

10.4 The Specialist

Note: Duplicate this section where there is more than one specialist.

Danie Brink

I, as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and that I:

- in terms of the general requirement to be independent (tick which is applicable):

☒	other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
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☐	am not independent, but another EAP that is independent and meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
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- have expertise in conducting specialist work as required, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- will ensure compliance with the EIA Regulations 2014;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- will take into account, to the extent possible, the matters listed in regulation 18 of the regulations when preparing the application and any report, plan or document relating to the application;
- will disclose to the proponent or applicant, registered interested and affected parties 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 with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- declare that all the particulars furnished by me in this form are true and correct;
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).

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Signature of the specialist

WSP Group Africa(PTY)Ltd

Name of company

21/07/2025

Date



10.5 The Review Specialist

Gerhard van der Linde

I as the appointed review specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- am independent, and other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;
- am fully aware of and meet all of the requirements of Regulation 13, and that failure to comply with any the requirements may result in disqualification;
- have reviewed/will review all the work undertaken by the specialist;
- have disclosed/will disclose, to the applicant, the EAP, other specialist (if any), the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

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WSP Group Africa(PTY)Ltd

Name of company

21/07/2025

Date





McCains Foods South Africa (Pty) Ltd

DELMAS: INSTALLATION OF WASTEWATER TREATMENT PLANT AND EXPANSION OF DIESEL STORAGE FACILITY

Groundwater Impact Assessment





McCains Foods South Africa (Pty) Ltd

DELMAS: INSTALLATION OF WASTEWATER TREATMENT PLANT AND EXPANSION OF DIESEL STORAGE FACILITY

Groundwater Impact Assessment

REPORT (FINAL) CONFIDENTIAL

PROJECT NO. 41107366

OUR REF. NO. 41107366-REP-00001

DATE: JUNE 2025



McCains Foods South Africa (Pty) Ltd

DELMAS: INSTALLATION OF WASTEWATER TREATMENT PLANT AND EXPANSION OF DIESEL STORAGE FACILITY

Groundwater Impact Assessment

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1 INTRODUCTION

WSP Group Africa (WSP) has been requested by McCain Foods (Pty) Ltd (McCain) to conduct a Groundwater Impact Assessment (IA) at their Delmas site in Mpumalanga Province (Figure 3-1). The purpose of the IA is to determine potential impacts from their proposed wastewater treatment plant (WWTP) and expansion of the diesel storage facility on the groundwater regime.

McCain Delmas utilise groundwater for their daily operations from three (3) boreholes situated on the site area (Aces ,2024). Water supplies from these three (3) boreholes are limited over the dry season due to excessive drawdown of the water tables in the boreholes.

This report documents the outcome of the Groundwater IA conducted at the McCain Delmas Site.

2 OBJECTIVE

The objective of the groundwater investigation is to:

- Document the current on-site groundwater quality; and
- Qualitative impact assessment (IA) to determine potential impacts (if any) from the proposed WWTP and expansion of diesel storage on the groundwater regime.

3 SCOPE OF WORK

The hydrogeological scope of work followed was:

- Desk study and Information Review;
- Groundwater Qualitative Impact Assessment (IA) Associated with the Installation of Wastewater Treatment plant and Diesel Storage Facility; and
- Groundwater Qualitative IA Report.

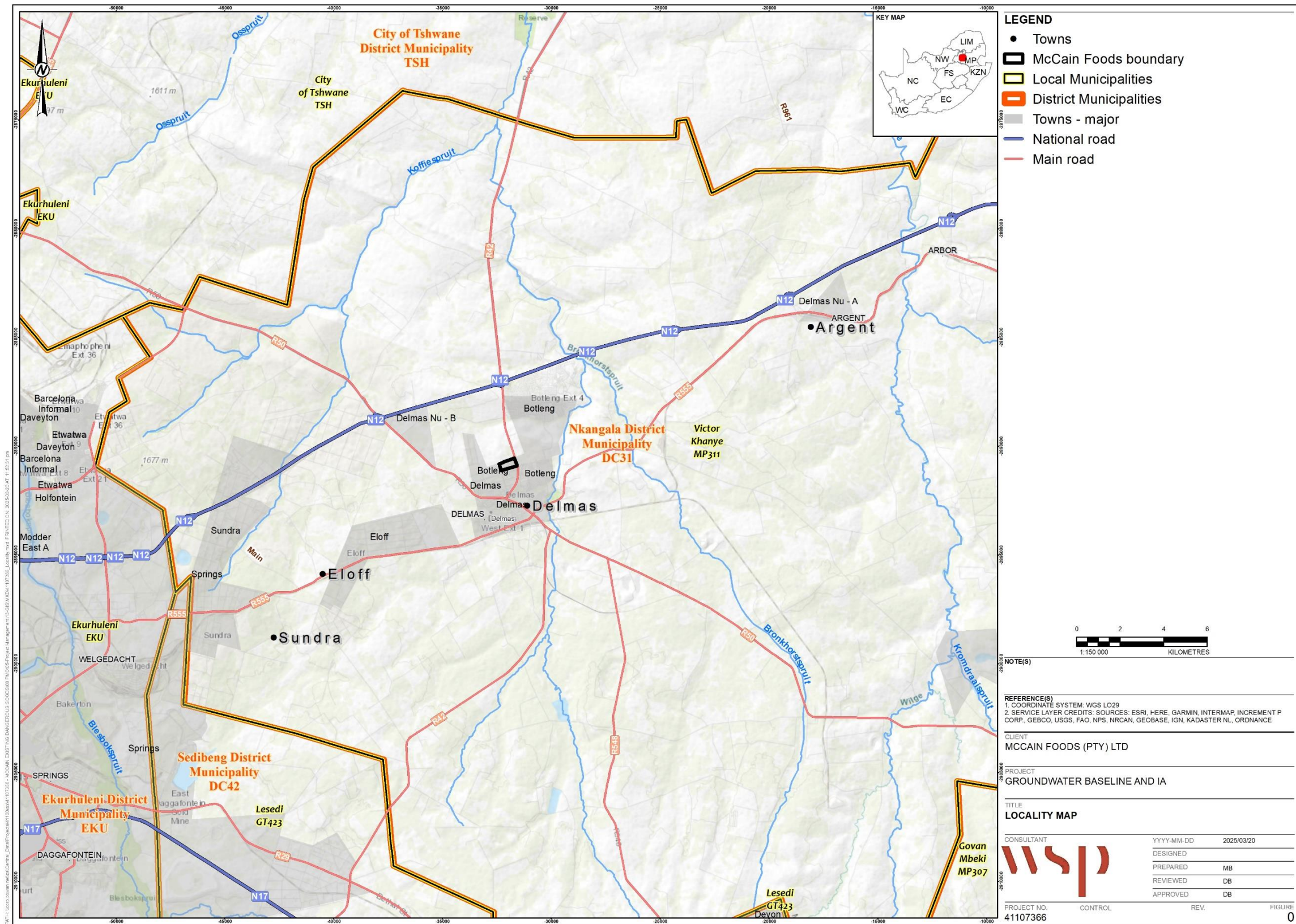


Figure 3-1 - Locality Map

4 DESK STUDY AND INFORMATION REVIEW

The IA focus on the potential impacts from the proposed WWTP and expansion of the diesel storage facility on the groundwater regime.

An information review of existing groundwater information was undertaken of the investigation area to gather and collate available relevant information pertaining to the entire study area. Regional groundwater information, monitoring data, existing groundwater, and hydrological reports, geological information, existing groundwater quality data, etc. were obtained and studied.

The information review to include the reports as referenced in section 7.

4.1 LOCALITY AND GEOGRAPHICAL SETTING

The McCain Delmas Site is situated approximately 3 km north of the town of Delmas in Mpumalanga Province. (Figure 3-1). The industrial area is flanked by large farmlands to the west, north and east (with prominent dry land cash crop farming and irrigations systems), and small industries/factories and agricultural plots to the south and southwest.

The McCain's Delmas Site covers approximately 25 ha and is located on Portion 74, of the farm Leeuwpoot 205 IR. The McCain's Delmas Site is located on the B20A regional quaternary catchment (QC).

The main surface water drainage system is the Bronkhorstspruit running in a southwest-northeast direction about 2.8 km east of the site area. Large formal and informal housing schemes are located further east from the site area (Golder 2021).

4.2 GEOLOGY

4.2.1 REGIONAL GEOLOGY

The regional geological setting of the McCain's Delmas Site is illustrated in Figure 4-2. Although the indication is that the site lies directly on the Malamni Dolomite Subgroup (Vma), it is situated on an outlier of the Rooihogte Chert Formation (Vr). This phenomenon is explained in detail below.

With reference to the geological cross section presented in Figure 4-1, the McCain's Delmas Site is underlain by a chert/quartzite formation down to between 20 and 30 m. This formation is a remnant of the Rooihogte Formation present in the area, i.e., representing the "outlier". The Rooihogte Chert Formation is underlain by dolomite and [less prominent] chert formations of the Malmani Subgroup, (Chuniespoort Group of the Transvaal Supergroup). The thickness of the dolomite basement is in the order of 500 to 800 m. The whole sequence dips slightly to the north (Golder 2021).

Secondary geological features are present in the form of sub-vertical/vertical diabase dykes as indicated in Figure 4-1. According to the 1992 geotechnical assessment of the site area, these dykes are fractured and weathered down to a depth of ~30 m (Pollock et al, 1992) and are, thus, not regarded as groundwater barriers on a local scale (Golder 2021).

The site area is covered with a loose gravels, pebbles and fragments – all origination from the underlying chert formation. Rock outcrops noted in open areas in the eastern part of the site area consists of fractured chert (Golder 2021).

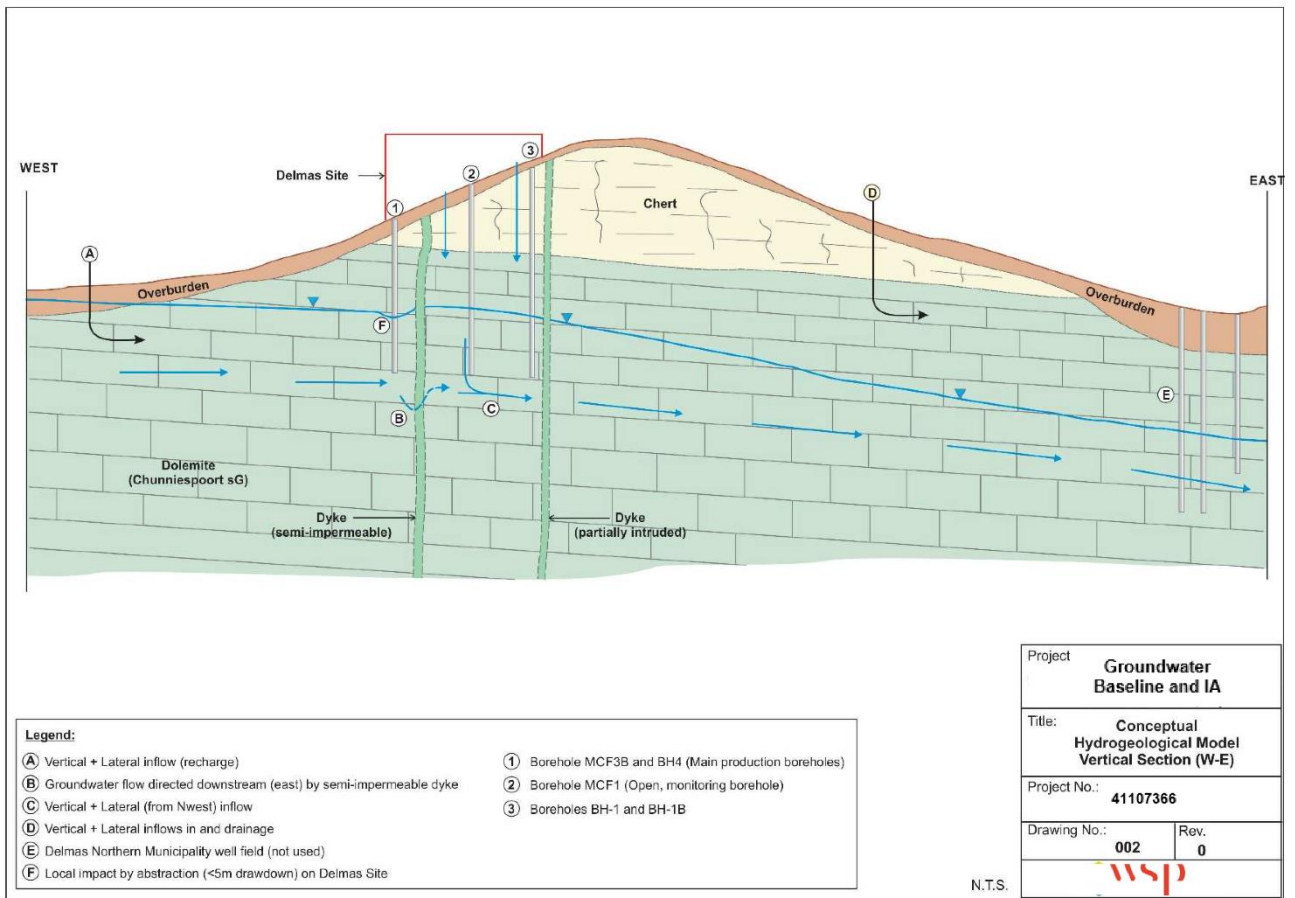


Figure 4-1 - West-East Geological Cross Section of the McCain Delmas Site showing the Main Geological Formations based on Drilling Information and Geological Maps (adapted Golder 2021)

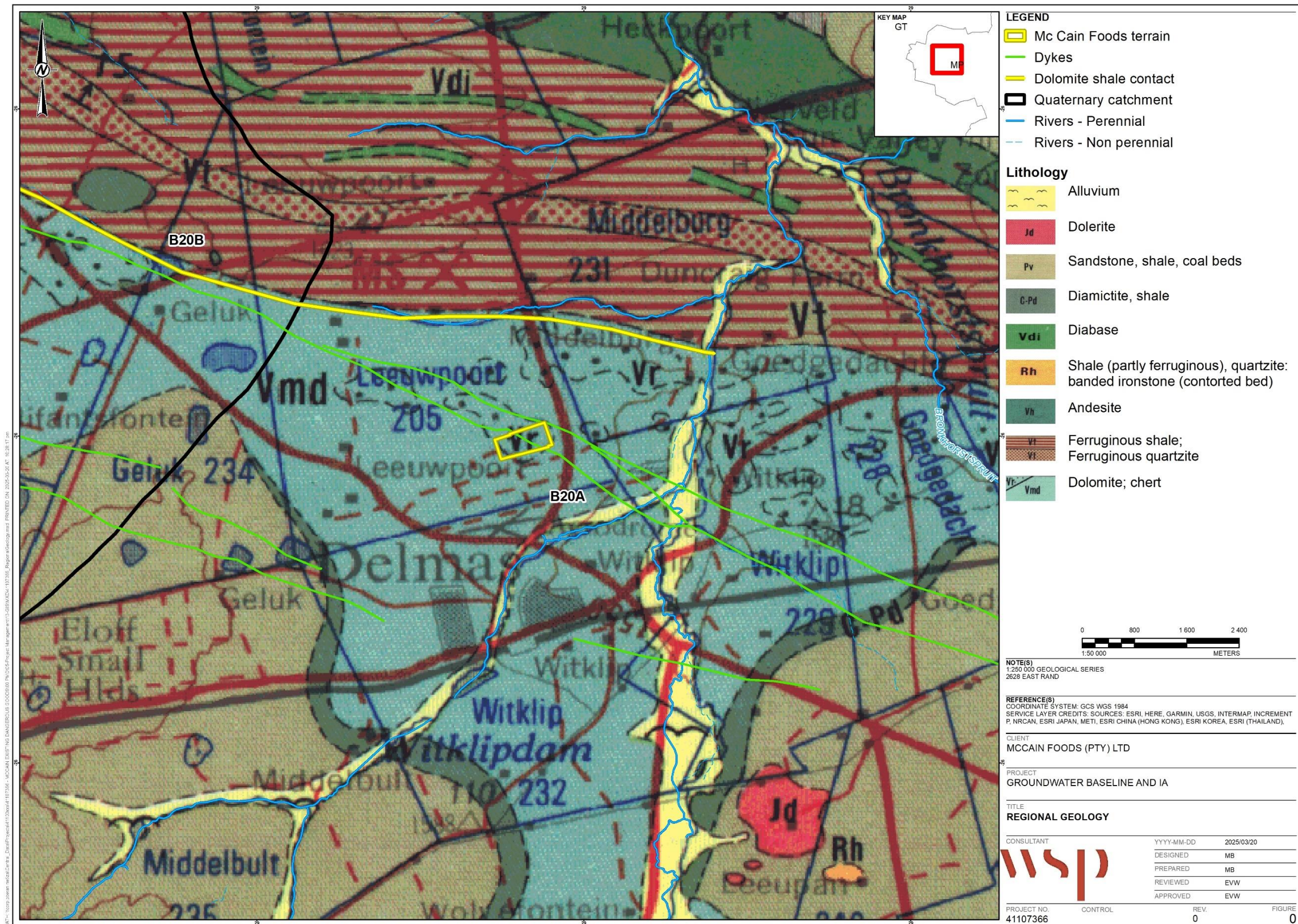


Figure 4-2 – Regional Geology

4.3 HYDROGEOLOGY

4.3.1 HYDROCENSUS

An initial comprehensive hydrocensus (46 boreholes) was conducted by Golder during 2015 and follow-up hydrocensus of McCain Delmas Site's onsite production and monitoring boreholes was completed in 2020 by Golder (7 boreholes). An additional hydrocensus was also conducted by Golder (7 boreholes) during 2021 to obtain hydrogeological information from the surrounding water users and collate information on their water supply boreholes and independent uses. The latest referenced hydrocensus was conducted by Aces (15 boreholes) during 2024.

The hydrocensus boreholes verified during the four (4) surveys are indicated on Figure 4-3 and listed in Table 4-2, Table 4-3, Table 4-4 and Table 4-5 respectively.

The hydrocensus surveys involved the collection of data from each facility located, including GPS co-ordinates, existing equipment, current use, reported yield, reported, or measured depth and the static water levels.

The latest groundwater levels (2024) recorded at McCain Delmas Site range from 23.9 m below ground level (mbgl) at Borehole 4 to 59.01 mbgl (Dplot140-2).

4.3.1.1 Groundwater Fluctuations

Four (4) groundwater level measurements obtained during the 2015 hydrocensus (Golder, 2015) were compared to the 2024 hydrocensus data (Aces 2024). The water level comparison shows a decrease in groundwater levels. A summary of the change in groundwater levels from the two hydrocensus campaigns is provided in Table 4-1.

The property owners from Plot140 (Mr. Ferreira), Plot 48 (Mr. Masango) as well as some other property owners including Plot (Mr. Van Der Hoff) stated that the boreholes are running dry. The decrease in groundwater levels substantiate the statement of the property owners. Cumulative groundwater abstraction impacts on the groundwater. Such cumulative impacts can be attributed to a new mining activity in the area, located northwest of McCain Delmas Site as well as industrial, agricultural, and municipal groundwater abstraction (Aces 2024).

Table 4-1 – Water Level Fluctuations between 2015 and 2024 (Adapted from Aces, 2024)

Borehole Number	Latitude	Longitude	Farm Name	Groundwater level (mbgl) Hydrocensus 2015	Groundwater level (mbgl) Hydrocensus 2024	Difference in Water Levels (m)
Dplot56	-26.1307	28.67672	Plot 56	26.07	30.66	-4.59
Dplot140-2	-26.1201	28.66655	Plot 140	51.62	59.01	-7.39
Dpot172	-26.1281	28.66843	Plot 172	38.4	40.3	-1.9
Dplot48	-26.1318	28.6711	Plot48	30.23	34.4	-4.17

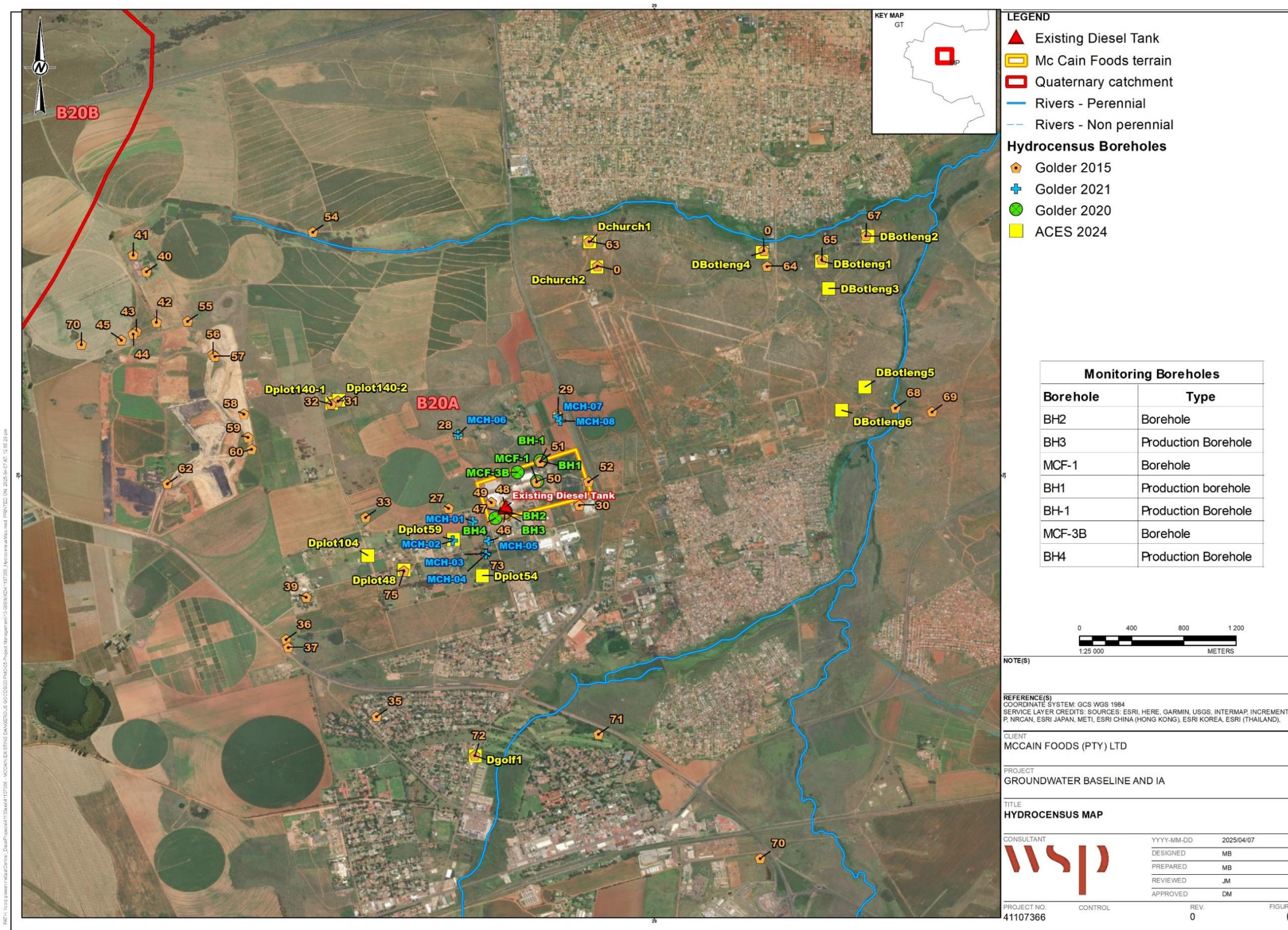


Figure 4-3 - Hydrocensus Boreholes

Table 4-2 - Hydrocensus Data (Golder 2015)

Borehole No.	Other No.	Owner	Farm	Latitude	Longitude	GPS Altitude (mamsl)	GOOGLE Altitude (mamsl)	Depth (m)	Casing Height (m)	Diameter (m)	Water Level (m)	Status	Equipment	Use	Comment
27	-	R. du Plooy	Plot 113 & 114	-26.12753	28.67418	1578	1587	45	0.35	157	34.02	Unused	Submersible	Garden	Pump Broken, 2500L tank, 2hours to fill tank, pump 2x per week, Municipal connection.
28	-	Buhle Farmers' Academy	205/6	-26.12245	28.67487	1595	1587	-	0.44	-	-	In use	Submersible	Domestic All	4.5" outer pipe, People = 10 to 150 (P), 2 x 5000L Jo-Jo tanks.
29	-	Buhle Farmers' Academy	205/6	-26.12105	28.6817	1570	1576	-	0.7	-	38.2	In use	Submersible	Irrigation	22ha Maize, soya beans & Lucerne, 2 x 5000L Jo-Jo tanks & cement irrigation dam, 4" & 6" outer pipes.
30	-	J.B. Sibanyoni	Plot 87	-26.12733	28.6832	1566	1563	-	0.15	165	23.18	In use	Submersible	Domestic All	P = 17, garden, 0.75kw sub, pump 2hours to fill tank, no municipal connection, Sampled from tap at reservoir.
31	-	A.F. Perreira	Plot 140	-26.12014	28.66654	1585	1582	86	0.25	200	51.62	In use	Submersible	Domestic All	119 Goats (SSU), house and garden, pump 1 hour to fill 5000L JoJo 3 x per week, dolerite chippings, yielding capacity diminishing.
32	-	A.F. Perreira	Plot 140	-26.12038	28.66606	1586	1583	60	0.2	-	43.76	Unused	None		Borehole dried-up, deepened to 60m but unsuccessful.
33	-	G Janse van Rensburg	Plot 172	-26.12815	28.66845	1581	1580	60	0.22	165	38.4	In use	Submersible	Domestic All	Pump 30 minutes every day, house plus garden.
35	-	Victor Khanye Local Municipality	Delmas Ext 2	-26.14188	28.66922	1565	1563	13.0	0.05	-	10.27	Unused	None	Municipal	Old municipal production well.
36	-	Dissiplek Kroeg & Restaurant	Delmas Ext 17	-26.13658	28.66296	1573	1574	6.68	0.27	165	2.98	Unused	None	-	Collapsed.
37	-	Dissiplek Kroeg & Restaurant	Delmas Ext 17	-26.13713	28.66311	1575	1572	-	0.12	165	7.88	In use	Submersible	Domestic All	House, restaurant & garden, 5000L JoJo.
39	-	Delmas Country Lodge	Plot 39	-26.13366	28.66436	1578	1577	-	0.3	165	13.46	In use	Submersible	Domestic All	16 Rooms + 5 self-catering units, house & gardens.
40	-	Buiteplaas Boerdery	205/3	-26.11121	28.65334	1595	1591	75	0.4	-	-	In use	Submersible	Domestic All	House, office & workshop, pump intake @ 60m [2 x 40ha pivots + 3 smaller circles].

Borehole No.	Other No.	Owner	Farm	Latitude	Longitude	GPS Altitude (mamsl)	GOOGLE Altitude (mamsl)	Depth (m)	Casing Height (m)	Diameter (m)	Water Level (m)	Status	Equipment	Use	Comment
41	-	Buiteplaas Boerdery	205/3	-26.11007	28.65241	1588	1591		0.3	-	8.6	In use	Submersible	Irrigation	Tanker filling point, irrigation dam, discharge rate 5L/s.
42		Buiteplaas Boerdery	205/3	-26.1147	28.65402	1587	1587	95	0.15	250	-	Unused	Submersible	Irrigation	4" Outer pipes, measuring tube blocked @ 60m,
43	-	Buiteplaas Boerdery	205/3	-26.11533	28.65262	1590	1590	-	0	250	-	Unused	Submersible	Irrigation	4" Outer pipes, measuring tube blocked @ 60m,
44	-	Buiteplaas Boerdery	205/3	-26.11551	28.65242	1590	1591	-	0.35	250	69.38	In use	Submersible	Irrigation	4" Outer pipes, static water level around 22m, pumping water level around 75m, discharge rate reduced from 25L/s to 10L/s
45	-	Buiteplaas Boerdery	205/3	-26.11593	28.65159	1589	1590	-	0	165	-	In use	Submersible	Irrigation	Yielding capacity not consistent, 3" rising pipe, 50mm outlet, pump 4 hours then pump trips.
70	-	Buiteplaas Boerdery	205/3	-26.11623	28.648843	-	1590	-	0	-	-	In use	Submersible	Irrigation	Yielding capacity 13.89L/s. Located inside irrigation circle.
54	-	Buiteplaas Boerdery	205/12	-26.10849	28.66482	1572	1572		0.12	165	3.58	Unused	Submersible	Domestic All	One House.
46	MFC3B	McCain Delmas	McCain	-26.12786	28.67806	1578	1575	54.25	0.27	256	-	Unused	Submersible	Industrial	Static water level 24.93m May 2011, recommended abstraction rate 40L/s, current meter reading 1151833.480m3.
47	MFC3A	McCain Delmas	McCain	-26.12777	28.67803	1576	1575	-	0.31	165	-	Unused	Submersible	Industrial	4" Outer pipes, current meter reading 312378.126m3
48	-	McCain Delmas	McCain	-26.12728	28.67805	1579	1577	-	0.19	20	31.97	In use	None	Observation	Depth of measuring tube (piezo) is 40.4m.
49	-	McCain Delmas	McCain	-26.12714	28.67714	1589	1576	-	0	110	-	Unused	None	Observation	Blocked.
50	MFC1	McCain Delmas	McCain	-26.12571	28.68026	1575	1574	>100	0.37	256	26.6	In use	None	Observation	Sampled @ 80mbs.
51	-	McCain Delmas	McCain	-26.12432	28.68051	1576	1574	-	0.15	165	-	Unused	Submersible	Industrial	Current meter reading 526817.674m3.
52	-	McCain Delmas	McCain	-26.12571	28.68383	1566	1564	-	0	-	-	-	-	-	Recently rehabilitated sinkhole.

Borehole No.	Other No.	Owner	Farm	Latitude	Longitude	GPS Altitude (mamsl)	GOOGLE Altitude (mamsl)	Depth (m)	Casing Height (m)	Diameter (m)	Water Level (m)	Status	Equipment	Use	Comment
55	-	DWAF	205/4	-26.11465	28.65616	1585	1582	-	0.27	150	90.63	In use	None	Observation	
56	-	DWAF	205/4	-26.11692	28.65792	1586	1583	-	0.39	128	56.29	In use	None	Observation	
57	-	DiCha Boerdery	205/4	-26.11705	28.65805	1587	-1583	-	0.17	250		In use	Submersible	Irrigation	4" Outer pipes, measuring tube. [2.5 x 40 ha - 3 circles plus another one smaller circle, 550 small stock units]
58	-	DiCha Boerdery	205/4	-26.12104	28.66005	1592	1588	-	0.49	250	74.42	In use	Submersible	Irrigation	4" Outer pipes, measuring tube.
59	-	DiCha Boerdery	205/4	-26.12264	28.66033	1591	-1586	-	0.15	250		In use	Submersible	Irrigation	4" Outer pipes, measuring tube.
60	-	DiCha Boerdery	205/4	-26.12346	28.66058	1590	1587	-	0.35	224	47.48	In use	Submersible	Irrigation	4" Outer pipes, measuring tube.
62	-	DiCha Boerdery	205/4	-26.12583	28.65477	1593	-1589	-	0.22	165	>94	In use	Submersible	Domestic Agri	3" Outer pipes, water falling down hole, house, workshop & office, pumping.
63	B8	Victor Khanye Local Municipality	231/15	-26.10914	28.68388	1547	1549	-	0.6	250	61.61	Unused	None	Municipal	Open hole. Fence broken.
0	B7	Victor Khanye Local Municipality	231/15	-26.11082	28.684451	1556	-	-	0	-	-	Destroyed		Municipal	Vandalised.
64	B6	Victor Khanye Local Municipality	231/15	-26.11085	28.69616	1534	1534	-	0.1	200	58.85	Unused	Submersible	Municipal	Broken.
0	-	Victor Khanye Local Municipality	231/15	-26.10976	28.695922	1530	1530	-	0	200	-	In use	Submersible	Municipal	80mm Outlet, pumping. Meter reading 749661m3.
65	BB1	Victor Khanye Local Municipality	231	-26.1104	28.69992	1531	1529	-	0	250	-	In use	Submersible	Municipal	80mm Outlet.
67	B9	Victor Khanye Local Municipality	231	-26.10873	28.70297	1530	1527	-	0	200	-	In use	Submersible	Municipal	Pumping.
68	-	Victor Khanye Local Municipality	231/14	-26.12061	28.70501	1533	1533	-	0	-	-	-	-	-	Sinkhole, started August 2014.
69	A4	Victor Khanye Local Municipality	231/14	-26.12089	28.70753	1535	-1537	-	0.47	-	30.36	In use	Submersible	Municipal	Working order.
70	BH1	Sephaku Cement	232/22	-26.15167	28.69567	1564	1549	-	0	165	-	In use	None	Observation	Borehole locked.
71	B2N0003	DWAF	Delmas Ext2	-26.14311	28.68452	1553	1548		0	-	1.17	In use	Recorder	Observation	Water level recorder Delmas Golf Club.

Borehole No.	Other No.	Owner	Farm	Latitude	Longitude	GPS Altitude (mamsl)	GOOGLE Altitude (mamsl)	Depth (m)	Casing Height (m)	Diameter (m)	Water Level (m)	Status	Equipment	Use	Comment
72	-	Victor Khanye Local Municipality	Delmas Ext5	-26.14458	28.67598	1553	1552	-	0	-	-	In use	Submersible	Irrigation	Supply Delmas Golf Club when needed.
73	-	Hennie and Elsa	Plot 56	-26.13067	28.67671	1570	1571		0.22	165	26.07	In use	Submersible	Domestic All	40mm outlet pipe. 2 x 5000L JoJo tanks.
75	-	Sam Masango	Plot 48	-26.13186	28.6711	1582 m	1574	-	0.25	165	30.23	In use	Submersible	Domestic All	1 x 5000L Jojo + 1 x 1500L tank.

Table 4-3 – Hydrocensus Data (Golder 2020)

Borehole No.	Latitude	Longitude	Type	Water Level (mbgl)	Depth (m)	Equipment	Use	Owner	Comments	Status	Sampled
BH2	-26.12778	28.67810	Borehole	35.38	39.5	None	Not in use.	McCain	Decommissioned production boreholes (Licensed): (BH-1 and BH-2/MCF-3A)	Open boreholes – monitoring	2019/11/15
BH3	-26.12786	28.67806	Production Borehole	-	MCF2	Submersible Pump	Factory	McCain	Current production boreholes (Licensed):(BH-1B and BH-3/MCF3B)	Bh's equipped for production	2019/11/15
MCF-1	-26.12571	28.68027	Borehole	29.71	100+	None	Not in use	McCain	Monitoring boreholes (open, cased): MCF-1 and MCF-2)	Open boreholes – monitoring	2019/11/15
BH1	-26.12430	28.68053	Production borehole	-	-	Submersible Pump	Factory	McCain	Current production boreholes (Licensed):(BH-1B and BH-3/MCF3B)	Bh's equipped for production	2019/11/15
BH-1	-26.12427	28.68050	Production Borehole	-	-	Submersible Pump	Not in use, Backup Borehole for BH-1B	McCain	Decommissioned production boreholes (Licensed): (BH-1 and BH-2/MCF-3A)	Bh's equipped but not used	2019/11/15
MCF-3B	-26.12507	28.67892	Borehole	44.82	100+	None	Not in use	McCain	Monitoring boreholes (open, cased) :(MCF-1 and MCF-2). Tested by GCS in 2011 at ~16 l/s with 0.84 m DD.	Open boreholes – monitoring	2019/11/15
BH4	-26.12823	28.67740	Production Borehole	-	-	-	-	McCain	Newly (Feb'21) drilled production borehole (BH-4 - replacement for BH-2/MCF-3A	Bh's equipped for production	2021/02/15

Table 4-4 - Hydrocensus Data (Golder 2021)

No on map	Latitude (Dec. Degrees)	Longitude (Dec. Degrees)	Date surveyed	Site Type	Water Level (mbgl)	Depth (m)	Yield (l/s)	Equipment	Site Status	Owner	Use
MCH-01	26.12846	28.67586	15 July 2021	Borehole	8.6	8.6	0.0	None	Not used.	Joseph Khoza	Decommissioned, caved in.
MCH-02	26.12978	28.67447			16.34	34	0.0	None	Not used.	Mr. Jacobs.	Borehole not in use.
MCH-03	26.13067	28.67676			*	*	<2.0 L/s	Submersible Pump	Used.	Unknown	Domestic



No on map	Latitude (Dec. Degrees)	Longitude (Dec. Degrees)	Date surveyed	Site Type	Water Level (mbgl)	Depth (m)	Yield (l/s)	Equipment	Site Status	Owner	Use
MCH-04	26.13071	28.67675			>32	32	0.0	None	Not used.	Unknown	Decommissioned.
MCH-05	26.12981	28.67695			*	*	<2.0 L/s	None	Filled	Mr. Johannes Sikozone	Decommissioned.
MCH-06	26.12249	28.67482			*	>64 m	>5.0 L/s	Submersible Pump	Used	Buhle Farmer Academy	Livestock and domestic water supply on farm. Well, maintained.
MCH-07	26.121207	28.68170			34.54	*	>5.0 L/s	Submersible Pump	Used	Buhle Farmer Academy	Intermittent irrigation, 4 months/a.
MCH-08	26.12152	28.68189			*	*	*	None	Not used.	Buhle Farmer Academy	Decommissioned.

Table 4-5 - Hydrocensus Data (Aces, 2024)

Borehole No.	Latitude	Longitude	Elevation (mamsl)	Farm	Owner info	Status/Equipment	Use	Casing Inside Diameter (mm)	Casing Diameter (m)	SWL	Comments
DBotleng1	-26.1105	28.6999	1565.56	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
DBotleng2	-26.1088	28.7031	1567.85	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
DBotleng3	-26.1124	28.7004	1577.53	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
DBotleng4	-26.1099	28.6958	1568.36	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
DBotleng5	-26.1192	28.7029	1581.87	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
DBotleng6	-26.1208	28.7013	1580.26	-	Municipality	Unknown	Unknown	Unknown	Unknown	Unknown	Status is unknown. Security is implemented to protect boreholes. Boreholes are expected to be functional
Dchurch1	-26.1092	28.6839	1580.71	-	Private	Unequipped	none	250	0.65		Blocked at
Dchurch2	-26.1109	28.6844	1585.75	-	Private	Unequipped	none	200	0		Blocked and vandalized at surface level
Dgolf1	-26.1446	28.676	1577.53	-	-	Equipped, Submersible pump	Domestic and golf course	-	-	-	-
Dplot104	-26.1308	28.6686	1594.89	Plot 104	Corne Pereira, 131102624	Equipped, Submersible pump	Domestic use	-	-	-	No access to the property could be obtained. Discussion with the owner took place via telephone.

Borehole No.	Latitude	Longitude	Elevation (mamsl)	Farm	Owner info	Status/Equipment	Use	Casing Inside Diameter (mm)	Casing Diameter (m)	SWL	Comments
Dplot140-1	-26.1203	28.6661	1604.59	Plot 140	Albert Perreira, 825643275	Equipped, Submersible pump	Unused	165	0.25		Pump or cable obstruction at 15m
Dplot140-2	-26.1201	28.6666	1603.26	Plot 140	Albert Perreira, 825643275	Equipped, Submersible pump	Domestic and agricultural	200	0	59.01	Borehole abstraction limited to less than 1 hour before borehole dries up. Storage of 50 000L JoJo tank
Dplot48	-26.1318	28.6711	1592.22	Plot48	Sam Masango, 839956601	Equipped, Submersible pump	Unused	-	-	34.4	Borehole Dry up after pumping occurs. The owner stated that the borehole used to have water sufficient water for use.
Dplot54	-26.1322	28.6765	1587.72	Plot 54	Arno van der Hoff, 829234214	Equipped, Submersible pump	Domestic use	165	0.1	dry	Borehole was dry at 30m during the site visit. The owner states the water level has decreased as it was used for abstraction
Dplot59	-26.1297	28.6745	1591.3	Plot 59	Jake Jacob, 0825233017	Equipped, Submersible pump	Domestic use	165	0.1	dry	Borehole was dry at 30m during the site visit. The owner states the water level has decreased and was used previously

4.3.2 AQUIFER CHARACTERISATION

The aquifer system on the site area consists of Malmani Dolomite Subgroup, capped by a competent chert horizon (overlying Rooihogte Chert Formation) with a thickness ranging between 10 and 30 m (Pollock et al, 1992). The dolomite rock formation has a thickness between 500 and 800 m (Golder 2021).

Although the local water table varies between 20 and 25 m on the site, the overlying chert formation is partially saturated at areas where its thickness is >20 m. The weathering nature of the chert formation has formed a highly porous gravel, pebbly and chert fragmented layers – where the chert formation outcrops mainly on the eastern part of the site area, it has a highly fractured nature that represents preferential recharge pathways to the underlying dolomite aquifer system. There is a good hydraulic connection between the overlying chert formation and the dolomite rock basement where both units are saturated – based on the aquifer testing that has been conducted since 2011 on the Delmas Site (Golder 2021).

The underlying dolomite rock formation is completely saturated; however, the aquifer is mainly characterised as a secondary water bearing unit, the hydraulic characteristics are high and therefore the aquifer system can be classified as a significant water resource (based on the Borehole Yield Classification, DWAF, 2003). This characteristic has been observed during the long-term constant rate borehole tests done on the selected abstraction boreholes on the site area (Golder 2021).

4.3.2.1 Groundwater Vulnerability

Groundwater vulnerability gives an indication of how susceptible an aquifer is to contamination. Aquifer vulnerability is used to represent the intrinsic characteristics that determine the sensitivity of various parts of an aquifer to being adversely affected by a contaminant load imposed from surface. The national groundwater vulnerability map (Figure 4-4) rates the underlying project area vulnerability as **HIGH**, indicating the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some surface location above the aquifer. The method is based on the DRASTIC method that includes the following parameters: Depth to water table; Recharge (net); Aquifer media; Soil media; Topography; Impact of the vadose (unsaturated) zone; and Conductivity (hydraulic).

Impacts on the groundwater resource quality due to industrial developments and activities are always a significant risk and measures needs to be introduced to minimise this. In the case of the McCain Delmas Site, paving and storm water draining have been addressed by paving and storm water drainages in the vulnerable areas, i.e., the raw product receival terrain. The original storm water dams, situated on the eastern (downstream) part of the terrain have been rehabilitated and all wastewater discharges are directed to the Delmas Municipality's wastewater reticulation system (Golder 2021).

Vulnerability in terms of Water Quality

- Based on the water quality analysis from the borehole tests (i.e., 2011 and 2021), any negative impact of the activity on the site area from local and/or regional potential sources, have obviously not manifested through time, because operations on the site have commenced as early as 1992.
 - The water quality type is a Ca/Mg–HCO₃, low TDS concentrations and no elevated macro/micro-elements, trace metals concentrations and/or phenolic compounds.

- This compares well with the general water quality in the surrounding area as per the 2021 hydrocensus survey in the area (Golder 2021), and latest groundwater quality results (2024/10/08) as indicated in Section 4.3.5.

Vulnerability in terms of Water Quantity

- Long-term water level measurements, i.e., since 2011 report a water rise at the site area that could be related to (i) higher recharge in the region, and/or (ii) a general decrease in groundwater abstractions in the area.
 - Continuous water level monitoring on the site area should be maintained at all times (Golder 2021).

Considering the fact that the basement rock formation in the area is a thick dolomite rock formation, deep leaching of chert-rich zones interbedded the dolomite rock could enhance ground stability risks, especially if the water table is lowered considerably due to abstraction, i.e., >6-7 m. This could develop into the formation of dolines and/or depressions where surface water accumulation forms and drains into the underlying dolomite. In the case of the McCain Delmas Site, the area is shielded by a thick chert layer – the Rooihooft Chert Formation (Golder 2021).

No superficial doline/depression features have been noted through the years and the factory follows the engineering construction principles by having large concrete pavements with storm water drainages installed in the factory area. A site “walk over” by a geotechnical expert has been conducted in July 2021 to confirm this aspect which limits potential impacts for the main aquifer system to acceptable levels (Golder, 2021b). No specific indication of the formation of dolines/depressions were noted; thus, the aquifer vulnerability in terms of surface deterioration(s) are currently present on the site area (see section 5.1.5.1, page 73) (Golder 2021).

4.3.2.2 Aquifer Classification

The aquifer system on the site area is classified as:

- A high yielding aquifer system (Karst with borehole yields >5 L/s) in terms of the groundwater potential, in terms of the former Department of Water Affairs (DWA) classification of borehole yields (Figure 4-5), i.e., the “Borehole Yield Classification”, this aquifer has a significant borehole yield classification. Individual borehole yields could be around 40 L/s and more (Golder 2021); and
- An aquifer containing “Good water quality”, i.e., a Class 0 water quality in terms of the hydrochemical composition (Golder 2021) and latest groundwater quality results (2024/10/08) as indicated in section 4.3.5.

Under the current water use figures (i.e., $\pm 0.78 \text{ Mm}^3/\text{a}$) it is estimated that the proposed abstraction ($1.257 \text{ Mm}^3/\text{a}$) is well balanced with the groundwater balance from local rainfall recharges and lateral flows from the upstream parts of the quaternary catchment. This is supported by the water level depths measured on the McCain Delmas Site area, i.e., a water level rise has been noted since 2011 on the site (Golder 2021).

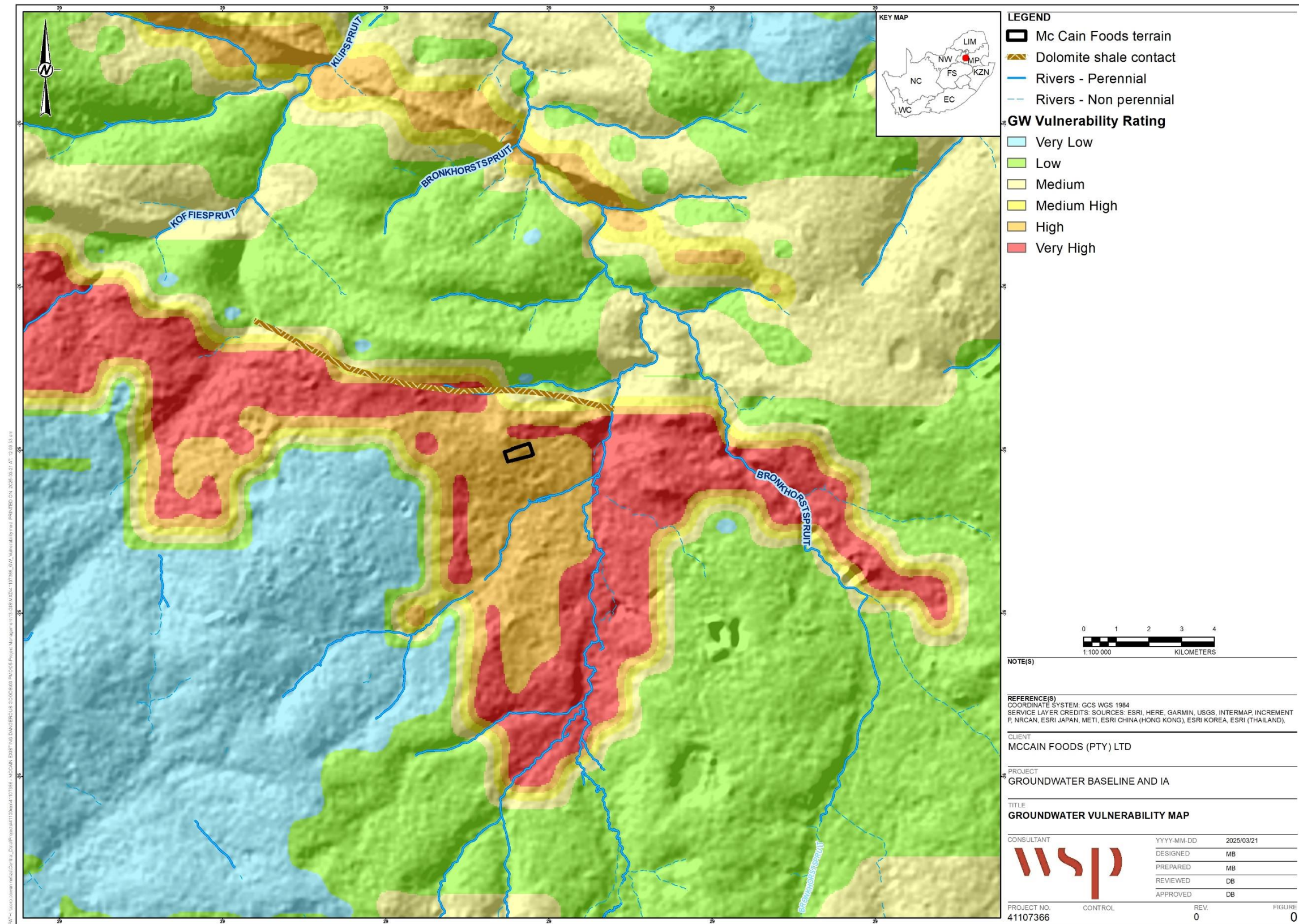


Figure 4-4 - Groundwater Vulnerability Map

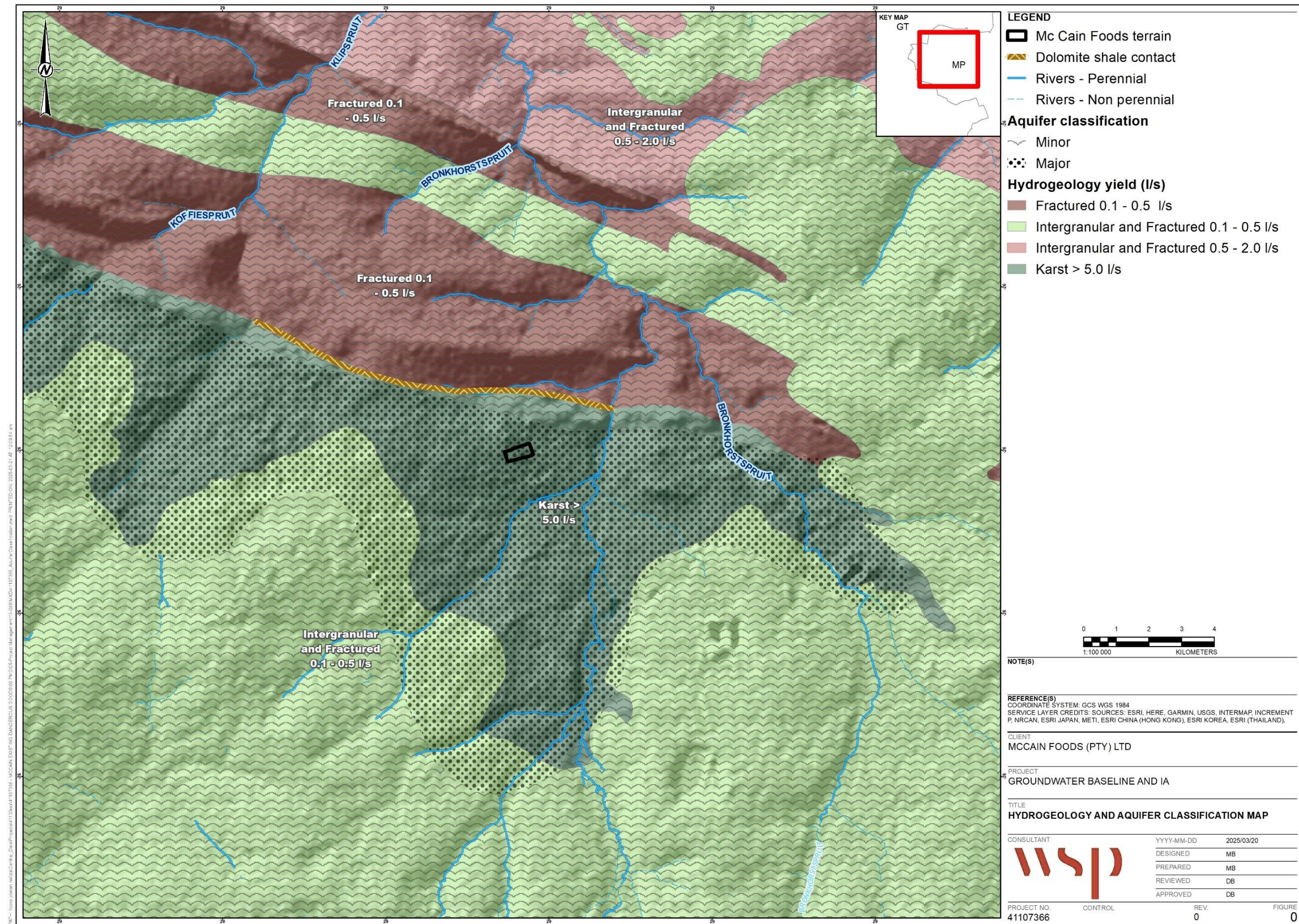


Figure 4-5 - Aquifer Classification

4.3.3 AQUIFER SYSTEM

Based on the existing groundwater information the McCain Delmas Site consists of two aquifer systems, namely:

- Weathered and fractured chert aquifer system; and
- Kart aquifer system.

4.3.3.1 Weathered and Shallow Fractured Chert Aquifer System

The weathered zone of the shallow chert band hosts the unconfined or semi-confined shallow weathered aquifer system. Due to direct rainfall recharge and dynamic groundwater flow through the unconfined aquifer in weathered sediments, the water quality is expected to be generally good, but in the absence of an overlying confining layer also vulnerable to pollution. Localised perched aquifers may occur on clay layers or lenses. Water intersections in the weathered aquifer are mostly above or at the interface to fresh bedrock (chert), where less permeable layers of weathering products and capillary forces limit the vertical percolation of water and promote lateral water movement (Aces, 2024).

Groundwater flow is governed by secondary porosities like faults, fractures, joints, bedding planes or other geological contacts, while the rock matrix itself is considered impermeable. Geological structures are generally better developed in competent rocks like chert, which subsequently show better water yields than the less competent intact rock matrix. Not all secondary structures are water bearing due to e.g. compressional forces by the neo-tectonic stress field overburden closing the apertures (Aces, 2024).

4.3.3.2 Kart Aquifer System

The karst/dolomitic aquifer system consists of chert-rich dolomite and chert breccias with boreholes yields exceeding 5 l/s. Water bearing properties of the dolomite stem from carbonate dissolution along structural and lithological discontinuities (such as faults, fractures, and joints). Storativity of South African dolomite aquifers generally vary between 1 and 5% (Barnard, 2000), but this property depends greatly on the extent of weathering and dissolution. Transmissivities can be several hundred m²/day or more. The aquifer can be regarded as a water-table aquifer with mostly unconfined conditions. Groundwater levels vary, however typically shallow in natural conditions, and show an immediate response to rainfall (WRC, 2011 – Aces, 2024).

4.3.4 GROUNDWATER LEVELS AND FLOW DIRECTION

The 2021 Golder hydrocensus groundwater levels have been adapted for the McCain Delmas Site. The groundwater flow direction at the site is mainly northeast towards the Bronkhorstspuit (Figure 4-6).

PATH: Y:\GIS Projects\1411362_McCainFoods\MXD\2015\Feb15\1411362_Census_Piezo_ContourA3Fra.mxd PRINTED ON: 2025-04-07 AT: 4:49:34 pm

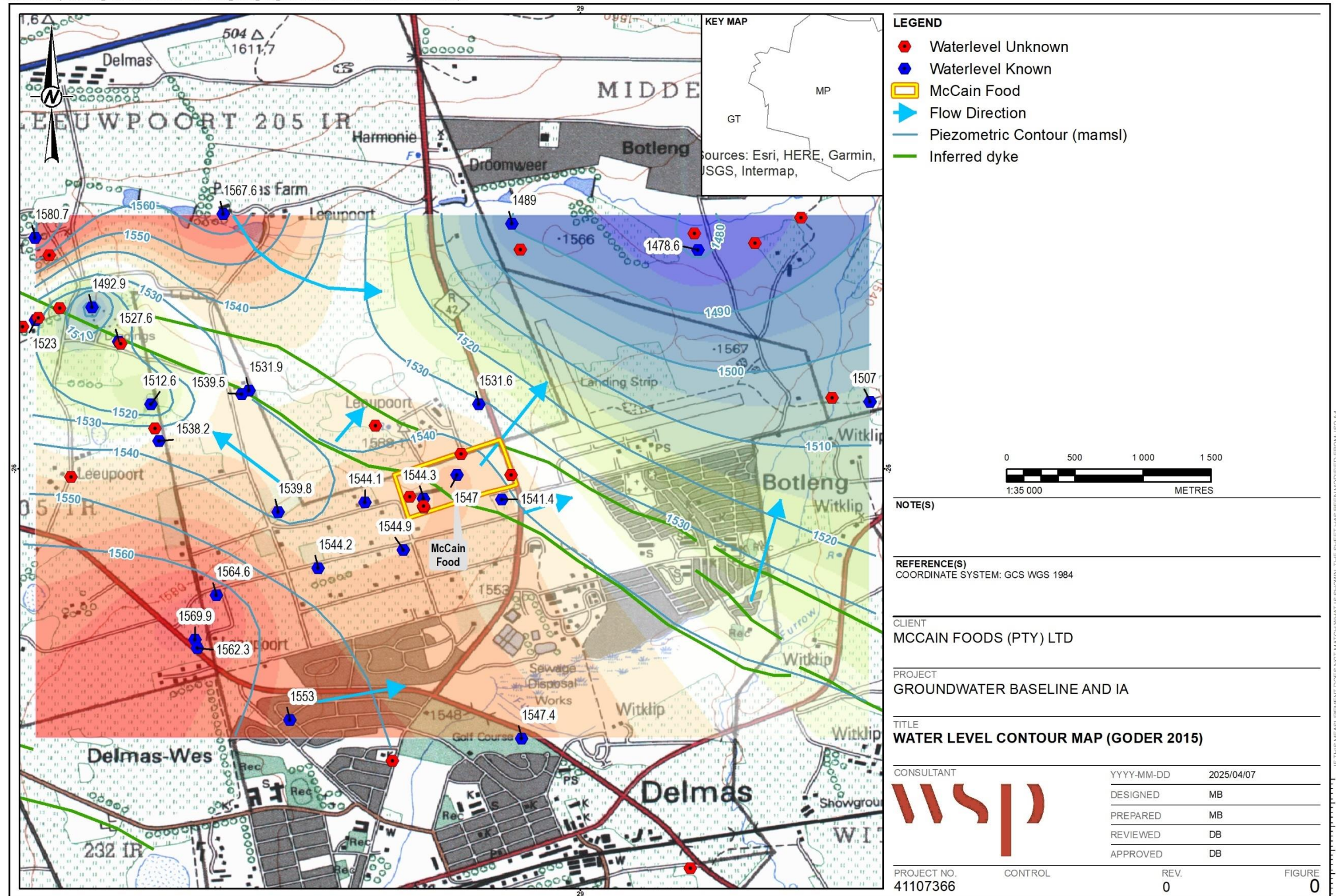


Figure 4-6 - Groundwater Flow Direction (Adapted Golder 2015/21)

4.3.5 GROUNDWATER QUALITY

The latest (2024/10/08) groundwater quality results were used to determine the current on-site groundwater quality (Table 4-7).

The analytical suite for water samples included major cations (e.g., Na, K, Mg, Ca), major anions (e.g., Cl⁻, F⁻, SO₄²⁻ and NO₃⁻), physico-chemical parameters (pH, conductivity, Total Dissolved Solids, Total alkalinity) and will include Cyanide, Cr, Fe, Al, Cu, Pb, Zn and trace elements as determined by ICP-OES).

The analytical results were compared to the following standards:

- Department of Water Affairs and Forestry, Domestic Water Quality Guidelines, Volume 1, 1996 and Water Research Commission, Water Quality Guidelines, 1998; and
- South African National Standards, Drinking Water Standards, 2015 (SANS 241:2015).

The SANS 241:2015 drinking water standard is used as reference guideline, whereas the DWAF 1998 guidelines were used to classify and discuss the water quality classes (Table 4-6). The analytical results are summarised in Table 4-7. A highlighted value in red (if any) exceeds the SANS 241:2015 maximum allowable limit, whereas the water quality classes are classified using the DWAF (1998) drinking water standards.

The latest on-site water quality results (2024/10/08) indicate that the groundwater has ideal water quality of Class 0 (Table 4-6).

Table 4-6 : DWAF Water Quality Classes (1998)

Water quality class	Description	Drinking health effects
Class 0	Ideal water quality	No effects, suitable for many generations.
Class 1	Good water quality	Suitable for lifetime use. Rare instances of sub-clinical effects
Class 2	Marginal water quality, water suitable for short-term use only	May be used without health effects by majority of users but may cause effects in some sensitive groups. Some effects possible after lifetime use.
Class 3	Poor water quality	Poses a risk of chronic health effects, especially in babies, children, and the elderly. May be used for short-term emergency supply with no alternative supplies available.
Class 4	Unacceptable water quality	Severe acute health effects, even with short-term use.



Table 4-7 - Summarised Latest's Analytical Results

Borehole	Date Analysed	Physical Determinants			Chemistry											Class
No.		pH	EC mS/m	TDS mg/l	MALK	Ca	K mg/l	Mg mg/l	Na mg/l	Cl	NO ₃ as N	SO ₄ mg/l	F	Fe	Mn	
					mg/l	mg/l				mg/l	mg/l		mg/l	mg/l	mg/l	
A 0326	2024/10/08	7	25.9	148	102	26	1.98	11.2	8.28		2.35		<0.2	0.0227	<0.01	0
Borehole 1	2024/10/08	6.96	26.1	140	102	26.5	1.31	13	5.53		3.91		<0.2	0.0265	<0.01	0
Borehole 3	2024/10/08	6.4	24.9	138	68	19.1	1.32	11.1	8.76		4.04		<0.2	0.0191	<0.01	0
Borehole 1	2024/10/23	7.32	29.8	186	123	31.5	1.46	63	6.94	18.1	4.54	2.63	<0.2	0.0315	<0.0002	0
SANS241: 2015 Max. Allowable Limit		≥ 5 to ≤ 9.7	≤ 170	≤ 1200		150	50	70	≤ 200	≤ 300	≤ 11	≤ 250, ≤ 500	≤ 1.5	<0.3;2	<0.4	
Class 0 Max. Allowable Limit		7-9.5	<70	<450	-	<80	<25	<70	<100	<100	<6	<200	<0.7	<0.01	<0.1	0
Class 1 Max. Allowable Limit		9.5-10	70-150	450-1000	-	80-150	25-50	70-100	100-200	100-200	6 to 10	200-400	0.7-1.0	0.01-0.2	0.1-0.4	1
Class 2 Max. Allowable Limit		10-10.5	150-370	1000-2400	-	150-300	50-100	100-200	200-400	200-600	10 to 20	400-600	1.0-1.5	0.2-2.0	1.0 to 4.0	2
Class 3 Max. Allowable Limit		10.5-11	370-520	2400-3400	-	>300	100-500	200-400	400-1000	600-1200	20-40	600-1000	1.5-3.5	2 to 10	4.0 to 10.0	3
Class 4 Max. Allowable Limit		>11	>520	>3400	-		>500	>400	>1000	>1200	>40	>1000	>3.5	>10.0	>10.0	4

4.3.6 GROUNDWATER CLASSIFICATION

The groundwater quality results of latest (2024/10/08) groundwater quality results are visually represented on an expanded Piper and Durov diagrams to distinguish between the different water quality classes/types.

4.3.6.1 Piper Diagram

Piper diagrams graphically represent the relative percentages of anions and cations in water samples. The cation percentages are plotted in the left triangle and the anion percentages in the right triangle. A projection of these cation and anion presentations onto the central diamond presents the chemical signature of the major ion composition of the water.

All the available samples plot on the blue sector of the diagram and represent background groundwater quality, calcium magnesium bicarbonate type of water (Ca,Mg)(HCO₃)₂). This type of groundwater is associated with recent rainfall recharge and not impacted, Class 0 water quality (Figure 4-7).

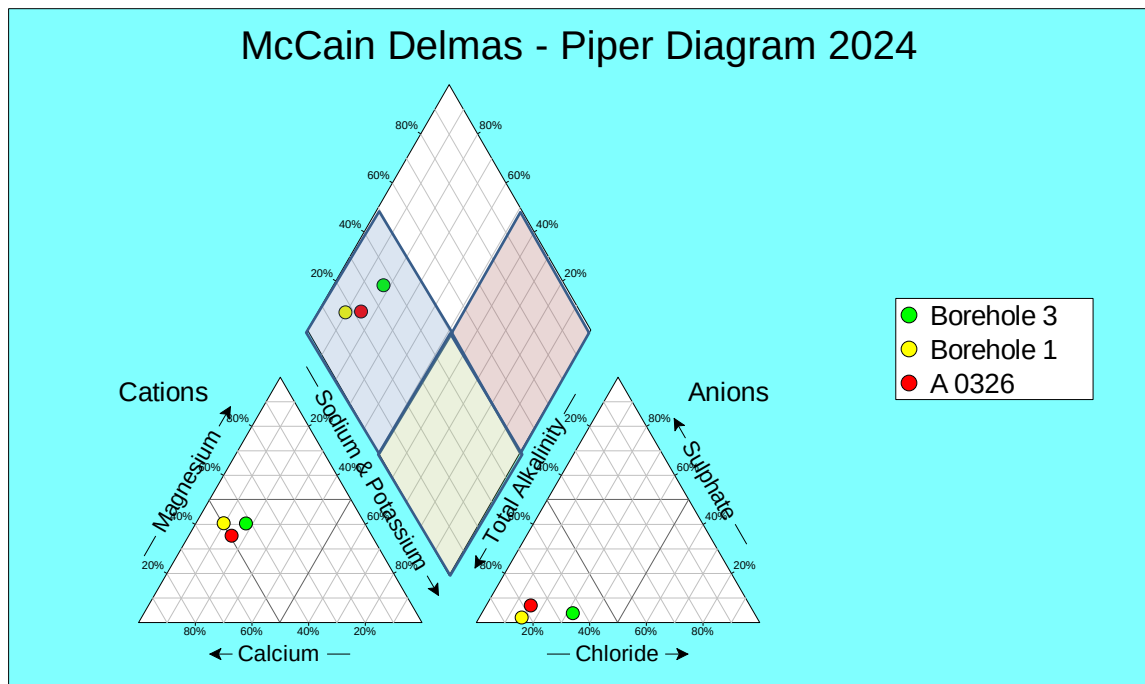


Figure 4-7 - Piper Diagram

4.3.6.2 Expanded Durov

Expanded Durov diagrams graphically represent the relative percentages of anions and cations in water samples. The cation percentages are plotted in the top part of the diagram and the anion percentages in the left part. A projection of these cation and anion percentages onto the central area presents the chemical signature of the major ion composition of the water. The chemical signature can be related to various hydrochemical environments and conditions.

All the available samples plot on the blue sector of the diagram and represent background groundwater quality, calcium magnesium bicarbonate type of water $(Ca,Mg)(HCO_3)_2$, Class 0 water quality (Figure 4-8).

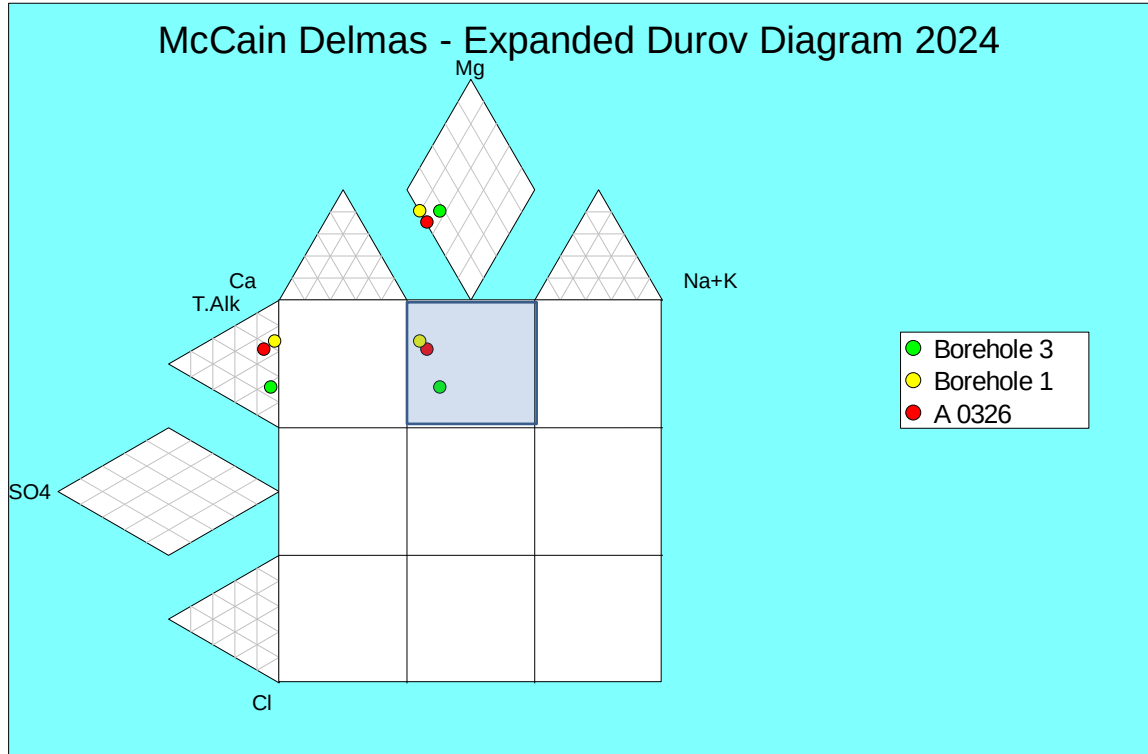


Figure 4-8 - Expanded Durov Diagram

4.3.7 GROUNDWATER CONCEPTUAL MODEL

The groundwater conceptual model of the site area is illustrated in Figure 4-9 (Golder, 2021).

Groundwater has been abstracted for the dolomite aquifer on the Delmas Site since 1992. Three detailed borehole yield tests were conducted on the selected production boreholes for the site, i.e., BH-1B (in 2019 by GCS), BH-3B (in 2011 by GCS) and BH4 (in 2021 by GCS). The geological information and borehole performance status were used to construct the groundwater flow regime on the site region (Golder, 2021).

A groundwater conceptual model has been developed showing the groundwater flow regime and is illustrated in Figure 4-9 below. Important aspects of the conceptual groundwater model are highlighted as follows:

- The site area lies on a prominent formation represented by a remnant of the Rooihogte Chert (Vr) Formation consisting of chert and quartzite ranging from fresh (deeper parts) to highly fractured and eroded (upper parts).
- The main aquifer is the Malmani Dolomite (Vma) formation consisting of a massive dolomite basement with secondary layers of chert – main water strikes on the site area is leached fracture zones forming part of an interconnected network of water bearing zones [probably] down to a depth of 100±20 m.
- Further north the Malmani Dolomite is overlain by the Timeball Hill Shale (Vt, ferruginous) formation. This formation forms a small escarpment directing surface runoff towards the underlying Malmani Dolomite formation.
- The dolomite aquifer system represents a significant water system with high transmissivity (130 to 400 m²/d) and storativity (~1.13E-01) – taken from local studies in the dolomite water area (Golder, 2020) and indicated by the 2011 (BH-3B), 2019 (BH-1B) and 2021 (BH04) production borehole test pumping exercises (Golder, 2021).

The hydrological cycle on the Delmas Site area includes the following components:

- Direct (or vertical) recharge from rainfall is estimated at 10.8 Mm³/for the B20A quaternary catchment based on the “dry season” annual volume (URRP) Groundwater Resources Assessment II estimate (DWAF, 2005).
- Lateral groundwater flow through the dolomite aquifer system is indicated on the conceptual model and indicates an eastward flow regime towards a secondary branch of the Bronkhorstspuit. The upstream quaternary catchment has a UGRP of 10.32 Mm³/a. It is estimated that at least 24% of this annual recharge potential drains towards the B20A quaternary catchment via preferential northwest-southeast pathways, i.e., large diabase/dolerite structures.
- As indicated above (see discussion under section 5.2) the Stress Factor (~0.18) is regarded as minimal and allows enough space for long-term adjustments, e.g., source depletion during significant climate variations.

In closing, long-term aquifer saturation levels over time, i.e., 2011 to 2021) indicates that historic groundwater abstractions from the McCain Delmas Site have not resulted in a groundwater resource depletion condition as the local water level has risen ~4.

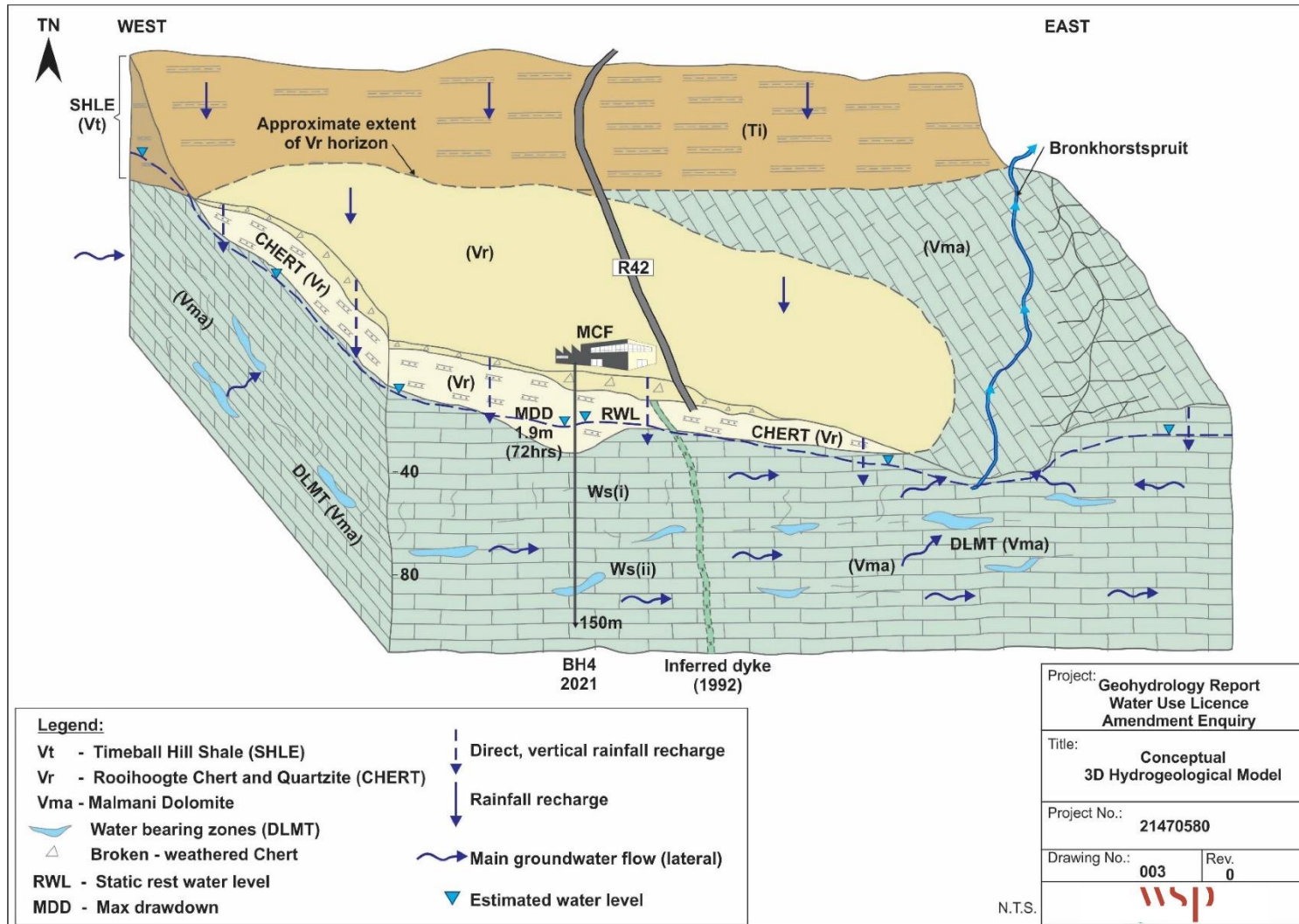


Figure 4-9 - Groundwater Conceptual Model (Adapted from Golder 2021)

5 QUALITATIVE IMPACT ASSESSMENT

5.1 IMPACT ASSESSMENT METHODOLOGY

5.1.1 ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed Project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct¹, indirect², secondary³ as well as cumulative⁴ impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria⁵ presented in Table 5-1.

Table 5-1 - Impact Assessment Criterion and Scoring System

Criteria	Score 1	Score 2	Score 3	Score 4	Score 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action

¹ Impacts that arise directly from activities that form an integral part of the Project.

² Impacts that arise indirectly from activities not explicitly forming part of the Project.

³ Secondary or induced impacts caused by a change in the Project environment.

⁴ Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

⁵ The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Criteria	Score 1	Score 2	Score 3	Score 4	Score 5
restore after the activity has caused environmental change					
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
Impact Significance Rating					
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High

5.1.2 IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction

of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 5-1 below.

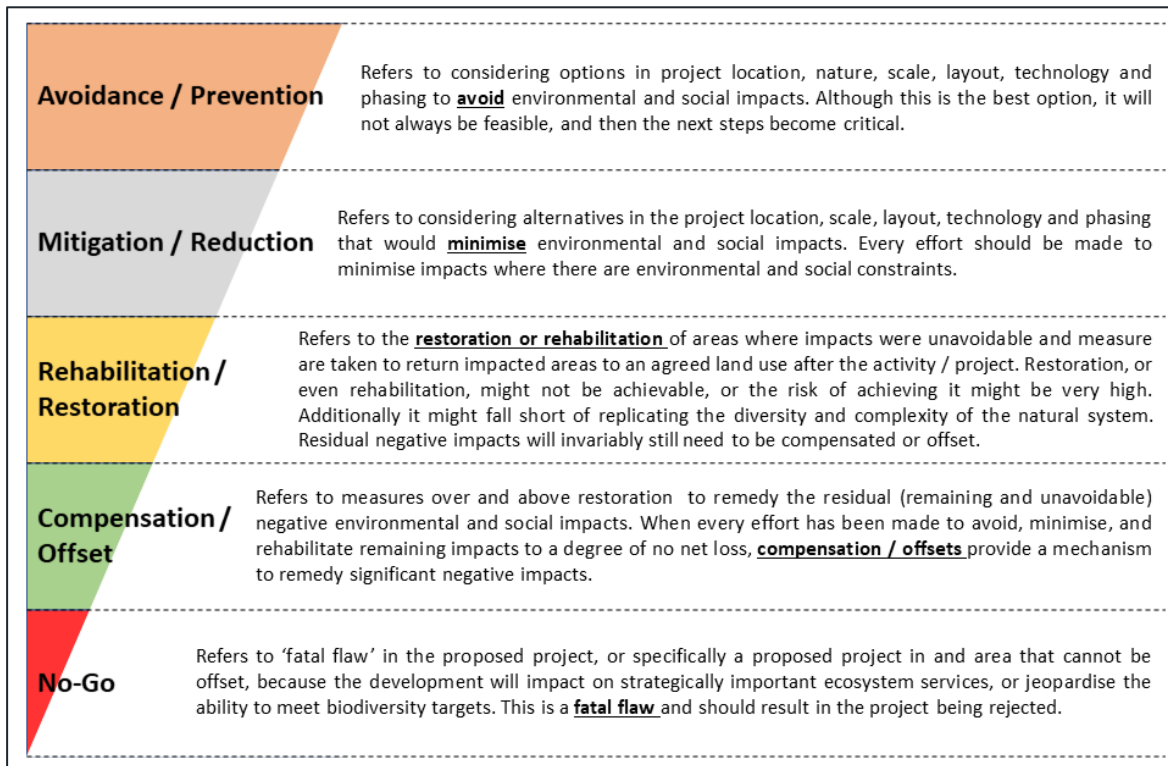


Figure 5-1 - Mitigation Sequence

The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

5.1.3 POSSIBLE IMPACTS ON GROUNDWATER

The possible impacts from the proposed WWTP and expansion of the diesel storage facility on the groundwater regime are evaluated against possible impacts on groundwater quality and quantity.

McCain Delmas utilise groundwater for their daily operations from three (3) boreholes situated on the site area (Aces, 2024). If additional groundwater is used during the construction phase of the WWTP, it is expected that the groundwater abstraction would increase and could change the volume of groundwater in the aquifer storage (e.g. lowering of water table).

Possible impacts on the groundwater resulting from the Project are:

- Impact on groundwater quality:
 - The WWTP in essence stores wastewater generated from waste material and liquid, either obtained from waste products (as feed) or as water production as effluent. The proposed engineering designs indicate the waste will be kept in specially designed storage holding areas and tanks. The WWTP storage facilities and tanks are designed to prevent any seepage or leakage from the waste to enter groundwater and the environment. However, leakage could occur causing localised contamination of the groundwater.
 - The expansion of the diesel storage facility should not pose any significant risk on the groundwater apart from accidental spillages or leakage.
- Impact on groundwater quantity:
 - Lowering of water levels impacting on surrounding groundwater user's boreholes and fountains (if any); and
 - Risk of subsidence and sinkhole formation due to excessive lowering of the water table within the karst formation (see Section 5.1.5). Sinkholes primarily occur due to one of two factors, namely concentrated ingress of water or extensive abstraction of groundwater. The interaction between groundwater and soils in nature causes soil loss, which is the mechanism of sinkhole formation.

Table 5-2, below provides a detailed analysis and classifications for the Construction & Operational, Decommissioning and Closure Phases of the proposed WWTP and diesel storage expansion facility respectively. For both the proposed WWTP and diesel storage facilities, the Environmental Significance Rating is very low negative, falling within the avoidance/prevention mitigation hierarchy to avoid environmental and social impacts.

The following Mitigation Measures can be implemented in case of accidental spills or leakages from the proposed facilities:

- Lined and roofed storage facilities as per engineering designs; ;
- Prevent and control surface runoff in case of spillage or leakage of waste storage facilities;
- Effective stormwater systems; and
- During construction phase, earthworks may remove soil cover reducing the travel time for any potential source of contamination to migrate into the aquifer, potentially impacting on the groundwater. Control any localised spillage, such as hydrocarbons, from earthworks machines.

5.1.4 GROUNDWATER CUMULATIVE IMPACTS

Groundwater Cumulative Impacts from the project are possible impacts arising from the combination of impacts from existing project infrastructure and the proposed WWTP and diesel storage facilities.

The cumulative environmental significance rating for both the proposed WWTP and the diesel storage facility is assessed as very low negative. These developments fall within the "avoidance/prevention" level of the mitigation hierarchy, indicating that with proper planning and design, potential environmental can be effectively avoided or prevented. As such, the cumulative impact McCain Site on the receiving environment is not considered significant.

Table 5-2 – McCain Delmas Groundwater IA

Criteria	Score 1	Score 2	Score 3	Score 4	Score 5	Impacts on the Groundwater Quality Construction & Operation		Impacts on the Groundwater Quantity Construction & Operation		Impacts on the Groundwater Quality Decommissioning & Closure	Impacts on the Groundwater Quantity Decommissioning & Closure
Impact Magnitude (M)	Very low:	Low:	Medium:	High:	Very High:	WWTP	Diesel Storage Tank	WWTP	Diesel Storage Tank	WWTP	Diesel Storage Tank
The degree of alteration of the affected environmental receptor	No impact on processes	Slight impact on processes	Processes continue but in a modified way	Processes temporarily cease	Permanent cessation of processes	2	1	2	1	1	1
Impact Extent (E)	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries						
The geographical extent of the impact on a given environmental receptor						2	1	2	1	1	1
Impact Reversibility (R)	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action						
The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change						1	1	1	1	1	1
Impact Duration (D)	Immediate:	Short term:	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite						
The length of permanence of the impact on the environmental receptor	On impact	0-5 years				1	1	1	1	1	1
Probability of Occurrence (P)	Improbable	Low Probability	Probable	Highly Probability	Definite						
The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation						2	2	2	1	2	1
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ <i>Significance = (Extent + Duration + Reversibility + Magnitude) × Probability</i>					12	8	12	4	8	4
Impact Significance Rating											
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100						
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High	Very low	Very low	Very low	Very low	Very low	Very low
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High						

5.1.5 AQUIFER PROTECTION CLASSIFICATION

Risks for water quality deterioration (or pollution) is high in the case of a shallow dolomite basement condition due to the possibility that preferential ingress areas for surface water, collecting pollution on the surface is washed down into the saturated zone – in this case, the dolomite aquifer system.

The McCain Delmas Site area is shielded by a competent chert formation of between 10 and 20 m. Although this formation is a competent, the presence of preferential pathways to the underlying dolomite aquifer will enhance ingress of pollutants present on the surface, especially during heavy rainfall events on the site causing surface runoff events. The aquifer protection classification is regarded as high and frequent “walk-over” surveys should be conducted on an annual interval. It should be part of the annual terrain audits of the site area (Golder 2021).

During a walk-over survey of the site area in July 2021, the only area recognised as a potential surface water ingress risk in the southeastern corner of an area that used to be utilised as original wastewater control dam(s). A detailed geotechnical investigation of this area has been conducted and discussed in Golder, 2016. A small part of this (an area of ± 0.47 ha) has been classified as a Dolomite Stability Zone A and any construction features that may enhance surface water accumulation/ingress have been forbidden. However, the whole area has since been rehabilitated, and a surface water management design was developed (Golder, 2016), see Figure 5-2. This site is located in the eastern corner of the site area and is:

- ± 350 m south of abstraction borehole BH-1A;
- ± 530 m east of BH-3(MCF3B); and
- ± 610 m east of BH04 (Golder 2021).

In closing, the site area can be regarded as having a high level of protection in terms of surface water ingress.

5.1.5.1 DOLOMITE RISK/GROUND STABILITY ASSESSMENT

Although the site is underlain by a large dolomite water area, the area is fully “capped” by a 20 to 30 m thick chert formation, thus no outcropping dolomite rock are present on the site area. Several geophysical surveys in support of borehole site selection and geotechnical studies since 1992 were conducted on the terrain, as well as a detailed geotechnical investigation for a storm water drainage system. The latter survey was conducted following earlier rehabilitation work for the initial storm-water storage dams situated in the southeastern part of the site area (Golder 2021).

The gravity surveys do not high light any significant “gravity low” areas/zones on the McCain Delmas Site that may have a risk for ground stability due to lowering of the water level due to abstraction. According to the 2019 geophysical survey for the selection of drill site for Borehole BH04, the site was selected on a “residual gravity” value of -0.27 mgal.

The geological log indicated that solid chert and dolomite were intercepted and three water bearing zones were intercepted namely:

- A shallow “dry” zone one at 21 m ($\phi=0.5$ m);
- A water bearing zone at 44 m ($\phi=0.5$ m); and
- A deep-water bearing zone at 81 m ($\phi=4.5$ m).

No dolomite residue in the form of soft clay WAD were intercepted; thus, these water bearing zones are merely leached fracture zones in a mass of competent dolomite rock (Figure 5-2).

At least two geotechnical investigations were conducted on the site area. During the initial geotechnical investigation in 1992, the area was described “to represent a low risk in terms of instability associated with dolomitic terrain” (Pollock et al, 1992). During this investigation a thorough study of the geological profile, including the overburden were conducted, at least five boreholes were drilled, and 15 geotechnical test pits were made and no specific evidence of thick leached dolomite residue, i.e., thick deposits of WAD, were encountered in these boreholes and test pits.

More recently, i.e., 2016, surface water management on the site area has been given a high precedence of the study and management protocols have been put forward. This requirement came during the rehabilitation of the original storm water storage facility situated in the southeastern corner of the site area. The rehabilitated area is shown in Figure 5-2, the wastewater stream of the plant is discharged into the municipal wastewater reticulation system. This area was regarded as a high-risk area as overflows from the storage dams could have affected the underlying dolomite aquifer systems in terms of ground stability and water quality.

The investigation included a geophysical survey (gravity method), exploration boreholes (4) and test pits (4). The test pits were for selecting adequate fill material for the rehabilitation works and fall outside the investigated area (i.e., along the eastern boundary of the McCain Delmas Site.

This rehabilitated area (Figure 5-2) was subdivided into four different “inherent hazard zones (IHCs) and corresponding dolomitic areas have been delineated (Figure 5-2), i.e.:

- **Dolomite Stability Zone A:** zone designated to areas reflecting high inherent hazard risk of large sinkhole and subsidence formation in respect to water ingress, wad is present and deep dolomite bedrock. Inherent hazard Class 7/7 (**High**):
 - These areas are located on the north-eastern portion of the rehabilitated site, gravity survey depicted these areas as areas on ‘gravity highs. Borehole 1 (BH1) drilled on this area profiles a thin colluvium material underlain by very soft, completely weathered chert fragments with silty clay or sandy silty (chert residuum). Below these, the borehole profile show penetration rates below 10 seconds and no sample return which was interpreted as wad material of 6 m thickness prior intersection of solid dolomite at 41 m; and This area falls on the eastern part of the site area where no activity is taking place, nor any infrastructure developments are planned.
 - This area should be included in an annual physical inspection following the biennial drone survey as recommended in the Golder 2021 terrain assessment of the site area (see section 12.0, page 77 and Golder, 2021b).
- **Dolomite Stability Zone B:** zone designated to areas depicting medium inherent hazard risk of large-size sinkhole and subsidence formation. Inherent hazard Class 4/4 (**Medium**):
 - This dolomitic zone is orientated towards north-eastern portions of the site and marks a ridge trending NW-SE. It defines the zones of change in gravity gradients between ‘lows’ and ‘highs’ and was investigated with Borehole 3 (BH3). At depth, the borehole profile shows a thick horizon of silty clay and chert rock fragments – shale and chert residuum that low penetration rates, maybe indicative of minor presence of wad; and
 - This area falls on the eastern part of the site area where no activity is taking place, nor any infrastructure developments are planned.
- **Dolomite Stability Zone C:** zone reflecting areas of medium inherent risk of small-size sinkhole and subsidence. Inherent hazard class 2/4 (**Low-Medium**):

- This zone covers the majority of the site and is demarcated by intermediate gravity contours from the geophysical map. The Borehole 4 (BH4) in and around these zones proved thick chert horizons up to depths below 57 m. Neither sand nor dolomite were encountered.
- **Dolomite Stability Zone D:** low inherent risk of sinkhole and subsidence formation. Inherent hazard class 1/1 (**Low**):
 - Certain areas on the study area are marked by carbonaceous shale at depth, and profile subsurface succession (Borehole 3 – BH3) that reflect low inherent risk of sinkholes and subsidence formation.

Boreholes drilled in these areas intercepted sandy silt matrix (colluvium) up to 3 m underlain by silty clay with highly weathered chert fragments up to 6 m. A thick horizon silty clay (residual shale) was drilled up to carbonaceous shale bedrock at 31 m. This formation is probably evidence of local patches of Karoo Supergroup (Ecca Group, Vryheid Formation) sediments deposited in palaeo-erosional depressions.

One of the recommendations of the 2016 dolomite stability study for the rehabilitated terrain was that groundwater levels must be frequently monitored to guard against high water level depletions, i.e., >6-7 m in the long-term. As noted above, the three abstraction boreholes are situated more than 300 m from the rehabilitated area and according to the numerical modelling simulation, the long-term drawdowns will be much less than the 6-7 m limit.

During 2021, a terrain assessment was conducted by a Golder civil engineer that focussed specifically on the ground stability issues at all the boreholes sites. A technical memorandum (Golder, 2021b) was submitted and summarised as follows:

- The walkover site inspection on 21 July 2021 indicated no visible settlement or deformations on surface within the plant area;
- The areas around the production boreholes were also inspected and no significant visible deformation or settlements could be observed;
- Areas where physical activities occur, e.g., the raw product receival terrain have been paved and equipped storm water drainages, see Figure 5-2; and
- The areas around the plant areas e.g., cooling chambers, boilers, off-loading areas of agricultural products and external roads areas were inspected. The presence of storm water drain inlets were observed and all roads and external production areas were well paved.

Each borehole terrain was inspected as well and the following reported:

- The observations during the site visit held on 21 July 2021 reflected no significant surface deformations or settlements within the proximity of the existing production boreholes;
- The surface drainage conditions in and around monitoring borehole BH-2(MCF-3A) and current abstraction borehole MCF-3B are functioning effectively and no ponding areas were observed; and

The surface water infrastructure in and around BH-1B, a current production borehole requires attention. The area around the borehole casing needs to be properly backfilled, construction of a slightly elevated (viz., 15 cm above ground level) paved (or solid concrete block) to reduce the influx of surface water into the borehole casing which is exposed (Golder 2021).

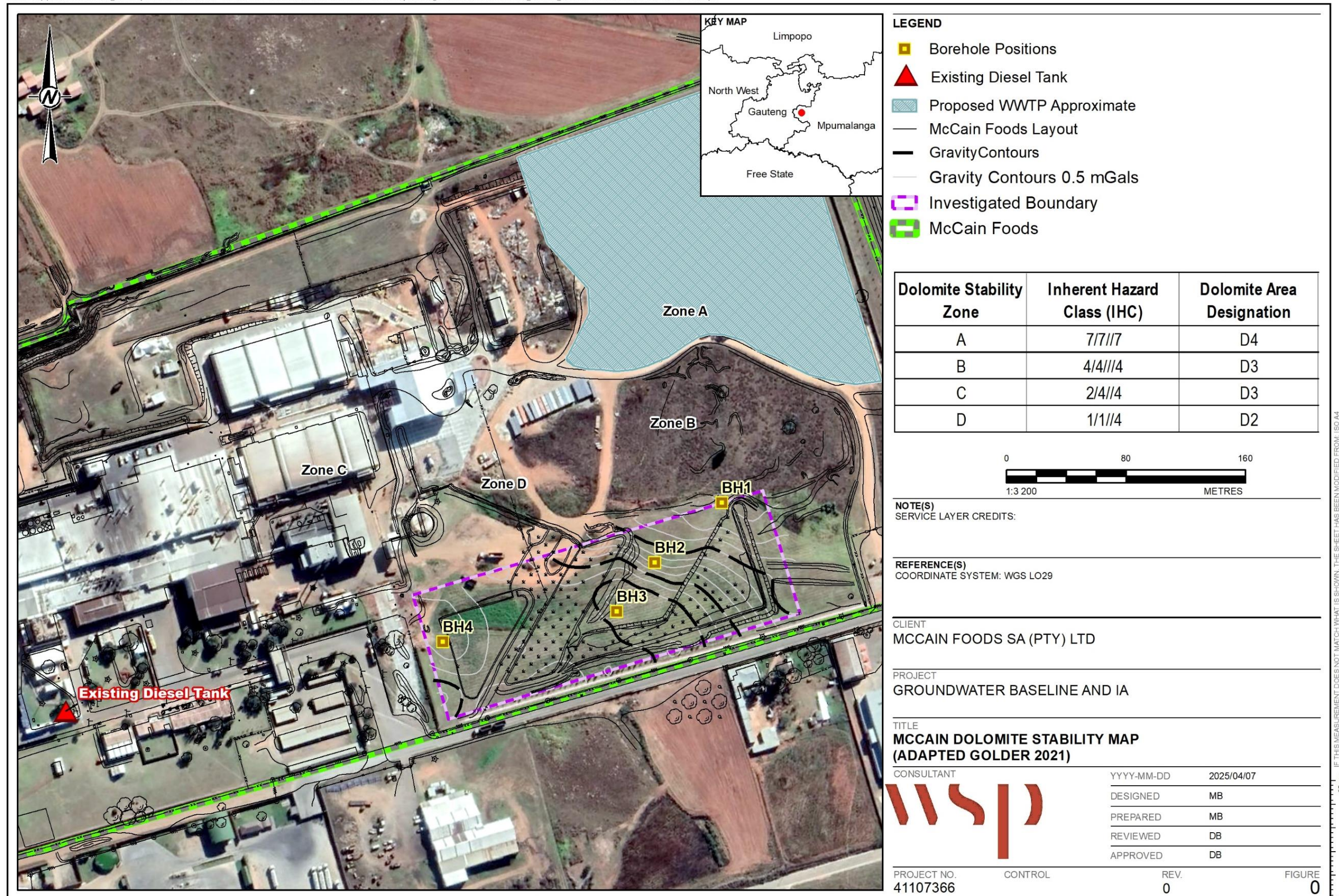


Figure 5-2 - Dolomite Risk Zones Demarcated after the 2016 Rehabilitation of the Storm Water Storage Facilities (Adapted from Golder, 2021)

5.2 GROUNDWATER MONITORING SYSTEM

5.2.1 GROUNDWATER MONITORING NETWORK

Four existing boreholes are available for monitoring the water use impacts on the site area, namely MCF1, MCF-1, BH-1 and BH-2, indicated in Figure 5-3 and represent the “on-site” monitoring boreholes for water use licence conditions (Golder 2021).

Monitoring Borehole BH-2 is situated in the main abstraction zone area and cover BH-3B and BH04, and BH-1 is close to the northern production borehole BH-1B. Due to space restrictions⁵ in Monitoring Borehole BH-1, it is recommended that the existing pump column is removed since this borehole is not used for abstraction, but (probably) fit for water level monitoring (Golder 2021).

There are seven (7) hydrocensus boreholes (viz. Golder 2021 hydrocensus survey) of which at least three (3) sites should be included as regional monitoring sites (with agreement from the landowners). The following boreholes are recommended as “Far Field” monitoring sites (Figure 5-4):

- MCH-02 (Private land, probably impacted by McCain abstractions);
- MCH-06 (Private land, irrigation borehole, no impact notices); and
- MCH-07 (Private land, occasional irrigation, no impacts noticed).

5.2.2 “ON SITE” MONITORING FREQUENCY AND PARAMETERS

“On Site” monitoring frequency and parameters. The following groundwater monitoring frequency is recommended (Golder, 2021):

- Groundwater levels at the selected Monitoring Borehole sites:
 - Site area – monthly intervals in boreholes BH-1, BH-2 (MCF3A) and MCF-2.
- Groundwater abstraction volumes:
 - Weekly water-flow meter readings from all abstraction boreholes, i.e., BH-1B, BH-3(MCF3B) and BH04 are required and should be regarded as a condition of the WUL Amendment; and
 - A tabular format of this information on a weekly interval is required to support future monitoring protocols and numerical modelling updates.
- Delmas Municipal water supply:
 - Weekly water volume “imported” from local municipal water source. This water supply is regarded as a “secured short term source” for (i) firefighting in the manufacturing plant and/or the site area and (ii) securing short-term daily water supply during critical periods of national line power supply.
- Groundwater quality characteristics:
 - Quarterly scheduled sampling and hydrochemistry analyses for the following boreholes:
 - BH-1B;
 - BH-3(MCF-3B); and
 - BH-4.

- Quarterly water quality analysis for the following hydrochemical constituents –
 - The analytical suite of the groundwater samples included (i) the major cations (Na, K, Mg, Ca), major anions (Cl, F, SO₄), (ii) physio-chemical parameters (pH, conductivity, Total Dissolved Solids and Total Alkalinity) and (iii) trace elements (including Fe, Cr, Se, Pb, Mn, Al, Zn, NO₃ and others determined by ICP-OES) (Golder 2021).

5.2.3 FAR FIELD MONITORING SITES (I.E., BACKGROUND RESPONSE MONITORING)

At least three (3) of the Far Field hydrocensus sites, i.e., MCH-02, MCH-06 and MCH-07 should be selected with the landowner's permission as the background monitoring sites and should address the following parameters:

- Quarterly water level measurements at:
 - At least two surrounding property owners (for example MCH-02 and MCH-07) should be measured.
- Quarterly water quality analyses at:
 - At least three surrounding property owners (for example MCH-02 and MCH-06 or -07 – using the same hydrochemical constituents' parameters as the required "on site" water quality analysis) should be sampled.
- Status of water use on the premisses, i.e., domestic/stock watering uses and/or irrigation water use must be noted on each quarterly survey (Golder, 2021).

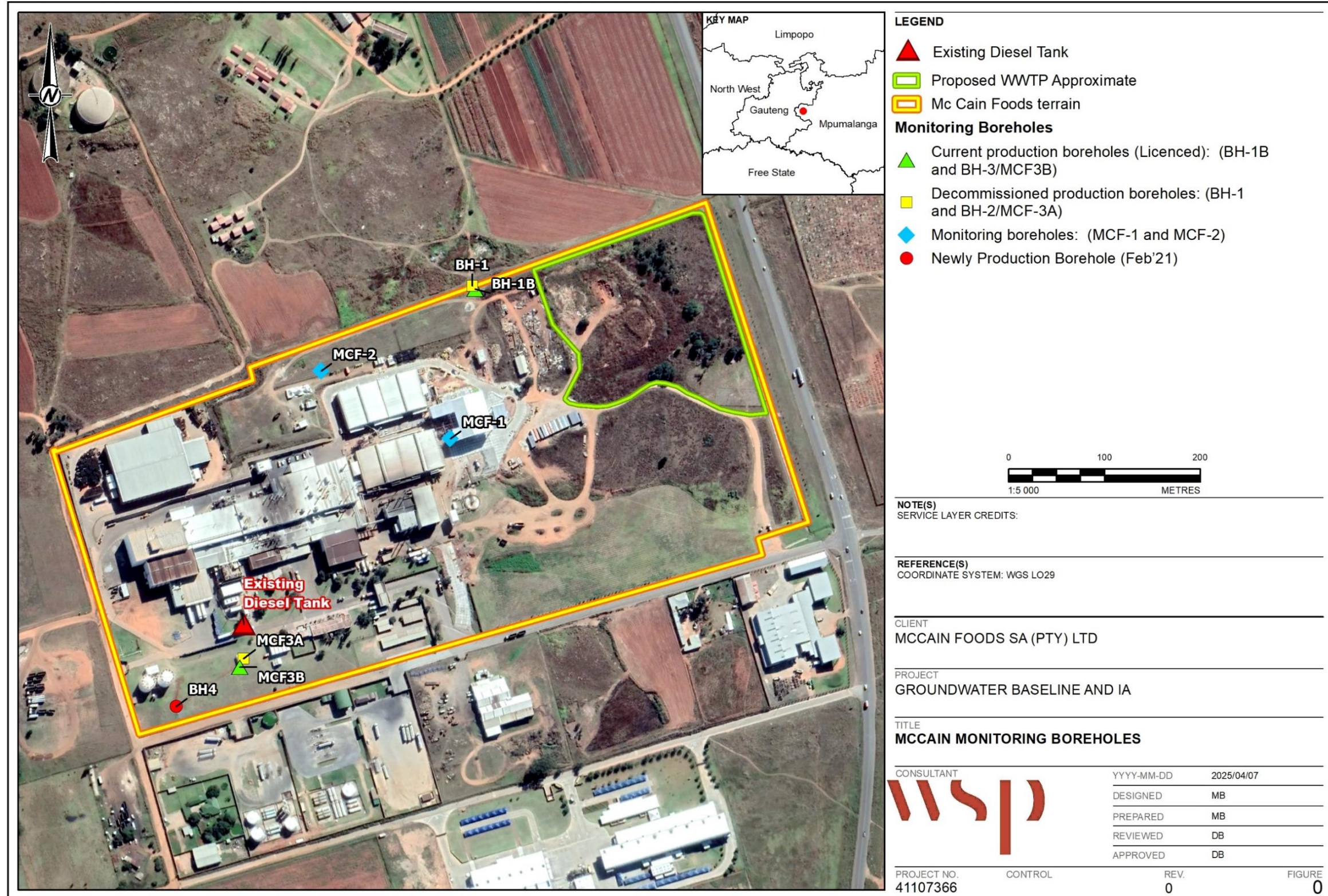


Figure 5-3 - McCain Delmas Monitoring Network (Adapted Golder, 2021)

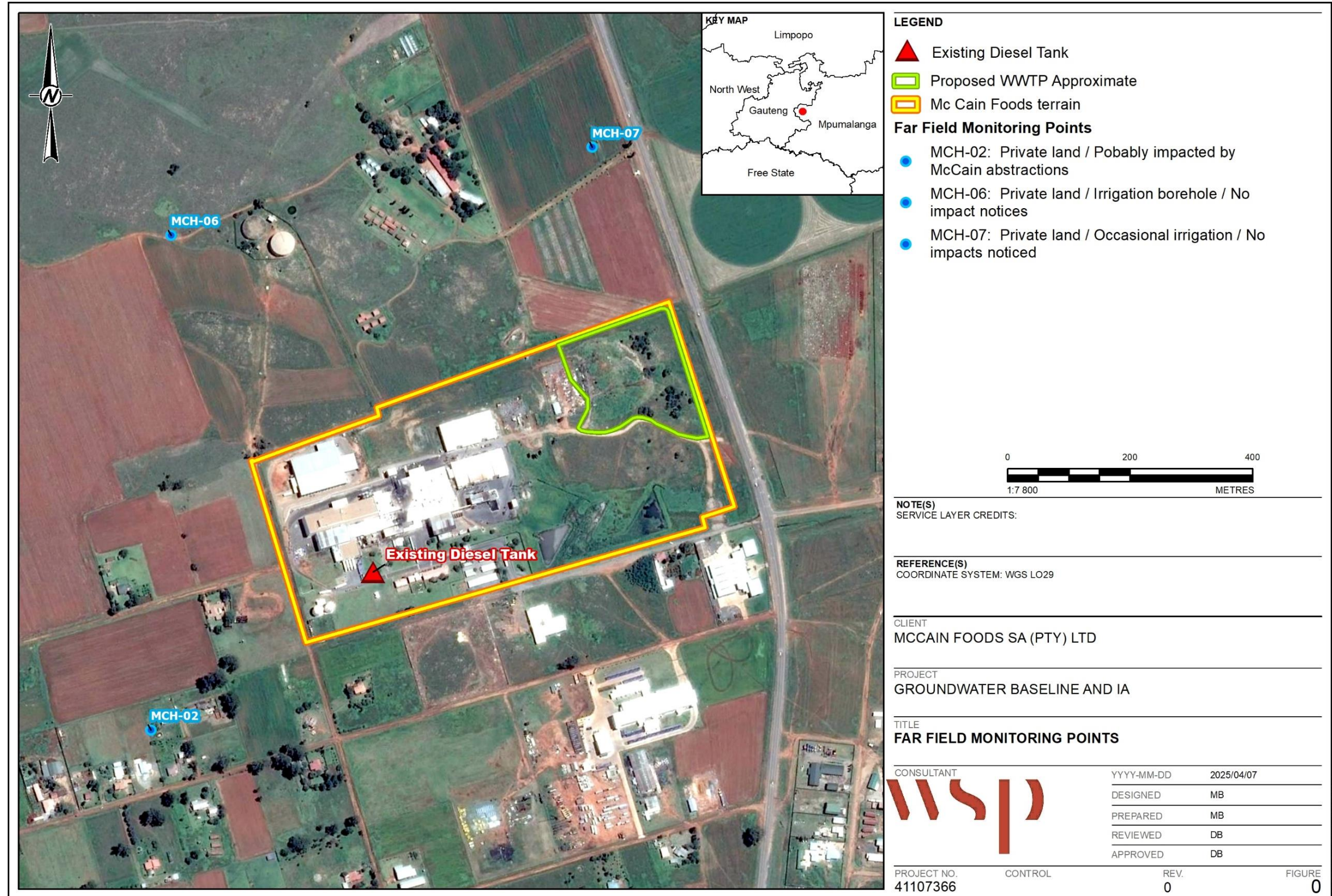


Figure 5-4 - Far Field Monitoring Points (Adapted Golder, 2021)

6 CONCLUSIONS AND RECOMMENDATIONS

The following groundwater conclusions are made relevant to impacts from the proposed WWTP and expansion of the diesel storage facility on the groundwater regime:

- Table 5-2, provides a detailed analysis and classifications for the Construction & Operational, Decommissioning and Closure Phases of the proposed WWTP and diesel storage expansion facility respectively. For both the proposed WWTP and diesel storage expansion facility, the Environmental Significance Rating is very low negative, falling within the avoidance/prevention mitigation hierarchy to avoid environmental and social impacts.

The following recommendations are made

- The groundwater monitoring programme needs to be maintained and expanded to include the private boreholes (far field monitoring) surrounding the site area. This includes:
 - Water levels;
 - Water quality analyses;
 - Groundwater abstraction rates/volumes should be monitored with flow meters at each of the three abstraction boreholes as per Section 5.2.2; and
 - Monitoring is also required from the proposed far field monitoring boreholes – as per Section 5.2.3.
- The available McCain Delmas Site monitoring network, both on-site and far field monitoring (section 5.2) are sufficient to monitor any possible impacts from current facilities on the groundwater and from the proposed diesel storage expansion project;
- An additional monitoring borehole should be installed down-gradient of the proposed WWTP (north-west site corner of the site) prior to construction phase. This borehole will act as early warning system for any possible contamination migrating of site. The groundwater flow direction is mainly towards the north-west (Figure 4-6); and
- Any additional monitoring should form part of the existing ISO14001 data management system. Store and assess the monitoring data as it will be required for annual water use audits (Golder 2021).

7 REFERENCES

- ACES (2024). McCain Delmas - Waste Water Treatment Plant (WWTP) - Geohydrological Study. Report Number: ZA2024_02.
- Golder (August 2021). McCain Foods South Africa (Pty) Ltd, Geohydrological Report for Water Use License Amendment Enquiry (DWS). Golder Report Number: 21470580-344623-1.
- Golder (January 2020). McCain Foods South Africa (Pty) Ltd, Groundwater Utilization at Delmas Site Area. Golder Report Number: 19132563-329576-1.
- Golder (February 2015). Hydrogeological Assessment for McCain, Delmas Operations. Golder Report Number: 1411362-13355-3.

8 DECLARATION OF INDEPENDENCE

I, Danie Brink (ID NO.:6304055023089), a duly authorised representative of WSP (Pty) Ltd, declare that I:

- Act as an independent specialist in this application.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed.
- Do not have nor will have a vested interest in the proposed activity proceeding.
- Have no, and will not engage in, conflicting interests in the undertaking of the activity.
- Undertake to disclose, to the competent authority, any information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

CONTACT DETAILS OF THE SPECIALIST

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Contact details: +27 11 254-4819 | danie.brink@wsp.com

Appendix A

HYDROGEOLOGIST CV





Danie Brink

Groundwater, Technical Director

CAREER SUMMARY

Danie Brink is a Hydrogeologist in the Groundwater Team, Mine Water Division of WSP Group Africa (Pty) Ltd. Danie is responsible for various groundwater supply and pollution studies at mining environments. Danie graduated with a BSc Honours degree in Geography from the University of South Africa (1991) and MSc Hydrogeology from University of Free State -IGS (2011) brings 36 years' experience of geophysical surveys for placement of monitoring networks in the mining sector.

His passion lies in groundwater resources investigations, comprising of management of geophysical surveys, boreholes siting, supervision of drilling and test pumping programmes and management of field contractors on site. Aquifer assessment to estimate the hydraulic parameters, hydrogeological characterization & mapping, water quality assessment, client liaison, data processing and report writing. Groundwater sampling programmes, data interpretations and slug testing. Danie has been responsible for various groundwater proposals and was project manager on numerous groundwater projects.

Countries of work experience include South Africa, Namibia, Botswana, Zambia, Mozambique, Ghana, Bakouma Central African Republic, and Tanzania.

2 Year with WSP

38 years of experience

Area of Expertise

Groundwater Pollution Studies

Geophysical Surveys for Placement of Monitoring, Supply and Production Borehole Networks in Mining Environments

Groundwater Resources Investigation and Development

Groundwater Supply Projects Rural Water Supply, Industrial and Mining

Specialised Drilling & Aquifer Testing Programmes

Aquifer Assessments

Groundwater Sampling Programmes

Groundwater Proposal and Project Management

Language

Afrikaans – Fluent

English - Fluent

EDUCATION

MSc Hydrogeology, University of Free State -IGS	2011
2 Year Certificate in Business Administration, University of South Africa	2002
BSc (Hons) Geography, University of South Africa	1999
BSc, University of South Africa	1996
National Diploma-Geology, Technicon Pretoria, South Africa	1989



Danie Brink

Groundwater, Technical Director

ADDITIONAL TRAINING

Mine Water Course, University of the Free State, 2008 Acid Mine Drainage Introduction, sampling, and monitoring activities in waste disposal sites with emphasis to Mining environment, introduction to WISH programme and introduction to groundwater in the Mining industry. 2008.

Technical Writing Course, GAA In-house, November 2008.

Project Management Course, GAA In-house (PM24), 9/06/2008.

Report Writing Course, wordsm; ths-Barbara English, July 2010.

Exploration Drill Rig Safety Training Course, DICASA, June 2011.

Project Management Fundamentals Course, GAA In-house, October 2012.

PROFESSIONAL MEMBERSHIPS

SACNSP (South African Council for Natural Scientific Professions, Pr. Sci. Nat.) Reg. no. 400027/11 2011

PROFESSIONAL HISTORY

WSP Group Africa (Pty) Ltd.	July 2022 – present
Golder Associates Africa (Pty) Ltd.	2007 – June 2022
VSA Geo-Consultants (Pty) Ltd.	2002 – 2007
Groundwater Project Management (Pty) Ltd	1998 - 2002
Department of Water Affairs (DWAF) Directorate Geohydrology	1985 - 1998

PROFESSIONAL EXPERIENCE – GEOPHYSICAL SURVEY & SUPPLY

Geophysical Survey and Groundwater Supply Projects - Various, South Africa:

As Learner Geohydrological Technician at DWAF, I was involved in various Geohydrological Projects. Ad hock borehole siting for various government departments in South Africa. Hydrocensus and groundwater sampling along the Nile River groundwater control area. Hydrocensus on the Dolomites of the Transvaal Sequence over the Grootfontein dolomitic Compartment. Discharge and recharge volumes were measured from irrigation dams as well borehole water level monitoring. Experience was gained in geological logging and pump testing of boreholes in the dolomites.

Geophysical Survey Walvisbay, Namibia; Member of investigation team to determine the volume of saturated sediments South of Walvisbay, along the Kuiseb River in Namibia which was estimated by modelling gravity and time-domain electromagnetic data, and calibrated by means of exploratory drilling, The position of the saline wedge due to seawater intrusion was mapped using the EM-34 electromagnetic method.

Member of the investigation team to conduct a gravity survey and drilling programme for possible groundwater supply to Zeerust from fault zones extending into the underlying dolomites (Northwest Province).

Member of gravity and electromagnetic survey team at Polfontein to identified potential groundwater resources.

Member of investigation team to determine the thickness of alluvium in the Limpopo River at Greefswald. EM-34 electromagnetic soundings were conducted and modelled to compile alluvial aquifer thickness contour maps. This investigation was for water supply to the Venicia diamond mine in the Northern Province.



Danie Brink

Groundwater, Technical Director

Part of geophysical team comprising out of gravitation and electromagnetic geophysical methods survey at Pomfret (North-western Cape) to identified potential groundwater resources for area and regional water supply.

Member of an investigation team who conducted a geophysical study at St Lucia and Richards Bay (KwaZulu Natal Province), to map salt-water intrusions into the freshwater lakes.

Cape Fold Belt (Southern Cape) research project for faulting and joint zones. Survey comprises out of Very Low Frequency (VLF) electromagnetic, EM-34 and magnetic survey.

Project leader of groundwater pollution study at Clayville - gravity survey (Gauteng) in the East Rand.

Member of the investigation team for Municipal groundwater supply projects for the following towns; Stella, Mareetsane, Amsterdam, Botriver, Francshoek, Ceres, Jefferysbay, Van Wyks Vlei, Williston and Groblersdal. Responsibilities included managing a drilling and test pumping programme that included drilling and test pumping supervision, borehole construction and groundwater sampling.

Part of investigation team conducting a combined gravity and seismic reflection survey at Bray (Northern Cape) to locate a graben structure beneath the Kalahari sediments.

Member of the investigation team to conduct an aquifer study at Witsand (Northern Cape). Geophysical survey comprises out of gravity, electromagnetic soundings, and magnetic method. Borehole drilling was conducted to confirm aquifer yield.

Part of the drought relief program in KwaZulu Natal for community water supply projects. Involvement included borehole siting, drilling, and testing supervision and geological borehole logging. Geophysical training of learner and junior technicians was also conducted as part of the programme.

Member of the investigation team to conduct a groundwater pollution study at Dundee (KwaZulu Natal) for proposed sludge irrigation site.

Member of the investigation team to conduct a groundwater pollution study at Paul Pietersburg (KwaZulu Natal) to determine groundwater contamination from coal mining activities.

Project leader of geophysical team conducting a characterisation study on the Transvaal Sequence Dolomite in the Nelspruit (Mpumalanga Province) area.

Municipal groundwater supply projects at Mara, Bandelierskop (Limpopo Province), Rietfontein, Mareetsane and Danielskuil (Northern Cape Province). Responsibilities included managing a drilling and test pumping programme that included drilling and test pumping supervision, borehole construction and groundwater sampling.

Member of the geophysical investigation team for kimberlite intrusions at Rietfontein (Northern Cape Province).

Part of Ghaaplatto LANDSAT research project - gravity, electromagnetic and magnetic survey.

Project leader of drought relief program for community water supply in Seshego, Mokerong 2 and Zebediela (Limpopo Province). Responsibilities included geophysical borehole siting, managing a drilling and test pumping programme, drilling and test pumping supervision, borehole construction and groundwater sampling.

Project leader of IFR (In Stream Flow Requirements) studies in the Mogalakwena Sabie and Sand rivers (Mpumalanga Province). Determination of sand thickness through selected river profiles using gravity, resistivity, and electromagnetic soundings methods.

Team member of geophysical LANDSAT research project at Adelaide (Eastern Cape).

Part of research and characterisation project in the Wolkberg (Limpopo Province) area to determine the extent of the karstification in these dolomites. Responsibilities included gravity survey, borehole siting, managing of drilling and test pumping programme, drilling and test pumping supervision, borehole construction and groundwater sampling.

Member of the investigation team of a research project at Calitzdorp (Southern Cape) to investigate the Cape Fold Belt underneath cretaceous sediments (Karoo sediments) - Gravity survey.



Danie Brink

Groundwater, Technical Director

Member of the investigation team of a research project across the Matlala and Moletsi Batholiths in the Limpopo Province for the possibility of groundwater occurrence on batholith contact zones at depth. Responsibilities included electromagnetic survey managing of drilling and test pumping programme, drilling and test pumping supervision, borehole construction and groundwater sampling.

Part of geophysical mineral exploration team for gold deposits near Barberton (Mpumalanga Province) - Electromagnetic survey.

Electromagnetic survey for mineral exploration for ISCOR, Iron deposits - Limpopo Province.

Part of the DWAF Refurbishment programme for community groundwater supply in Mokerong 1(Limpopo Province) - Involvement includes hydrocensus, crisis identification, geophysical surveys, borehole siting, geological logging, pump test and drilling supervision.

Part of pollution control study's at Koorfontein and Douglas collieries near Witbank (Mpumalanga Province) - borehole logging and drilling supervision, slug testing, EC measuring and water sampling of pollution inflows into boreholes.

Groundwater Strategic Planning and Groundwater Data Management Various, South Africa:

KwaZulu Natal Groundwater perspective - Compilation maps on ArcView.

El Nino mitigation program- study report for DWAF.

The possible utilization of governmental drilling rigs of the Northern Province under the water services program - study report

Borehole data management of Northern Province Refurbishment programme - Aquabase groundwater database.

Borehole data management of the Limpopo Province - Aquabase. Compilation of user maps - ArcView.

Assisting with groundwater statistics and First Order Strategy maps of Limpopo, Northwest Eastern Cape, Free State, Mpumalanga, Northern Cape, and KwaZulu Natal Provinces.

Compiling of Limpopo, Eastern Cape, and KwaZulu Natal provinces Groundwater Development Strategic planning maps - ArcView.

Geophysical Survey and Groundwater Supply Projects - Various, South Africa:

Bothithong (Northern Cape), responsible for hydrocensus and borehole verification.

Conduct Stratagem survey at Manthatayaneng (groundwater supply project), and processing of data.

Project team leader for Kgalagadi community water supply project. Responsibilities included borehole verification, geophysical borehole siting, managing of drilling and test pumping programmes, drilling and test pumping supervision, borehole construction and groundwater sampling. Pump test analyses and management recommendations of boreholes for K GALAGADI water supply program and Lily Farms (Zambia project) with FC interpretation software.

Groundwater supply project for irrigation farmers at Kookfontein and Jagersfontein in Northwest Province. Responsibilities included geophysical survey, drilling and test pumping supervision, borehole construction and groundwater sampling.

Member of investigation team at Coligny verification project for the possible groundwater resource potential of granite aquifer for water supply augmentation. Responsible for detailed hydrocensus survey and resource assessment.

Responsible for drilling and testing supervision at Bapong community water supply project. Responsible for data processing and management recommendations with FC interpretation software.

Danie Brink

Groundwater, Technical Director

Part of Moshaweng village sanitation project, which include borehole verification, water quality sampling, identification of aquifer and source protection zones and potential pollution sources.

School sanitation project (Gill and Ass.), which include borehole verification, village baseline water quality, identification of aquifer and source protection zones and potential pollution sources. Assist in report compiling.

Pump testing of existing boreholes at Lanseria Polo Estates development, Water quality analyses and management recommendation - Report.

Geophysical groundwater investigation at Pollack Park Golf Course in Springs - Gauteng Province. Data analysis and report writing.

Geophysical survey, Orapa, Botswana Conduct a Stratagem survey to outline kimberlite intrusions at Orapa and Lethlakane kimberlite diamond mines in Botswana.

Grootpan Dolomite Survey. Detailed Hydrocensus surveys of boreholes and springs for updating of groundwater databases and hydrogeological investigations.

Willodene (Free State Province), groundwater supply project. Responsible for electromagnetic (EM) and magnetic geophysical investigation for groundwater and report writing.

Part of Source development programme for drought relief villages in the Limpopo Province. Responsible for geophysical survey comprising out of electromagnetic and magnetic methods for groundwater and report writing.

Crocodile Creek Polo Estate. Prepare relevant documentation for borehole licensing procedures and Water service provider contract.

Vryburg South, groundwater supply project for low-cost residential development. Responsible for geophysical survey.

Hyde Park High School. Geophysical survey comprising out of electromagnetic and magnetic methods.

Mabeskraal sanitation survey. Responsibilities include borehole verification, water quality sampling, identification of aquifer and source protection zones and potential pollution sources.

Laxey Gravity groundwater supply Project. Responsible for geophysical survey comprising out of gravity and magnetic methods.

Project team leader of Uitvalgrond (Northwest Province) groundwater supply project. Management of extensive gravity survey and data manipulation.

Fullgro gravity survey in Northwest Province for manganese deposits Responsible for drilling and test pumping supervision, groundwater sampling of exploration boreholes.

Camden and Wyksfontein ward 8, community groundwater supply projects. Responsible for geophysical survey.

Burnstone groundwater project at Balfour in Mpumalanga Province. Responsible for test pumping supervision. Data analyses of test results with FC interpretation software and report writing.

Mabula Lodge groundwater supply project (Limpopo Province). Responsibilities included managing of drilling and test pumping programme including drilling and test pumping supervision, borehole construction and groundwater sampling. Interpretation and management recommendations of test pumping results with FC interpretation software.

Magalies Water Round 7, community supply programme (Ruigtesloot, Transactie and Tweelaagte; 36 Boreholes drilled). Responsibilities included managing of drilling and test pumping programme which include drilling and test pumping supervision, borehole construction and groundwater sampling. Pump test data interpretation and management recommendations (FC software).

Drought Relief project at Derby in Northwest Province (13 Boreholes drilled). Responsibilities included managing of drilling and test pumping programme which include drilling and test pumping supervision, borehole construction and groundwater sampling. Pump test data interpretation and management recommendations (FC interpretation software).



Danie Brink

Groundwater, Technical Director

Magalies Water round 7, on-going community supply programmes. Managing drilling and testing programme, drilling and pump testing supervision at 9 villages as part of a drought relief program. 11 Boreholes were drilled, and 10 boreholes pump tested. Pump test analyses of test results with FC interpretation software.

Mabula Lodge groundwater supply project, Mokai Kai area (Limpopo Province). Extension of previous survey to Mokai Kai area. Responsibilities included managing of drilling and test pumping programme, drilling and test pumping supervision, borehole construction and groundwater sampling. Interpretation and management recommendations of test pumping results with FC interpretation software.

Well field development for Magalies Water at Shakung/Jericho, community groundwater supply project. Responsible for management of drilling programme of advance borehole drilling techniques in loose Karoo sediments with Johnson screen constructions (4 boreholes) and double casing constructions with perforated steel outside and PVC inside (2 boreholes).

Drought Relief programme at Koster in Northwest Province (South Africa). Responsibilities included hydrocensus, managing of drilling and test pumping programme including drilling and test pumping Supervision, borehole construction and groundwater sampling. Interpretation and management recommendations of test pumping results with FC interpretation software.

Swartruggens Drought relief programme (Northwest Province), Magalies Water Round 7. Responsibilities included managing of drilling and test pumping programme including drilling and test pumping supervision, borehole construction and groundwater sampling. Interpretation and management recommendations of test pumping results with FC interpretation software.

Groundwater supply project AT Nacala, Mozambique; Drilling supervision and borehole construction at Nacala in Mozambique for Murray and Roberts for water supply to new planned coal terminal.

Groundwater Baseline study Hydrocensus, Groundwater Supply and Geophysical surveys projects Various, South Africa

Responsible for drilling supervision of monitoring boreholes at Bravo Eskom project near Ogies.

Member of geophysical team conducting a geophysical investigation for monitor boreholes at Cullinan Diamond Mine (CDM) in Cullinan, Gauteng Province. Managing geophysical survey, data interpretation and borehole siting.

Conduct a hydrocensus at Dawn Park for new residential development.

Responsible for pump testing programme and supervision of groundwater monitoring boreholes at Heidelberg as part of planned underground Coal mining project.

Manganese Metal Company, characterisation, and baseline assessment. Responsible for drilling supervision, groundwater sampling and slug testing of monitoring boreholes. Slug test data interpretation.

Part of groundwater sampling team of monitoring boreholes at Shisen Iron Mine (South Africa).

Responsible for two groundwater source development reports; Ga-Magatle and Thamoyanche in Northern Cape Province.

Eskom Underground Coal Gasification project - Amersfoort. Responsible for magnetic survey, borehole siting, drilling supervision, groundwater sampling and slug testing of boreholes. Slug test data interpretation.

Kloof Gold mine (South Africa), Groundwater contamination study. Responsible for geophysical survey, managing of drilling and test pumping programme including drilling and test pumping supervision.

Proposed tailings facility at Geluksdal site - Rand Uranium. Responsible for managing of drilling and test pumping programme including drilling and test pumping supervision and report writing.

Bakouma, Central African Republic. Bakouma Groundwater Assessment. A Geohydrological investigation that formed part of an environmental feasibility study with the aim of developing pit dewatering strategies as well as groundwater



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impacts. Responsibilities included managing of test pumping programme, data interpretation and installation of water level loggers.

Involved in the Vaal Gamagara Groundwater Resource Assessments and possible augmentation of the Vaal-Gamagara pipeline water scheme. Responsible for hydrocensus, supervision of drilling of large diameter boreholes in the Dolomite Karst formation at Danielskuil area. Test pumping supervision and interpretation of high yielding boreholes. Responsible for groundwater reports of two source development areas (SD1 and SD2).

Project manager of a hydrogeological investigation for Sedibeng Water and the Department of Water and Sanitation to verify the status and use of existing production boreholes and to augment shortfalls in water demand at three villages (Atamelang, Khunwana and Vrischgewaagd) within the Tswaing Local Municipality as part of emergency supply services. ADI Engineering (ADI) was appointed by Sedibeng Water as Professional Service Provider for the above stated Project and Poloko Trading 634 CC the appointed contractor. Responsible for Groundwater task management and reporting. Task involved geophysical survey, drilling and aquifer testing.

Project manager of a hydrogeological investigation for Sedibeng Water and the Department of Water and Sanitation is upgrading water sources of villages within the Tswaing Local Municipality as part of emergency water supply services. B2B Consultants (PTY) Ltd (B2B) appointed Golder Associates to conduct a hydrogeological investigation at Mofutse 1 as part of the emergency water supply service. Responsible for Groundwater task management and reporting. Task involved geophysical survey, drilling and aquifer testing.

Project manager of groundwater verification and source development projects for Oppel Consulting & Construction Management (OCCM) who appointed Golder Associates (Pty) Ltd to verify and assess the existing groundwater potential at Magong, Kameelboom and Madikwe in the Northwest Province. Responsible for Groundwater task management and reporting. Task involved geophysical survey, drilling, aquifer testing, borehole registration and reporting.

Project manager of source verification and development projects for Oppel Consulting & Construction Management (OCCM) who appointed Golder Associates (Pty) Ltd to verify and assess the existing groundwater potential at Disake, Mokgalwaneng and Pella, Silwerkrans in the Northwest Province.

Conduct hydrogeological support services as part of the Dr Ruth S Mompoti Rural Water Supply Programme (2016-2019) at Broedersput, Schweizer Reneke, Reivilo, Lykso, Shaleng, Geduldspan and Maeng. Responsible for groundwater project management and reporting. Tasks involved geophysical survey, drilling and aquifer testing.

Project manager of Aquifer testing programme for KMSD Consulting Engineers, to test two existing boreholes, one each at Madibeng and Perth Primary Schools. Responsible for Groundwater task management and reporting.

Conduct a Hydrological Investigation at 23 villages in Madibeng LM for the 2018/2019 DWS drought relief program. Responsible for groundwater project management and reporting. Tasks involved verification of existing boreholes, aquifers testing, geophysical survey, drill site selection and drilling.

Conduct a hydrogeological investigation at Makwassie and Lebaleng located in the Northwest Province. The objective of the investigation was the feasibility for the development of groundwater sources. Responsible for groundwater project management and reporting. Tasks involved verification of existing boreholes, extensive geophysical surveys, drilling and aquifer testing.

Groundwater Mining Projects: Impact Assessment (Contamination) and Groundwater Baseline Studies Various, South Africa:

Conduct a groundwater impact assessment for Foskor (PTY) LTD near Phalaborwa, as part of their EIA for their proposed pyroxenite expansion project (PEP). Involvement includes managing geophysical survey, drilling and test pumping programme including drilling and test pumping supervision, borehole construction and groundwater sampling. Data interpretation, groundwater conceptual model and report writing.



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Conduct a hydrogeological investigation at the Norcros, Olifantsfontein site, near Irene. The study involved hydrogeological site assessment, groundwater quality and vulnerability, identify possible pollution sources and access impact on groundwater system and nearby wetland. Responsible for field survey, data interpretation and groundwater report writing.

Involved in the on-going hydrogeological consultancy services to Eskom's Underground Coal Gasification (UCG) project team at the Majuba trial site in south-eastern Mpumalanga Province. Responsible for geophysical survey, borehole siting for relocated community, installation of level loggers and monitoring of water level of shallow aquifer and six-monthly groundwater hydrochemistry monitoring report and technical memos.

Conduct a phase I hydrogeological investigation for Foskor (PTY) LTD at their North Pyroxenite Mine (NPM). Foskor (Pty) Ltd is currently operating two open pit mines in Phalaborwa. The study comprises out of a hydrocensus, groundwater sampling, quality analyses, GAP analyses and inception report.

Responsible for drilling supervision for monitor boreholes for Unitrans Fuel and Chemicals (Pty) Ltd (Unitrans), at the Tulisa Park Truck Depot. Write technical memo on drilling results.

Conduct a groundwater study at Xstrata Atcom for two adjacent projects. Responsible for geophysical survey, the drilling supervision, slug testing and groundwater sampling. Data interpretation and report writing.

Conduct a phase II hydrogeological investigation for Foskor (PTY) LTD at their North Pyroxenite Mine (NPM). Foskor (Pty) Ltd is currently operating two open pit mines in Phalaborwa. Responsible for managing of geophysical survey, drilling and test pumping programme including drilling and test pumping supervision, borehole construction, slug testing and groundwater sampling. Data interpretation, groundwater conceptual model and report writing.

Ruighoek Chrome Mine in the Northwest province, Groundwater, and geochemical investigation as part of basic assessment. Responsible for drilling supervision of two new monitoring boreholes adjacent to TSF, hydrocensus, groundwater and geochemical sampling and report.

Integrated Water and Waste management Plan for Koornfontein Mines (Pty) Ltd. The mine forms part of the Optimum Coal Holdings Group and operates underground and planned open pit mining operations, as well as a coal beneficiation plant near Komati Power Station in Mpumalanga Province Responsible for groundwater specialist reporting.

Conduct a hydrogeological assessment at the AngloGold Ashanti Iduapriem (AAIL) mine which is located in the southwest of Ghana close to the town of Tarkwa. The assessment of the hydrogeology of the mining and surrounding area was undertaken to identify sources of groundwater contamination (arsenic was reported), the extent of any associated groundwater pollution plumes and the construction of a preliminary conceptual hydrogeological model. Responsible for site assessment, hydrogeology data evaluation, drilling supervision of monitoring boreholes, water sampling, hydrocensus, GAP analyses and assessment report.

Responsible for baseline groundwater assessment report for Lonmin Platinum mines in Northwest Province.

Responsible for groundwater sampling and characterising at Sappi Usutu - Swaziland. Data interpretation and technical reporting.

Conducted a groundwater baseline assessment at Enviroil's site at Wadeville, Germiston. The groundwater assessment form part of the specialist studies of the Environmental Impact Assessment (EIA) at the new Enviroil site. Responsible for drilling supervision, slug testing, groundwater sampling, data interpretation and reporting.

Groundwater specialist report to inform the EIA in support of the application for an Integrated Waste Management Licence Application for Evraz Highveld Limited (Mpumalanga Province).

Part of investigating team at Platreef mine in Mokopane. Responsible for geophysical survey, drilling supervision and test pumping at proposed decline portal.

Drilling of additional groundwater monitoring boreholes at Evraz Highveld steel and Vanadium steel works to characterise the groundwater quality outside the site boundary and map pollution plume. Responsible for drilling supervision and groundwater report writing.

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Drilling of additional groundwater monitoring boreholes at Evraz Highveld steel Mapochs mine to characterise and monitor groundwater quality down gradient of paddocks. Responsible for drilling supervision and groundwater report writing.

Conduct groundwater study at Sasol Secunda Halve pan site. Responsible for geophysical survey, data interpretation and drilling site selection, drilling and test supervision, sampling, and reporting.

Contribute to Groundwater specialist report for Arnot Colliery (Mpumalanga Province).

Nyanzaga, Tanzania. Involved into assessment of the potential impacts that the proposed Nyanzaga mine in Tanzania will have on the receiving surface and groundwater regimes.

Responsible for groundwater baseline report for Exxaro Resources (Pty) Ltd at their Zincor facility located in the Springs district of Gauteng.

Part of groundwater specialist study at Impala Platinum Refinery as part of the Environmental Impact Assessment (EIA) and for a Water Use Licence application (WULA).

Conduct a hydrogeological assessment at the proposed passive water treatment plant at Anglo Coal Vryheid Coronation Colliery (VCC) in KwaZulu Natal Province. The hydrogeological assessment is part of the Environmental Impact Assessment (EIA) and Water Use Licence application (WUL) for the proposed passive water treatment plant. Responsible fieldwork and reporting.

Conduct a groundwater baseline report for Zitholele Consulting (Pty) Ltd to provide a specialist groundwater input in support of the Waste License process at Kendal Power Station. This process involves an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) - as part of the Integrated Water Use License (IWUL) for the extension of the existing dry ashing facility and a Waste Management Licence (WML) for the existing ash dump to continue disposal of ash for the next 7 years whereupon a new ash dump will be commissioned. Project manager, responsible for task management and reporting.

Part of the team who conducted groundwater assessment at the Dimbaza Foundry site located close to King Williams Town (Buffalo City Municipality) in Eastern Cape. Responsible for reporting on the groundwater status following the site visit and to inform the DEA of the proposed monitoring boreholes which will support the groundwater specialist study for the closure of the Dimbaza Foundry site.

Conduct a groundwater baseline report for Zitholele Consulting (Pty) Ltd to provide a specialist groundwater input in support of the Waste License process at Kendal Power Station and for the waste management licencing for the 30-year extension of ash disposal upon a new ash dump. Project manager, responsible for task management and reporting.

Project manager of geophysical survey at Samancor Lannex operations near Steelpoort. Objective was to map the pollution plume, identify zones of deeper weathering and fracturing of the bedrock which could act as preferential groundwater flow paths. Responsible for task management and reporting.

Project manager of a geophysical survey and drilling programme at Sasol Secunda Halvepan, to optimize installation of scavenger boreholes. Responsibility includes data interpretation, drilling site selection and groundwater report writing.

Conduct a hydrogeological assessment at the proposed passive water treatment plant at Anglo Coal Vryheid Coronation Colliery (VCC) in KwaZulu Natal Province. The hydrogeological assessment is part of the Environmental Impact Assessment (EIA) and Water Use Licence application (WUL) for the proposed passive water treatment plant. Responsible fieldwork and reporting.

Conduct a groundwater baseline report for Zitholele Consulting (Pty) Ltd to provide a specialist groundwater input in support of the Waste License process at Kendal Power Station. This process involves an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) - as part of the Integrated Water Use License (IWUL) for the extension of the existing dry ashing facility and a Waste Management Licence (WML) for the existing ash dump to continue disposal of ash for the next 7 years whereupon a new ash dump will be commissioned. Project manager, responsible for task management and reporting.



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Task manager of ongoing hydrogeological consultancy services to Eskom's Underground Coal Gasification (UCG) team at the Majuba trial site in south-eastern Mpumalanga Province. As part of the ongoing Hydrogeological services a geophysical survey was conducted during March 2015 to assist with the selection of drill sites for the installation of shallow monitoring boreholes in the compliance zone around Gasifier 1 and 2 (existing production boreholes).

Project manager of groundwater investigation to undertake the Environmental Impact Assessment (EIA) and Waste Management Licence (WML) application, including a water use licence application (WULA) for Eskom at their proposed Flue Gas Desulphurisation (FGD) retrofit to Medupi Power Station.

Project manager of groundwater specialist study for Khongoni Coal as part of their Mining Right Applications (MRA). Writing of the scoping report, conduct groundwater Impact assessment to determine the impact of the proposed opencast coal mine on the groundwater.

Part of investigation team for Midal Cables International LDA to do a hydrogeological and geophysical Investigation at their water treatment plant (WTP). The water quality of groundwater abstracted do not confirm to the specifications for which the plant was originally for.

Conduct groundwater specialist investigation for Anglo American Inyosi Coal (Pty) Ltd (AAIC) for their Heidelberg South Rand Underground Mining Project, Gauteng Province. It comprises an area of 75 square kilometres and is located ~ 35 km to the northwest of Eskom's Grootvlei Power Station. Compile Scoping report and conduct groundwater impact assessment.

Conduct aquifer testing of existing boreholes and an Earth Resistivity Image (ERI) profile for Exxaro at Pegasus South at their Inyanda Colliery – Mpumalanga Province.

Project manager of a geophysical survey for Delta H at Commissiekraal to determine optimal drilling sites for the groundwater impact investigation for the proposed underground coal mine in the KwaZulu Natal Province.

Project manager of groundwater specialist study for Zitholele Consulting (Pty) Ltd to undertake the Environmental Impact Assessment (EIA) and Waste Management Licence (WML) application, including a water use licence application (WULA) for the proposed Flue Gas Desulphurisation (FGD) retrofit to Medupi Power Station. Responsible for Groundwater task management and reporting.

Project manager of Aquifer testing programme for Exxaro at Inyanda Colliery – Mpumalanga Province. Responsible for Groundwater task management and reporting.

Project manager of drilling project of scavenger boreholes for Sasol Synfuels at Secunda - Mpumalanga Province and the update the groundwater numerical model of Sasol Synfuels Halvepan.

Project manager of a groundwater specialist study for Glencore's IMpunzi Office and Phoenix pit, Mpumalanga Province. The groundwater specialist study is part of an EIA and WULA application for IMpunzi for the proposed extension of their opencast operations at the Office and Phoenix area. Responsible for Groundwater task management and reporting.

Project manager of Aquifer testing programme for at Anglo American's Umlalazi Minipit, and Kromdraai Colliery near Witbank– Mpumalanga Province. Responsible for Groundwater task management and reporting.

Project manager of an Earth Resistivity Image (ERI) survey for Kimopax (PTY) Ltd at Tshandama – Limpopo Province. Involvement, task management and reporting.

Part of investigation team for Khumani Iron Ore Mine (KIOM) to develop groundwater resources on the farms Bruce and King to augment the total shortfall in water supply. Accountable for drilling and aquifer testing programmes and reporting.

Project manager of a geophysical survey for Delta-H at Standerton in the Mpumalanga Province. The geophysical survey is to locate suitable geological targets and deep weathering zones to optimize drilling targets. Responsible for Groundwater task management and reporting.

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Part of investigation team to conduct a groundwater specialist study for Ukwazi's copper project near Musina, Limpopo Province. The groundwater specialist study is part of a scoping level of confidence mining study to compile a Mining Works Programme (MWP) as part of the Mining Right Application (MRA). Responsible for Groundwater task management and reporting.

Project manager of a groundwater investigation for Onno Fortuin Consulting, to install additional groundwater supply and monitoring boreholes at Vryburg's new Wastewater Treatment Works (WWTW). Responsible for Groundwater task management and reporting. Task involved geophysical survey, drilling and aquifer testing.

Project manager of a groundwater feasibility study for McCain Springs Plant site. Study includes desk study, hydrocensus groundwater quality analyses and reporting.

Conduct a groundwater baseline study for a proposed new open cast copper mine close to Musina. The hydrogeological investigation was based on available information as input into a scoping report that includes a gap analysis and scope of work required to support IRL environmental permitting process.

Project manager for a geophysical survey at Sasol Synfuels at their Sasol Nitro Fertilizer (Nitro) plant, to investigate the sub-surface for geological structures namely; dolerite dyke intrusions, deep weathering and fracture zones which could act as preferential groundwater pathways. Responsible for Groundwater task management and reporting. Task involved geophysical survey (ERI and magnetic methods) and reporting.

Conduct a hydrogeological phase I investigation at Phola Coal Processing Plant (PTY) Ltd near Ogies, Mpumalanga Province. The objective of the groundwater investigation is to establish a comprehensive and site wide groundwater monitoring programme. Responsible for Groundwater project management and reporting.

Conduct a groundwater baseline investigation and Environmental Impact Assessment (EIA) for Exxaro at Turfvlakte adjacent to Grootegeeluk Mine, Limpopo Province. Responsible for groundwater task management and reporting. Tasks involved geophysical survey, drilling support, aquifer testing and impact scenarios and mitigation measures.

Conduct a groundwater source verification and development investigation at Campbell in the Northern Cape Province. The objective of the hydrogeological investigation is the verification of the status of exiting boreholes, fountains, groundwater quality and long-term safe yields of production boreholes. Responsible for groundwater project management and reporting. Tasks involved geophysical survey, drilling, aquifer testing and borehole management recommendations.

Installation of new background monitoring boreholes at Tubatse Chrome at Steelpoort. Responsible for groundwater project management and reporting.

Update of existing 2014 Tubatse Ferro Chrome groundwater numerical model, with updated hydrocensus data, water levels, water qualities and groundwater monitoring data. Project manager and reporting.

Project manager of geophysical surveys for Delta-H at Mafube and Zibulo Collieries, Mpumalanga Province. The geophysical survey is to locate suitable geological targets and deep weathering zones to optimize drilling targets. Responsible for Groundwater task management and reporting.

Conduct a compliance audit of the groundwater license conditions for the Lattakoo Estate, Kathu Northern Cape Province. Responsible for 2017, 2018, 2019 AND 2020 field audit and reporting.

Task manager of geophysical survey at Cullinan Diamond Mine to identify the existence of geological structures.

Conduct a hydrogeological investigation at Mutanda Mining SARL (Mumi) to identify drilling sites for drinking water for Kisenda and surrounding communities. Responsible for groundwater project management and reporting. Tasks involved hydrocensus and geophysical survey.

Project manager of groundwater project for installation of additional monitoring boreholes at Phola Coal Processing Plant (PTY) Ltd near Ogies, Mpumalanga Province. Tasks involved geophysical survey, drilling, slug testing and reporting.



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Project manager of hydrogeological investigations for LSO Africa to augment the groundwater supply, at identified draught relief programme villages in Madibeng LM. Task involved aquifer testing and refurbishing existing boreholes, geophysical surveys, of new boreholes and reporting.

Responsible for groundwater specialist input for Glencore Operations South Africa (Pty) Ltd (GOSA) with their Water Use Licence Application (WULA) for the Nooitgedacht shaft. The Nooitgedacht Project (NGD) is located approximately halfway between Bethal and Ogies (30 km), in the province of Mpumalanga. Task involved hydrocensus, groundwater analyses, GAP analyse and Numerical model (Shaft), Qualitative Impact Assessment. Deliverable was a GN267 Geohydrological Report, Department Water and Sanitation (DWS) Format.

Responsible for a GN267 Geohydrological Report, Department Water and Sanitation (DWS) Format for SOC Eskom Holdings Limited (Eskom Holdings) for their Underground Coal Gasification (UCG) project at the Majuba trial site in Mpumalanga Province. The groundwater report was completed based on existing hydrogeological information and reports.

Project manager of hydrogeological investigations for Bushveld Vanchem (PTY) Ltd to conduct a hydrogeological and impact assessment for their Vanchem Operations (VO). Vanchem is located at Ferrobank Industrial Park in Emalahleni (Witbank) Local Municipality, Mpumalanga Province in the Republic of South Africa and has been operating since the late 1970s. Tasks involved desk study, hydrocensus, hydrochemical analyses, Groundwater Gap analyses, Geochemical assessment, groundwater numerical model and impact assessment, monitoring programme and reporting.

Project manager of hydrogeological services for LSO Africa for the development of water resources for Thabazimbi/Regorogile, Leeupoort/Raphuti and Rooiberg. Tasks involved desk studies, hydrocensus, hydrochemical analyses, Liaison, Project Co-ordination and Management, aquifer testing of existing boreholes, and reporting.

Project manager to conduct a groundwater specialist investigation for Exxaro Coal Mpumalanga (Pty) Ltd (Exxaro) for their Belfast Expansion Project (BEP) and railway loop, which falls inside their Belfast mining right area. Task involved Desk study Review of existing Groundwater Information, Groundwater Numerical Model and Impact Assessment, Review and update Existing Groundwater Monitoring Programme and a GN267 Geohydrological Report, Department Water and Sanitation (DWS) Format.

Project manager to conduct a Groundwater Resource Source Assessment for Afrisam South Africa, Dudfield Cement Operation at Houthaaldoorns Wellfield. Project entail of a hydrocensus, geophysical survey (gravity method) of the site area for karst aquifer mapping and siting of exploration/production boreholes. Telescopic drilling, Aquifer testing (100-hour Constant Draw Down test and analyses), hydrochemical analyses and Numerical model and Impact Assessment. Deliverable was a GN267 Geohydrological Report, Department Water and Sanitation (DWS) Format.

Project manager of hydrogeological support services as part of the Dr Ruth S Mompoti Rural Water Supply (RWS) Programme (2019-2023) for both Tsela Tsweu and BVI Consulting Engineers. RWS projects entail source verification and source development investigation to meet various village water demands and DWS quality standards. Tasks involved geophysical survey (magnetic, EM-34 and 2D Lund Resistivity methods), drilling, aquifer testing of existing and new production boreholes reporting. Investigations were conducted at the following villages for Tsela Tsweu; Kagiso/Kagisonyana, Ditshukutswaneng, Pomfret, Piet Plessis and Dipodi. Investigations for BVI entail the following villages; Amalia, Glaudina, Migdol, Gasebusho, Bloemhof, Highlandspan, Modimong, Madibaneng, Chokonyane, Sekhing, Modutung, Upper and Lower Majeakgoro and Schweizer Reneke.

Project manager to conduct a sanitation protocol for several villages in Dr Ruth Mompoti District Municipality for 2020 to 2023. The main objective of the study was to compile (at village level) protocols for on-site sanitation systems for annual prioritised project communities. These village-based protocols were supported by an area-based protocol for various communities at local municipality level using existing borehole information (desk study). The following villages reports were issued, Gamodisenyane, Morokweng, Broedersput, Geduldspan and Devondale.

Project manager to conduct a groundwater investigation at Bafokeng Rasimone Platinum Mine (BRPM) Maseve Mine, to update their monitoring boreholes and numerical groundwater model. Project entail source verification and source development investigation to meet various village water demands and DWS quality standards. Tasks involved a

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Groundwater, Technical Director

geophysical survey (magnetic, EM-34 and 2D Lund Resistivity methods) drilling, aquifer testing and numerical model update.

Project manager of a hydrogeological investigation at the Road Traffic Management Company (RTMC) Training Centre, Boekenhoutkloof, Gauteng Province. The main objective of the hydrogeological investigation was to assess the groundwater quality and quantity of the two existing boreholes and the installation of two additional production boreholes to meet the short-term water demand of 4.6 l/s 12 h/day. Tasks entail a geophysical survey (magnetic, EM-34 and 2D Lund Resistivity methods) drilling, aquifer testing, assessment of borehole safe yield and management recommendations and reporting.

Part of a groundwater investigation team for undertaking hydrogeological & hydrochemical investigations and subsequent groundwater modelling in association with Botash's brine-field abstraction operation, Sua Pan, Botswana. Field investigations entail drilling, groundwater sampling, EC profiling and signal testing.

Responsible for a GN267 Geohydrological Report, Department Water and Sanitation (DWS) Format for McCain's Foods Springs extended operations in South Africa, which is situated along Hasset Road, Nuffield in Springs, Gauteng Province. The groundwater report was completed based on an updated hydrocensus and existing hydrogeological information and reports.

Conduct a Groundwater Impact Assessment for Kelvin Power of the Decommissioning and Demolition of Kelvin Power A Station situated in the Ekurhuleni Metropolitan Municipality in Gauteng. Task involved the following: Desk study, Groundwater Conceptual Model, Groundwater Monitoring Programme, Groundwater Qualitative Impact Assessment. Deliverable was a Groundwater Baseline and Impact Assessment Report and Recommendations to support the environmental authorisation process.

Project manager, to conduct a groundwater monitoring investigation for Elandspruit Pan for Glencore Operations South Africa (Pty) Ltd (GOSA), at their Izimbiwa Complex. The investigation is part of an imminent Water Use Licence Application to the Department of Water and Sanitation (DWS). GOSA intends to approach the Department for an application and to mine through the wetland and offset off in the area to be determined. The main objective of the groundwater investigation is to monitor Elandspruit Pan groundwater conditions and report on the groundwater and functionality of Elandspruit Pan in support of an imminent Water Use Licence Application. Scope of work involved, Desk Study, Drilling of four (4) pairs of Shallow and Deep Monitoring Boreholes, Slug Testing, Installation of Electronic Water Level Loggers (4) and Barra Logger (1), Quarterly Groundwater Sampling and Chemical Analysis. Monthly Water Level Monitoring, Groundwater Conceptual Model and Understanding, and Groundwater Report and Recommendations.

Task Manger of a groundwater investigation team appointed by Kabanga Nickel to conduct a water project for the proposed refinery and residue storage facilities (RSF) at the closed Buzwagi Gold Mine, Kahama Tanzania. The start of the investigation involved a combined site visit and hydrocensus to be familiarised with the current and proposed infrastructure layout, gain an understanding of the hydrogeological conditions, and verify status of existing boreholes (hydrocensus). Update the existing Groundwater Conceptual Model to gain an understanding of the hydrogeological conditions and to provide input for the construction of the groundwater numerical model, Impact Assessment and update the groundwater monitoring programme.

Part of a groundwater investigation team for undertaking Seriti Coal Proprietary to conduct a Geohydrological, Geophysical and Geochemical Assessment of Klipspruit Colliery. Task manager of the geophysical survey to optimize drilling positions for additional boreholes and to delineate the structural geological features which could act as preferred groundwater pathways. A total of 12 geophysical traverses were conducted and comprise out of the magnetic EM-34 and Abem Lund 2D resistivity system methods. A total of 30 provisional drill sites were selected for future drilling targeting geological structures and preferred groundwater flow paths.

Project manager for the update of existing 2019 Tubatse Ferro Chrome groundwater numerical model, with updated hydrocensus data, water levels, water qualities and groundwater monitoring data.

Task manager for the groundwater team to conduct an environmental authorisations process for Glencore Operations South Africa (Pty) Ltd (GOSA) at their proposed Paardekop Mining Right Area (MRA). Tasks involved comprehensive



Danie Brink

Groundwater, Technical Director

hydrocensus and wet and dry season monitoring events. Responsible for a GNR 267 Geohydrological Report, Department Water and Sanitation (DWS) Format.

Project manager to conduct a Hydrogeological Investigation (Source, Pathway and Receptor characterisation – SPR) for Impala Platinum Ltd – Springs (Implats). Project entails redrill of six (6) pairs of new monitoring Boreholes; update the 2013 numerical flow and transport model to be able to conduct a quantitative impact assessment that covers the source – pathway – receptor model; update the source and receptor characterisation; support Implats Spring with their WULA authorisation process and a hydrogeological report GNR 267, DWS format.

Project manager to assess the potential of a sustainable water supply resource for Central Termica de Ressano Garcia (CTRG), at their Ressano Garcia site, Mozambique. The main objective of the phase 1 investigation was to conduct a desk study and a site reconnaissance investigation to identify possible water resources available to CTRG to meet their current and future water demand of ~15 m³/day (0.2 l/s for 24h/day). Tasks involved desk study, site reconnaissance, hydrocensus, sampling, water treatment assessment, reporting and way forward (proposed scope of work).



herewith certifies that

Danie Brink

Registration Number: 400027/11

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)

Earth Science (Professional Natural Scientist)

Effective **2 March 2011**

Expires **31 March 2026**



A handwritten signature in black ink, appearing to read 'S. Neph'.

Chairperson

A handwritten signature in black ink, appearing to read 'N. S. S. S.'.

Chief Executive Officer



To verify this certificate scan this code

Appendix B

DOCUMENT LIMITATIONS





DOCUMENT LIMITATIONS

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10.4 The Specialist

Note: Duplicate this section where there is more than one specialist.

Danie Brink

I, as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and that I:

- in terms of the general requirement to be independent (tick which is applicable):

☒	other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
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☐	am not independent, but another EAP that is independent and meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
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- have expertise in conducting specialist work as required, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- will ensure compliance with the EIA Regulations 2014;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- will take into account, to the extent possible, the matters listed in regulation 18 of the regulations when preparing the application and any report, plan or document relating to the application;
- will disclose to the proponent or applicant, registered interested and affected parties 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 with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- declare that all the particulars furnished by me in this form are true and correct;
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).

 Digitally signed by Brink,
Danie (ZADB05055)
Date: 2025.07.21
13:07:51 +02'00'

Signature of the specialist

WSP Group Africa(PTY)Ltd

Name of company

21/07/2025

Date



10.5 The Review Specialist

Gerhard van der Linde

I as the appointed review specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- am independent, and other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;
- am fully aware of and meet all of the requirements of Regulation 13, and that failure to comply with any the requirements may result in disqualification;
- have reviewed/will review all the work undertaken by the specialist;
- have disclosed/will disclose, to the applicant, the EAP, other specialist (if any), the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

 van der Linde,
Gerhard
(ZAGV05067)
2025.07.21
11:26:45 +02'00'

Signature of the review specialist

WSP Group Africa(PTY)Ltd

Name of company

21/07/2025

Date

