, and site-specific hydrogeological investigations undertaken over multiple years.

Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems.

The specialist investigations indicate that the proposed abstraction targets a deeper confined fractured aquifer system, while nearby wetlands are primarily associated with shallow soil-water processes and responsive near-surface hydrology. Based on the available hydrogeological and hydropedological

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Offices: Johannesburg
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information, limited hydraulic connectivity is expected between the abstraction zone and the shallow wetland systems. The investigations therefore conclude that impacts on wetland hydrology and baseflow are anticipated to be low.

The assessments further recognise existing catchment pressures and historical land-use transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures were considered within the groundwater balance and cumulative impact assessment undertaken as part of the WULA process.

The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes, groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.

With regard to cumulative impacts, the investigations considered existing groundwater use, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an adequate and scientifically defensible basis for decision-making by the DWS.

The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.

With respect to public participation, the process undertaken complies with the applicable legislative requirements and provided Interested and Affected Parties with an opportunity to review and comment on the application. The concerns raised regarding accessibility, language, and community engagement are acknowledged and will be considered as part of ongoing stakeholder engagement and communication measures.

The Technical Report and supporting specialist studies were prepared and reviewed under the oversight of appropriately registered Professional Natural Scientists in accordance with the requirements of the Natural Scientific Professions Act, 2003, the South African Council for Natural Scientific Professions (SACNASP), and accepted professional practice. The specialist investigations were undertaken by suitably qualified and registered specialists in the relevant fields of hydrogeology, hydropedology, freshwater ecology, and environmental science.

In conclusion, it is submitted that the WULA has been prepared in accordance with the applicable legal and regulatory framework and is supported by comprehensive specialist investigations. The issues raised by SEJN do not render the application incomplete or incapable of determination by the DWS. The WULA provides a lawful, technically sound, and scientifically defensible basis for the DWS to assess the application in terms of Section 27 of the NWA, with any additional monitoring, mitigation, management, or reporting requirements capable of being addressed through licence conditions imposed by the Department.

Thank you, for your participation in the public participation process and for taking the time to submit detailed comments on behalf of the SEJN. Your input and the concerns raised are acknowledged and

appreciated as part of the ongoing assessment and review process. Should you require any additional information or clarification, please do not hesitate to contact our office.

Yours faithfully,

Paula Tolksdorff Digitally signed by Paula Tolksdorff Date: 2026.05.13 19:35:54 +02'00'

For and on behalf of GCS Environment South Africa (Pty) Ltd
Paula Tolksdorff
Senior Technical Manager
Pr.Sci.Nat. Environmental Science (SACNASP Reg. No. 152904)
EAPASA Registered Environmental Assessment Practitioner (Reg. No. 2019/509)

APPENDIX Q: LETTER FROM ALL RISE

ALLRISE
Attorneys for climate and environmental justice

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26 May 2026

Department of Water and Sanitation
Head Office
Chief Director: Water Use Authorisation Management
Mr Moses Sipho Skosana
By email: Skosanam@dws.gov.za; WULAinfo@dws.gov.za

Department of Water and Sanitation
KwaZulu-Natal Regional Office
Ms Angela Masefield
By email: Masefielda@dws.gov.za

Cc: GCS Environment South Africa
Senior Technical Manager
Ms Paula Tolksdorff
By email: paulat@gcs-sa.biz

Dear Sirs and Mesdames,

RE: WATER USE LICENCE APPLICATION (REF: WU41899) — THIRSTI BOTTLING PLANT, NORMANDIEN, KWAZULU-NATAL: INADEQUATE RESPONSE BY GCS TO SEJN'S OBJECTION OF 18 MARCH 2026 AND REQUEST THAT NO LICENCE BE ISSUED PENDING RESOLUTION

Introduction

1. We act for the **Sisonke Environmental Justice Network** ("SEJN"), a community organisation representing residents and land users in and around Normandien, KwaZulu-Natal, who have objected to Thirsti's water use licence application ("WULA") for the proposed water uses at the Thirsti Bottling Plant.

All Rise Attorneys for Climate and Environmental Justice is a non-profit company with registration number 2019/305876/08 and NPO Ref. 232-020 and an accredited law clinic in terms of section 34(8)(b)(iv) of the Legal Practice Act, 2014
Directors: Renee Kirkham (non-executive), Mawande Mazibuko (non-executive), Trudie Nichols (non-executive), Dineo Skosana-Ngwenya (non-executive), Janice Tooley (executive), Kirsten Youens (chief executive) Attorneys: Kirsten Youens, Janice Tooley

2. We write with reference to the letter dated 13 May 2026 from GCS Environment South Africa (Pty) Ltd ("GCS Response"), the applicant's appointed consultants, which purported to address SEJN's objection submitted on 18 March 2026 ("SEJN's Objection"). *Copies of the GCS Response and SEJN's Objection are attached hereto as* ***Annexures A and B****, respectively*.

Inadequacy of GCS's Response

3. We are instructed to write to the Department directly to set out why GCS's response remains inadequate in several material respects and to request that the Department refrain from issuing a Water Use Licence until the matters raised in SEJN's Objection have been substantively addressed.

4. SEJN's Objection raised ten distinct grounds of objection, supported by specific factual concerns, identified evidential gaps, and concrete requests for further information. GCS's response was framed as a single narrative letter rather than a structured, point-by-point reply. Several issues receive no substantive response at all; others are addressed only through broad assurances or general statements that do not meaningfully engage with the specific concerns raised.

5. ***Kindly refer to Schedule 1 (pages 5 to 17 of this letter), which records the inadequacies of GCS's Response to each of SEJN's grounds of objection, and identifies the outstanding issues that remain unresolved.***

Legal Framework

6. The Department's decision under section 27 of the National Water Act 36 of 1998 ("the NWA") must be based on an evidentiary record sufficient to enable proper consideration of all relevant factors, including the probable effect of the proposed water use on the water resource and other water users, the public interest, existing lawful water uses, and the long-term sustainability of the resource.

7. In addition, the environmental management principles in section 2 of the National Environmental Management Act 107 of 1998 ("NEMA"), including the requirement in section 2(4)(a)(vii) that a risk-averse and cautious approach be applied where there is uncertainty regarding environmental impacts, read together with the requirements of procedural fairness under the Promotion of Administrative Justice Act 3 of 2000 ("PAJA"), require meaningful

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participation by affected communities and sufficiently reliable information to support rational and informed decision-making.

8. As reflected in **Schedule 1**, the present record remains characterised by unresolved technical uncertainties, incomplete disclosure, acknowledged needs for further assessment by the applicant's own specialists, and unresolved procedural shortcomings in the public participation process. In these circumstances, the Department is unlikely to be in a position to lawfully discharge its obligations under section 27 of the NWA on the basis of the current application record.

9. In the absence of sufficiently reliable and complete information addressing these matters, there is a material risk that any decision taken may be vulnerable to challenge on the basis of procedural unfairness, irrationality, or failure to consider relevant factors.

Request

10. **Schedule 1** demonstrates that, despite the breadth and specificity of SEJN's Objection, GCS has, in many instances, failed to engage substantively with the concerns raised and has instead relied on broad assurances, partial responses, or statements indicating that further refinement, monitoring, or assessment may still be required. The cumulative effect is that material factual disputes, technical uncertainties, and procedural deficiencies remain unresolved.

11. Of particular concern is that the applicant's own reports acknowledge the need for further assessment, including updated groundwater modelling and cumulative impact assessment, while the response simultaneously maintains that the existing material is sufficient for licensing purposes. The response further does not substantively engage with unresolved issues relating to abstraction volumes, cumulative groundwater impacts, neighbouring users, wetland connectivity, historical compliance, monitoring thresholds, and the adequacy of public participation.

12. These deficiencies are not isolated technical matters. Collectively, they materially impede the Department's ability properly to assess the probable effects of the proposed water uses, the sustainability of the affected resource, the implications for other users and groundwater-dependent ecosystems, and whether the application satisfies the requirements of section 27 of the NWA. The unresolved shortcomings in the public participation process further raise

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concerns regarding the procedural fairness and legitimacy of any decision taken on the present record.

13. In the circumstances, we respectfully submit that the Department should **not issue a Water Use Licence** in respect of Application WU41899 unless and until the applicant has adequately addressed the outstanding deficiencies identified in **Schedule 1** through the provision of sufficiently complete and reliable technical information, meaningful engagement with affected parties and neighbouring users, and such further assessment, modelling, disclosure, and procedural remediation as may be necessary to enable a lawful and informed decision under section 27 of the NWA.

14. We accordingly request that this letter be treated as a formal representation in the WULA process and that the Department confirm the steps it proposes to take to address the unresolved issues identified herein and in **Schedule 1** prior to making any licensing decision.

15. SEJN further reserves all of its rights in relation to any decision taken on an incomplete or procedurally deficient record, including its rights to seek access to the full administrative record, specialist material, underlying modelling and supporting information relied upon in any eventual decision-making process.

16. We look forward to the Department's substantive engagement with these submissions.

Yours sincerely,

Janice Tooley
Attorney
All Rise Attorneys for Climate and Environmental Justice
On behalf of the Sisonke Environmental Justice Network

(Sent by email and therefore not signed)

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Directors: Renee Kirkham (non-executive), Mawande Mazibuko (non-executive), Trudie Nichols (non-executive), Dineo Skosana-Ngwenya (non-executive), Janice Tooley (executive), Kirsten Youens (chief executive) Attorneys: Kirsten Youens, Janice Tooley

SCHEDULE 1: Water Use Licence Application (Ref: WU41899) — Thirsti Bottling Plant, Normandien, KwaZulu-Natal

Inadequate response from GCS to SEJN's Objection (18 March 2026)

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
1. Historical Groundwater Abstraction Without Authorisation The Technical Report indicates that groundwater has been abstracted from several boreholes since the bottling plant was established in 2015, in absence of a Water Use Licence. The application seeks authorisation for the abstraction of 281,371 m³/a from eight production boreholes. This raises concerns about compliance with the NWA. Groundwater abstraction exceeding General Authorisation thresholds without a Water Use Licence is an offence under the NWA. Two prescribed thresholds are relevant: ▪ General Authorisation (Ref: 27/2/1/V31F/1) issued on 17 June 2015 permitting 36,000 m³/a from a single borehole on Portion 0, Buffelshoek Farm. The current abstraction of 281,371 m³/a from eight boreholes exceeds this by approximately 681%. ▪ Under GN 538 of 2016, Table 2, Appendix B, the V31F quaternary catchment falls within the 45 m³/ha/a abstraction rate category. For properties totalling approximately 2,413.92 ha, this yields a threshold subject to the statutory cap of 40,000 m³/a per property (maximum 80,000 m³/a across both properties). The applied-for volume exceeds this by a substantial margin. In addition, the boreholes, septic tank, and French drains are located within 500 m of a wetland. Water uses within this proximity are specifically excluded from qualifying under the respective General Authorisation.	Groundwater abstraction at the Thirsti Bottling Plant initially commenced under a valid General Authorisation (Ref: 27/2/1/V31F/1) issued by the Department of Water and Sanitation (DWS) on 17 June 2015 in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). It is acknowledged that operational expansion and increased production requirements subsequently resulted in abstraction volumes exceeding the applicable General Authorisation thresholds. In response, the Applicant initiated the WULA process in order to regularise and formally authorise the expanded water use through the prescribed statutory process under the NWA. The WULA therefore does not represent an attempt to avoid regulation, but rather the mechanism through which the DWS is able to assess the abstraction, consider specialist investigations, evaluate impacts, and impose appropriate enforceable licence conditions.	The GCS response is partial and inadequate. While it acknowledges that abstraction exceeded the General Authorisation thresholds, it does not address the specific compliance concerns raised: 1. No disclosure is provided of the date each borehole was installed, when abstraction commenced, annual abstraction volumes since 2015, or wastewater volumes directed to the septic tank and French drains. 2. The response does not address SEJN's point that abstraction exceeds the General Authorisation by approximately 681%, nor does it address the GN 538 of 2016 thresholds. 3. The response does not address the exclusion from General Authorisation of water uses within 500 m of a wetland. 4. None of the specific disclosure requests made by SEJN (the 2019 GCS report, pre-application meeting minutes, enforcement history) have been addressed. 5. The characterisation of the WULA as merely a mechanism to "regularise" the water use understates the significance of a decade of potentially unlawful abstraction. The compliance history remains a material factor under s27 NWA that DWS must consider. **Outstanding issues:** Full compliance history disclosure; response to all specific disclosure requests; acknowledgment of the legal significance of operating without authorisation for over a decade.

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SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
The applicant's compliance history is a relevant consideration under section 27 of the National Water Act, particularly in relation to the public interest, lawful use of water, and the protection of water resources. Full disclosure of the history of abstraction since 2015 is necessary for this purpose and to enable meaningful participation by I&APs. SEJN requests that Normandien Farms and GCS publicly disclose: ▪ The date each borehole was installed and when abstraction commenced; ▪ Annual abstraction volumes from each borehole since 2015; ▪ Total annual wastewater volumes directed to the septic tank and French drains since 2015; ▪ When Normandien became aware its water uses may have been unlawful; ▪ A copy of the 2019 GCS report titled "Thirsti Bottling Plant Water Supply Investigation"; ▪ Minutes of the pre-application meeting held on 24 March 2020 and records of any subsequent meetings with, or directives from, DWS; and ▪ Whether any enforcement action has been taken by DWS or any other government department.		
2. The WULA Is Incomplete The Technical Report discloses that several other water uses occur on Normandien's two farms (Buffelshoek 15469T and Woodburn 15470), including additional boreholes, storage/irrigation dams, and commercial forestry. All affect the same aquifer and catchment. Yet the application seeks a licence only for water uses connected to the bottling operation.	The assessments further recognise existing catchment pressures and historical land-use transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures were considered within the groundwater balance and cumulative impact	The GCS response is vague and does not address the specific concerns raised: 1. The response does not address the fact that the WULA covers only bottling-related water uses and excludes other water uses on the same properties (additional boreholes, storage/irrigation dams, commercial forestry).

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
When multiple water uses occur on the same properties, they interact with and affect each other. The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This cannot be done without a complete picture of all water uses. Commercial forestry reduces groundwater recharge through interception and transpiration. According to data cited in the Technical Report itself, the V31F quaternary catchment loses approximately 1–5% of annual streamflow due to dense afforestation (Le Maitre et al., 2020). If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure on the aquifer is greater than either use alone would suggest. The Technical Report references 11 boreholes (BH2, BH3, BH4, BH6, BH7, BH8, BH9, BH11, BH12, BH13, BH14). Boreholes 1, 5, and 10 are not mentioned. Their existence, location, status, and history of use are unknown. There is also insufficient information for the boreholes referenced as 34890, 0348992A, 35081, 35097 and 34891 which are also located on Normandien's farms. **Gap:** No explanation for the omission of boreholes 1, 5, and 10. **Gap:** No assessment of the combined impact of forestry, dams, and all boreholes on the aquifer. As an aside, the Technical Report's executive summary refers to "the A91K quaternary catchment," while the body of the report consistently refers to V31F. A91K is located in Limpopo. This basic error needs to be corrected. SEJN requests that the Department require a comprehensive, integrated WULA covering all water uses on these properties before making a licensing decision.	assessment undertaken as part of the WULA process. Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems.	2. The missing boreholes (BH1, BH5, BH10) and the inadequately documented boreholes (34890, 0348992A, 35081, 35097, 34891) are not mentioned or explained. 3. The response makes a general claim that "catchment pressures" and "forestry" were considered, but provides no specifics on the combined impact of forestry, dams, and all boreholes on the aquifer. 4. SEJN's request for a comprehensive, integrated WULA covering all water uses on the properties is not addressed. 5. The A91K/V31F error in the Technical Report is not acknowledged. **Outstanding issues:** Explanation for missing boreholes; integrated assessment of all water uses on the properties; correction of the A91K error; response to the request for a comprehensive WULA.

3. Aquifer Stress and Volume Discrepancy The Technical Report classifies the groundwater resource as Category C (moderate stress), based on a stress index of 0.23. This calculation uses an abstraction figure of 618,579 m³/a — more than double the 281,371 m³/a applied for. The Technical Report explains that 618,579 m³/a is the "recommended sustainable abstraction rate" based on flow characteristics calculations for the eight boreholes on a 12-hour pumping schedule. This raises important questions: ▪ If 618,579 m³/a is the recommended sustainable yield and the stress index is calculated on this basis, then the stress index reflects a much larger abstraction than is formally applied for. The Department must understand which figure drives the actual licensing decision. ▪ If the intended long-term abstraction is 618,579 m³/a, the application significantly understates the volume being sought. ▪ If the intended abstraction is 281,371 m³/a, then the stress index should be recalculated on the correct basis. ▪ Uncertainty: Whether the 618,579 m³/a figure represents future planned abstraction, a theoretical maximum, or a modelling input. The Technical Report does not clearly explain this. The Technical Report's groundwater balance (Table 4-8) indicates that 2,918,072 m³/a of groundwater is available for abstraction at the sub-catchment scale, with a surplus of 2,299,493 m³/a remaining after the recommended abstraction of 618,579 m³/a. However, this balance appears to be calculated at sub-catchment scale and may not account for localised drawdown effects, the concentrated nature of abstraction from eight boreholes in close proximity, or the cumulative impact of forestry and other land uses on recharge. Category C stress indicates that the aquifer is already under moderate pressure. In fractured rock aquifers, where water moves through fractures rather than	The specialist investigations confirm that the proposed abstraction volume remains within the sustainable capacity of the aquifer system. The higher abstraction figure referenced in the Hydrogeological Investigation represents a conservative sustainable abstraction benchmark calculated for assessment purposes and not the applied-for abstraction volume. The proposed abstraction remains substantially lower than the calculated sustainable abstraction rate and is supported by aquifer testing, groundwater balance assessments, hydrocensus information, and site-specific hydrogeological investigations undertaken over multiple years. With regard to cumulative impacts, the investigations considered existing groundwater use, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an adequate and scientifically defensible basis for decision-making by the DWS.	The GCS response is partially responsive but leaves key issues unresolved: 1. The response characterises the 618,579 m³/a figure as a "conservative sustainable abstraction benchmark calculated for assessment purposes" but does not clearly explain why the stress index was calculated using this figure rather than the applied-for volume of 281,371 m³/a. The material discrepancy identified by SEJN remains unexplained. 2. No recalculation of the stress index based on the actual applied-for volume has been provided. 3. The response does not address SEJN's concern about whether 618,579 m³/a represents future planned abstraction, which would mean the application understates the volume being sought. 4. No drought scenario modelling has been provided or referenced. 5. The response does not address the concern that the baseline stress assessment does not account for a decade of unlicensed abstraction. 6. The acknowledgment that "future refinement and ongoing monitoring may be implemented" implicitly concedes that the current assessment may not be complete. **Outstanding issues:** Clear explanation of the discrepancy between the two abstraction figures; recalculated stress index on the applied-for volume; drought scenario modelling; accounting for historical unlicensed abstraction in baseline assessment.

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SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
uniformly permeable material, responses to abstraction can be difficult to predict. Conservative management is particularly important. **Gap:** The Technical Report does not model aquifer stress under drought conditions. Groundwater that appears sustainable in average rainfall years can become critically depleted during droughts. **Gap:** The baseline stress assessment does not account for the decade of unlicensed abstraction already experienced. SEJN requests that before the Department makes its decision, the applicant demonstrates through independent expert evidence that the proposed abstraction has been modelled under drought scenarios, that the total licensed volume will not push the aquifer from Category C to a higher stress category under any foreseeable conditions, and that the decade of unlicensed abstraction has been accounted for in any baseline assessment.		
4. Impacts on Neighbouring Groundwater Users When large volumes of water are pumped from boreholes, the water table drops. This drawdown can spread outward and affect neighbouring boreholes, springs, and streams. In a fractured rock aquifer, drawdown can be unpredictable and may extend over large distances. Farms, smallholdings, and communities in the Normandien area depend on the same aquifer for drinking water, livestock, and food production. The Technical Report refers to a hydrocensus but the documentation does not demonstrate that all groundwater users within the potential radius of influence have been identified or consulted.	Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems. The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes,	The GCS response is general and does not address SEJN's specific requests: 1. No evidence is provided of a full borehole survey within a 5 km radius identifying all registered and unregistered boreholes and dependent users, as requested by SEJN. 2. No modelled drawdown effects under current or proposed abstraction rates, including drought conditions, have been provided or referenced. 3. No evidence has been provided that neighbouring landowners, communal water users, and communities have been directly consulted, as distinct from the formal public participation process. 4. The response refers generically to investigations having "considered groundwater users within the surrounding area"

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
The Technical Report indicates that the radius of influence of individual boreholes ranges between 69 m and 496 m. Given that eight boreholes are proposed, the combined zone of influence may be substantially larger. SEJN requests: ▪ A full borehole survey within at least a 5 km radius identifying all registered and unregistered boreholes and dependent users; ▪ Modelled drawdown effects under both current and proposed abstraction rates, including drought conditions; and ▪ Evidence that neighbouring landowners, communal water users, and communities have been directly consulted. The Department should ensure that the NWA s27(1)(d) factor — the probable effect on the resource and on other water users — is fully assessed before making its decision.	groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.	but does not specify the scope of the hydrocensus, the radius covered, or the number of users identified. 5. The combined zone of influence of eight boreholes operating simultaneously is not addressed. **Outstanding issues:** Full borehole survey within 5 km radius; modelled drawdown effects including drought scenarios; evidence of direct consultation with neighbouring groundwater users and communities.
5. Cumulative Groundwater Impacts The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This necessarily includes cumulative effects when multiple uses draw on the same resource. The Technical Report acknowledges that groundwater in the catchment is used by multiple sectors, including agriculture, commercial forestry, and domestic users. The report includes some catchment water balance data (Table 4-8) and references WARMS users (Table 4-2). However, the report does not provide a comprehensive catchment-scale model that accounts for all abstraction and all recharge-reducing activities, including commercial pine plantations.	With regard to cumulative impacts, the investigations considered existing groundwater use, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an adequate and scientifically defensible basis for decision-making by the DWS. The assessments further recognise existing catchment pressures and historical land-use	The GCS response is insufficient and internally contradictory: 1. SEJN specifically highlighted that the applicant's own Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." The GCS response does not address this admission or explain why the current assessment should be considered adequate despite this recommendation. 2. The response claims that cumulative impacts were considered, but provides no detail on how forestry, irrigation, and all abstraction were quantified or modelled at catchment scale. 3. No catchment-wide groundwater model has been provided or referenced.

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
This gap is significant because the Technical Report itself notes that the V31F catchment loses approximately 1–5% of annual streamflow to dense afforestation. Pine plantations intercept rainfall and transpire large volumes of water, reducing the recharge that sustains the aquifer. If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure may exceed what either use alone would suggest. The applicant's own consultants acknowledge this gap. The Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." This is a significant admission that the current assessment is incomplete. - Gap: No catchment-wide groundwater model accounting for forestry, irrigation, and all abstraction. - Gap: No assessment of whether the aquifer is already in deficit from a decade of unlicensed abstraction. The Department should not grant a licence on the basis of an assessment that the applicant's own experts acknowledge needs further work.	transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures were considered within the groundwater balance and cumulative impact assessment undertaken as part of the WULA process.	4. The response does not address whether the aquifer may already be in deficit from a decade of unlicensed abstraction. 5. The statement that "future refinement and ongoing monitoring may be implemented where necessary" again implicitly concedes the assessment's limitations without explaining why a licence should be granted before that refinement occurs. **Outstanding issues:** Catchment-wide groundwater model; explanation of the Technical Report's own recommendation for further cumulative impact assessment; assessment of historical abstraction deficit.
6. Monitoring, Mitigation, and Transparency The Technical Report proposes mitigation measures including staggered pumping schedules, groundwater monitoring, septic system management, and stormwater controls. These are necessary tools. However, they reduce risk only if supported by enforceable monitoring requirements, defined trigger thresholds, and clear response protocols. The proposed monitoring programme lacks clearly defined trigger levels — specific groundwater depth or quality thresholds that would require a management response. Without trigger thresholds and response	The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes, groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.	The GCS response is generic and does not engage with SEJN's specific concerns about the adequacy of the monitoring framework: 1. SEJN's central concern — that the monitoring programme lacks clearly defined trigger thresholds and response protocols — is not addressed. The response refers to "adaptive management measures" without specifying what triggers adaptation or what the response would be. 2. None of SEJN's seven specific requests for licence conditions have been individually addressed (monthly groundwater level monitoring, quarterly water quality testing, trigger thresholds, independent compliance reports, public

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
protocols, monitoring becomes record-keeping with no meaningful management function. The bottling plant has operated for more than a decade without a Water Use Licence and without any of the oversight conditions that a licence would have imposed. SEJN requests that any licence granted include: ▪ Monthly monitoring of groundwater levels in all abstraction and dedicated monitoring boreholes; ▪ Quarterly water quality testing at the boreholes, the septic system outlet, and the nearest watercourse; ▪ Clearly defined trigger thresholds with documented response protocols; ▪ Annual compliance reports prepared by an independent Pr.Sci.Nat. not affiliated with GCS or the applicant; ▪ All monitoring data to be made publicly accessible within 30 days of collection; ▪ Annual compliance reports shared with registered I&APs; and ▪ Direct written notification to SEJN of any trigger-level exceedance, licence breach, or emergency event.		accessibility of data, sharing with I&APs, or direct notification of exceedances). 3. The response effectively defers the issue to DWS by stating the framework provides "a basis upon which enforceable licence conditions may be imposed," without committing to or proposing specific enforceable conditions. 4. The concern that the plant operated for over a decade without any oversight conditions is not addressed. **Outstanding issues:** Defined trigger thresholds and response protocols; commitment to specific monitoring frequencies; independent compliance reporting; public accessibility of monitoring data; direct notification mechanisms for I&APs.
7. Potential Impacts on Wetlands Wetlands are among the most valuable and fragile ecosystems. South African law restricts activities in their vicinity because they are easily damaged and difficult to restore. The boreholes, septic tank, and French drains are all located within 500 m of wetlands, which is why a Water Use Licence is required. The Technical Report states that the proposed boreholes abstract water from a deeper confined aquifer that is assumed to be largely hydraulically separated from the shallow groundwater system that supports wetlands. On	The specialist investigations indicate that the proposed abstraction targets a deeper confined fractured aquifer system, while nearby wetlands are primarily associated with shallow soil-water processes and responsive near-surface hydrology. Based on the available hydrogeological and hydropedological information, limited hydraulic connectivity is expected between the abstraction zone and the shallow wetland systems. The investigations therefore conclude that impacts on wetland	The GCS response restates the Technical Report's conclusions but does not address SEJN's core concerns: 1. SEJN's central point — that the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has not been empirically tested — is not addressed. The response uses language such as "limited hydraulic connectivity is expected" and "based on the available … information," which confirms the conclusion is based on expectation rather than empirical verification.

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
this basis, the report concludes that abstraction will have minimal direct impact on wetlands. However, this conclusion rests on an assumption of hydraulic separation that has not been empirically tested. The documentation does not include a detailed numerical model specifically assessing how the proposed abstraction volumes could affect groundwater levels beneath nearby wetlands, or how this assumption has been verified. - Uncertainty: Whether the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has been empirically tested. An additional concern relates to the septic tank and French drain system. Leachate including chemical residues, excess nutrients, and pathogens can contaminate shallow groundwater feeding wetlands. The Technical Report acknowledges that the septic tank was previously observed to be overflowing. While the report states the system has since been upgraded, no independent verification of the upgrade's adequacy has been provided. The potential contamination from years of overflow has not been assessed, of if it has, has not been disclosed. Several of the wetlands near the site are classified as Critically Endangered ecosystem types, with present ecological states assessed as moderately to largely modified (Categories C to D). Given their already degraded condition, any additional pressure could cause further irreversible harm. SEJN requests that the Technical Report be amended to include: ▪ An assessment of the hydrological connectivity between the boreholes and nearby wetlands,	hydrology and baseflow are anticipated to be low. The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.	2. No numerical model assessing abstraction impacts on groundwater levels beneath wetlands has been provided or referenced. 3. The septic tank and French drain concerns are entirely unaddressed. SEJN raised specific issues about historical overflow, potential contamination of shallow groundwater feeding wetlands, and the absence of independent verification of the system upgrade. None of these are mentioned in the response. 4. The Critically Endangered classification and degraded ecological state (Categories C to D) of the nearby wetlands are not acknowledged or addressed. 5. None of SEJN's three specific requests (hydrological connectivity assessment, septic/French drain risk assessment, historical contamination investigation) have been addressed. **Outstanding issues:** Empirical verification of hydraulic separation assumption; numerical modelling of abstraction impacts on wetland groundwater; septic tank and French drain risk assessment; historical contamination investigation; acknowledgment of wetland conservation status.

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
including modelled analysis under average and dry-year conditions; ▪ A dedicated risk assessment of the septic tank and French drain system with respect to wetland water quality; and ▪ An investigation of historical contamination from years of septic tank overflow.		
8. Protection of Water Resources in a Strategic Water Source Area The Thirsti Bottling Plant is located within the Northern Drakensberg Strategic Water Source Area (SWSA). Although SWSAs cover only about 8% of South Africa's land area, they generate a disproportionately large share of the country's water resources. Water use decisions in these areas have implications that extend well beyond the immediate locality. Section 2 of the National Environmental Management Act 107 of 1998 (NEMA) requires that, where there is uncertainty about the environmental consequences of an action, decision-makers should apply a risk-averse and cautious approach. While WUL decisions are made under the NWA, NEMA's environmental management principles bind all organs of state, and a precautionary approach is consistent with the Department's obligations under NWA s27(1) to consider the probable effect on the water resource. Significant uncertainties remain about the true sustainable yield of the aquifer, the cumulative impact of all water uses, the impact on groundwater-fed wetlands, and the adequacy of the specialist assessments. Granting a licence in the face of these unresolved uncertainties would be inconsistent with a precautionary approach especially in a Strategic Water Resource Area which demands greater sensitivity and protection.	The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.	The GCS response is superficial and does not adequately address the precautionary principle argument: 1. The response merely "acknowledges" the SWSA concern and then asserts that the abstraction is within sustainable capacity, without engaging with SEJN's argument that the precautionary principle requires robust evidence in the face of uncertainty. 2. The response does not address the NEMA s2 precautionary principle or explain why the identified uncertainties (sustainable yield, cumulative impacts, wetland impacts, assessment adequacy) do not warrant a precautionary approach. 3. The claim that "conservative assumptions" were applied is not substantiated with specifics. 4. The significance of the SWSA designation — covering only 8% of South Africa's land area but generating a disproportionate share of water resources — is not engaged with in terms of the heightened duty of care it implies. 5. SEJN's request for robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security is not directly addressed. **Outstanding issues:** Substantive engagement with the precautionary principle; explanation of why identified uncertainties do not warrant a more cautious approach;

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
- Uncertainty: Whether the proposed abstraction is sustainable within the carrying capacity of the SWSA, given the cumulative pressures from forestry, agriculture, and bottling. SEJN requests that the Department apply a precautionary approach and require robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security before granting any licence.		specific evidence that the SWSA's strategic function will not be compromised.
9. Inadequacy of Public Participation Meaningful public participation is a legal right. The NWA and its regulations require that I&APs be given a genuine and reasonable opportunity to participate. PAJA requires that administrative decisions be procedurally fair. NEMA section 2 principles require that the participation of all I&APs must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured. The public participation process conducted by GCS falls short in two respects: ▪ All WULA documents are in English and in highly technical language. Many community members in and around Normandien speak isiZulu as their first language and lack the technical background to understand the proposals and risks. Providing documents only in English to isiZulu-speaking communities is a form of exclusion. ▪ GCS has not arranged community meetings to explain the proposed water use, answer questions, or provide an accessible forum. A 60-day written comment period in English only, without meetings, plain-language summaries, or isiZulu materials, is not	With respect to public participation, the process undertaken complies with the applicable legislative requirements and provided Interested and Affected Parties with an opportunity to review and comment on the application. The concerns raised regarding accessibility, language, and community engagement are acknowledged and will be considered as part of ongoing stakeholder engagement and communication measures.	The GCS response is dismissive and does not adequately address the substantive concerns: 1. The response asserts that the public participation process "complies with the applicable legislative requirements" without explaining how a process conducted entirely in English, without community meetings, can constitute meaningful participation for isiZulu-speaking communities with literacy barriers and limited internet access. 2. The response does not engage with SEJN's legal arguments based on PAJA (procedural fairness), NWA regulations, or NEMA s2 principles regarding vulnerable and disadvantaged persons. 3. None of SEJN's three specific requests have been addressed: no commitment to prepare isiZulu plain-language summaries; no commitment to arrange community meetings in isiZulu; no commitment to extend the comment period. 4. The vague statement that concerns "will be considered as part of ongoing stakeholder engagement" does not constitute a concrete commitment and does not remedy the existing procedural deficiencies. 5. Meaningful participation is a precondition for a lawful licensing decision, not a matter for post-decision engagement.

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
meaningful participation for communities facing literacy barriers and limited internet access. SEJN requests that GCS: ▪ Prepare plain-language summaries translated into isiZulu and distribute them to affected communities; ▪ Arrange accessible community meetings conducted in isiZulu before the comment period closes; and ▪ Extend the comment period to allow meaningful participation after accessible information is provided. ▪ The Department should not make a licensing decision until these procedural deficiencies have been remedied.		**Outstanding issues:** Commitment to isiZulu translations and plain-language summaries; commitment to community meetings; extension of the comment period; substantive response to the legal arguments on procedural fairness.
10. Technical Report, Specialist Reports and Professional Registration Technical and specialist assessments form the evidentiary basis on which the Department must evaluate the impacts of the proposed water use. The Natural Scientific Professions Act 27 of 2003 requires that persons practising in the natural scientific professions must be registered with SACNASP in the appropriate category and field of practice. SEJN's primary concern relates to the WULA Technical Report, which is the central document on which the licensing decision depends. The primary author (Luyanda Macheke) is not registered with SACNASP. The two co-authors (Marandela Muzhambi and Paula Tolksdorff) hold Pr.Sci.Nat. registration in Environmental Science, not in Earth Science or Water Resources Science — the fields relevant to a water use licence application. The director and signatory (Danielle Kriel) is also not registered.	The Technical Report and supporting specialist studies were prepared and reviewed under the oversight of appropriately registered Professional Natural Scientists in accordance with the requirements of the Natural Scientific Professions Act, 2003, the South African Council for Natural Scientific Professions (SACNASP), and accepted professional practice. The specialist investigations were undertaken by suitably qualified and registered specialists in the relevant fields of hydrogeology, hydropedology, freshwater ecology, and environmental science.	The GCS response is a blanket assertion that does not engage with the specific concerns raised: 1. SEJN identified specific individuals by name and their registration status. The primary author of the Technical Report (Luyanda Macheke) is identified as not being registered with SACNASP. The response does not address this specific concern or confirm or deny the registration status of named individuals. 2. The response does not address the distinction between Environmental Science registration and Earth Science or Water Resources Science registration — the fields SEJN argues are relevant to a WULA Technical Report. 3. The concern that sign-off by a registered director may not constitute the "substantive supervision" required by the Act is not addressed. 4. The specific concerns about the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D) are not individually addressed.

SEJN Objection Grounds – 18 March 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues
This means the most important report in this application was not authored, supervised, or signed off by a Pr.Sci.Nat. registered in the relevant field of practice. Similar concerns arise with the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D), where the primary authors are not registered as Pr.Sci.Nat. in the relevant fields. While directors holding full registration have signed off, it is not clear that sign-off alone constitutes the substantive supervision the Act requires. Only the Hydropedology Report (Appendix E) appears compliant. The Department should not issue a licence until all professional qualification and registration deficiencies have been satisfactorily remedied and revised or re-certified reports have been made available to I&APs for comment.		5. The response does not commit to remedying any identified deficiencies or making revised or re-certified reports available to I&APs. **Outstanding issues:** Confirmation or denial of the registration status of named individuals; explanation of how Environmental Science registration qualifies practitioners for water resource assessments; clarification of the level of supervision exercised; commitment to remedy any deficiencies and make revised reports available.

ANNEXURE "A"

From: Sisonke Environmental Justice Network

To: GCS Environment South Africa (Pty) Ltd

Email: MarandelaM@gcs-sa.biz; ppp@gcs-sa.biz

Subject: Comment on the Water Use Licence Application for the Thirsti Bottling Plant, Normandien, KwaZulu-Natal (WULA Ref: WU41899)

1. Introduction

We, the Sisonke Environmental Justice Network (SEJN), submit these comments as an Interested and Affected Party (I&AP) regarding the Water Use Licence Application (WULA) for the Thirsti Bottling Plant operated by Normandien Farms (Pty) Ltd, in the Newcastle Local Municipality, KwaZulu-Natal. Kindly register SEJN as an I&AP.

SEJN is an environmental justice organisation based in northern KwaZulu-Natal. Formed in 2015, it works with rural communities around Newcastle, advocating for environmental rights and supporting communities affected by environmental and resource-related impacts.

The National Water Act 36 of 1998 (NWA) requires that water resources be protected and used sustainably and equitably in the public interest. Section 27(1) of the NWA sets out the factors the licensing authority must consider when making a decision, including:

- equitable access to water;
- the need to redress past discrimination;
- the efficient and beneficial use of water in the public interest;
- the socio-economic impact of the proposed use;
- the probable effect on the water resource and other water users;
- any catchment management strategy;
- the likely effect on the resource directed measures; and
- investments already made by the applicant.

In addition, the Promotion of Administrative Justice Act 3 of 2000 (PAJA) requires that any administrative decision, including a licensing decision, must be procedurally fair. Affected parties must have a genuine opportunity to understand what is proposed, to access relevant information, and to make meaningful representations before the decision is made.

This objection is structured around the s27(1) factors and identifies the grounds on which the current application is insufficient for an informed and lawful licensing decision.

Grounds of Objection

SEJN formally objects to the granting of this Water Use Licence as currently applied for. Our objection rests on the following grounds, each developed in the sections below:

- The bottling plant has operated without a Water Use Licence for more than ten years. The compliance history of the applicant is a material factor that the Department must consider.
- The WULA does not cover all water uses on the relevant properties and is therefore incomplete.
- The aquifer is already under moderate stress (Category C) and the proposed abstraction, combined with other catchment pressures, risks increasing that stress.
- The Technical Report contains a material discrepancy between the abstraction volume applied for (281,371 m³/a) and the volume used in its stress index calculation (618,579 m³/a), which has not been explained.
- Neighbouring groundwater users have not been adequately identified, consulted, or protected.
- The cumulative groundwater impact of all uses in the catchment, including commercial forestry, has not been properly assessed.
- The proposed mitigation and monitoring measures lack enforceable trigger thresholds, independent oversight, and public transparency.
- Proximity to wetlands creates risks that have not been independently assessed, particularly regarding the untested assumption of hydraulic separation between the confined aquifer and shallow wetland systems.
- The application proposes large-scale abstraction in a nationally designated Strategic Water Source Area. The precautionary approach should be applied.
- The public participation process is conducted only in English, without community meetings, making it inaccessible to affected isiZulu-speaking residents.
- The main Technical Report was not prepared under the responsibility of appropriately registered Professional Natural Scientists in the relevant fields of practice and similar concerns exist for some of the specialist reports.

2. Historical Groundwater Abstraction Without Authorisation

The Technical Report indicates that groundwater has been abstracted from several boreholes since the bottling plant was established in 2015, in absence of a Water Use Licence. The application seeks authorisation for the abstraction of 281,371 m³/a from eight production boreholes.

This raises concerns about compliance with the NWA. Groundwater abstraction exceeding General Authorisation thresholds without a Water Use Licence is an offence under the NWA. Two prescribed thresholds are relevant:

- General Authorisation (Ref: 27/2/1/V31F/1) issued on 17 June 2015 permitting 36,000 m³/a from a single borehole on Portion 0, Buffelshoek Farm. The current abstraction of 281,371 m³/a from eight boreholes exceeds this by approximately 681%.
- Under GN 538 of 2016, Table 2, Appendix B, the V31F quaternary catchment falls within the 45 m³/ha/a abstraction rate category. For properties totalling approximately 2,413.92 ha, this yields a threshold subject to the statutory cap of 40,000 m³/a per property (maximum 80,000 m³/a across both properties). The applied-for volume exceeds this by a substantial margin.

In addition, the boreholes, septic tank, and French drains are located within 500 m of a wetland. Water uses within this proximity are specifically excluded from qualifying under the respective General Authorisation.

The applicant's compliance history is a relevant consideration under section 27 of the National Water Act, particularly in relation to the public interest, lawful use of water, and the protection of water resources. Full disclosure of the history of abstraction since 2015 is necessary for this purpose and to enable meaningful participation by I&APs.

SEJN requests that Normandien Farms and GCS publicly disclose:

- The date each borehole was installed and when abstraction commenced;
- Annual abstraction volumes from each borehole since 2015;
- Total annual wastewater volumes directed to the septic tank and French drains since 2015;
- When Normandien became aware its water uses may have been unlawful;
- A copy of the 2019 GCS report titled "Thirsti Bottling Plant Water Supply Investigation";
- Minutes of the pre-application meeting held on 24 March 2020 and records of any subsequent meetings with, or directives from, DWS; and
- Whether any enforcement action has been taken by DWS or any other government department.

3. The WULA Is Incomplete

The Technical Report discloses that several other water uses occur on Normandien's two farms (Buffelshoek 15469T and Woodburn 15470), including additional boreholes, storage/irrigation dams, and commercial forestry. All affect the same aquifer and catchment. Yet the application seeks a licence only for water uses connected to the bottling operation.

When multiple water uses occur on the same properties, they interact with and affect each other. The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This cannot be done without a complete picture of all water uses. Commercial forestry reduces groundwater recharge through interception and transpiration. According to data cited in the Technical Report itself, the V31F quaternary catchment loses approximately 1–5% of annual streamflow due to dense afforestation (Le Maitre et al., 2020). If forestry reduces recharge while the bottling plant

increases abstraction, the combined pressure on the aquifer is greater than either use alone would suggest.

The Technical Report references 11 boreholes (BH2, BH3, BH4, BH6, BH7, BH8, BH9, BH11, BH12, BH13, BH14). Boreholes 1, 5, and 10 are not mentioned. Their existence, location, status, and history of use are unknown. There is also insufficient information for the boreholes referenced as 34890, 0348992A, 35081, 35097 and 34891 which are also located on Normandien's farms.

- **Gap:** No explanation for the omission of boreholes 1, 5, and 10.
- **Gap:** No assessment of the combined impact of forestry, dams, and all boreholes on the aquifer.

As an aside, the Technical Report's executive summary refers to "the A91K quaternary catchment," while the body of the report consistently refers to V31F. A91K is located in Limpopo. This basic error needs to be corrected.

SEJN requests that the Department require a comprehensive, integrated WULA covering all water uses on these properties before making a licensing decision.

4. Aquifer Stress and the Volume Discrepancy

The Technical Report classifies the groundwater resource as Category C (moderate stress), based on a stress index of 0.23.

This calculation uses an abstraction figure of 618,579 m³/a — more than double the 281,371 m³/a applied for. The Technical Report explains that 618,579 m³/a is the "recommended sustainable abstraction rate" based on flow characteristics calculations for the eight boreholes on a 12-hour pumping schedule.

This raises important questions:

- If 618,579 m³/a is the recommended sustainable yield and the stress index is calculated on this basis, then the stress index reflects a much larger abstraction than is formally applied for. The Department must understand which figure drives the actual licensing decision.
- If the intended long-term abstraction is 618,579 m³/a, the application significantly understates the volume being sought.
- If the intended abstraction is 281,371 m³/a, then the stress index should be recalculated on the correct basis.
- **Uncertainty:** Whether the 618,579 m³/a figure represents future planned abstraction, a theoretical maximum, or a modelling input. The Technical Report does not clearly explain this.

The Technical Report's groundwater balance (Table 4-8) indicates that 2,918,072 m³/a of groundwater is available for abstraction at the sub-catchment scale, with a surplus of 2,299,493 m³/a remaining after the recommended abstraction of 618,579 m³/a. However, this balance appears to be calculated at sub-catchment scale and may not account for

localised drawdown effects, the concentrated nature of abstraction from eight boreholes in close proximity, or the cumulative impact of forestry and other land uses on recharge.

Category C stress indicates that the aquifer is already under moderate pressure. In fractured rock aquifers, where water moves through fractures rather than uniformly permeable material, responses to abstraction can be difficult to predict. Conservative management is particularly important.

- **Gap:** The Technical Report does not model aquifer stress under drought conditions. Groundwater that appears sustainable in average rainfall years can become critically depleted during droughts.
- **Gap:** The baseline stress assessment does not account for the decade of unlicensed abstraction already experienced.

SEJN requests that before the Department makes its decision, the applicant demonstrates through independent expert evidence that the proposed abstraction has been modelled under drought scenarios, that the total licensed volume will not push the aquifer from Category C to a higher stress category under any foreseeable conditions, and that the decade of unlicensed abstraction has been accounted for in any baseline assessment.

5. Impacts on Neighbouring Groundwater Users

When large volumes of water are pumped from boreholes, the water table drops. This drawdown can spread outward and affect neighbouring boreholes, springs, and streams. In a fractured rock aquifer, drawdown can be unpredictable and may extend over large distances.

Farms, smallholdings, and communities in the Normandien area depend on the same aquifer for drinking water, livestock, and food production. The Technical Report refers to a hydrocensus but the documentation does not demonstrate that all groundwater users within the potential radius of influence have been identified or consulted.

The Technical Report indicates that the radius of influence of individual boreholes ranges between 69 m and 496 m. Given that eight boreholes are proposed, the combined zone of influence may be substantially larger.

SEJN requests:

- A full borehole survey within at least a 5 km radius identifying all registered and unregistered boreholes and dependent users;
- Modelled drawdown effects under both current and proposed abstraction rates, including drought conditions; and
- Evidence that neighbouring landowners, communal water users, and communities have been directly consulted.

The Department should ensure that the NWA s27(1)(d) factor — the probable effect on the resource and on other water users — is fully assessed before making its decision.

6. Cumulative Groundwater Impacts

The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This necessarily includes cumulative effects when multiple uses draw on the same resource.

The Technical Report acknowledges that groundwater in the catchment is used by multiple sectors, including agriculture, commercial forestry, and domestic users. The report includes some catchment water balance data (Table 4-8) and references WARMS users (Table 4-2). However, the report does not provide a comprehensive catchment-scale model that accounts for all abstraction and all recharge-reducing activities, including commercial pine plantations.

This gap is significant because the Technical Report itself notes that the V31F catchment loses approximately 1–5% of annual streamflow to dense afforestation. Pine plantations intercept rainfall and transpire large volumes of water, reducing the recharge that sustains the aquifer. If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure may exceed what either use alone would suggest.

The applicant's own consultants acknowledge this gap. The Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." This is a significant admission that the current assessment is incomplete.

- **Gap:** No catchment-wide groundwater model accounting for forestry, irrigation, and all abstraction.
- **Gap:** No assessment of whether the aquifer is already in deficit from a decade of unlicensed abstraction.

The Department should not grant a licence on the basis of an assessment that the applicant's own experts acknowledge needs further work.

7. Monitoring, Mitigation, and Transparency

The Technical Report proposes mitigation measures including staggered pumping schedules, groundwater monitoring, septic system management, and stormwater controls. These are necessary tools. However, they reduce risk only if supported by enforceable monitoring requirements, defined trigger thresholds, and clear response protocols.

The proposed monitoring programme lacks clearly defined trigger levels — specific groundwater depth or quality thresholds that would require a management response. Without trigger thresholds and response protocols, monitoring becomes record-keeping with no meaningful management function.

The bottling plant has operated for more than a decade without a Water Use Licence and without any of the oversight conditions that a licence would have imposed.

SEJN requests that any licence granted include:

- Monthly monitoring of groundwater levels in all abstraction and dedicated monitoring boreholes;
- Quarterly water quality testing at the boreholes, the septic system outlet, and the nearest watercourse;
- Clearly defined trigger thresholds with documented response protocols;
- Annual compliance reports prepared by an independent Pr.Sci.Nat. not affiliated with GCS or the applicant;
- All monitoring data to be made publicly accessible within 30 days of collection;
- Annual compliance reports shared with registered I&APs; and
- Direct written notification to SEJN of any trigger-level exceedance, licence breach, or emergency event.

8. Potential Impacts on Wetlands

Wetlands are among the most valuable and fragile ecosystems. South African law restricts activities in their vicinity because they are easily damaged and difficult to restore. The boreholes, septic tank, and French drains are all located within 500 m of wetlands, which is why a Water Use Licence is required.

The Technical Report states that the proposed boreholes abstract water from a deeper confined aquifer that is assumed to be largely hydraulically separated from the shallow groundwater system that supports wetlands. On this basis, the report concludes that abstraction will have minimal direct impact on wetlands.

However, this conclusion rests on an assumption of hydraulic separation that has not been empirically tested. The documentation does not include a detailed numerical model specifically assessing how the proposed abstraction volumes could affect groundwater levels beneath nearby wetlands, or how this assumption has been verified.

- **Uncertainty:** Whether the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has been empirically tested.

An additional concern relates to the septic tank and French drain system. Leachate including chemical residues, excess nutrients, and pathogens can contaminate shallow groundwater feeding wetlands. The Technical Report acknowledges that the septic tank was previously observed to be overflowing. While the report states the system has since been upgraded, no independent verification of the upgrade's adequacy has been provided. The potential contamination from years of overflow has not been assessed, of if it has, has not been disclosed.

Several of the wetlands near the site are classified as Critically Endangered ecosystem types, with present ecological states assessed as moderately to largely modified (Categories C to D). Given their already degraded condition, any additional pressure could cause further irreversible harm.

SEJN requests that the Technical Report be amended to include:

- An assessment of the hydrological connectivity between the boreholes and nearby wetlands, including modelled analysis under average and dry-year conditions;
- A dedicated risk assessment of the septic tank and French drain system with respect to wetland water quality; and
- An investigation of historical contamination from years of septic tank overflow.

9. Protection of Water Resources in a Strategic Water Source Area

The Thirsti Bottling Plant is located within the Northern Drakensberg Strategic Water Source Area (SWSA). Although SWSAs cover only about 8% of South Africa's land area, they generate a disproportionately large share of the country's water resources. Water use decisions in these areas have implications that extend well beyond the immediate locality.

Section 2 of the National Environmental Management Act 107 of 1998 (NEMA) requires that, where there is uncertainty about the environmental consequences of an action, decision-makers should apply a risk-averse and cautious approach. While WUL decisions are made under the NWA, NEMA's environmental management principles bind all organs of state, and a precautionary approach is consistent with the Department's obligations under NWA s27(1) to consider the probable effect on the water resource.

Significant uncertainties remain about the true sustainable yield of the aquifer, the cumulative impact of all water uses, the impact on groundwater-fed wetlands, and the adequacy of the specialist assessments. Granting a licence in the face of these unresolved uncertainties would be inconsistent with a precautionary approach especially in a Strategic Water Resource Area which demands greater sensitivity and protection.

- **Uncertainty:** Whether the proposed abstraction is sustainable within the carrying capacity of the SWSA, given the cumulative pressures from forestry, agriculture, and bottling.

SEJN requests that the Department apply a precautionary approach and require robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security before granting any licence.

10. Inadequacy of Public Participation

Meaningful public participation is a legal right. The NWA and its regulations require that I&APs be given a genuine and reasonable opportunity to participate. PAJA requires that administrative decisions be procedurally fair. NEMA section 2 principles require that the participation of all I&APs must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

The public participation process conducted by GCS falls short in two respects:

- All WULA documents are in English and in highly technical language. Many community members in and around Normandien speak isiZulu as their first language and lack the technical background to understand the proposals and risks. Providing documents only in English to isiZulu-speaking communities is a form of exclusion.
- GCS has not arranged community meetings to explain the proposed water use, answer questions, or provide an accessible forum. A 60-day written comment period in English only, without meetings, plain-language summaries, or isiZulu materials, is not meaningful participation for communities facing literacy barriers and limited internet access.

SEJN requests that GCS:

- Prepare plain-language summaries translated into isiZulu and distribute them to affected communities;
- Arrange accessible community meetings conducted in isiZulu before the comment period closes; and
- Extend the comment period to allow meaningful participation after accessible information is provided.

The Department should not make a licensing decision until these procedural deficiencies have been remedied.

11. Technical Report, Specialist Reports and Professional Registration

Technical and specialist assessments form the evidentiary basis on which the Department must evaluate the impacts of the proposed water use. The Natural Scientific Professions Act 27 of 2003 requires that persons practising in the natural scientific professions must be registered with SACNASP in the appropriate category and field of practice.

SEJN's primary concern relates to the WULA Technical Report, which is the central document on which the licensing decision depends. The primary author (Luyanda Macheke) is not registered with SACNASP. The two co-authors (Marandela Muzhambi and Paula Tolksdorff) hold Pr.Sci.Nat. registration in Environmental Science, not in Earth Science or Water Resources Science — the fields relevant to a water use licence application. The director and signatory (Danielle Kriel) is also not registered.

This means the most important report in this application was not authored, supervised, or signed off by a Pr.Sci.Nat. registered in the relevant field of practice.

Similar concerns arise with the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D), where the primary authors are not registered as Pr.Sci.Nat. in the relevant fields. While directors holding full registration have signed off, it is not clear that sign-off alone constitutes the substantive supervision the Act requires. Only the Hydropedology Report (Appendix E) appears compliant.

The Department should not issue a licence until all professional qualification and registration deficiencies have been satisfactorily remedied and revised or re-certified reports have been made available to I&APs for comment.

12. Conclusion

SEJN acknowledges that the Thirsti Bottling Plant creates jobs in an area where employment opportunities are limited. This objection is not about opposing economic development. It is about ensuring that development dependent on a shared natural resource does so lawfully, responsibly, and with proper protection for communities and ecosystems.

The Department should not issue a Water Use Licence until:

- GCS and Normandien Farms have disclosed all compliance history information requested in Sections 2 and 3;
- A comprehensive, integrated WULA covering all water uses on the relevant properties has been submitted;
- Independent expert assessments have been provided addressing aquifer stress, cumulative impact, wetland connectivity, and neighbouring-user impacts (Sections 4–8);
- The material discrepancy between the applied-for volume (281,371 m³/a) and the volume used in the stress index (618,579 m³/a) has been explained and resolved;
- Meaningful multilingual community engagement, including isiZulu materials and community meetings, has been conducted;
- The SACNASP registration deficiencies identified in Section 11 have been remedied; and
- A robust, independent, and publicly accessible monitoring programme with enforceable trigger thresholds has been designed and put forward for approval.

If further information is provided by GCS and Normandien Farms during the 60-day comment period, the comment period must be extended and SEJN reserves the right to supplement its submission.

Please acknowledge receipt of this objection and confirm that SEJN has been registered as an Interested and Affected Party.

Yours faithfully,

Mr Lucky Shabalala

On behalf of the Sisonke Environmental Justice Network

Date: March 2026

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

To: Sisonke Environmental Justice Network

Attention: Mr. Lucky Shabalala

13 May 2026

RESPONSE TO COMMENTS: WATER USE LICENCE APPLICATION (REF: WU41899) THIRSTI BOTTLING PLANT, NORMANDIEN, KWAZULU-NATAL

Dear Mr. Shabalala

GCS Environment South Africa (Pty) Ltd (GCS), acting on behalf of Normandien Farms (Pty) Ltd (the Applicant), hereby acknowledges receipt of the submission by the Sisonke Environmental Justice Network (SEJN) dated 18 March 2026.

The comments and concerns raised by SEJN have been carefully considered together with the findings of the Hydrogeological Investigation, Hydropedology Assessment, Freshwater Ecosystem Assessment, and supporting technical documentation prepared as part of the Water Use Licence Application (WULA) process.

Groundwater abstraction at the Thirsti Bottling Plant initially commenced under a valid General Authorisation (Ref: 27/2/1/V31F/1) issued by the Department of Water and Sanitation (DWS) on 17 June 2015 in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). It is acknowledged that operational expansion and increased production requirements subsequently resulted in abstraction volumes exceeding the applicable General Authorisation thresholds. In response, the Applicant initiated the WULA process in order to regularise and formally authorise the expanded water use through the prescribed statutory process under the NWA.

The WULA therefore does not represent an attempt to avoid regulation, but rather the mechanism through which the DWS is able to assess the abstraction, consider specialist investigations, evaluate impacts, and impose appropriate enforceable licence conditions.

The specialist investigations confirm that the proposed abstraction volume remains within the sustainable capacity of the aquifer system. The higher abstraction figure referenced in the Hydrogeological Investigation represents a conservative sustainable abstraction benchmark calculated for assessment purposes and not the applied-for abstraction volume. The proposed abstraction remains substantially lower than the calculated sustainable abstraction rate and is supported by aquifer testing, groundwater balance assessments, hydrocensus information, and site-specific hydrogeological investigations undertaken over multiple years.

Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems.

The specialist investigations indicate that the proposed abstraction targets a deeper confined fractured aquifer system, while nearby wetlands are primarily associated with shallow soil-water processes and responsive near-surface hydrology. Based on the available hydrogeological and hydropedological

information, limited hydraulic connectivity is expected between the abstraction zone and the shallow wetland systems. The investigations therefore conclude that impacts on wetland hydrology and baseflow are anticipated to be low.

The assessments further recognise existing catchment pressures and historical land-use transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures were considered within the groundwater balance and cumulative impact assessment undertaken as part of the WULA process.

The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes, groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.

With regard to cumulative impacts, the investigations considered existing groundwater use, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an adequate and scientifically defensible basis for decision-making by the DWS.

The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.

With respect to public participation, the process undertaken complies with the applicable legislative requirements and provided Interested and Affected Parties with an opportunity to review and comment on the application. The concerns raised regarding accessibility, language, and community engagement are acknowledged and will be considered as part of ongoing stakeholder engagement and communication measures.

The Technical Report and supporting specialist studies were prepared and reviewed under the oversight of appropriately registered Professional Natural Scientists in accordance with the requirements of the Natural Scientific Professions Act, 2003, the South African Council for Natural Scientific Professions (SACNASP), and accepted professional practice. The specialist investigations were undertaken by suitably qualified and registered specialists in the relevant fields of hydrogeology, hydropedology, freshwater ecology, and environmental science.

In conclusion, it is submitted that the WULA has been prepared in accordance with the applicable legal and regulatory framework and is supported by comprehensive specialist investigations. The issues raised by SEJN do not render the application incomplete or incapable of determination by the DWS. The WULA provides a lawful, technically sound, and scientifically defensible basis for the DWS to assess the application in terms of Section 27 of the NWA, with any additional monitoring, mitigation, management, or reporting requirements capable of being addressed through licence conditions imposed by the Department.

Thank you, for your participation in the public participation process and for taking the time to submit detailed comments on behalf of the SEJN. Your input and the concerns raised are acknowledged and

appreciated as part of the ongoing assessment and review process. Should you require any additional information or clarification, please do not hesitate to contact our office.

Yours faithfully,

Paula Tolksdorff
Digitally signed by Paula Tolksdorff
Date: 2026.05.13 19:35:54 +02'00'

For and on behalf of GCS Environment South Africa (Pty) Ltd
Paula Tolksdorff
Senior Technical Manager
Pr.Sci.Nat. Environmental Science (SACNASP Reg. No. 152904)
EAPASA Registered Environmental Assessment Practitioner (Reg. No. 2019/509)

APPENDIX R: RESPONSE TO ALL RISE

GUNN ATTORNEYS | COMMERCIAL MINING ENVIRONMENTAL

Attention:

Department of Water and Sanitation
Head Office
Chief Director: Water Use Authorisation Management
Mr Moses Sipho Skosana

by e-mail:
Skosanam@dws.gov.za; and
WULAinfo@dws.gov.za

Department of Water and Sanitation
KwaZulu-Natal Regional Office
Ms Angela Masefield

By email: Masefielda@dws.gov.za

CC:
All Rise Attorneys
Janice Tooley
info@allrise.org.za

2 June 2026

Dear Mr Skosana and Ms Masefield

RE: WATER USE LICENCE APPLICATION (REF: WU41899) – THIRSTI BOTTLING PLANT, NORMANDIEN, KWAZULU-NATAL

1. We are instructed by Normandien Farms (Pty) Ltd, trading as Thirsti Beverages, ("**the Applicant**" or **our Client**") in the above matter.

2. We refer to the letter submitted by All Rise Attorneys on behalf of the Sisonke Environmental Justice Network ("**SEJN**"), dated 26 May 2026 ("**the All Rise Letter**") alleging various deficiencies in the above-mentioned Water Use Licence Application ("**WULA**") and requesting that the Department of Water and Sanitation ("**the Department**" or "**DWS**") refrain from determining the WULA pending the provision of further information to All Rise Attorneys.

3. The concerns raised in the All Rise Letter relate to matters that have already been addressed in the specialist studies, the WULA documentation, the PPP, and the responses submitted on behalf of the

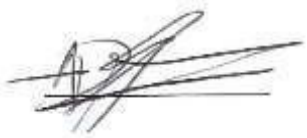
Applicant. Accordingly, our Client strongly disagrees that the alleged deficiencies identified by SEJN render the application incomplete or incapable of determination.

4. Without conceding that any further information is required to be provided to SEJN / All Rise Attorneys, our Client has nevertheless prepared a comprehensive response to the issues raised by SEJN in the interests of assisting the DWS and ensuring that the WULA administrative and public participation record is comprehensive. The table of responses prepared on behalf of our Client in reply to the All Rise Letter, is submitted herewith and attached as Annexure "**A**".

5. Our Client is therefore of the respectful opinion that the WULA (as supplemented by this response) complies with and contains all of the necessary information required terms of Section 27 of the National Water Act, 36 of 1998 to enable the Department to process the WULA and ultimately to take a decision therein.

6. Should the Department require any additional information or clarification in relation to the WULA, as always, our Client remains available to provide this information to the Department.

Yours sincerely



_____

Gunn Attorneys
Per: Adam Gunn

ANNEXURE A

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
1. **Historical Groundwater Abstraction Without Authorisation** The Technical Report indicates that groundwater has been abstracted from several boreholes since the bottling plant was established in 2015, in absence of a Water Use Licence. The application seeks authorisation for the abstraction of 281,371 m³/a from eight production boreholes. This raises concerns about compliance with the NWA. Groundwater abstraction exceeding General Authorisation thresholds without a Water Use Licence is an offence under the NWA. Two prescribed thresholds are relevant: • General Authorisation (Ref: 27/2/1/V31F/1) issued on 17 June 2015 permitting 36,000 m³/a from a single borehole on Portion 0, Buffelshoek Farm. The current abstraction of 281,371 m³/a from eight boreholes exceeds this by approximately 681%. • Under GN 538 of 2016, Table 2, Appendix B, the V31F quaternary catchment falls within the 45 m³/ha/a abstraction rate category. For properties totalling approximately 2,413.92 ha, this yields a threshold tied to the statutory cap of 40,000 m³/a per property (maximum 80,000 m³/a across both properties). The applied-for volume exceeds this by a substantial margin. In addition, the boreholes, septic tank, and French drains are located within 500 m of a wetland. Water uses within this proximity are specifically excluded from qualifying under the respective General Authorisation. The applicant's compliance history is a relevant consideration under section 27 of the National Water Act, particularly in relation to the public interest, lawful use of water, and the protection of water resources. Full disclosure of the history of abstraction since 2015 is necessary for this purpose and to enable meaningful participation by I&APs. SEJN requests that Normandien Farms and GCS publicly disclose: The date each borehole was installed and when abstraction commenced; • Annual abstraction volumes from each borehole since 2015; • Total annual wastewater volumes directed to the septic tank and French drains since 2015; • When Normandien became aware its water uses may have been unlawful; • A copy of the 2019 GCS report titled "Thirsti Bottling Plant Water Supply Investigation"; • Minutes of the pre-application meeting held on 24 March 2020 and records of any subsequent meetings with, or directives from, DWS;	Groundwater abstraction at the Thirsti Bottling Plant initially commenced under a valid General Authorisation (Ref: 27/2/1/V31F/1) issued by the Department of Water and Sanitation (DWS) on 17 June 2015 in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). It is acknowledged that operational expansion and increased production requirements subsequently resulted in abstraction volumes exceeding the applicable General Authorisation thresholds. In response, the Applicant initiated the WULA process in order to regularise and formally authorise the expanded water use through the prescribed statutory process under the NWA. The WULA therefore does not represent an attempt to avoid regulation, but rather the mechanism through which the DWS is able to assess the abstraction, consider specialist investigations, evaluate impacts, and impose appropriate enforceable licence conditions.	The GCS response is partial and inadequate. While it acknowledges that abstraction exceeded General Authorisation thresholds, it does not address the specific compliance concerns raised: 1. No disclosure is provided of the date each borehole was installed, when abstraction commenced, annual abstraction volumes since 2015, or wastewater volumes directed to the septic tank and French drains. 2. The response does not address SEJN's point that abstraction exceeds the General Authorisation by approximately 681%, nor does it address the GN 538 of 2016 thresholds. 3. The response does not address the exclusion from General Authorisation of water uses within 500 m of a wetland. 4. None of the specific disclosure requests made by SEJN (the 2019 GCS report, pre-application meeting minutes, enforcement history) have been addressed. 5. The characterisation of the WULA as merely a mechanism to "regularise" the water use understates the significance of a decade of potentially unlawful abstraction. The compliance history remains a material factor under s27 NWA that DWS must consider. Outstanding issues: Full compliance history disclosure; response to all specific disclosure requests; acknowledgement of the legal significance of operating without authorisation for over a decade.	GCS notes the concerns raised and appreciates the opportunity to provide further clarification on the matters identified. While some of the issues raised relate to information that is not expressly presented within the current documentation, GCS is of the view that the Water Use Licence Application (WULA) documentation and supporting specialist studies provide an appropriate basis for the Department of Water and Sanitation (DWS) to assess the application in terms of Section 27 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). Our responses to the specific matters raised are provided below. <u>1. Disclosure of borehole installation dates, abstraction commencement dates, abstraction volumes and wastewater volumes</u> SEJN requests disclosure of the date each borehole was installed, when abstraction commenced from each borehole, annual abstraction volumes since 2015, and wastewater volumes directed to the septic tank and French drains. The purpose of the WULA is to assess and authorise the current and proposed water uses associated with the Thirsti Bottling Plant. The application documentation identifies the operational boreholes currently utilised by the facility, the abstraction volumes for which authorisation is sought, and the associated water uses requiring authorisation in terms of the NWA. Historical operational records, including borehole installation dates, historical abstraction volumes, abstraction commencement dates, wastewater volumes, or other operational information predating the current WULA process, does not form part of the WULA or the specialist assessment conclusions upon which the WULA is based. <u>2. Allegation that abstraction exceeds the General Authorisation by approximately 681% and that GN 538 of 2016 thresholds have not been addressed</u> The current abstraction requirement under the original General Authorisation was a volume of 36,000 m³/a authorised under DWS Reference 27/2/1/V31F/1, issued on 17 June 2015. The reason for the present WULA is because the current water use can no longer be accommodated under the applicable General Authorisation framework. Where a General Authorisation no longer adequately covers a water user's water requirements, the NWA requires the user to apply for and obtain a Water Use Licence. This WULA process was initiated in 2019 but due to certain delays and the intervening COVID pandemic, it has not yet been completed. The WULA therefore constitutes the appropriate statutory process through which DWS can assess, in accordance with the requirements of the National Water Act, 1998 (Act No. 36 of 1998), the expanded abstraction, its sustainability, potential impacts on the water resource, potential impacts on other water users, and any licence conditions that may be required. The hydrogeological assessment indicates that the proposed abstraction volume remains below the calculated sustainable abstraction capacity of

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
• Whether any enforcement action has been taken by DWS or any other government department.			the aquifer system and that groundwater monitoring and management measures are recommended to ensure sustainable utilisation of the resource. The issue before DWS is therefore whether the proposed water use can be authorised under a Water Use Licence having regard to the factors set out in Section 27 of the NWA. <u>3. Exclusion from General Authorisation for water uses within 500 m of a wetland</u> Certain water uses and infrastructure associated with the Thirsti Bottling Plant occur within regulated areas associated with wetlands and watercourses. For this reason, the Applicant is not seeking to rely on General Authorisation provisions for these activities. The WULA explicitly includes water uses requiring authorisation in terms of Section 21(a), Section 21(c), Section 21(i), and Section 21(g) of the NWA, including groundwater abstraction, activities occurring within or affecting watercourses, and wastewater disposal-related activities. The application therefore recognises that certain activities require licensing and has included those activities within the WULA for assessment and decision by DWS. <u>4. Disclosure requests for the 2019 GCS report, pre-application meeting minutes and enforcement history</u> SEJN's request for a copy of the 2019 GCS report is noted. The report titled "Thirsti Bottling Plant Water Supply Investigation" formed part of the original WULA process initiated in 2019 and was used to support the original WULA submission. The findings of that investigation have subsequently been updated and incorporated into the current WULA and supporting specialist studies. SEJN also requests information relating to engagement between the Applicant and DWS, including the pre-application meeting held on 24 March 2020. While engagement with DWS formed part of the licensing process, records of such engagements do not form part of the public participation requirements prescribed under the NWA and were therefore not included within the public participation documentation made available to stakeholders. With respect to the history of the matter with DWS, the Applicant confirms that it is not aware of any enforcement action, directive, or similar regulatory action having been issued by DWS or any other competent authority in relation to the Thirsti Bottling Plant water use. Furthermore, Thirsti has participated in DWS General Authorisation audits, submitted the requisite information to DWS and kept its General Authorisation payments up-to date. Site visits were conducted by the DWS in November 2020 and May 2022, during which records were made available to DWS. Improvements and upgrades to the septic tank were made subsequent to the DWS site visit of May 2022.

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
			<u>5. Characterisation of the WULA as a mechanism to regularise the water use and the relevance of compliance history under Section 27 of the NWA</u> GCS acknowledges that compliance history may be a relevant consideration for DWS when assessing an application in terms of Section 27 of the NWA. However, it is not correct to suggest that the Thirsti Bottling Plant has operated entirely without authorisation since commencement. Normandien Farms has operated the Thirsti Bottling Plant, since 2015, under a General Authorisation issued by the DWS under reference 27/2/1/V31F/1. Up to and including 2018, groundwater abstraction and production volumes remained within the limits authorised under the General Authorisation. As the business expanded and future growth requirements became evident, Normandien Farms appointed GCS in early 2019 to undertake a WULA process. Following completion of specialist investigations, including hydrogeological, freshwater ecological, hydropedological, hydrological and groundwater vulnerability assessments, the WULA process formally commenced and was subsequently registered under DWS reference WU41899. As the operation expanded over time, groundwater abstraction requirements increased. The current WULA therefore seeks authorisation for a groundwater abstraction volume of 281,371 m³/a. The need for a Water Use Licence arose as a consequence of this operational growth and forms the basis of the present application. The use of the term "regularise" should therefore not be interpreted as diminishing the significance of the expanded water use or suggesting that compliance history is irrelevant. Rather, it refers to the statutory process through which the expanded water uses are brought before DWS for assessment, authorisation and regulation under a Water Use Licence. Importantly, the WULA process was initiated several years before the current re-application process and was not commenced only after concerns regarding abstraction volumes were raised. The licensing process has been ongoing since 2019 and has included specialist investigations, engagement with DWS, public participation processes, requests for additional information, and updated technical assessments to support DWS's consideration of the application. The WULA process enables DWS to consider all relevant factors required under Section 27 of the NWA, including the nature and extent of the water use, impacts on the resource, impacts on other users, public interest considerations, sustainability considerations, and any relevant compliance history. DWS remains fully empowered to consider these factors and impose such licence conditions as it considers necessary. Accordingly, GCS submits that the current WULA provides the appropriate regulatory mechanism through which DWS can assess the water uses and make an informed decision in accordance with the requirements of the NWA.
<u>2. The WULA Is Incomplete</u> The Technical Report discloses that several other water uses occur on Normandien's two farms (Buffelshoek 15469T and Woodburn 15470),	The assessments further recognise existing catchment pressures and historical land-use transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures	The GCS response is vague and does not address the specific concerns raised: 1. The response does not address the fact that the WULA covers only bottling-related water uses and excludes other water uses on the	GCS notes the concerns raised and welcomes the opportunity to provide additional clarification regarding the scope and completeness of the WULA. The comments raise a number of questions relating to the water uses included in the application, the status of certain boreholes, and the consideration of broader catchment pressures. The responses below are

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
including additional boreholes, storage/irrigation dams, and commercial forestry. All affect the same aquifer and catchment. Yet the application seeks a licence only for water uses connected to the bottling operation. When multiple water uses occur on the same properties, they interact with and affect each other. The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This cannot be done without a complete picture of all water uses. Commercial forestry reduces groundwater recharge through interception and transpiration. According to data cited in the Technical Report itself, the V31F quaternary catchment loses approximately 1–5% of annual streamflow due to dense afforestation (Le Maitre et al., 2020). If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure on the aquifer is greater than either use alone would suggest. The Technical Report references 11 boreholes (BH2, BH3, BH4, BH6, BH7, BH8, BH9, BH11, BH12, BH13, BH14). Boreholes 1, 5, and 10 are not mentioned. Their existence, location, status, and history of use are unknown. There is also insufficient information for the boreholes referenced as 34890, 0348992A, 35081, 35097, 34891 which are also located on Normandien's farms. Gap: No explanation for the omission of boreholes 1, 5, and 10. Gap: No assessment of the combined impact of forestry, dams, and all boreholes on the aquifer. As an aside, the Technical Report's executive summary refers to "the A91K quaternary catchment," while the body of the report consistently refers to V31F. A91K is located in Limpopo. This basic error needs to be corrected. SEJN requests that the Department require a comprehensive, integrated WULA covering all water uses on these properties before making a licensing decision.	were considered within the groundwater balance and cumulative impact assessment. assessment undertaken as part of the WULA process. Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems.	same properties (additional boreholes, storage/irrigation dams, commercial forestry). 2. The missing boreholes (BH1, BH5, BH10) and the inadequately documented boreholes (34890, 0348992A, 35081, 35097, 34891) are not mentioned or explained. 3. The response makes a general claim that "catchment pressures" and "forestry" were considered, but provides no specifics on the combined impact of forestry, dams, and all boreholes on the aquifer. 4. SEJN's request for a comprehensive, integrated WULA covering all water uses on the properties is not addressed. 5. The A91K/V31F error in the Technical Report is not acknowledged. Outstanding issues: Explanation for missing boreholes; integrated assessment of all water uses on the properties; correction of the A91K error; response to the request for a comprehensive WULA.	intended to provide further context regarding the basis upon which the application has been prepared and will be assessed by the DWS. <u>1. Allegation that the WULA covers only bottling-related water uses and excludes other water uses on the properties</u> The purpose of the present WULA is to seek authorisation for the water uses associated with the Thirsti Bottling Plant, namely groundwater abstraction from the operational production boreholes and associated water uses linked to the bottling operation. The application therefore identifies and assesses the specific water uses requiring authorisation in terms of Section 21(a), Section 21(c), Section 21(i) and Section 21(g) of the NWA. The fact that other land uses or water-related activities may occur on the broader properties, including forestry operations, dams or other boreholes, does not necessarily mean that all such activities must be consolidated into a single WULA. The NWA requires an application to identify and assess the specific water uses for which authorisation is sought. DWS remains empowered, in terms of Section 27 of the NWA, to consider the broader catchment context, cumulative pressures, existing lawful uses and other relevant resource management considerations when evaluating the application. <u>2. Missing and inadequately documented boreholes</u> SEJN raises concerns regarding boreholes BH1, BH5 and BH10, as well as boreholes identified through historical reports and the National Groundwater Archive (NGA). The status of BH1, BH5 and BH10 has been specifically considered. These boreholes were drilled during earlier investigations, they are not included in the water uses for which authorisation is being sought under the current WULA. With respect to boreholes 34890, 034892A, 35081, 35097 and 34891, these boreholes were identified as part of the desktop hydrocensus undertaken for the Hydrogeological Investigation. The hydrocensus included a review of NGA records and borehole information within a 5 km radius of the Thirsti Bottling Plant, together with boreholes identified during previous investigations undertaken. The inclusion of these boreholes in the hydrogeological assessment reflects their role in characterising the broader groundwater environment and identifying surrounding groundwater users within the study area. Their inclusion does not indicate that they form part of the operational abstraction system associated with the Thirsti Bottling Plant, nor does it imply that abstraction from these boreholes forms part of the water uses for which authorisation is sought under the current WULA. The purpose of the hydrocensus was to establish baseline groundwater conditions and to inform the assessment of groundwater levels, aquifer characteristics, groundwater flow patterns, surrounding groundwater users and potential cumulative impacts within the study area. As such, the hydrocensus intentionally included boreholes that are not owned or operated by Thirsti and which fall outside the operational abstraction network.

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
			The operational abstraction system assessed in the WULA comprises eight production boreholes, namely BH3, BH4, BH6, BH7, BH8, BH11, BH12 and BH13. These are the boreholes from which groundwater abstraction is undertaken for the Thirsti Bottling Plant and which form the basis of the Section 21(a) water use application. The additional boreholes referenced by SEJN form part of the broader hydrocensus dataset used to characterise groundwater conditions within the study area and were not identified as operational production boreholes associated with the Thirsti Bottling Plant. <u>3. Consideration of the combined impacts of forestry, dams and groundwater abstraction</u> The WULA documentation does not assess the Thirsti Bottling Plant in isolation and does not ignore broader catchment pressures. The Hydrogeological Investigation considered the wider groundwater environment through a desktop hydrocensus that included NGA records and borehole information within a 5 km radius of the site, together with information from previous investigations undertaken. The assessment incorporated groundwater recharge, existing groundwater abstraction, groundwater contribution to baseflow, groundwater availability within the delineated sub-catchment, and the potential cumulative impacts associated with groundwater use in the area. The study also recognised the potential for cumulative impacts on neighbouring groundwater users and recommended ongoing groundwater monitoring and management measures. The Hydrological Assessment considered catchment-scale pressures and existing land uses within the study area, including dams, wetlands, forestry plantations, agricultural activities, invasive alien vegetation, historical farming practices and water users within the sub-catchment. The report specifically identifies pine and pecan nut plantations as ongoing influences on the hydrological cycle and recognises cumulative impacts associated with these land uses. The Freshwater Ecosystem Assessment evaluated the condition of wetlands and riparian systems within the study area and identified dams altering flow regimes, plantation forestry, grazing, hay production, invasive alien vegetation and erosion as contributors to the current ecological condition of the freshwater ecosystems. These existing pressures were considered when evaluating the significance of potential impacts associated with the Thirsti Bottling Plant. The Hydropedology Assessment further evaluated hydrological flow drivers, wetland functioning, groundwater-fed baseflow processes and the interaction between groundwater abstraction and freshwater ecosystems. The assessment concluded that groundwater abstraction occurs from a confined fractured aquifer system and that marginal to negligible impacts are anticipated on baseflow contributions to wetlands and watercourses. Accordingly, while the WULA seeks authorisation for water uses associated with the Thirsti Bottling Plant, the supporting specialist investigations considered the broader groundwater environment, surrounding groundwater users, forestry plantations, dams, agricultural land uses, wetlands and cumulative catchment pressures relevant to the assessment of the proposed water use.

SEJN Objection Grounds – dated 18 March 2026, received on the 16 April 2026	GCS Response – 13 May 2026	Inadequacy of GCS Response & Outstanding Issues	Applicant's Response
			4. Request for a comprehensive integrated WULA covering all water uses on the properties SEJN's request for a single integrated WULA covering all water uses on Buffelshoek 15469 and Woodburn 15470 is noted. However, GCS is not aware of any provision within the NWA that requires all water uses occurring on a property to be consolidated into a single licence application irrespective of ownership, operational purpose, legal status or authorisation requirements. The current application seeks authorisation for defined water uses associated with the Thirsti Bottling Plant. The existence of other land uses or water uses on the properties does not, in itself, render the application incomplete. DWS remains empowered to request any additional information it considers necessary as part of its decision-making process. Accordingly, while SEJN's request is noted, GCS does not agree that a consolidated property-wide WULA is a prerequisite for DWS to consider and determine the present application. 5. Reference to A91K instead of V31F SEJN's comment regarding the reference to "A91K" in the Executive Summary is accepted. The correct quaternary catchment applicable to the Thirsti Bottling Plant is V31F, as reflected throughout the body of the WULA Technical Report and the specialist studies. The reference to A91K in the Executive Summary is a typographical error and will be corrected in the final report. This correction does not affect the underlying technical assessment, which was undertaken for Quaternary Catchment V31F.
3. Aquifer Stress and Volume Discrepancy The Technical Report classifies the groundwater resource as Category C (moderate stress), based on a stress index of 0.23. This calculation uses an abstraction figure of 618,579 m³/a — more than double the 281,371 m³/a applied for. The Technical Report explains that 618,579 m³/a is the "recommended sustainable abstraction rate" based on flow characteristic calculations for the eight boreholes on a 12-hour pumping schedule. This raises important questions: • If 618,579 m³/a is the recommended sustainable yield and the stress index is calculated on this basis, then the stress index reflects a much larger abstraction than is formally applied for. The Department must understand which figure drives the actual licensing decision. • If the intended long-term abstraction is 618,579 m³/a, the application significantly understates the volume being sought. • If the intended abstraction is 281,371 m³/a, then the stress index should be recalculated on the correct basis.	The specialist investigations confirm that the proposed abstraction volume remains within the sustainable capacity of the aquifer system. The higher abstraction figure referenced in the Hydrogeological Investigation represents a conservative sustainable abstraction benchmark calculated for assessment purposes and not the applied-for abstraction volume. The proposed abstraction remains substantially lower than the calculated sustainable abstraction rate and is supported by aquifer testing, groundwater balance assessments, hydrocensus information, and site-specific hydrogeological investigations undertaken over multiple years. With regard to cumulative impacts, the investigations considered existing groundwater users, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an	The GCS response is partially responsive but leaves key issues unresolved: 1. The response characterises the 618,579 m³/a figure as a "conservative sustainable abstraction benchmark calculated for assessment purposes" but does not clearly explain why the stress index was calculated using this figure rather than the applied-for volume of 281,371 m³/a. The material discrepancy identified by SEJN remains unexplained. 2. No recalculation of the stress index based on the actual applied-for volume has been provided. 3. The response does not address SEJN's concern about whether 618,579 m³/a represents future planned abstraction, which would mean the application understates the volume being sought. 4. No drought scenario modelling has been provided or referenced. 5. The response does not address the concern that the baseline stress assessment does not account for a decade of unlicensed abstraction 6. The acknowledgment that "future refinement and ongoing monitoring may be implemented"	GCS notes the concerns raised and welcomes the opportunity to provide further clarification regarding the hydrogeological assessment and the abstraction volumes referenced in the WULA documentation. The comments primarily relate to the distinction between the abstraction volume applied for under the WULA and the sustainable abstraction benchmark derived from the hydrogeological assessment, as well as the manner in which groundwater stress and sustainability were evaluated. The responses below are intended to clarify the purpose of the respective abstraction figures, the basis of the groundwater stress assessment, and the conclusions reached by the hydrogeological specialist regarding the sustainability of the proposed groundwater use. 1. Difference between the applied-for abstraction volume and the 618,579 m³/a figure SEJN raises concerns regarding the apparent discrepancy between the abstraction volume applied for under the WULA (281,371 m³/a) and the higher abstraction figure of 618,579 m³/a referenced in the Hydrogeological Investigation. The two figures serve different purposes within the assessment and are not intended to represent the same abstraction scenario. The volume of 618,579 m³/a represents the recommended sustainable abstraction capacity calculated for the eight operational production boreholes using the Flow Characteristic Method and a conservative 12-

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• Uncertainty: Whether the 618,579 m³/a figure represents future planned abstraction, a theoretical maximum, or a modelling input. The Technical Report does not clearly explain this. The Technical Report's groundwater balance (Table 4-8) indicates that 2,918,072 m³/a of groundwater is available for abstraction at the sub-catchment scale, with a surplus of 2,299,493 m³/a remaining after the recommended abstraction of 618,579 m³/a. However, this balance appears to be calculated at sub-catchment scale and may not account for localised drawdown effects, the concentrated nature of abstraction from eight boreholes in close proximity, or the cumulative impact of forestry and other land uses on recharge. Category C stress indicates that the aquifer is already under moderate pressure. In fractured rock aquifers, where water moves through fractures rather than uniformly permeable material, responses to abstraction can be difficult to predict. Conservative management is particularly important. Gap: The Technical Report does not model aquifer stress under drought conditions. Groundwater that appears sustainable in average rainfall years can become critically depleted during droughts. Gap: The baseline stress assessment does not account for the decade of unlicensed abstraction already experienced. SEJN requests that before the Department makes its decision, the applicant demonstrates through independent expert evidence that the proposed abstraction has been modelled under drought scenarios, that the total licensed volume will not push the aquifer from Category C to a higher stress category under any foreseeable conditions, and that the decade of unlicensed abstraction has been accounted for in any baseline assessment.	adequate and scientifically defensible basis for decision-making by the DWS.	implicitly concedes that the current assessment may not be complete. Outstanding issues: Clear explanation of the discrepancy between the two abstraction figures; recalculated stress index on the applied-for volume; drought scenario modelling; accounting for historical unlicensed abstraction in baseline assessment.	hour daily pumping schedule. The report expressly identifies this figure as a sustainable abstraction benchmark derived from aquifer testing and notes that it is approximately double the long-term abstraction required for Thirsti Bottling Plant's production requirements. By contrast, the WULA seeks authorisation for a substantially lower abstraction volume. The Hydrogeological Investigation identifies a long-term production requirement of approximately 253,778 m³/a, while the WULA application has subsequently been refined to 281,371 m³/a. Both figures remain significantly below the calculated sustainable abstraction capacity of the aquifer system. Accordingly, the 618,579 m³/a figure does not represent the volume applied for under the WULA, nor does it represent a future planned abstraction volume. It is a sustainability benchmark used to assess the capacity of the aquifer system and to demonstrate that the abstraction volume sought through the WULA falls within the estimated sustainable yield of the production boreholes. <u>2. Recalculation of the stress index using the applied-for volume</u> SEJN requests that the stress index be recalculated using the abstraction volume applied for under the WULA rather than the recommended sustainable abstraction benchmark derived from the hydrogeological assessment. The stress index presented in the Hydrogeological Investigation was intentionally calculated using a conservative abstraction scenario. Rather than assessing only the volume currently being applied for, the hydrogeologist assessed the groundwater resource using the recommended sustainable abstraction benchmark of 618,579 m³/a together with existing groundwater use within the delineated sub-catchment. This approach effectively evaluates a higher groundwater utilisation scenario than the abstraction volume for which authorisation is being sought under the WULA. The purpose of this approach was to test the resilience of the groundwater resource under a more conservative set of assumptions. In other words, the stress assessment was not based on the proposed abstraction volume of 281,371 m³/a, but on a substantially larger abstraction volume representing the estimated sustainable abstraction capacity of the operational borehole network. The assessment therefore considered a "worst-case" abstraction scenario relative to the volume currently being applied for. Using this higher abstraction scenario, the groundwater resource unit was classified as Status Category C (moderately stressed). Importantly, this classification was derived using an abstraction volume that is more than double the volume currently being sought through the WULA. The hydrogeological assessment therefore demonstrates that, even when assessed against a substantially higher abstraction scenario, the groundwater resource remains within acceptable utilisation limits, subject to the implementation of the recommended monitoring and management measures. Given that the WULA seeks authorisation for a significantly lower abstraction volume than that used in the stress index calculation, it would be expected that a stress assessment based solely on the applied-for

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			volume would result in a lower level of groundwater stress than the scenario assessed in the report. Consequently, the hydrogeological assessment adopted a precautionary approach by assessing the groundwater resource against a more conservative abstraction scenario than that proposed under the WULA. 3. Concern that 618,579 m³/a represents future planned abstraction The Hydrogeological Investigation does not present the 618,579 m³/a figure as an intended abstraction volume, future abstraction target, or future development scenario. The report explains that the volume was derived using the Flow Characteristic Method, a hydrogeological assessment tool used to estimate the sustainable abstraction capacity of a borehole or aquifer based on aquifer testing results and groundwater response characteristics. Using a conservative 12-hour daily pumping schedule, the Flow Characteristic Method was applied to determine the recommended sustainable abstraction capacity of the eight operational production boreholes. This assessment produced a combined sustainable abstraction benchmark of 618,579 m³/a. Importantly, the report explicitly states that the Flow Characteristic-derived volume is approximately double the long-term abstraction required for Thirsti's production requirements and concludes that the proposed abstraction falls within sustainable operating limits. The purpose of the Flow Characteristic assessment was therefore not to define the volume required by the Thirsti Bottling Plant, but rather to determine the abstraction capacity that the aquifer system could sustainably support. The volume for which authorisation is sought is clearly defined in the WULA documentation and is substantially lower than the Flow Characteristic -derived sustainable abstraction benchmark. The higher figure was included solely to demonstrate the estimated sustainable abstraction capacity of the aquifer system based on aquifer testing data and to assess groundwater resource sustainability. It should therefore not be interpreted as an indication of future abstraction intentions, planned expansion volumes, or a future licensing target. 4. Drought scenario modelling SEJN notes that no specific drought scenario modelling has been presented. The Hydrogeological Investigation does not include a dedicated drought modelling exercise. However, the assessment of sustainable abstraction was based on site-specific aquifer testing, groundwater availability assessments, groundwater balance calculations and conservative abstraction assumptions, including a 12-hour daily pumping schedule used in the determination of the sustainable abstraction capacity of the operational borehole network. The assessment further recognises that groundwater conditions may vary over time in response to climatic variability, abstraction patterns and cumulative groundwater use. For this reason, the Hydrogeological Investigation recommends quarterly groundwater level monitoring, hydrochemical monitoring, annual hydrogeological review, rotational pumping of operational boreholes and adaptive groundwater management

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			measures to verify assessment predictions and respond to changing groundwater conditions should they arise. While a drought-specific scenario was not modelled, the proposed abstraction volume (281,371 m³/a) remains substantially below the estimated sustainable abstraction capacity (618,579 m³/a) of the aquifer system. The assessment therefore concluded that the proposed groundwater abstraction can be sustainably supported, subject to the implementation of the recommended monitoring and management measures. <u>5. Consideration of existing abstraction in the baseline assessment</u> SEJN raises concerns that the baseline assessment does not account for historical abstraction. The Hydrogeological Investigation incorporates existing groundwater abstraction, proposed groundwater use and a groundwater balance assessment undertaken at sub-catchment scale. The assessment therefore does not assume an undeveloped or pristine groundwater environment. Rather, it evaluates groundwater availability and abstraction within the context of existing groundwater use within the delineated sub-catchment. The purpose of the hydrogeological assessment was to evaluate the sustainability of the current and proposed groundwater use based on observed aquifer conditions, aquifer testing results, groundwater availability and groundwater balance calculations. The assessment therefore reflects the groundwater conditions that existed at the time the investigation was undertaken. <u>6. Monitoring recommendations and future refinement</u> SEJN suggests that the recommendation for future monitoring implies that the assessment is incomplete. Groundwater monitoring and adaptive management are standard components of groundwater resource management and are commonly recommended even where assessments conclude that groundwater abstraction is sustainable. The recommendation for quarterly groundwater level monitoring, hydrochemical monitoring, annual hydrogeological review and rotational pumping does not indicate that the assessment is incomplete. Rather, it reflects good groundwater management practice and provides a mechanism for verifying assessment predictions and responding proactively to any future changes in groundwater conditions. The Hydrogeological Investigation concludes that the proposed groundwater abstraction is sustainable, falls within the estimated abstraction capacity of the aquifer system, and can be supported through the implementation of the recommended monitoring and management measures.
<u>4. Impacts on Neighbouring Groundwater Users</u> When large volumes of water are pumped from boreholes, the water table drops. This drawdown can spread outward and affect neighbouring boreholes, springs, and streams. In a fractured	Potential impacts on neighbouring groundwater users, wetlands, and broader catchment systems have been assessed through hydrogeological, hydropedological, and freshwater specialist investigations. These investigations considered groundwater users within the surrounding area, cumulative groundwater pressures, groundwater	The GCS response is general and does not address SEJN's specific requests: 1. No evidence is provided of a full borehole survey within a 5 km radius identifying all registered and unregistered boreholes and dependent users, as requested by SEJN.	GCS notes the concerns raised and welcomes the opportunity to provide additional clarification regarding the assessment of neighbouring groundwater users, the hydrocensus undertaken as part of the Hydrogeological Investigation, and the evaluation of potential groundwater impacts. The Hydrogeological Investigation specifically considered surrounding groundwater users, groundwater availability, aquifer response

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rock aquifer, drawdown can be unpredictable and may extend over large distances. Farms, smallholdings, and communities in the Normandien area depend on the same aquifer for drinking water, livestock, and food production. The Technical Report refers to a hydrocensus but the documentation does not demonstrate that all groundwater users within the potential radius of influence have been identified or consulted. The Technical Report indicates that the radius of influence of individual boreholes ranges between 69 m and 496 m. Given that eight boreholes are proposed, the combined zone of influence may be substantially larger. SEJN requests: • A full borehole survey within at least a 5 km radius identifying all registered and unregistered boreholes and dependent users; • Modelled drawdown effects under both current and proposed abstraction rates, including drought conditions; and • Evidence that neighbouring landowners, communal water users, and communities have been directly consulted. The Department should ensure that the NWA s27(1)(d) factor — the probable effect on the resource and on other water users — is fully assessed before making its decision.	recharge, aquifer behaviour, wetland functioning, and the relationship between shallow and deeper groundwater systems. The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes, groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.	2. No modelled drawdown effects under current or proposed abstraction rates, including drought conditions, have been provided or referenced. 3. No evidence has been provided that neighbouring landowners, communal water users, and communities have been directly consulted, as distinct from the formal public participation process. 4. The response refers generically to investigations having "considered groundwater users within the surrounding area" but does not specify the scope of the hydrocensus, the radius covered, or the number of users identified. 5. The combined zone of influence of eight boreholes operating simultaneously is not addressed. Outstanding issues: Full borehole survey within 5 km radius; modelled drawdown effects including drought scenarios; evidence of direct consultation with neighbouring groundwater users and communities.	to abstraction, radius of influence and potential cumulative impacts. The responses below address the specific matters raised by SEJN. <u>1. Borehole survey within a 5 km radius</u> SEJN requests evidence of a full borehole survey within a 5 km radius identifying all registered and unregistered boreholes and dependent users. The Hydrogeological Investigation included a desktop hydrocensus undertaken using NGA records, previous investigations undertaken by, and available borehole information for the study area. The assessment identified seven boreholes within a 5 km radius of the site from the NGA database, together with additional boreholes identified during previous investigations. The hydrocensus and identified boreholes are presented in the Hydrogeological Investigation. The purpose of the hydrocensus was to establish the baseline groundwater-use environment and identify surrounding groundwater users within the study area. As with any hydrocensus, the identification of unregistered boreholes is inherently constrained by available information and access to private properties. The Hydrogeological Investigation therefore relied on recognised data sources and previous field investigations to characterise groundwater users within the area of potential influence. <u>2. Drawdown modelling and drought scenarios</u> SEJN notes that no numerical groundwater model or drought-specific drawdown simulation has been provided. The Hydrogeological Investigation did not utilise a numerical groundwater model. Instead, the assessment was based on site-specific hydrogeological investigations undertaken between 2014 and 2019, including aquifer testing of all operational production boreholes. These investigations generated empirical data on aquifer response, borehole performance, groundwater recovery characteristics, sustainable abstraction rates and the radius of influence associated with each production borehole. The assessment of groundwater availability and groundwater stress was undertaken using the estimated sustainable abstraction capacity of the operational borehole network, calculated at 618,579 m^3/a using the Flow Characteristic Method, together with existing groundwater use within the groundwater resource unit. The purpose of this approach was to evaluate groundwater resource sustainability under a conservative utilisation scenario relative to the abstraction volume currently being sought through the WULA. Using the aquifer testing results, the Hydrogeological Investigation calculated radii of influence ranging from approximately 69.21 m to 496.36 m for the operational production boreholes. The assessment further recognised that simultaneous abstraction from multiple boreholes could result in overlapping cones of depression, increased cumulative drawdown, borehole interference and reduced yields. These potential impacts were therefore expressly considered as part of the groundwater quantity assessment.

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			Importantly, the abstraction volume applied for under the WULA (281,371 m³/a) is substantially lower than the sustainable abstraction capacity used in the groundwater stress assessment. The hydrogeological assessment therefore evaluated groundwater resource sustainability using a higher abstraction scenario than that proposed under the application and concluded that the groundwater resource could sustainably support the proposed abstraction. To manage uncertainty and verify assessment predictions, the report recommends rotational pumping of operational boreholes, quarterly groundwater level monitoring, hydrochemical monitoring, annual hydrogeological review and adaptive groundwater management measures. These recommendations are intended to identify any emerging groundwater-level trends and provide a mechanism for responding to changing groundwater conditions, including prolonged dry periods, should they occur. While a drought-specific numerical modelling exercise was not undertaken, the assessment incorporated conservative assumptions regarding sustainable abstraction and concluded that the proposed abstraction volume remains well below the estimated sustainable abstraction capacity of the aquifer system. The hydrogeologist further recommended that, where warranted by future monitoring results, an updated groundwater model and cumulative impact assessment may be undertaken to further refine long-term groundwater management. <u>3. Consultation with neighbouring groundwater users and communities</u> SEJN states that no evidence has been provided that neighbouring landowners, communal water users and communities have been directly consulted, as distinct from the formal public participation process. The WULA process includes a public participation process specifically intended to identify, notify and provide an opportunity for potentially affected parties to participate in the application. This process includes neighbouring landowners, occupiers, communities, organs of state, interested organisations and other Interested and Affected Parties (I&APs) who may be affected by, or have an interest in, the proposed water uses. In addition, the Hydrogeological Investigation specifically considered surrounding groundwater users through the desktop hydrocensus and groundwater-user assessment undertaken as part of the baseline assessment. The purpose of this exercise was to identify groundwater users and assess potential impacts on the groundwater resource and neighbouring users. The findings of the assessment informed the impact evaluation and the development of recommended monitoring and management measures. Accordingly, while a separate consultation process targeting individual groundwater users was not undertaken, potentially affected landowners, communities and groundwater users were afforded an opportunity to participate through the WULA public participation process, and the interests of neighbouring groundwater users were considered through the hydrogeological assessment undertaken in support of the application.

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			4. Scope of the hydrocensus and groundwater user assessment SEJN notes that the previous response did not specify the scope of the hydrocensus. The Hydrogeological Investigation clearly defines the scope of the desktop hydrocensus. NGA records were reviewed for a 5 km radius surrounding the site, identifying seven boreholes within the search area. In addition, previous hydrocensus investigations undertaken for the project identified further boreholes within and around the site. The assessment therefore considered boreholes identified through NGA records, previous hydrocensus surveys, and site-specific investigations to establish the groundwater-user context and baseline hydrogeological conditions within the study area. 5. Combined zone of influence of eight boreholes operating simultaneously SEJN raises concerns regarding the potential combined zone of influence associated with simultaneous abstraction from the eight operational production boreholes. This issue is specifically acknowledged in the Hydrogeological Investigation. The assessment notes that while the calculated radius of influence for individual boreholes ranges from approximately 69.21 m to 496.36 m, simultaneous pumping of multiple boreholes may result in overlapping cones of depression, increased cumulative drawdown, borehole interference and reduced yields. The potential for cumulative impacts on neighbouring groundwater users is therefore expressly recognised in the report. (Also refer above to the response under 'Drawdown modelling and drought scenarios') The Hydrogeological Investigation further recommends that the operational boreholes be pumped on a rotational basis to minimise cumulative drawdown and reduce interference between boreholes. In addition, quarterly groundwater-level monitoring and ongoing hydrogeological review are recommended to monitor aquifer response and identify any unforeseen impacts associated with groundwater abstraction. Accordingly, the potential cumulative effects associated with simultaneous operation of the production boreholes were identified, considered and addressed through the hydrogeological assessment and the recommended groundwater management measures.
5. Cumulative Groundwater Impacts The NWA s27(1) requires the Department to consider the probable effect of the proposed water use on the water resource. This necessarily includes cumulative effects when multiple uses draw on the same resource. The Technical Report acknowledges that groundwater in the catchment is used by multiple sectors, including agriculture, commercial forestry, and domestic users. The report includes some catchment water balance data (Table 4-8) and references WARMS users (Table 4-2). However, the report does not provide a comprehensive catchment-scale model that	With regard to cumulative impacts, the investigations considered existing groundwater users, broader land-use pressures, recharge dynamics, and available groundwater resources within Quaternary Catchment V31F. The groundwater balance assessment indicates that sufficient groundwater remains available within the sub-catchment after accounting for existing and proposed abstraction. While future refinement and ongoing monitoring may be implemented where necessary, the current assessment provides an adequate and scientifically defensible basis for decision-making by the DWS.	The GCS response is insufficient and internally contradictory: 1. SEJN specifically highlighted that the applicant's own Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." The GCS response does not address this admission or explain why the current assessment should be considered adequate despite this recommendation. 2. The response claims that cumulative impacts were considered, but provides no detail on how forestry, irrigation, and all abstraction were quantified or modelled at catchment scale.	GCS notes the concerns raised and welcomes the opportunity to provide further clarification regarding the assessment of cumulative groundwater impacts. The Hydrogeological Investigation was undertaken to assess groundwater availability, groundwater sustainability and potential impacts associated with the proposed abstraction. The responses below addresses the specific concerns raised by SEJN. 1. Recommendation for a future groundwater model and cumulative impact assessment SEJN notes that the Hydrogeological Investigation recommends that an updated groundwater model and cumulative impact assessment may be developed and submits that this indicates that the current assessment is incomplete.

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accounts for all abstraction and all recharge-reducing activities, including commercial pine plantations. This gap is significant because the Technical Report itself notes that the V31F catchment loses approximately 1–5% of annual streamflow to dense afforestation. Pine plantations intercept rainfall and transpire large volumes of water, reducing the recharge that sustains the aquifer. If forestry reduces recharge while the bottling plant increases abstraction, the combined pressure may exceed what either use alone would suggest. The applicant's own consultants acknowledge this gap. The Technical Report recommends that "an updated groundwater model and cumulative impact assessment should be developed." This is a significant admission that the current assessment is incomplete. Gap: No catchment-wide groundwater model accounting for forestry, irrigation, and all abstraction. Gap: No assessment of whether the aquifer is already in deficit from a decade of unlicensed abstraction. The Department should not grant a licence on the basis of an assessment that the applicant's own experts acknowledge needs further work.	The assessments further recognise existing catchment pressures and historical land-use transformation within the area, including forestry, agriculture, and associated hydrological modifications. These broader land-use pressures were considered within the groundwater balance and cumulative impact assessment undertaken as part of the WULA process.	3. No catchment-wide groundwater model has been provided or referenced. 4. The response does not address whether the aquifer may already be in deficit from a decade of unlicensed abstraction. 5. The statement that "future refinement and ongoing monitoring may be implemented where necessary" again implicitly concedes the assessment's limitations without explaining why a licence should be granted before that refinement occurs. Outstanding issues: Catchment-wide groundwater model; explanation of the Technical Report's own recommendation for further cumulative impact assessment; assessment of historical abstraction deficit.	The recommendation is acknowledged. However, the recommendation should be understood in its proper context. The Hydrogeological Investigation does not conclude that the current assessment is inadequate for the purposes of evaluating the WULA, nor does it state that a groundwater model is required before a licensing decision can be made. Rather, the recommendation forms part of a broader adaptive groundwater management approach and recognises that additional refinement of groundwater management tools may be beneficial as further monitoring data becomes available over time. Such recommendations are common within groundwater assessments and are intended to support ongoing resource management rather than indicate a deficiency in the existing assessment. The Hydrogeological Investigation nevertheless concludes that the proposed abstraction can be sustainably supported by the aquifer system and provides recommendations for monitoring and management to verify groundwater performance over time. <u>2. Consideration of cumulative impacts</u> SEJN submits that cumulative impacts associated with forestry, irrigation and groundwater abstraction have not been adequately quantified. This is not correct. The Hydrogeological Investigation specifically considered groundwater recharge, groundwater abstraction by existing users, groundwater contribution to baseflow, groundwater availability within the delineated sub-catchment and the groundwater stress status of the resource. The assessment further recognised that plantation forestry and agricultural activities influence groundwater recharge and groundwater availability within the study area. Similarly, the Hydrological Assessment identified plantation forestry, agricultural land uses, groundwater abstraction and other land-use activities as factors influencing the hydrological functioning of the catchment. The assessment specifically notes that pine plantations and other land uses represent existing pressures within the catchment and were considered as part of the broader hydrological and groundwater context. The cumulative impact assessment was therefore not limited to the Thirsti abstraction alone but considered groundwater use and land-use pressures within the surrounding groundwater resource system. <u>3. Catchment-wide groundwater model</u> SEJN notes that no catchment-wide numerical groundwater model has been provided. It is acknowledged that a numerical groundwater model was not developed as part of the WULA. However, neither the NWA nor the WULA process requires a numerical groundwater model in all circumstances. The Hydrogeological Investigation relied on site-specific aquifer testing, hydrocensus information, groundwater balance calculations, groundwater stress assessments, sustainable abstraction calculations and groundwater monitoring data to assess groundwater availability and sustainability.

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			These are recognised hydrogeological assessment tools and provided the basis upon which the specialist conclusions were reached. The absence of a numerical groundwater model does not mean that cumulative groundwater impacts were not assessed. Rather, the assessment utilised alternative hydrogeological methods considered appropriate for the characteristics of the aquifer system and the available information. <u>4. Historical groundwater abstraction</u> SEJN raises concerns regarding whether the aquifer may already be in deficit as a result of historical abstraction. The Hydrogeological Investigation assessed the current condition of the groundwater resource using available groundwater information, aquifer testing data, groundwater balance calculations and groundwater stress assessments. The assessment did not identify evidence that the delineated sub-catchment is currently experiencing a groundwater deficit attributable to the Thirsti abstraction. Furthermore, the assessment determined a sustainable abstraction benchmark of approximately 618,579 m³/a, while the WULA seeks authorisation for 281,371 m³/a. The assessment therefore concluded that the proposed abstraction volume falls within the sustainable capacity of the aquifer system. <u>5. Future refinement and monitoring</u> SEJN submits that the recommendation for future refinement and ongoing monitoring implies that the current assessment is incomplete and that licensing should not proceed until additional work has been undertaken. GCS does not agree with this interpretation. Groundwater systems are inherently dynamic and ongoing monitoring forms a standard component of responsible groundwater management. The recommendation for continued monitoring, annual review and potential future refinement reflects a precautionary and adaptive management approach rather than an admission that the existing assessment is inadequate. The purpose of monitoring is to verify assessment predictions, track aquifer response over time and provide an evidence base for future management decisions. The inclusion of monitoring and adaptive management measures therefore strengthens the assessment rather than undermines it. In conclusion, the Hydrogeological Investigation considered cumulative groundwater impacts through groundwater balance assessments, groundwater stress assessments, hydrocensus information, aquifer testing and consideration of broader land-use pressures within the catchment. While the assessment recommends ongoing monitoring and potential future refinement as part of good groundwater management practice, the specialist investigation concludes that the proposed abstraction can be sustainably supported and provides a sufficient technical basis for DWS to assess the application in terms of Section 27 of the NWA.

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6. Monitoring, Mitigation, and Transparency The Technical Report proposes mitigation measures including staggered pumping schedules, groundwater monitoring, septic system management, and stormwater controls. These are necessary tools. However, they reduce risk only if supported by enforceable monitoring requirements, defined trigger thresholds, and clear response protocols. The proposed monitoring programme lacks clearly defined trigger levels — specific groundwater depth or quality thresholds that would require a management response. Without trigger thresholds and response protocols, monitoring alone does not protect the aquifer. Protocols, monitoring becomes record-keeping with no meaningful management function. The bottling plant has operated for more than a decade without a Water Use Licence and without any of the oversight conditions that a licence would have imposed. SEJN requests that any licence granted include: • Monthly monitoring of groundwater levels in all abstraction and dedicated monitoring boreholes; • Quarterly water quality testing at the boreholes, the septic system outlet, and the nearest watercourse; • Clearly defined trigger thresholds with documented response protocols; • Annual compliance reports prepared by an independent Pr.Sci.Nat. not affiliated with GCS or the applicant; • All monitoring data to be made publicly accessible within 30 days of collection; • Annual compliance reports shared with registered I&APs; and Direct written notification to SEJN of any trigger-level exceedance, licence breach, or emergency event.	The WULA further includes mitigation and management measures aimed at ensuring ongoing protection of groundwater resources and neighbouring users. These measures include rotational pumping of boreholes, groundwater level monitoring, abstraction tracking, groundwater and surface water quality monitoring, adaptive management measures, and ongoing hydrogeological review where required. The monitoring and management framework provides the DWS with an appropriate basis upon which enforceable licence conditions may be imposed.	The GCS response is generic and does not engage with SEJN's specific concerns about the adequacy of the monitoring framework: 1. SEJN's central concern — that the monitoring programme lacks clearly defined trigger thresholds and response protocols — is not addressed. The response refers to "adaptive management measures" without specifying what triggers adaptation or what the response would be. 2. None of SEJN's seven specific requests for licence conditions have been individually addressed (monthly groundwater level monitoring, quarterly water quality testing, trigger thresholds, independent compliance reports, public reporting, etc.). Accessibility of data, sharing with I&APs, or direct notification of exceedances). 3. The response effectively defers the issue to DWS by stating the framework provides "a basis upon which enforceable licence conditions may be imposed," without committing to or proposing specific enforceable conditions. 4. The concern that the plant operated for over a decade without any oversight conditions is not addressed. Outstanding issues: Defined trigger thresholds and response protocols; commitment to specific monitoring frequencies; independent compliance reporting; public accessibility of monitoring data; direct notification mechanisms for I&APs.	GCS notes the concerns raised and welcomes the opportunity to provide further clarification regarding the proposed groundwater monitoring framework. The purpose of the Hydrogeological Investigation was to assess the sustainability of the proposed groundwater abstraction and identify appropriate monitoring and management measures to support the long-term protection of the resource. The responses below address the specific concerns raised by SEJN. 1. Trigger thresholds and response protocols SEJN notes that the monitoring framework does not include specific trigger thresholds and response protocols. The Hydrogeological Investigation recommends a groundwater monitoring and adaptive management programme comprising quarterly groundwater level monitoring, hydrochemical monitoring, annual hydrogeological review and rotational pumping of operational boreholes. The purpose of these measures is to track aquifer response over time and identify any emerging trends that may indicate impacts on groundwater availability, borehole performance or neighbouring groundwater users. While the specialist report does not prescribe specific numerical trigger levels or response thresholds, it provides a monitoring framework that enables such thresholds and associated management actions to be incorporated into licence conditions, should DWS consider this necessary. The establishment of regulatory trigger levels and associated compliance requirements is typically undertaken as part of the licensing process and may be informed by site-specific monitoring data, specialist recommendations and DWS requirements. 2. SEJN's proposed licence conditions SEJN has proposed a number of specific licence conditions, including monthly groundwater level monitoring, quarterly water quality monitoring, trigger thresholds, independent compliance reporting, public reporting, public access to monitoring data and notification procedures. These proposals are noted but are not accepted as appropriate for the Thirsti WUL for the following reasons. The Hydrogeological Investigation already recommends groundwater level monitoring, hydrochemical monitoring and annual hydrogeological review as part of the groundwater management framework. The frequency, reporting requirements, data-sharing mechanisms and compliance obligations associated with any monitoring programme ultimately form part of the licence conditions determined by DWS following consideration of the application and specialist assessments. Accordingly, while the specialist report does not prescribe each of the specific conditions proposed by SEJN, the recommended monitoring framework provides a basis upon which DWS may determine appropriate monitoring, reporting and compliance requirements for inclusion in any Water Use Licence that may be issued. 3. Proposed enforceable licence conditions SEJN expresses concern that the response defers the matter to DWS without proposing specific enforceable conditions. This is not correct.

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			The purpose of the Hydrogeological Investigation is to assess groundwater impacts and provide specialist recommendations regarding groundwater management and monitoring. The report accordingly recommends groundwater-level monitoring, hydrochemical monitoring, annual hydrogeological review, rotational pumping of operational boreholes and adaptive groundwater management measures. The determination of enforceable licence conditions falls within the mandate of DWS as the competent authority responsible for assessing the application in terms of Section 27 of the NWA. Should DWS determine that additional monitoring frequencies, trigger thresholds, reporting requirements or notification procedures are necessary, DWS is fully empowered to incorporate such requirements into any licence issued. Certain recommendations are made by the specialists and these are combined into the proposed Water Use and Environmental Management plan in the WULA. <u>4. Historical monitoring and oversight</u> SEJN raises concerns regarding historical monitoring and oversight of groundwater abstraction. As previously noted, the Thirsti Bottling Plant initially operated under a General Authorisation issued by DWS in 2015. The current WULA seeks to obtain authorisation for increased abstraction volumes. The purpose of the present WULA process is not only to assess the sustainability of the proposed groundwater abstraction but also to establish an appropriate regulatory framework for future groundwater management. The Hydrogeological Investigation therefore includes recommendations for ongoing groundwater monitoring and management that can be formalised through licence conditions and implemented over the operational life of the facility. In conclusion, the Hydrogeological Investigation provides a structured groundwater monitoring and management framework based on quarterly groundwater-level monitoring, hydrochemical monitoring, annual hydrogeological review and adaptive management. While specific regulatory thresholds, reporting obligations and compliance requirements are matters for determination by DWS through the licensing process, the specialist assessment provides a foundation upon which such conditions may be developed and implemented.
<u>7. Potential Impacts on Wetlands</u> Wetlands are among the most valuable and fragile ecosystems. South African law restricts activities in their vicinity because they are easily damaged and difficult to restore. The boreholes, septic tank, and French drains are all located within 500 m of wetlands, which is why a Water Use Licence is required. The Technical Report states that the proposed boreholes abstract water from a deeper confined aquifer that is assumed to be largely hydraulically separated from the shallow groundwater system that supports wetlands. On this basis, the report	The specialist investigations indicate that the proposed abstraction targets a deeper confined fractured aquifer system, while nearby wetlands are primarily associated with shallow soil-water processes and responsive near-surface hydrology. Based on the available hydrogeological and hydropedological information, limited hydraulic connectivity is expected between the abstraction zone and the shallow wetland systems. The investigations therefore conclude that impacts on wetland hydrology and baseflow are anticipated to be low. The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist	The GCS response restates the Technical Report's conclusions but does not address SEJN's core concerns: 1. SEJN's central point — that the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has not been empirically tested — is not addressed. The response uses language such as "limited hydraulic connectivity is expected" and "based on the available information," which confirms the conclusion is based on expectation rather than empirical verification. 2. No numerical model assessing abstraction impacts on groundwater levels beneath wetlands has been provided or referenced.	GCS notes the concerns raised regarding potential impacts on nearby wetlands, including the assumption of hydraulic separation between the abstraction boreholes and wetland systems, the potential influence of the septic tank and French drain system, and the ecological sensitivity of the wetlands identified within the study area. <u>1. Hydraulic connectivity between the abstraction boreholes and wetlands</u> SEJN submits that the conclusion in the WULA regarding limited hydraulic connectivity between the abstraction boreholes and nearby wetlands has not been empirically tested and is therefore based on assumption rather than evidence. This conclusion in the WULA is not based solely on assumption. It is derived from multiple specialist investigations, including the Hydrogeological Investigation, Hydropedology Assessment and

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concludes that abstraction will have minimal direct impact on wetlands. However, this conclusion rests on an assumption of hydraulic separation that has not been empirically tested. The documentation does not include a detailed numerical model specifically assessing how the proposed abstraction volumes could affect groundwater levels beneath nearby wetlands, or how this assumption has been verified. Uncertainty: Whether the assumption of hydraulic separation between the confined aquifer and the shallow wetland systems has been empirically tested. An additional concern relates to the septic tank and French drain system. Leachate including chemical residues, excess nutrients, and pathogens can contaminate shallow groundwater feeding wetlands. The Technical Report acknowledges that the septic tank was previously observed to be overflowing. While the report states the system has since been upgraded, no independent verification of the upgrade's adequacy has been provided. The potential contamination from years of overflow has not been assessed, or if it has, has not been disclosed. Several of the wetlands near the site are classified as Critically Endangered ecosystem types, with present ecological states assessed as moderately to largely modified (Categories C to D). Given their already degraded condition, any additional pressure could cause further irreversible harm. SEJN requests that the Technical Report be amended to include: • An assessment of the hydrological connectivity between the boreholes and nearby wetlands, including modelled analysis under average and dry-year conditions; • A dedicated risk assessment of the septic tank and French drain system with respect to wetland water quality; and • An investigation of historical contamination from years of septic tank overflow.	investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.	3. The septic tank and French drain concerns are entirely unaddressed. SEJN raised specific issues about historical overflow, potential contamination of shallow groundwater feeding wetlands, and the absence of independent verification of the system upgrade. None of these are mentioned in the response. 4. The Critically Endangered classification and degraded ecological state (Categories C to D) of the nearby wetlands are not acknowledged or addressed. 5. None of SEJN's three specific requests (hydrological connectivity assessment, septic/French drain risk assessment, historical contamination investigation) have been addressed. Outstanding issues: Empirical verification of hydraulic separation assumption; numerical modelling of abstraction impacts on wetland groundwater; septic tank and French drain risk assessment; historical contamination investigation; acknowledgment of wetland conservation status.	Freshwater Ecosystem Assessment, which collectively evaluated aquifer characteristics, groundwater occurrence, soil-water processes, wetland functioning and groundwater abstraction impacts. The Hydropedology Assessment concluded that the groundwater abstraction targets a deeper confined fractured aquifer system, while the wetlands are predominantly supported by shallow hydropedological processes, including responsive and interflow soil-water pathways within the weathered zone. The assessment further concluded that any dewatering effects associated with abstraction are expected to be largely confined to the deeper fractured aquifer, with limited drawdown anticipated within the shallow weathered zone that contributes to wetland and stream baseflow. On this basis, the assessment concluded that marginal to negligible impacts are anticipated in relation to reduced baseflow contributions to nearby wetlands and watercourses. Similarly, the Freshwater Ecosystem Assessment concluded that groundwater abstraction occurs from deep confined aquifers generally located between approximately 50 m and 100 m below ground level and assessed the risk posed by the boreholes to adjacent wetland ecosystems as negligible. <u>2. No numerical model assessing abstraction impacts on groundwater levels beneath wetlands has been provided or referenced</u> While a numerical groundwater model was not developed for the project, the assessment conclusions are supported by site-specific aquifer testing, hydrogeological investigations, hydropedological assessment and freshwater ecosystem specialist studies. The absence of a numerical groundwater model does not, in itself, invalidate the conclusions reached by the specialist team. <u>3. Septic tank and French drain system</u> SEJN raises concerns regarding historical septic tank overflows, potential contamination of shallow groundwater and wetlands, and the adequacy of remedial measures implemented at the facility. This issue was specifically investigated as part of the 2025 Freshwater Ecosystem Assessment. During field investigations, the specialist identified that the septic tank was overflowing and recognised that this could present a water quality risk to downstream wetland systems if left unmanaged. The report expressly notes that upgrades to the septic tank system have subsequently been undertaken and that the tanks were no longer overflowing or impacting the receiving environment at the time of finalisation of the assessment. The Freshwater Ecosystem Assessment further concluded that, provided mitigation measures are maintained and implemented, the septic tank and associated infrastructure represent a low risk to freshwater ecosystems. To provide ongoing verification, the specialist recommended bi-annual wetland water quality monitoring, regular septic tank management and maintenance, and continued monitoring of receiving freshwater ecosystems. In addition, the Hydrological Assessment identified wastewater management, stormwater control and monitoring measures as part of the

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			overall water management framework for the facility and incorporated long-term surface water and wetland monitoring requirements. 4. Ecological status and conservation importance of wetlands GCS acknowledges that the freshwater ecosystems identified within the study area are classified as Critically Endangered ecosystem types and that the ecological condition of certain wetlands ranges from moderately modified to critically modified. Importantly, however, the Freshwater Ecosystem Assessment determined that the primary drivers of degradation are historical and ongoing land-use activities, including erosion, channel incision, invasive alien vegetation, water supply dams, grazing activities, hay production and plantation forestry. The assessment does not attribute the degraded ecological condition of these systems to groundwater abstraction associated with the Thirsti Bottling Plant. The specialist assessment further concluded that the boreholes pose a negligible risk to adjacent wetland ecosystems and that the overall risk associated with the bottling plant's boreholes and septic tank infrastructure is low, provided that the recommended mitigation, monitoring and management measures are implemented and maintained. 5. Requests for additional investigations SEJN requests additional hydrological connectivity modelling, a dedicated septic tank and French drain risk assessment, and an investigation into historical contamination associated with previous septic tank overflows. The specialist investigations undertaken as part of the WULA have specifically assessed groundwater abstraction impacts, groundwater-wetland interactions, wetland condition, ecological functioning, water quality risks and wastewater management. Based on these investigations, the specialists concluded that groundwater abstraction impacts on wetlands are expected to be negligible, that risks associated with the septic tank system are low following upgrades to the infrastructure, and that ongoing monitoring provides an appropriate mechanism to verify these conclusions and identify any unforeseen impacts should they arise. Accordingly, the specialist team considered the available information sufficient to assess the potential impacts associated with the proposed water uses and to support the Department's consideration of the application.
8. Protection of Water Resources in a Strategic Water Source Area The Thirsti Bottling Plant is located within the Northern Drakensberg Strategic Water Source Area (SWSA). Although SWSAs cover only about 8% of South Africa's land area, they generate a disproportionately large share of the country's water resources. Water use decisions in these areas have implications that extend well beyond the immediate locality. Section 2 of the National Environmental Management Act 107 of 1998 (NEMA) requires that, where there is uncertainty about the	The concerns relating to wetlands and the Northern Drakensberg Strategic Water Source Area are acknowledged. However, the specialist investigations indicate that the proposed abstraction is within the sustainable capacity of the aquifer and is unlikely to materially affect wetland functioning or regional water resource sustainability. The investigations also apply conservative assumptions and recommend monitoring and adaptive management measures to address uncertainty and ensure long-term resource protection.	The GCS response is superficial and does not adequately address the precautionary principle argument: 1. The response merely "acknowledges" the SWSA concern and then asserts that the abstraction is within sustainable capacity, without engaging with SEJN's argument that the precautionary principle requires robust evidence in the face of uncertainty. 2. The response does not address the NEMA s2 precautionary principle or explain why the identified uncertainties (sustainable yield, cumulative impacts, wetland impacts, assessment adequacy) do not warrant a precautionary approach.	GCS notes the concerns raised regarding the location of the Thirsti Bottling Plant within the Northern Drakensberg Strategic Water Source Area (SWSA) and the application of the precautionary principle. 1 Application of the precautionary principle and SWSA's SEJN submits that the precautionary principle requires a more cautious approach in light of the uncertainties identified in relation to sustainable yield, cumulative impacts, wetland impacts and the adequacy of the specialist assessments. GCS agrees that the precautionary principle is an important consideration in environmental decision-making and that the strategic importance of SWSAs warrants careful assessment of proposed water uses. However, the precautionary principle does not require the elimination of all

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environmental consequences of an action, decision-makers should apply a risk-averse and cautious approach. While WUL decisions are made under the NWA, NEMA's environmental management principles bind all organs of state, and a precautionary approach is consistent with the Department's obligations under NWA s27(1) to consider the probable effect on the water resource. Significant uncertainties remain about the true sustainable yield of the aquifer, the cumulative impact of all water uses, the impact on groundwater-fed wetlands, and the adequacy of the specialist assessments. Granting a licence in the face of these unresolved uncertainties would be inconsistent with a precautionary approach especially in a Strategic Water Resource Area which demands greater sensitivity and protection. Uncertainty: Whether the proposed abstraction is sustainable within the carrying capacity of the SWSA, given the cumulative pressures from forestry, agriculture, and bottling. SEJN requests that the Department apply a precautionary approach and require robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security before granting any licence.		3. The claim that "conservative assumptions" were applied is not substantiated with specifics. 4. The significance of the SWSA designation — covering only 8% of South Africa's land area but generating a disproportionate share of water resources — is not engaged with in terms of the heightened duty of care it implies. 5. SEJN's request for robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security is not directly addressed. Outstanding issues: Substantive engagement with the precautionary principle; explanation of why identified uncertainties do not warrant a more cautious approach; specific evidence that the SWSA's strategic function will not be compromised.	uncertainty before a decision can be made, nor does it require proof of an absence of impact under all future conditions. Rather, it requires that uncertainty be identified, assessed using the best available scientific information, and appropriately managed through the application of conservative assumptions, mitigation measures, monitoring programmes and adaptive management. The WULA is supported by multiple specialist investigations, including hydrogeological, hydrological, hydropedological and freshwater ecological assessments. These investigations were undertaken using site-specific data, field investigations, aquifer testing, groundwater balance assessments, wetland assessments and specialist analyses. The identified uncertainties were therefore not ignored, but formed a central component of the assessment process. <u>2. Consideration of uncertainty and the precautionary principle</u> SEJN raises concerns regarding uncertainty relating to sustainable yield, cumulative impacts, wetland impacts and assessment adequacy. The specialist investigations do not ignore these uncertainties. Rather, they identify and assess them directly. The Hydrogeological Investigation specifically considers groundwater availability, sustainable abstraction capacity, existing groundwater users, cumulative groundwater abstraction and groundwater stress within the broader sub-catchment. The Hydropedology Assessment evaluates the potential interaction between groundwater abstraction and wetlands, while the Freshwater Ecosystem Assessment evaluates the condition and sensitivity of freshwater receptors within the study area. Importantly, none of the specialist studies conclude that the available information is insufficient to assess the proposed abstraction or that unacceptable impacts are likely to occur. Instead, the assessments conclude that the proposed abstraction can be sustainably supported, subject to the implementation of the recommended monitoring and management measures. <u>3. Conservative assumptions applied in the assessment</u> SEJN notes that the reference to conservative assumptions has not been adequately explained. The Hydrogeological Investigation applied a number of precautionary and conservative approaches. These include: • Determination of a sustainable abstraction benchmark using the Flow Characteristic Method based on aquifer testing results rather than production requirements. • Assessment of groundwater stress using the sustainable abstraction benchmark of approximately 618,579 m³/a, rather than the lower WULA abstraction volume of 281,371 m³/a. • Consideration of cumulative groundwater use within the broader groundwater resource unit and delineated sub-catchment. • Recognition of potential cumulative drawdown, borehole interference and impacts on neighbouring groundwater users. • Recommendation of rotational pumping, groundwater level monitoring, hydrochemical monitoring and adaptive groundwater management measures.

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			The assessment therefore considered a groundwater utilisation scenario that is substantially more conservative than the abstraction volume currently being applied for. 4. Strategic importance of the Northern Drakensberg SWSA GCS agrees that SWSAs are nationally important water resource areas and that their protection is essential for long-term water security. The significance of the Northern Drakensberg SWSA was recognised during the assessment process and forms part of the broader environmental context within which the application was evaluated. However, the designation of an area as an SWSA does not create a presumption that all groundwater abstraction is unacceptable. Rather, it requires that proposed water uses be carefully assessed to determine whether they can be undertaken without compromising the ecological functioning and water resource value of the area. The specialist investigations concluded that the proposed abstraction volume represents a relatively small proportion of the available groundwater resource within the assessed sub-catchment. The Hydrogeological Investigation determined that approximately 2,918,072 m^3/a of groundwater is available within the delineated sub-catchment and that approximately 2,299,493 m^3/a would remain available after accounting for the recommended sustainable abstraction benchmark of 618,579 m^3/a. The abstraction volume sought through the WULA (281,371 m^3/a) is substantially lower than both the estimated sustainable abstraction capacity and the groundwater available within the assessed sub-catchment. In addition, the Hydropedology Assessment concluded that abstraction occurs from a deeper fractured aquifer system, while the wetlands are primarily supported by shallow soil-water processes and responsive soils. On this basis, the assessment concluded that marginal to negligible impacts are anticipated on wetland baseflow and associated freshwater ecosystems. 5. Long-term water security and protection of the SWSA SEJN requests robust scientific evidence demonstrating that the proposed abstraction will not compromise long-term water security within the Northern Drakensberg SWSA. Absolute certainty regarding future environmental conditions is not achievable in any assessment. The relevant question is whether sufficient scientific evidence exists to assess the likely impacts of the proposed abstraction and whether appropriate management measures are available to manage any residual uncertainty. The WULA is supported by multiple specialist investigations, including aquifer testing undertaken over several years, groundwater balance assessments, groundwater stress assessments, hydropedological investigations, freshwater ecological assessments and hydrological evaluations. Collectively, these studies indicate that the proposed abstraction volume of 281,371 m^3/a is substantially below the estimated sustainable abstraction capacity of the operational borehole network (618,579 m^3/a), that significant impacts on wetlands and watercourses are

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			unlikely, and that substantial groundwater resources remain available within the assessed sub-catchment. The specialist assessments are further supported by a comprehensive monitoring and adaptive management framework designed to verify assessment predictions and provide early detection of any unforeseen impacts. • Groundwater monitoring includes weekly groundwater level monitoring, weekly abstraction volume monitoring and annual groundwater quality monitoring of the operational production boreholes. Monitoring parameters include groundwater levels, abstraction volumes, pH, electrical conductivity, total dissolved solids, alkalinity, major ions, nutrients and microbiological indicators. Monitoring data will be reviewed by qualified hydrogeologists and supported by annual hydrogeological review to assess aquifer response and confirm the ongoing sustainability of groundwater abstraction. • Surface water monitoring includes bi-annual surface water quality monitoring, stormwater monitoring during significant rainfall events and monthly inspections of stormwater infrastructure. Monitoring parameters include pH, electrical conductivity, total dissolved solids, sediment load, nutrients, microbiological indicators and other water quality parameters relevant to the protection of downstream watercourses and the identification of potential pollution sources. • Wetland monitoring includes bi-annual water quality monitoring of sensitive wetland systems by an independent specialist. Monitoring includes temperature, electrical conductivity, dissolved oxygen, pH, salinity, ammonia, nitrate, phosphate and microbiological indicators to verify that the operation is not adversely affecting wetland ecological functioning or water quality. The monitoring framework is further supported by annual internal and external environmental audits and annual reporting to the DWS. Importantly, the purpose of this monitoring programme is not merely to record environmental conditions, but to provide a mechanism through which management actions can be implemented should monitoring identify adverse trends or unforeseen impacts. In GCS's view, the combination of multiple specialist investigations and long-term monitoring constitutes an evidence-based and precautionary approach consistent with the requirements of Section 2 of the NEMA and the considerations set out in Section 27 of the NWA. Accordingly, while GCS acknowledges the strategic importance of the Northern Drakensberg SWSA, the available specialist evidence does not indicate that the proposed abstraction would compromise the long-term water resource function of the area or undermine regional water security.
<u>9. Inadequacy of Public Participation</u> Meaningful public participation is a legal right. The NWA and its regulations require that I&APs be given a genuine and reasonable opportunity to participate. PAJA requires that administrative decisions be procedurally fair. NEMA section 2 principles require that the participation of all I&APs be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by	With respect to public participation, the process undertaken complies with the applicable legislative requirements and provided Interested and Affected Parties with an opportunity to review and comment on the application. The concerns raised regarding accessibility, language, and community engagement are acknowledged and will be considered as part of ongoing stakeholder engagement and communication measures.	The GCS response is dismissive and does not adequately address the substantive concerns: 1. The response asserts that the public participation process "complies with the applicable legislative requirements" without explaining how a process conducted entirely in English, with no community meetings, can constitute meaningful participation for isiZulu-speaking communities with literacy barriers and limited internet access. 2. The response does not engage with SEJN's legal arguments based on PAJA (procedural	GCS notes the concerns raised; however, we respectfully disagree with the assertion that the public participation process was procedurally deficient or failed to provide meaningful opportunities for participation. The comments appear to overlook a number of material facts regarding the public participation undertaken during both the original WULA process and the subsequent re-application process, as well as the requirements of the applicable regulatory framework. Our responses to the specific issues raised are provided below.

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vulnerable and disadvantaged persons must be ensured. The public participation process conducted by GCS falls short in two respects: • All WULA documents are in English and in highly technical language. Many community members in and around Normandien speak isiZulu as their first language and lack the technical background to understand the proposals and risks. Providing documents only in English to isiZulu-speaking communities is a form of exclusion. • GCS has not arranged community meetings to explain the proposed water use, answer questions, or provide an accessible forum. A 60-day written comment period in English only, without meetings, plain-language summaries, or isiZulu materials, is not meaningful participation for communities facing literacy barriers and limited internet access. SEJN requests that GCS: • Prepare plain-language summaries translated into isiZulu and distribute them to affected communities; • Arrange accessible community meetings conducted in isiZulu before the comment period closes; and • Extend the comment period to allow meaningful participation after accessible information is provided. The Department should not make a licensing decision until these procedural deficiencies have been remedied.		fairness), NWA regulations, or NEMA s2 principles regarding vulnerable and disadvantaged persons. 3. None of SEJN's three specific requests have been addressed: no commitment to prepare isiZulu plain-language summaries; no commitment to arrange community meetings in isiZulu; no commitment to extend the comment period. 4. The vague statement that concerns "will be considered as part of ongoing stakeholder engagement" does not constitute a concrete commitment and does not remedy the existing procedural deficiencies. 5. Meaningful participation is a precondition for a lawful licensing decision, not a matter for post-decision engagement. Outstanding issues: Commitment to isiZulu translations and plain-language summaries; commitment to community meetings; extension of the comment period; substantive response to the legal arguments on procedural fairness.	<u>1. Allegation that the public participation process was conducted entirely in English and did not enable meaningful participation for isiZulu-speaking communities</u> This statement is not accurate and does not reflect the full history of the public participation process. During the original WULA process undertaken between 2019 and 2024, public participation was not conducted solely in English. Following a request from Mr Shabalala, site notices were placed in English, Afrikaans and isiZulu, and newspaper advertisements were published in both English and isiZulu. A public meeting was also held during June 2021, and I&APs were afforded a 60-day review period to consider and comment on the application documentation. Importantly, Mr Shabalala was the only stakeholder who specifically requested communication in isiZulu. This request was accommodated during the original WULA process through the use of isiZulu notices and newspaper advertisements. No other stakeholders requested communication in isiZulu, translation of project documentation, interpretation services, or the holding of meetings in isiZulu. Furthermore, Mr Shabalala and SEJN actively participated in both the original application process and the re-application process, submitting detailed comments in English on each occasion. The fact that SEJN was aware of the process, accessed the application documentation, and submitted substantive comments demonstrates that the notification and engagement measures were effective in enabling participation. <u>2. Allegation that the response does not engage with PAJA, the NWA Regulations or NEMA Section 2 principles</u> GCS acknowledges the importance of procedural fairness and the principles contained in the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) (PAJA), the National Water Act, 1998 (Act No. 36 of 1998) (NWA), and Section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). However, neither PAJA, the NWA Regulations, nor NEMA establish a requirement that all consultations must be translated in all official languages, nor do they require that every request made by a stakeholder during a public participation process must be implemented. The relevant legal test is whether affected persons have been provided with fair and reasonable notice of the application and a reasonable opportunity to make representations before a decision is taken. In this instance, stakeholders were notified through multiple communication channels, a public meeting was held during the original process, two separate 60-day public review periods were provided, comments and objections were accepted and responded to, and stakeholder concerns have been documented and will be considered by the DWS during its decision-making process. Accordingly, GCS remains of the view that the public participation process has satisfied the requirements of procedural fairness and has afforded stakeholders a meaningful opportunity to participate in the licensing process.

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			3. Allegation that SEJN's specific requests have not been addressed SEJN's requests have been considered. However, the absence of a commitment to implement a requested measure should not be interpreted as a failure to consider the request. Neither the NWA nor the Regulations require the preparation of plain-language summaries in multiple different languages, the translation of technical specialist reports, the holding of additional community meetings, or the extension of public review periods beyond what has already been provided. The original public participation process included multilingual notification measures and a public meeting. No requests were received at that time for interpretation services, an isiZulu presentation, or additional community meetings. Furthermore, stakeholders were afforded a 60-day review period during both the original application process and the re-application process, which exceeds the public review periods commonly applied in many environmental and water use authorisation processes. While stakeholders are entitled to request additional participation measures, the legal requirement is that the process be reasonable, fair, and compliant with the applicable regulations GCS believes that it did respond appropriately and in accordance with the law to public participation requests made during the process. GCS remains satisfied that this standard has been met. 4. Allegation that ongoing stakeholder engagement does not remedy procedural deficiencies GCS agrees that ongoing stakeholder engagement cannot remedy a fundamentally defective public participation process. However, GCS does not accept the premise that any procedural deficiency exists in the public participation process for the WULA. The statement that concerns will be considered as part of ongoing stakeholder engagement was intended to reflect Thirsti's commitment to continued transparency and responsiveness throughout the licensing process. It was not intended as an acknowledgement that the public participation process was inadequate or that remedial measures are required. The public participation process has included notification, consultation, public review periods, stakeholder engagement, and formal responses to comments received. Accordingly, GCS remains of the view that the process satisfies the requirements of the NWA and associated Regulations. 5. Allegation that meaningful participation is a precondition for a lawful licensing decision GCS agrees that meaningful public participation is an important component of a lawful licensing process. However, meaningful public participation must be assessed based on whether stakeholders were provided with a fair and reasonable opportunity to participate, rather than on whether all stakeholders agree

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			with the application or whether every requested measure has been implemented. The record demonstrates that stakeholders were notified of the application through multiple communication channels, provided access to information, afforded extended review periods, given opportunities to submit written comments, and able to engage directly with the process. Comments received have been documented and responded to, and will form part of the information available to the DWS when considering the application. The participation of Mr Shabalala and SEJN in both the original application process and the re-application process is itself evidence that the notification and consultation mechanisms were effective in enabling stakeholder engagement. If SEJN considered the original public participation process to be procedurally unfair or inaccessible due to language barriers, it is notable that such concerns were not raised during the original process despite active participation and the accommodation of requests for isiZulu notification measures. For these reasons, GCS remains of the view that the public participation process undertaken complies with the requirements of the NWA and associated Regulations and that meaningful and lawful participation has occurred during the WULA process and prior to any licensing decision being taken.
10. Technical Report, Specialist Reports and Professional Registration Technical and specialist assessments form the evidentiary basis on which the Department must evaluate the impacts of the proposed water use. The Natural Scientific Professions Act 27 of 2003 requires that persons practising in natural scientific professions must be registered with SACNASP in the appropriate category and field of practice. SEJN's primary concern relates to the WULA Technical Report, which is the central document on which the licensing decision depends. The primary author (Luyanda Macheke) is not registered with SACNASP. The two co-authors (Marandela Muzhambi and Paula Tolksdorff) hold Pr.Sci.Nat. registration in Environmental Science, not in Earth Science or Water Resources Science — the fields SEJN argues are relevant to a water use licence application. The director and signatory (Danielle Kriel) is also not registered. This means the most important report in this application was not authored, supervised, or signed off by a Pr.Sci.Nat. registered in the relevant field of practice. Similar concerns arise with the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D), where the primary authors are not registered as Pr.Sci.Nat. in the relevant fields. While directors holding full registration have signed off, it is not clear that sign-off alone constitutes the substantive	The Technical Report and supporting specialist studies were prepared and reviewed under the oversight of appropriately registered Professional Natural Scientists in accordance with the requirements of the Natural Scientific Professions Act, 2003, the South African Council for Natural Scientific Professions (SACNASP), and accepted professional practice. The specialist investigations were undertaken by suitably qualified and registered specialists in the relevant fields of hydropedology, freshwater ecology, and environmental science.	The GCS response is a blanket assertion that does not engage with the specific concerns raised: 1. SEJN identified specific individuals by name and their registration status. The primary author of the Technical Report (Luyanda Macheke) is identified as not being registered with SACNASP. The response does not address this specific concern or confirm or deny the registration status of named individuals. 2. The response does not address the distinction between Environmental Science registration and Earth Science or Water Resources Science registration — the fields SEJN argues are relevant to a WULA Technical Report 3. The concern that sign-off by a registered director may not constitute the "substantive supervision" required by the Act is not addressed. 4. The specific concerns about the Hydrology Report (Appendix B), Hydrogeology Report (Appendix C), and Freshwater Ecology Report (Appendix D) are not individually addressed. 5. The response does not commit to remedying any identified deficiencies or making revised or re-certified reports available to I&APs. Outstanding issues: Confirmation or denial of the registration status of named individuals; explanation of how Environmental Science registration qualifies practitioners for water resource assessments; clarification of the level of supervision exercised; commitment to remedy any deficiencies and make revised reports available.	GCS notes the concerns raised and welcomes the opportunity to provide further clarification regarding the qualifications, professional registration and oversight associated with the WULA Technical Report and supporting specialist studies. <u>1. Registration status of named individuals</u> SEJN specifically raises concerns regarding the registration status of certain individuals involved in the preparation of the WULA documentation. The WULA Technical Report identifies Ms Luyanda Macheke as an author and contributor to the report. Her academic qualifications, including a Postgraduate Diploma in Integrated Water Management and a Bachelor of Science in Geography and Geology. Ms Macheke is not presented in the report as a registered Professional Natural Scientist, nor does she certify or sign off on the report in that capacity. Her contribution formed part of a multidisciplinary project team operating under the review, oversight and professional responsibility of registered Professional Natural Scientists. The WULA Technical Report was prepared within a structured professional framework involving Ms Paula Tolksdorff (Pr.Sci.Nat., Registration No. 152904) and Ms Desire Marandela Muzhambi (Pr.Sci.Nat., Registration No. 124123), both of whom are registered Professional Natural Scientists in the field of Environmental Science and who were involved in the preparation, review and oversight of the report. <u>2. Environmental Science registration and water resource assessments</u> SEJN raises a distinction between Environmental Science registration and registration in fields such as Earth Science or Water Resources Science. The WULA Technical Report is an integrated environmental and regulatory document that consolidates information from multiple specialist

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supervision the Act requires. Only the Hydropedology Report (Appendix E) appears compliant. The Department should not issue a licence until all professional qualification and registration deficiencies have been satisfactorily remedied and revised or re-certified reports have been made available to I&APs for comment.			disciplines, including hydrogeology, hydrology, freshwater ecology, hydropedology, engineering, environmental management and water resource management. It is not itself a hydrogeological, hydrological or freshwater ecological specialist study, nor does it seek to replace or supersede the findings of the discipline-specific specialist assessments. For this reason, the preparation and review of the WULA Technical Report by registered Environmental Scientists is considered appropriate and consistent with the multidisciplinary nature of Water Use Licence Applications. The role of the Technical Report is to integrate and present the findings of the specialist studies, assess the proposed water uses against the requirements of the NWA, and provide a consolidated basis for decision-making by the DWS. The discipline-specific specialist assessments relied upon by the Technical Report were undertaken and certified by appropriately qualified and registered specialists within the relevant fields of practice. These include hydrogeological input from a Professional Natural Scientist registered in Earth Science, hydropedological input from a Professional Natural Scientist registered in Water Resources Science, and freshwater ecological input from Professional Natural Scientists registered in Ecological Science. SEJN also refers to the sign-off of the Technical Report by a GCS director. It is important to distinguish between GCS's internal quality assurance and quality control (QA/QC) procedures and the professional certification of specialist studies. Director review and sign-off form part of GCS's internal QA/QC process to ensure technical consistency, quality and completeness of project deliverables. This internal review process is separate from, and does not replace, the professional sign-off and certification provided by the relevant registered specialists responsible for the discipline-specific specialist studies. Accordingly, the WULA Technical Report has been prepared within a multidisciplinary professional framework that incorporates input from appropriately qualified and registered specialists, while the underlying specialist studies have been certified by professionals registered in the fields most directly relevant to the subject matter being assessed. <u>3. Professional oversight and supervision</u> SEJN questions whether professional sign-off constitutes substantive supervision. GCS acknowledges that professional oversight involves more than the final act of signing a report. Professional sign-off is the culmination of a broader process of review, technical input, quality assurance and professional accountability. In terms of the Natural Scientific Professions Act and SACNASP requirements, the registered professional who certifies work assumes responsibility for the scientific content and conclusions of that work and is required to exercise appropriate professional judgement in doing so. The WULA Technical Report was prepared within a structured professional framework involving appropriately qualified staff, technical specialists and registered Professional Natural Scientists. Registered professionals were involved throughout the preparation, review and quality assurance process and not solely at the point of final certification. Their role included

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			the drafting of report chapters, review of technical content, consideration of specialist findings, verification of conclusions and oversight of the overall report development process. Accordingly, GCS does not agree that the involvement of registered professionals was limited to administrative sign-off. The registered professionals associated with the WULA Technical Report exercised professional oversight and assumed responsibility for the final document in accordance with the requirements of the Natural Scientific Professions Act and SACNASP's Code of Conduct. <u>4. Specialist reports</u> SEJN raises specific concerns regarding the Hydrology Report, Hydrogeology Report and Freshwater Ecology Report. These specialist studies were not prepared or signed off solely by Environmental Scientists. The application includes specialist input from appropriately qualified and registered professionals within the relevant fields of practice, including: • Hydrogeology: Mr Andrew Clifford Johnstone (Pr.Sci.Nat., Earth Science, Registration No. 400192/87). • Freshwater Ecology: Mrs Fiona Eggers (Pr.Sci.Nat., Ecological Science, Registration No. 400606/15) and Mr Craig Cowden (Pr.Sci.Nat., Ecological Science, Registration No. 400197/05). • Hydropedology: Mr Andries Renier Wilke (Pr.Sci.Nat., Water Resources Science, Registration No. 400087/12) and Mr Johannes Hendrik Botha (Pr.Sci.Nat., Ecological Science, Registration No. 400229/04). Accordingly, the specialist studies relied upon by the WULA have been prepared and certified by professionals registered within the fields most directly relevant to the subject matter of those assessments. <u>5. Remedying alleged deficiencies and availability of revised reports</u> SEJN requests a commitment to remedy any identified deficiencies and make revised reports available to I&APs. GCS does not agree that any legal or technical deficiency has been demonstrated in relation to the qualifications, registration or professional oversight associated with the WULA Technical Report or supporting specialist studies. The reports have been prepared and reviewed within a multidisciplinary framework that includes appropriately qualified and registered professionals and, in GCS's view, satisfy the requirements of the Natural Scientific Professions Act, SACNASP and the applicable environmental legislation. Should any amendments, corrections or additional information be required by the DWS during its review of the application, such information will be incorporated into the licensing process in the normal course. Any updated documentation forming part of the public participation process will be made available in accordance with the applicable regulatory requirements