



Ridgeburn Limited

Ridgeburn Groundwater Take Assessment of Effects

TECHNICAL REPORT

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Statement of Qualifications and Experience

Cameron Jasper (Author)

I am a Senior Hydrogeologist employed by Wallbridge Gilbert Aztec, an employee-owned engineering and environmental consultancy with over 700 staff distributed throughout New Zealand and Australia. I hold a Master of Science in Hydrology and Water Resources Science and a Bachelor of Science in Geology Earth Science. I am a member of the New Zealand Hydrological Society.

I have over 10 years professional experience as a consultant in hydrogeology, water resources science, and environmental investigations. My expertise includes the assessment of groundwater resources, stormwater and wastewater discharge effects, contaminant transport, and protection of community drinking water sources, with extensive project experience in Otago and New Zealand.

I have undertaken Assessments of Environmental Effects (AEE) and technical reviews supporting resource consenting for groundwater takes, community wastewater discharges to land, and water supplies. My experience in stormwater and wastewater management and discharge effects includes hydrogeological assessments, contaminant transport modelling and monitoring system designs for municipal wastewater discharges. I have undertaken numerous technical reviews of resource consent applications on behalf of Otago Regional Council, where my work primarily included hydrogeological review of on-site wastewater discharge proposals, contaminant transport assessment, and risk evaluation to domestic and community drinking water supplies.

My experience in protection of community drinking water sources includes groundwater effects assessments, source protection zone delineation, contamination risk assessments, and evaluation of wastewater and stormwater discharge effects on supply bores. My contaminant transport modelling includes nitrate, microbial, and emerging contaminants (PFAS) in groundwater systems, with application to wastewater discharges, stormwater, landfills, and contaminated sites.

I confirm that, in my capacity as author of this report, I have read and acted in accordance with the Environment Court of New Zealand Code of Conduct for Expert Witnesses (Practice Note 2023).

Brett Sinclair (Reviewer)

I am a Senior Principal Hydrogeologist and Associate employed by Wallbridge Gilbert Aztec, an employee-owned engineering and environmental consultancy with over 700 staff distributed throughout New Zealand and Australia.

I hold a Master of Science in Geology from Auckland University and a Postgraduate Certificate in Hydrogeology and Engineering Geology of Tropical and Subtropical Regions from the University of Tübingen, Germany. I have over 30 years professional experience as a consultant and contractor in hydrogeology, water resources science, and environmental investigations. I have worked internationally as a consultant, based in New Zealand, Australia and Germany. I am a member of the New Zealand Hydrological Society.

Since 2000, I have managed and undertaken numerous investigations within New Zealand for the supply of water for human consumption and horticultural, agricultural and industrial purposes. These investigations have included evaluation of water availability as part of the security of supply assessment. Over the same period, I have undertaken assessments of the effects for a wide range of stormwater and solid and liquid waste storage and disposal systems on groundwater, surface water and existing users. I have constructed and acted as technical advisor or reviewer for numerous groundwater flow and contaminant transport models including for groundwater takes.

During the past fifteen years, I have worked on and led on the assessment, consenting, design, construction, commissioning, monitoring and optimisation and managed aquifer recharge projects. I also have wide experience in mine water management, with a focus on minimising environmental impacts during operations and long-term site rehabilitation.

I confirm that, in my capacity as reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

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1 INTRODUCTION

1.1 Background

The Ridgeburn residential development (Ridgeburn) proposed by Ridgeburn Limited (RDL), a registered corporate entity associated with Gibbons Co, consists of approximately 1,210 homes, commercial, retail and recreational spaces. Ridgeburn is located on an approximately 212 ha site at 122 Morven Ferry Road, between Arrowtown and the Kawarau River, Queenstown Lakes District.

RDL is seeking a resource consent to abstract groundwater from two new production bores, BH04 and BH05, located at 122 Morven Ferry Road, Arrow Junction, Queenstown Lakes District (Figure 1), for community water supply purposes. The proposed groundwater take is to meet the projected potable water demand for the Ridgeburn mixed-use development, including residential, commercial, and community facilities.

Pumping tests have been undertaken by SouthDrill Limited on the production bores to provide data to support the resource consent application. Groundwater drawdown and recovery resulting from the pumping tests were measured in the production bores for the purpose of assessing bore capacity, sustainable yield, and aquifer parameters. The pumping test data was also recorded to support assessments of surface water interactions and groundwater drawdown effects arising from the proposed abstraction. Other site investigations including machine drillholes, hand auguring, test pitting, and soakage testing across the development site are documented separately in a hydrogeological site investigations report (WGA, 2026a).

A source water protection area for the Ridgeburn production bores has been evaluated and documented in the WGA (2026a) site investigations report. Further detail regarding this protection area has been presented in a wastewater disposal options and effects report (WGA, 2026b) for Ridgeburn.

1.2 Scope of Works

Wallbridge Gilbert Aztec (WGA) has been contracted to:

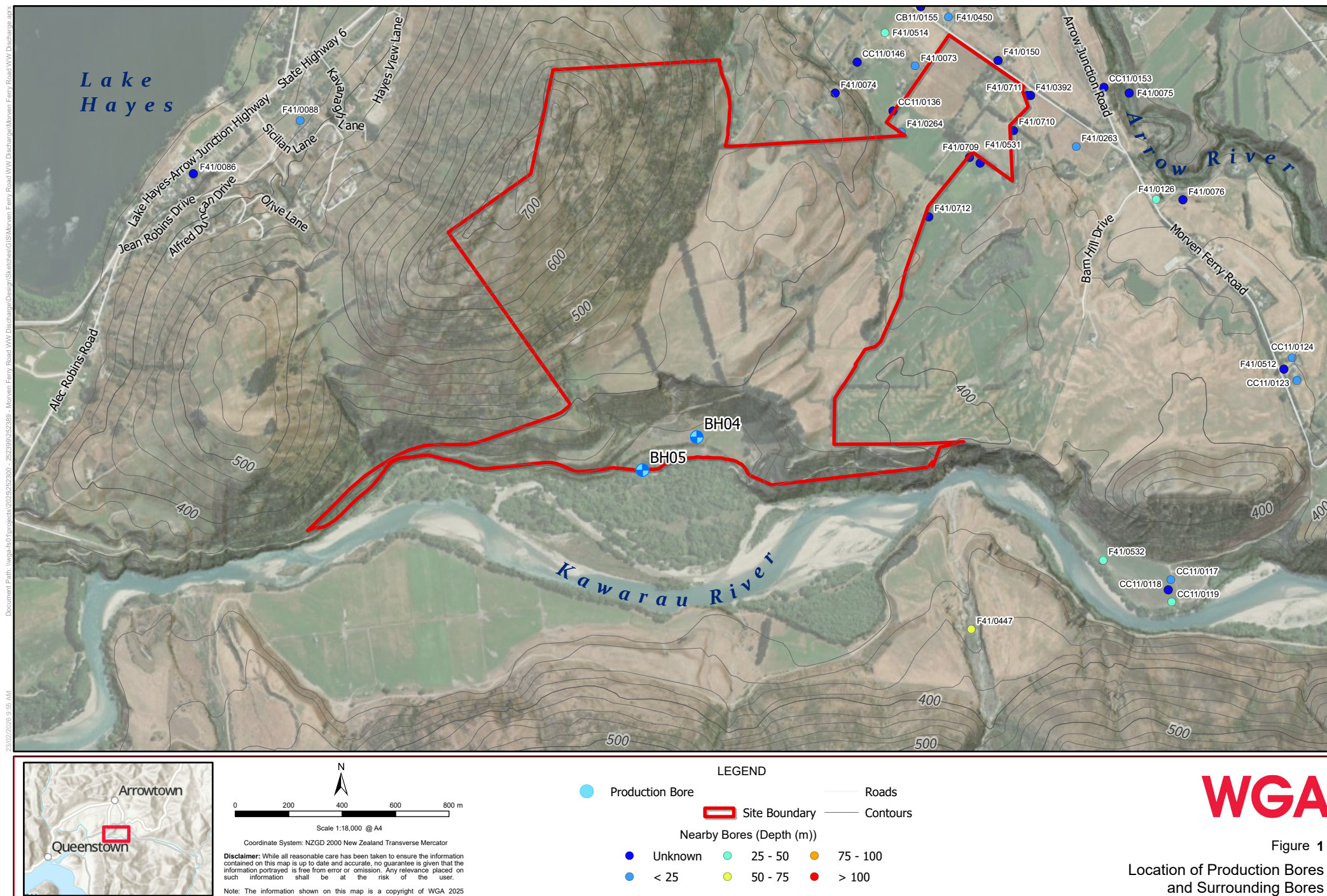
- Analyse the pumping test data from bores BH04 and BH05, to determine appropriate aquifer properties and characteristics to support an effects assessment.
- Assess the environmental effects of the proposed groundwater abstraction.

This technical report documents the above work, and the potential effects of the proposed groundwater take.

1.3 Water Requirements and Use

RDL is seeking to abstract and treat groundwater from the production bores for community water supply to approximately 1,210 homes, commercial, retail, and recreational spaces. Potential water requirements are provided by GWE Consulting Ltd. (GWE 2026) and McKenzie & Co. (McKenzie 2026). These reports have indicated an average water demand of approximately 1,003 m³/day, with a peak daily demand of 2,006 m³/day.

If the bores were pumped to meet the peak daily demand continuously over a 365-day period, this equates to the annual volume of 732,190 m³. The actual abstraction is expected to be less than this due to the variability in community water requirements. The peak daily demand also incorporates a contingency allowance (GWE 2026, McKenzie 2026).



To account for contingency and variability, the groundwater take consent sought is for:

- A combined maximum daily volume of 2,006 m³ (equivalent to approximately 23 L/s)
- A total combined maximum annual volume of 732,190 m³

The assessed maximum daily rate above has been applied to the assessment for the abstraction and associated drawdown effects.

1.4 Bore Construction

The construction details for the production bores are summarised in Table 1, with the driller's bore logs provided in Appendix A of this report. Production bore BH04 (identified as hole number 140 by SouthDrill as per the bore log provided in Appendix A) targets gravelly aquifer sediments underlying a river terrace north of the Kawarau Alluvial Ribbon Aquifer as mapped by ORC (2017). Production Bore BH05 targets deeper fractured schist bedrock underlying the river terraces and aquifer strata adjacent to the Kawarau River. Production Bore BH05 is located within the extent of the Kawarau Alluvial Ribbon Aquifer as mapped by ORC (2017).

Table 1: Production Bores Construction Details

PARAMETER	PRODUCTION BORE BH04	PRODUCTION BORE BH05
Consent Number	RM25.435.01	RM25.435.05
Aquifer Test Use	Pumped Bore	Pumped Bore
Address	122 Morven Ferry Road, Arrow Junction	122 Morven Ferry Road, Arrow Junction
Easting NZTM	1271608	1271404
Northing NZTM	5008548	5008426
Ground Elevation (m RL) ⁽¹⁾	318	307
Depth (m)	41.8	102
Screen Depth (m) ⁽²⁾	34.8 – 37.8	65 – 102
Bore Diameter (mm)	150	200
Static Water Level (m BGL) ⁽³⁾	8.9	0.3
Static Water Level (m RL)	309.1	306.7
Recommended Deepest Pumped Water Level (m BGL) ⁽⁴⁾	27.8	58.0
Available Drawdown (m)	18.9	57.7

Notes:

⁽¹⁾ RL is Relative Level in meters above mean sea level from available topographic information (LINZ digital elevation model derived from LiDAR).

⁽²⁾ Production Bore BH05 is not screened as it is open hole from 65 – 102 m depth with steel casing extending to 65 m depth.

⁽³⁾ m BGL is metres below ground level.

⁽⁴⁾ The calculation of available drawdown includes an allowance of 2 m to install the pump above the base of the bore casing and a further 5 m for cavitation protection.

The lowest recommended operating water levels for BH4 and BH05 are 27.8 m and 58 m depth, respectively (Table 1)., which is 18.9 m below the initial static groundwater level at 8.9 m for BH04 and 57.7 m below the initial static groundwater level at 0.3 m for BH05.

2 HYDROGEOLOGY OVERVIEW

2.1 Regional Geology and Hydrogeology

The Wakatipu Basin is underlain by Mesozoic schist basement rock, which forms the structural and hydraulic base of the aquifer system. Overlying this schist basement are sequences of glacial outwash gravels, tills, and interbedded lake and river sediments, primarily deposited during multiple Late Pleistocene glacial advances and retreats. These depositional episodes have shaped the current geomorphology and aquifers in the basin. Individual aquifers within the basin are considered to form part of the Wakatipu Basin Aquifer (ORC, Map C4: 2022) as presented in Figure 2 and Appendix B.

The aquifers within the Wakatipu Basin typically include transmissive sandy and gravely strata. These aquifers include the Kawarau Alluvial Ribbon Aquifer and the Morven Aquifer at the south and north of Ridgeburn, respectively. Wakatipu Basin aquifers are also generally unconfined, with moderate to high transmissivity and gradients that direct groundwater flow toward receiving surface water bodies (Rekker, 2014).

Deeper groundwater is also present within the schist bedrock. However, the bedrock in the basin is generally expected to be of low permeability and consequently effectively represent a no-flow boundary to groundwater flow. The schist is typically not characterised as an aquifer or groundwater resource. Bore yields in the bedrock are normally low, compared to bores targeting the overlying unconsolidated and unconfined aquifers. Bore yields can be higher where the bore intersects schist that is highly fractured and hydraulically connected to overlying water sources. Higher yielding bores completed within bedrock are rare in the Wakatipu area.

The aquifers in the Wakatipu Basin are laterally restricted by bounding landforms and low permeability materials, including the basement schist. These aquifers receive recharge from infiltrating rainfall and leakage from adjoining surface water bodies. The aquifers discharge their groundwater as springs and base flows to surface water bodies (Rekker, 2014). Two mutually consistent estimates for average annual rainfall recharge to groundwater across the Wakatipu Basin are available in published literature:

- 184 mm/year (Rekker, 2014)
- 0.4 – 0.5 mm/day, equivalent to 146 – 183 mm/year (GNS, 2019).

The Kawarau River forms a geomorphic and hydraulic boundary marking the southern edge of both Ridgeburn and the Wakatipu Basin (Turnbull 2000). River terraces are present along the Kawarau River, comprised predominantly of glacial till (including finer-grained silts) and gravels. The ORC (2017) map of individual Wakatipu Basin aquifers (Figure 3) indicates these terraces form part of the Kawarau Alluvial Ribbon Aquifer (KARA). The KARA is considered to be directly hydraulically connected to the river. A surficial geology map of the Wakatipu area (Barrell et. al., 1994) shows the recent floodplain alluvium to be in contact with the older river terrace alluvium (Figure 4), which is consistent with WGA site investigation results (WGA 2026a, 2026b).

Terrace alluvium as well as glacial deposits overlying schist form the Morven Aquifer to the north of Ridgeburn (Figure 3, Figure 4), which is within the surface water catchment of the Arrow River. The Morven Aquifer is expected to be effectively hydraulically separated from the River terraces and the KARA by the basement schist that underlies the Morven Aquifer. The Ridgeburn residential area is located on an elevated terrace, with a steep drop-off to the south down to the River Terraces. The underlying schist bedrock mirrors this drop-off in elevation behind, forming a groundwater flow barrier along the northern side of the River Terraces on which the production bores are located.

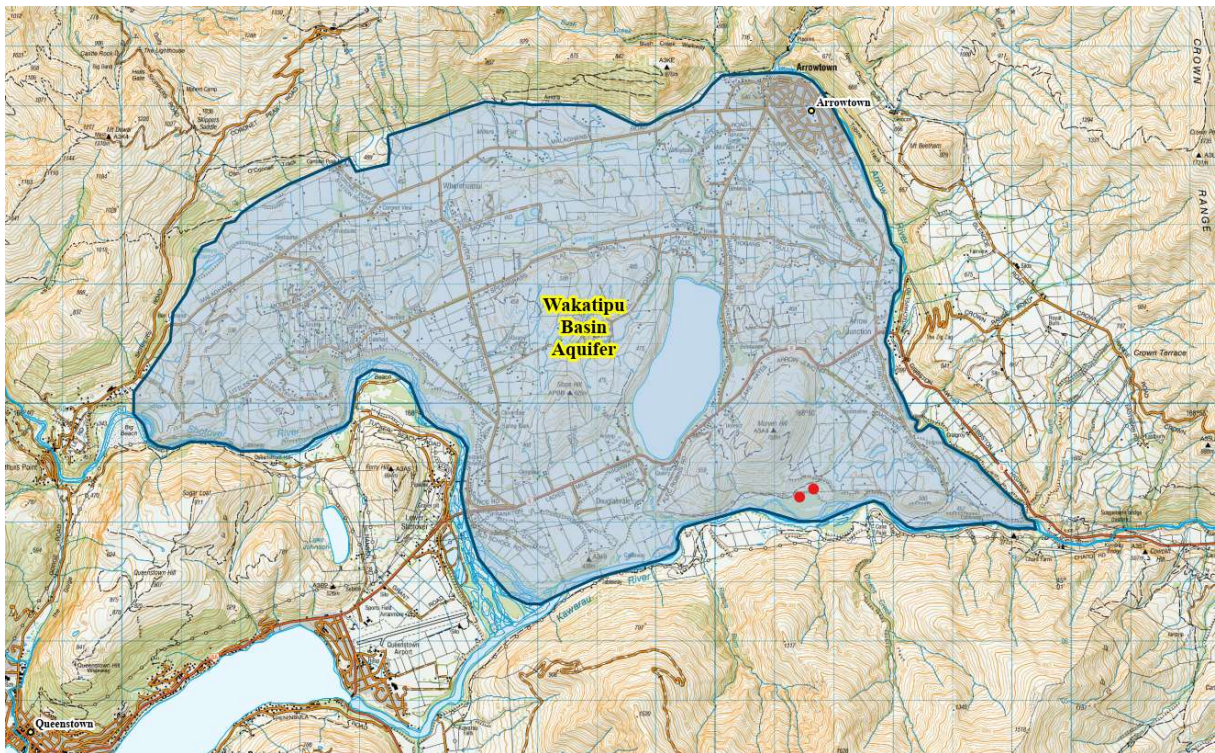


Figure 2. Otago Regional Council designated Wakatipu Basin Aquifer Map C4, 2022.

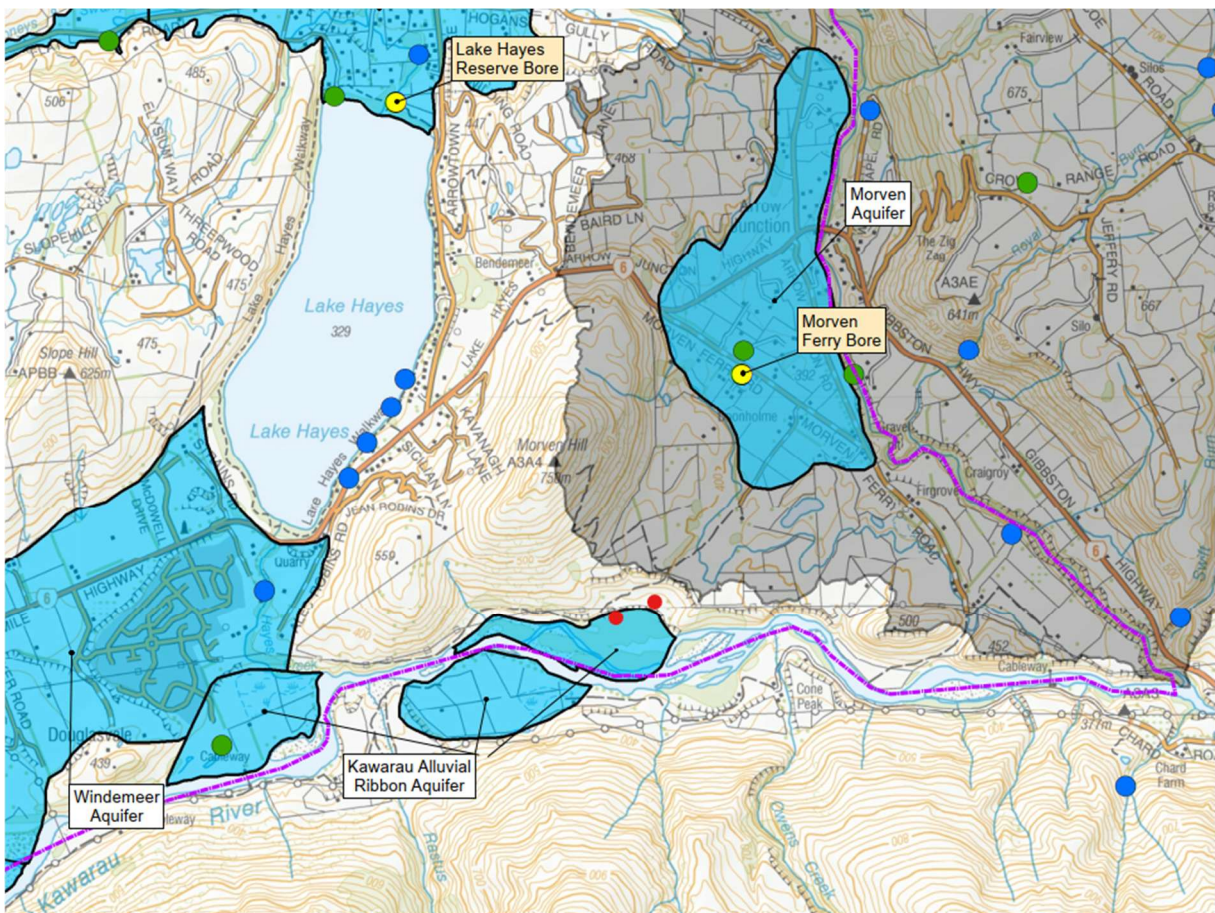
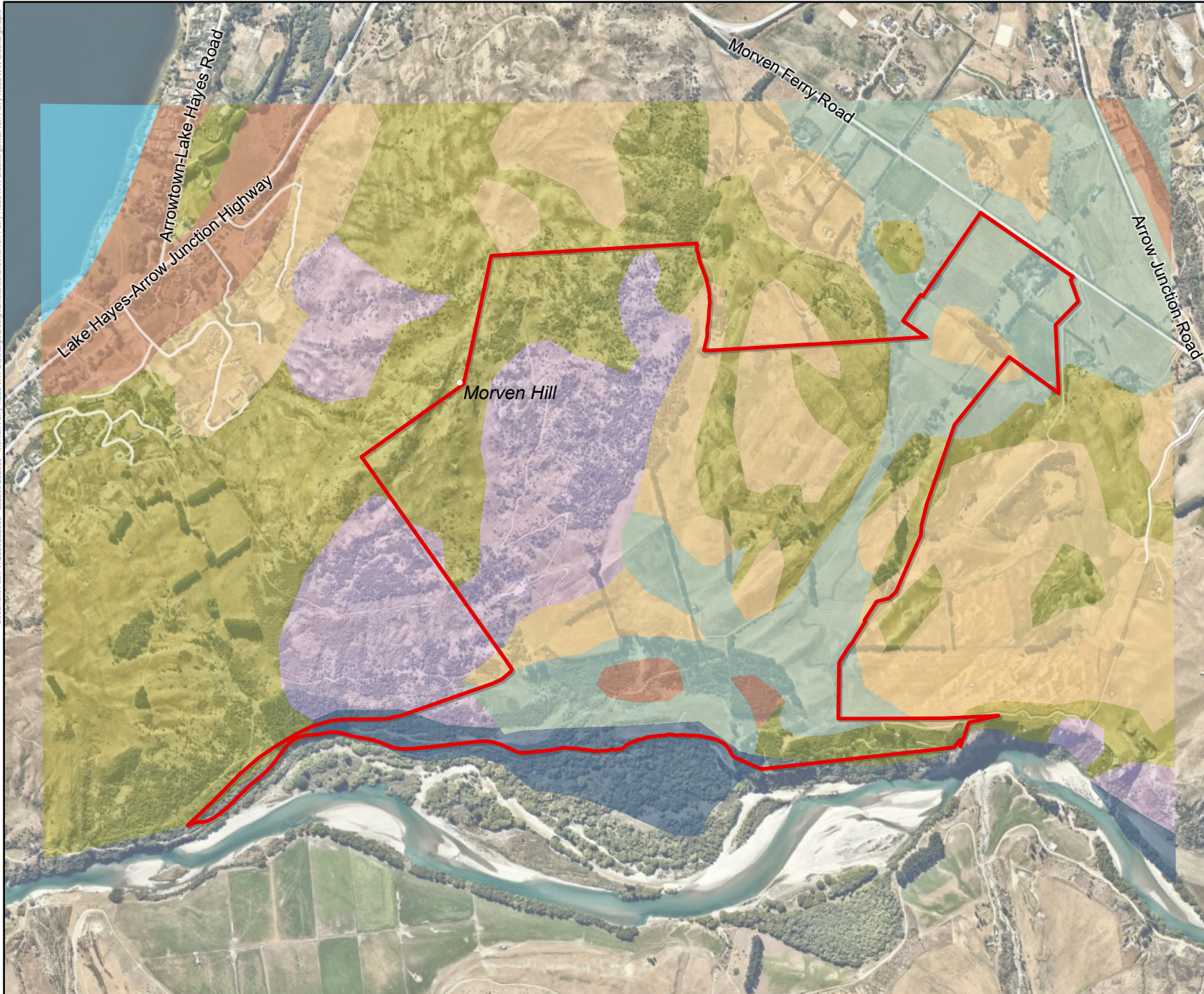


Figure 3. Otago Regional Council map of individual Wakatipu Basin aquifers, 2017.



LEGEND

- Site Boundary
- Surficial Geology
 - Schist Bedrock
 - Beach
 - Glacial Deposits
 - Lake
 - Colluvium
 - Recent Floodplain
 - Terrace Alluvium



Scale 1:16,000 @ A4

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

WGA

Figure 4

Surficial Geology Map of
Investigation Area
(Barrell et al 1994)

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

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2.2 Local Aquifer Definition

The more northerly of the two water supply trial bores, BH04, was drilled on a terrace of the Kawarau River slightly to the north (outside) of the defined KARA. The KARA appears to be defined by the drop-off between the Middle and Lower Terraces (Figure 3 & Figure 5).

The Middle Terrace, where BH04 is constructed, has an elevation of approximately 318 mRL. The drillhole intersected topsoils and unconfined sandy gravels to a depth of 8.4 m below ground level (m BGL) (Table 2), which is consistent with piezometers constructed in this area (WGA, 2026a; Figure 5). Below 8.4 m BGL, silts and gravelly silts were intersected to a depth of 34.4 m BGL, with this unit interpreted as representing a confining layer. From 34.4 m to 38.8 m BGL silty gravels were intersected with 'large water flows' (Appendix A). Basement schist was intersected at 38.8 m depth, with little water flow generated from this unit. The silty gravels intersected from 34.4 m to 38.8 m depth in BH04 are expected to behave as a leaky confined aquifer with a thickness of approximately 4.4 m.

Table 2. Geological Log Summary for Production Bore BH04

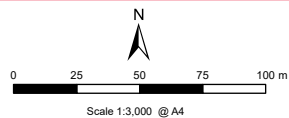
Depth (m)		Description ⁽¹⁾	Hydrogeological Interpretation
From	To		
0.0	0.4	Topsoil	Aquifer
0.4	8.4	Brown Silty Gravels	
8.4	22.0	Blue Silts with Cobbles and Gravels	Aquitard
22.0	34.4	Blue Silts	
34.4	38.8	Silty Gravels	Aquifer
38.8	41.8	Schist	Aquitard

Note:

⁽¹⁾ Data from driller's bore log (Appendix A).

Prior to testing BH04, the static groundwater level was measured at about 8.9 m BGL. Conceptually, Production Bore BH04 is screened in a 4.4 m thick gravel aquifer that is underlain by impermeable (relative to the aquifer) schist bedrock and overlain by a 26 m thick leaky silt confining layer. Above the leaky confining layer is a more-permeable gravelly stratum forming an unconfined aquifer, which was mostly unsaturated at the time field investigations were undertaken (WGA 2026a). Piezometers installed within the upper unconfined river terrace aquifer have been tested using falling head infiltration tests (WGA 2026a). At its closest approach, the Kawarau River is approximately 330 m from BH04 (Figure 5), and it has an elevation of approximately 306 mRL at this point. The hydraulic gradient between BH04 and the river, assuming a direct hydraulic connection between the aquifer and the riverbed, is approximately 0.009 m/m. The hydraulic characteristics of the aquifer targeted by BH04 are documented in Section 3.

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Coordinate System: NZGD 2000 New Zealand Transverse Mercator

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LEGEND

- Pylon
- Hand Auger Hole
- Piezometer
- Water Supply Trail Bore
- Drop Off
- Alluvial Fan
- Slope Break

WGA

Figure 5

Geomorphological Sketch and Investigation
Locations for the Kaurau River Terraces

The more southerly of the two deep water supply trial bores, BH05, was drilled on an access track from the Lower Terrace to the river flood plain, at an elevation of approximately 307 mRL. Production Bore BH05 intersected topsoils and sandy gravels to a depth of 8.2 m BGL (Table 3). Below that depth, bands of silts and silt-bound gravels were intersected to a depth of 28.8 m BGL, with this unit interpreted as representing a leaky confining layer. Basement schist was intersected at 28.8 m BGL, and drilling continued to a depth of 102 m BGL. The schist intersected was apparently heavily fractured and produced substantial flows of water during the drilling. The driller's description of alternating hard and soft bands, together with substantial inflows of water, is rare for basement schist rock mass in Otago. The observed flows led to the driller leaving almost the entire schist section as open hole, with the overlying sediments cased off.

Table 3. Geological Log Summary for Production Bore BH05

Depth (m bgl)		Description ⁽¹⁾	Hydrogeological Interpretation	
From	To			
0.0	3.1	Topsoils and Gravels	Aquifer	
3.1	8.2	Sandy Gravels		
8.2	20.2	Blue Silts with Gravels	Aquitard	
20.2	28.8	Bands of Blue Silts and Gravels	Aquitard	Aquifer
28.8	30.9	Schist	Aquitard	
30.9	100.0	Schist with Soft Zones and Groundwater Flows	Aquifer	
100.0	102.0	Schist with Soft Fracture Zone		

Note:

⁽¹⁾ Data from driller's bore log (Appendix A)

Schist bedrock was intersected at approximately the same elevation in both Production Bores. The drillers log for BH05 does not indicate a significant gravel layer above the schist, unlike BH04 which targets a distinct 4.4 m thick layer of silty gravels. Instead, SouthDrill logged bands of silts and gravels in BH05 overlying the schist, which are interpreted to represent a mixture of aquitard and aquifer strata. The gravel aquifer targeted by BH04 and the gravels intersected by BH05 above the schist are expected to be hydraulically connected to the Kawarau River. By extension, the fractured schist intersected in BH05 is also expected to be hydraulically connected to the Kawarau River.

Prior to a constant rate pumping test being performed on BH05, the static groundwater level was measured at about 0.3 m below the top of casing, which is equivalent to approximately 308.3 m RL. At its closest approach, the Kawarau River is approximately 280 m from BH05 (Figure 5), and it has an elevation of approximately 306.5 mRL at this point. The lateral hydraulic gradient between BH05 and the river, assuming a direct hydraulic connection between the aquifer and the riverbed, is approximately 0.006 m/m.

Conceptually, BH05 is screened in heavily fractured zone of schist with a total exposed thickness in the drillhole of 73 m. The overlying 29 m of interbedded silts and gravels were cased off and are interpreted to constitute leaky silt confining layers interbedded with transmissive gravelly aquifer strata. Pumping test analyses documented in Section 3 suggest that the fractured schist is recharged from leakage and ultimately from the Kawarau River.

Piezometers installed in BH3 and BH4 on the middle river terrace did not encounter groundwater, indicating the uppermost unconfined gravelly strata under these terraces is unsaturated. IN contrast, groundwater was observed within the unconfined gravelly strata at approximately 4.2 m BGL in piezometers installed in BH1 and BH2 on the lower river terrace (Figure 5). The lower terrace in the vicinity of the piezometers is at an elevation of approximately 309.5 m RL, indicating the groundwater level was at approximately 305.3 m RL. This elevation is similar to the elevation of the surface water in the adjacent Kawarau River, suggesting a direct hydraulic connection. This interpretation is consistent with the interpretation by Rekker (2014) for the KARA.

3 PUMPING TEST ANALYSES

3.1 Piezometer Testing

The investigation holes (BH1 to BH4) were drilled through the surficial soils on the middle and lower river terraces and were instrumented with piezometers screened in the uppermost three metres of the underlying unconfined gravels. These piezometers were tested by Kirk Roberts using falling head infiltration tests. The recovery curves from these falling head tests were analysed to determine the hydraulic conductivity of the surrounding (upper unconfined) gravel sediments (WGA, 2026a).

The results from analysis of the falling head tests (WGA, 2026a) were consistent from site to site (Table 4), within a range from 1×10^{-4} to 4×10^{-4} m/s. The average hydraulic conductivity results for each of these piezometers (Table 4) indicate the permeability of these gravelly sand layers, which informs the potential range in upper unconfined aquifer transmissivity that could be expected in the vicinity of the production bores and the Kawarau River.

Table 4: Falling Head Average Test Results for River Terrace Gravels

BORE ID	AVERAGE HYDRAULIC CONDUCTIVITY ⁽¹⁾	
	(m/s)	(m/day)
BH1	1.4×10^{-4}	12
BH2	2.7×10^{-4}	24
BH3	3.9×10^{-4}	34
BH4	4.1×10^{-4}	36

Note:

⁽¹⁾ Average of the results from three falling head tests performed on each piezometer. Refer to WGA 2026a for borehole logs and analysis sheets.

The upper unconfined gravelly strata tested by piezometers BH1 and BH2 on the lower terrace is considered representative of the unconfined KAWA for the purpose of estimating surface water interactions with groundwater and potential drawdown effects. The interpreted upper unconfined aquifer saturated thickness is up to about 6 m and the range of hydraulic conductivity for the BH1 and BH2 bores is about 12 to 24 m/day (Table 4). This results in a potential range of upper unconfined aquifer transmissivity of about 72 to 144 m²/day. The upper unconfined gravelly aquifer storativity is conservatively expected to be on the order of 0.1 (Johnson, 1967).

3.2 Production Bore Testing

Production bores BH04 and BH05 were tested through 1-day constant rate pumping tests in November and December 2025. These tests provided a basis for estimating aquifer parameters and water supply bore capacities for BH04 and BH05, which are estimated at approximately 600 and 1,880 m³/day, respectively. These capacities exceed the maximum total supply requirement of 2,006 m³/day, enabling a pumping schedule with regular rest periods. These estimated capacities are detailed below on Table 5 along with the tested pumping rates and in-bore drawdown observed. Drawdown and recovery curves provided in Appendix C indicate typical surface water recharge effects through rapid recovery and characteristic flattening of the drawdown curves.

Table 5: Water Supply Bore Capacity Estimates

PARAMETER	UNITS	BH04	BH05
Test Flow Rate	L/s	6.45	11.7
	m ³ /day	557	1,010
Available Drawdown ⁽¹⁾	m	18.9	57.7
Test Drawdown	m	17.4	31.0
Specific Capacity	m ³ /day/m	32.0	32.6
Bore Production Capacity	m ³ /day	600	1,880
	L/s ⁽²⁾	6.9	21.8

Note:

⁽¹⁾ The calculation of available drawdown includes an allowance of 2 m to install the pump above the base of the casing and a further 5 m for cavitation protection.

⁽²⁾ The flow rate in L/s is an average over 24 hours equivalent to the m³/day value.

Analysis results from the pumping tests are summarised in Table 6, with analysis sheets provided in Appendix C. Based on the characteristic flattening of drawdown and rapid drawdown recovery, it is reasonable to expect that the pumping test undertaken on BH04 could have been influenced by recharge from the river. Similarly, the results from the analysis method applied (Moench leaky confined aquifer method with a constant head in an overlying aquifer) suggest recharge from the river may have influenced drawdown during the pumping test.

Table 6: Hydraulic Test Results from Water Supply Trial Bores

PARAMETER	UNITS	BH04	BH05
Aquifer type		Gravel, leaky confined	Fractured rock, leaky confined
Analysis methodology applied		Moench (1985) leaky confined aquifer with constant head in overlying aquifer	Hantush (1960) leaky confined aquifer
Pumping rate applied	L/s	6.45	11.7
	m ³ /day	560	1,010
Saturated aquifer thickness	m	4.4	73
Aquifer hydraulic conductivity	m/s	1.3×10^{-4}	8×10^{-7}
	m/day	10.9	0.07
Aquifer transmissivity	m ² /s	5.5×10^{-4}	6×10^{-5}
	m ² /day	48	5.2
Confining aquitard thickness	m	26	29
Confining aquitard vertical hydraulic conductivity ⁽¹⁾	m/s	1.6×10^{-8}	-
	m/day	0.0014	-

Note:

⁽¹⁾ The hydraulic conductivity estimate of the leaky confining layer is subject to uncertainty; therefore, a potentially higher range value is also adopted for the assessment of effects.

The testing results and analysis of the aquifer parameters from the pumping test performed on BH05 indicates a direct hydraulic connection to the Kawarau River. The alternating hard and soft bands in the schist intersected suggest the drillhole intersected a complex and steeply dipping fault zone. Furthermore, the results from the analysis method applied (Hantush leaky confined aquifer method) suggest a strong hydraulic connection to a nearby water source. On this basis, it is reasonably expected that water drawn to BH05 by pumping will be predominantly sourced from the Kawarau River during long term abstraction for supply.

3.3 Adopted Aquifer Parameters

The testing results above have been applied conservatively for assessing potential effects of the abstraction from BH04 and BH05. Given the water abstracted from BH05 in fractured schist is expected to originate from leakage from the overlying aquifer targeted by BH04, a multi-layer analytical model is proposed for the assessment of effects in accordance with Ward and Lough (2011). This model estimates stream depletion effects and drawdown within upper aquifer strata while applying the aquitard leakage and hydraulic boundary effect of the river.

The multi-layer analytical model utilises the aquifer testing results and applies conservative assumptions based on literature. The site conceptual model implies a direct hydraulic connection to the Kawarau River occurs through the KARA, with leakage and recharge to the targeted aquifers occurring through interbedded silts and gravels. Drawdown effects within the fractured schist are not applicable to this model, as the abstraction is treated analytically to occur from the unconsolidated strata above the schist (i.e., from the lower gravelly unconsolidated aquifer targeted by BH04). The adopted analytical aquifer model parameters applied to the Ward and Lough (2011) solution for the assessment of effects are provided in Table 7.

Table 7. Adopted Analytical Aquifer Model Parameters

LAYER	PARAMETER	UNITS	VALUE
Kawarau River Streambed ⁽¹⁾	Streambed Conductance (λ)	m/day	1,000
Upper Unconfined Kawarau River Alluvial Ribbon Aquifer	Transmissivity	m ² /day	72 – 144
	Storativity ⁽²⁾	-	0.1
Lower Unconsolidated Silty Aquitard	Aquitard Conductance ⁽³⁾	1/day	5.4×10^{-5} – 5.4×10^{-4}
Lower Unconsolidated Gravelly Aquifer	Transmissivity	m ² /day	48
	Storativity ⁽⁴⁾	-	0.001 – 0.01

Note:

⁽¹⁾ Streambed conductance is defined as the Kawarau River width (approximately 100 m) divided by the streambed thickness (1 m assumed) multiplied by the hydraulic conductivity of the streambed (low-range representative value for silty gravels of 10 m/day as per Freeze & Cherry, 1979).

⁽²⁾ The upper unconfined aquifer storativity is conservatively expected to be on the order of 0.1 (-) in accordance with Johnson (1967).

⁽³⁾ Aquitard conductance is the vertical aquitard hydraulic conductivity 0.0014 m/day estimated from BH04 testing divided by the aquitard thickness of 26 m. A higher-range value is also adopted for the purpose of the assessment of effects one-magnitude higher.

⁽⁴⁾ A range of potential lower unconsolidated gravelly aquifer is applied as semi-confined with the lower range value of 0.001 in accordance with BH05 testing. The long-term potential drawdown effects within the lower and upper aquifer plus long-term stream depletion effects are insensitive to this parameter.

4 ASSESSMENT OF EFFECTS

4.1 Drawdown Effects

A drawdown assessment has been undertaken using the conservative range of expected aquifer parameters set out in Section 3.3 derived from the production bore and piezometer testing. The maximum water use scenario is considered to provide a conservative estimate of the potential effects of the proposed take. The maximum use scenario estimates drawdown due to pumping the production bores at the maximum combined abstraction rate of 23 L/s (2,006 m³/day) continuously for years across the long-term operation for the development supply (Table 8). Under this scenario, both production bores are expected to be pumping suitably below their respective capacities.

Table 8. Maximum Abstraction Rate Scenario

SCENARIO	BASIS	DAILY DEMAND (m ³)	FLOW RATE (L/s)
Maximum Use	BH04 and BH05 pumping at a combined 2,006 m ³ /day with continuous operation over years. BH04 at 3 L/s and BH05 at 20 L/s.	2,006	23

The Ward and Lough (2011) solution is applied for multi-well pumping forward drawdown and stream depletion projections. It is unlikely that the production bores will be pumped continuously at the maximum rate, therefore, the projections are expected to be a worst-case scenario for assessing potential drawdown effects.

There are no neighbouring bores according to the ORC database in the expected drawdown and groundwater source area for the production bores due to the Kwarau River hydraulic boundary effect, surrounding schist terrain, and absence of neighbouring supply bores on the relevant eastern section of the Kwarau Alluvial Ribbon Aquifer (refer Figure 1 and Figure 3). Therefore, no drawdown effects are expected on neighbouring bores and no further assessment of potential impacts on neighbouring bores is undertaken.

The results of the forward multi-well drawdown assessment under the maximum use scenario are tabulated below on Table 9 for the closest existing infrastructure being the two closest Transpower pylons with cement foundations set on the east middle and west middle river terrace. The locations of these two closest pylons are shown on Figure 5 in the context of the production bore locations. The modelled drawdown estimates provided on Table 9 are for the range of results across the range of expected parameters provided on Table 7. The modelled drawdown effects on Table 9 are the cumulative effect of both production bores under the maximum long-term use scenario.

Table 9. Modelled Drawdown Effects

PYLON	BASIS	DRAWDOWN (m)
West middle river terrace	Long-term maximum use scenario. Drawdown is estimated within the upper unconfined Kwarau Alluvial Ribbon Aquifer as potential lowering of the phreatic surface within gravelly strata.	0.64 – 2.77
East middle river terrace		0.72 – 1.57

It is understood these drawdown estimates support and accompany geotechnical assessment for the potential magnitude of settlement effects. Settlement effects are expected to be low for the clast-supported (low potential compressibility) unconfined gravelly sediments underlying the Middle Terrace where potential lowering of the phreatic surface is modelled. Potential for differential drawdown across the footprint of the pylon foundations is modelled to be negligible (modelled to be on the order of 0.001 m). The projected drawdown induced settlement within the clast-supported gravelly strata at the closest Transpower pylons is expected to be less than minor and within tolerances for the infrastructure with negligible differential settlement depending on the findings from the associated geotechnical assessment.

All nearby production bores target the Morven Aquifer (Figure 3), to the north and east of Ridgeburn. These bores are hydraulically separated from Bores BH04 and BH05 by the basement rise behind the Residential Terrace drop-off (Section 2.1). No drawdown arising from pumping from the new production bores is expected at existing neighbouring water supply bores due to the location of the new production bores and the hydrogeological setting. Therefore, drawdown on neighbouring bores is expected below the guideline value of 0.2 m as defined in Schedule 5B of the Otago Regional Plan, which outlines the method for identifying bores potentially affected by drawdown interference. The projected drawdown effects of the proposed take on nearby bores are assessed as less than minor.

4.2 Stream Depletion

As per the requirements under Schedule 5A of the Otago Regional Plan: Water, the Ward and Lough (2011) analytical solution is expected to be representative of the potential stream depletion effect on the Kawarau River given the hydrogeological setting and adopted aquifer parameters.

The long-term stream depletion effect on the Kawarau River under the maximum use scenario is modelled to be approximately 19.5 L/s for BH05 and 2.9 L/s for BH04, totalling 22.4 L/s or 97% of the sought maximum daily volume equivalent to 23 L/s. The stream depletion effect becomes stable as the groundwater drawdown becomes balanced with induced recharge (depletion) effects via modelled leakage through the Kawarau River riverbed and upper unconfined aquifer.

River flow rates for the Kawarau River at Chard Road, approximately 2.5 km downstream from Ridgeburn, have been estimated and recorded by Earth Sciences New Zealand (ESNZ, formerly NIWA), with these records available through the Hydro Web Portal and the ORC Environmental Data Portal. Flow estimates are available for the period from August 1998 to January 2022, a period of approximately 32 years. The available flow estimates are only available on an approximately monthly basis throughout this period, with a total of 389 records.

A Kawarau River flow exceedance curve has been derived from the Chard Road flow estimates (Figure 6), which indicates that the 0.5 % low flow is approximately 60.3 m³/s. In lieu of more accurate flow data for the Kawarau River, this flow rate has been accepted as an indication of the mean annual low flow in the river adjacent to Ridgeburn.

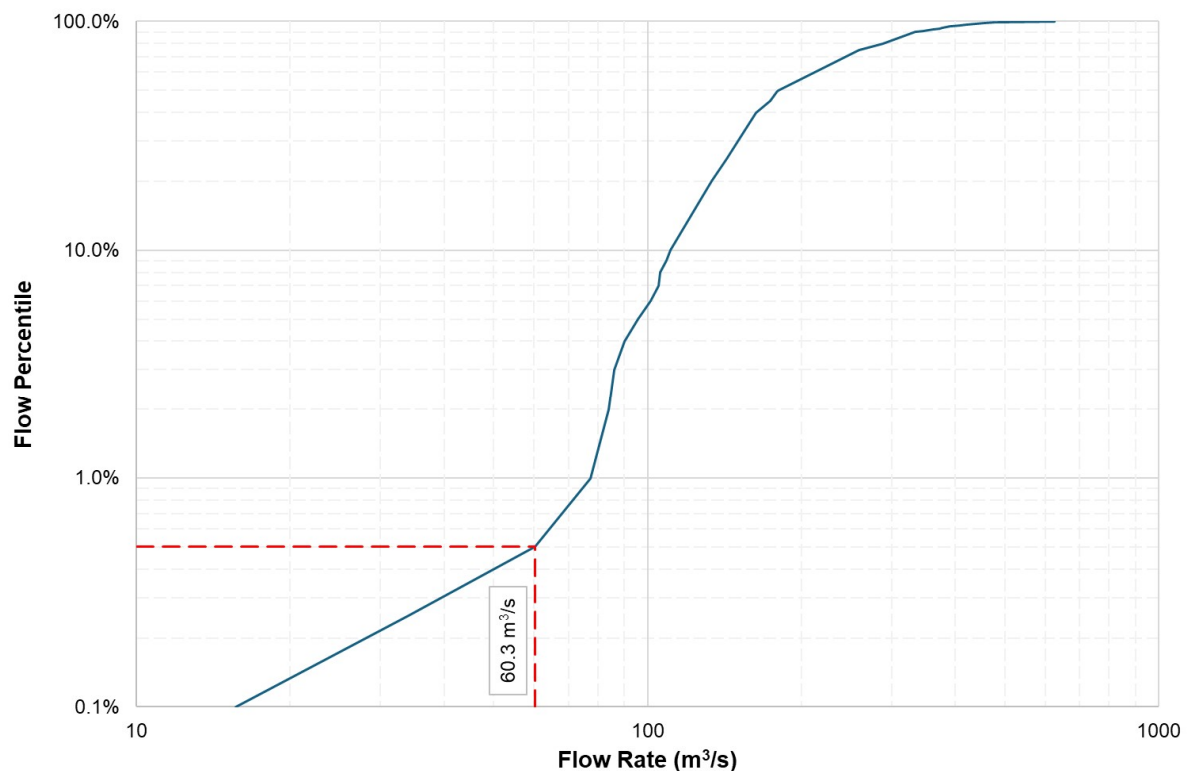


Figure 6: Kawarau River at Chard Road Flow Exceedance Curve

The modelled maximum long-term stream depletion effect represents approximately 97% of the groundwater take and only 0.037% of the Kawarau River flow during low flow conditions. This effect is assessed to be negligible, with no measurable effects on the river flow or surface water levels in the river and surrounding riparian environment.

No wetlands were identified within 1 km of the production bores on the ORC wetland database. Wetlands identified in the residential area within the development are outside of the groundwater drawdown area of the production bores. Given the negligible in-stream effects on the Kawarau River and lack of nearby wetlands in the drawdown area of the bores, the proposed groundwater abstraction is not considered to have any adverse effect on surface water bodies.

4.3 Aquifer Allocation

The Wakatipu Basin aquifers are managed as part of the Clutha/Mata-Au catchment, with alluvial ribbon aquifers along the Shotover and Kawarau Rivers recommended for allocation as surface water equivalents under Schedule 2C (Rekker, 2014). Both production bores are in the wider ORC Wakatipu Basin Aquifer (Map C4) area and are expected to be hydraulically connected to the Kawarau River based on the analyses of the pumping tests and modelled stream depletion effect.

A hydraulically connected groundwater take is one where abstracted groundwater is considered to be connected to surface water as per Policy 6.4.1A. Under Policy 6.4.1A, the groundwater take would be allocated as surface water and subject to minimum flow conditions if the bores are in a Schedule 2C aquifer or within 100 m of a perennial surface water body. As the bores are not in a Schedule 2C aquifer and are more than 100 m from the Kawarau River, Policy 6.4.1A (c) is relevant for the bores as stream depletion is expected to be above 5 L/s. According to this policy, the portion of the abstracted groundwater allocated to surface water is determined as per Schedule 5A (determination of stream depletion effect) with no minimum flow restrictions.

The estimated stream depletion effect indicates that about 97% of the proposed groundwater abstraction in the long-term is to be allocated to surface water with the remaining 3% of the proposed groundwater take allocated to the KARA. According to ORC consent and bores data, there are no existing groundwater takes on the eastern section of the KARA where the production bores are located (Figure 3). An approximate delineation of the surface water catchment supporting groundwater recharge to this aquifer suggests an area on the order of 160 ha, which includes some of the south and southwest extent of Morven Hill outside of the development area as well as the upper river terraces south and southwest within the development. With the mean annual recharge of 184 mm applied (Section 2.1), 50% of the mean annual recharge as a volume for the eastern section of the KARA is 147,200 m³.

Only 3% of the proposed groundwater abstraction (equivalent to about 0.6 L/s, or 18,922 m³/year) is modelled to be sourced from groundwater recharge originating from the contributing up-gradient catchment (i.e., not from the Kawarau River). This volume is well within the approximate 50% mean annual recharge and is therefore not considered to result in an adverse long-term decline or loss of the groundwater resource. Further to this, potential long-term drawdown effects are estimated during long-term operation of the production bores, however, the effect is steady via balance from river recharge/leakage and localised around the bores.

5 CONCLUSIONS

A consent is being sought by Ridgeburn Limited for the abstraction of groundwater from new production bores BH04 and BH05 at 122 Morven Ferry Road, Arrow Junction, for community water supply purposes. The combined abstraction rate being sought for community water supply is as follows:

- A combined maximum daily volume of 2,006 m³ (equivalent to 23 L/s)
- A total combined maximum annual volume of 732,190 m³

The maximum annual volume of 732,190 m³ would be expended at the maximum daily volume over a 365-day period, though actual abstraction is expected to be less due to variability in community water requirements.

Production Bore BH04 is interpreted to take water from a gravelly aquifer underlying the river terraces, with source water primarily from leakage through overlying strata and ultimately from the Kawarau River. Production Bore BH05 is interpreted to take water from a heavily fractured schist bedrock aquifer, with source water also primarily from leakage through overlying strata and ultimately from the Kawarau River.

Constant rate pumping tests performed on the production bores produced data that was analysed indicating the bores can support the proposed combined maximum daily volume with a pumping arrangement of approximately 3 L/s for BH04 and 20 L/s for BH05. The constant rate pumping tests produced data used to analyse the hydraulic behaviour of the source aquifers. Analysis of the pumping test data indicates appropriate aquifer parameters for characterisation of the bulk aquifer strata connected to the production bores are:

- Upper unconfined Kawarau Alluvial Ribbon Aquifer transmissivity: 72 – 144 m²/day
- Upper unconfined Kawarau Alluvial Ribbon Aquifer storativity: 0.1 (-)
- Lower gravelly aquifer transmissivity: 48 m²/day
- Lower gravelly aquifer storativity: 0.001 – 0.01 (-)
- Aquitard conductance: 5.4×10^{-5} – 5.4×10^{-4} 1/day

The results from the pumping test analysis have been used to estimate the effects of the proposed abstraction on nearby infrastructure and bores. Modelled drawdown in the upper unconfined (gravelly clast-supported) aquifer at the closest Transpower pylons ranges from 0.64 m to 2.77 m under the long-term maximum use scenario, with projected settlement effects assessed as less than minor and within tolerances for the infrastructure, subject to geotechnical assessment. There are no neighbouring bores within the expected drawdown area. Drawdown on existing bores is expected to be below the guideline 0.2 m as defined in Schedule 5B of the Otago Regional Plan. Therefore, the projected cumulative drawdown effect of the proposed takes on nearby bores is assessed as less than minor.

Analytical modelling estimates that the proposed maximum take scenario is expected to result in flow depletion in the Kawarau River of approximately 22.4 L/s (97% of the take), which represents only 0.037% of the river's mean annual low flow. This effect is assessed as negligible, with no measurable effects on river flow, surface water levels, or the surrounding riparian environment.

No wetlands were identified within 1 km of the production bores on the ORC wetland database, and wetlands within the development are outside the drawdown area. Given the negligible in-stream effects and lack of nearby wetlands in the drawdown area, the proposed abstraction is not considered to have any adverse effect on surface water bodies.

The proposed groundwater take is expected to be hydraulically connected to the Kawarau River, with approximately 97% of the abstraction allocated as surface water under Policy 6.4.1A and Schedule 5A of the Otago Regional Plan: Water, and the remaining 3% (approximately 18,922 m³/year) allocated to the Kawarau Alluvial Ribbon Aquifer. This volume is well within 50% of the estimated mean annual recharge for the relevant section of the aquifer and is not considered to result in an adverse long-term decline or loss of the groundwater resource.

6 LIMITATIONS

This report has been based on data provided to WGA by others. No WGA staff member was present at the site during the pumping tests. No validation of the data provided by the drillers has been undertaken. Any issues with data quality that have been identified during the analysis are documented in this report. WGA has not attempted to resolve data quality issues except where clearly stated. The data has been analysed on an “as provided” basis. No liability is accepted for incorrect or misleading analysis results arising from poorly documented, incomplete, or incorrect pumping test data.

7 REFERENCES

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APPENDIX A

DRILLER'S BORE LOGS



Bore Construction Report

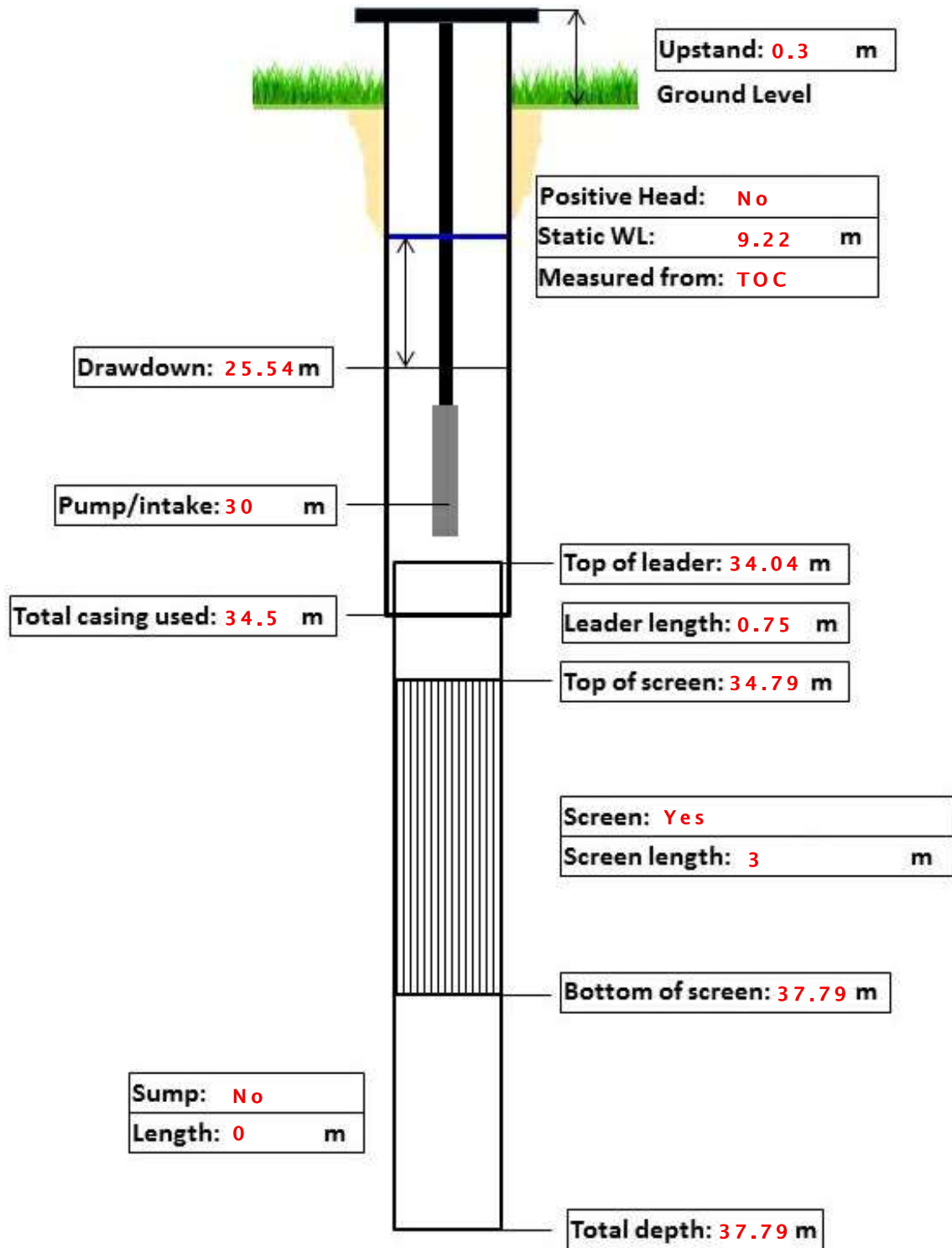


OFFICE USE ONLY		
Date received:	Accession number:	Signed:
Bore number: sou 2852 hole no140	Entered IRIS date:	Invoice date:

GENERAL DETAILS		
Client/Consent holder's name: Cameron		Consent number: RM25.435.01
Location/Address: 122 Morven Ferry Road Queenstown		
Grid reference - Easting: 1271608m E	Northing: 5008548m N	Mobile phone: 02108851148
Sketch plan attached: Yes	Photos attached: Yes	Home phone:
DRILLING DETAILS		
Drilling company: SouthDrill Ltd		Driller: Rowland Harrex
Machine/Rig: Western Star Drilling Rig [QCL493]		Fleet no. 2030
Drill method(s): Air Rotary		
BORE CONSTRUCTION DETAILS		
Start date: 12/11/2025	Finish date: 24/11/2025	
Bore diameter: 200mm	Casing material: Steel	
Screen material: s/s		
Screen diameter (inside): 156mm	Screen diameter (outside): 162mm	
Screen slots: 2.5mm	Overdrilled: Yes	
PUMPING/WATER DETAILS		
Dry bore: No	If dry, was casing retrieved?	Bore filled in:
Development period: 39 hours	Development method: Airlifted	
Yield/test pumping: Pumped	Test pump period: 27 hours	
Test pump rate: 6.5 litres/second	Method of measuring rate: meter	
Comments: 3 stage pump test and 24 hr constant rate		
Pumped water level: 25.53 metres		
WATER QUALITY ETC		
Bacterial water test: Yes	Chemical water test: Yes	
Casing top sealed: Yes	Impervious seal at ground: Yes	
Comments: water test taken by hydrologist		
BORE LOG (METRES BELOW REFERENCE POINT)		
0m-0.4m	top soils	
0.4m-8.4m	brown silty gravels	
8.4m-11.9m	blue silts large cobbels	
11.9m-22m	blue silts odd gravels	
22m-34.4m	blue silts	
34.4m-38.8m	silty gravels large water flow	
38.8m-41.83m	tight silty gravels possible schist	
41.83m	tried to get water flow 41.83-38.83 with 3m screen not much flow pulled screen and casing back	
Do you intend to drill more bores under this Land Use Consent number? No		
If yes, number of bores drilled:		Number of bore logs provided:

Bore Construction Diagram

Bore number:
sou 2852 hole no140



Bore Construction Report

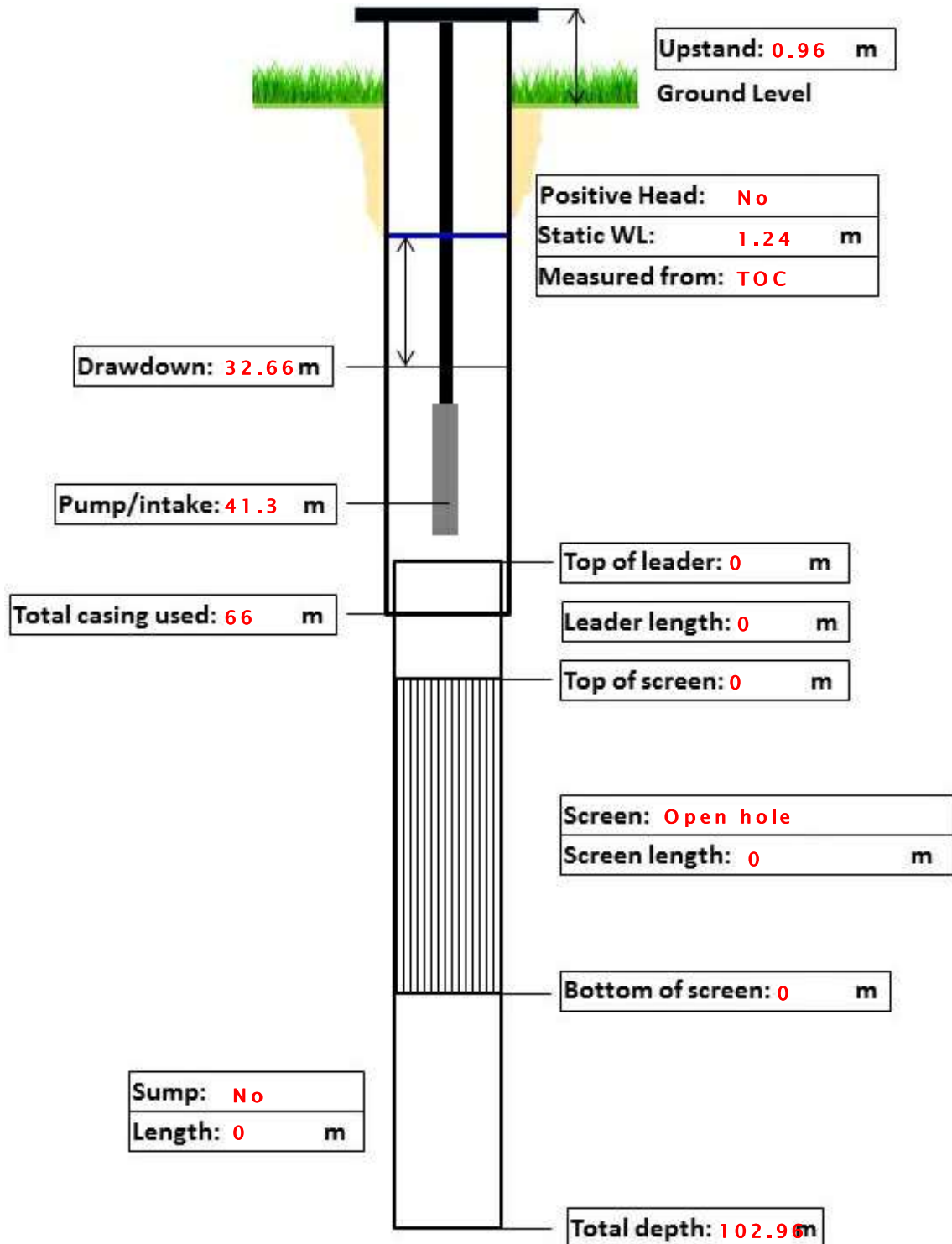


OFFICE USE ONLY		
Date received:	Accession number:	Signed:
Bore number: 2852 bore no5	Entered IRIS date:	Invoice date:

GENERAL DETAILS		
Client/Consent holder's name: Cameron		Consent number: RM25.435.05
Location/Address: 122 MORVEN FERRY ROAD		
Grid reference - Easting: 1271404m E	Northing: 5008426m N	Mobile phone: 02108851148
Sketch plan attached: Yes	Photos attached: Yes	Home phone:
DRILLING DETAILS		
Drilling company: SouthDrill Ltd		Driller: Rowland Harrex
Machine/Rig: Western Star Drilling Rig [QCL493]		Fleet no. 2030
Drill method(s): Air Rotary		
BORE CONSTRUCTION DETAILS		
Start date: 21/11/2025		Finish date: 05/12/2025
Bore diameter: 200mm		Casing material: Steel
Screen material: N/A		
Screen diameter (inside): 0mm		Screen diameter (outside): 0mm
Screen slots: 0mm		Overdrilled: Yes
PUMPING/WATER DETAILS		
Dry bore: No	If dry, was casing retrieved?	Bore filled in:
Development period: 29 hours	Development method: Airlifted	
Yield/test pumping: Pumped	Test pump period: 28 hours	
Test pump rate: 11.7 litres/second	Method of measuring reate: METER	
Comments: DID 2 STAGE PUMP TEST AND 26HRS CONSTANT RATE		
Pumped water level: 32.5 metres		
WATER QUALITY ETC		
Bacterial water test: Yes	Chemical water test: Yes	
Casing top sealed: Yes	Impervious seal at ground: Yes	
Comments: TOKE HILL LAB TEST WHEN DEVELOPING AND CONSALTENT DID HIS OWN WILL WE PUMPED 0.63NTU		
BORE LOG (METRES BELOW REFERENCE POINT)		
0m-3.1m	TOP SOILS ODD GRAVEL	
3.1m-8.2m	SANDY GRAVELS	
8.2m-15.2m	BLUE SILTS ODD GRAVELS	
15.2m-20.2m	TIGHT SILTS GRAVELS	
20.2m-28.8m	BANDS BLUE SILTS AND GRAVELS	
28.8m-30.89m	SCHIST ROCK	
30.89m-42m	OPEN HOLE 30.89M SOFT AND HARD BANDS SCHIST BLOWING ABOUT 2 LTS/SEC WATER	
42m-60m	SOFT AND HARD BANDS SCHIST BLOWING 10-15 LTS/SEC aprox	
60m-72m	SCHIST HARD SMALL SOFT ZONES BLOWING 10-15LTS/SEC PLUS aprox	
72m-73.2m	SOFT ZONE POSSABLY MORE WATER FLOW	
73.2m-100m	SCHIST HARD SMALL SOFT ZONES	
100m-102m	SOFT FRACTUERD HOLE CAVEING IN	
102m	6inch CASEING TO 66M	
Do you intend to drill more bores under this Land Use Consent number? No		
If yes, number of bores drilled:		Number of bore logs provided:

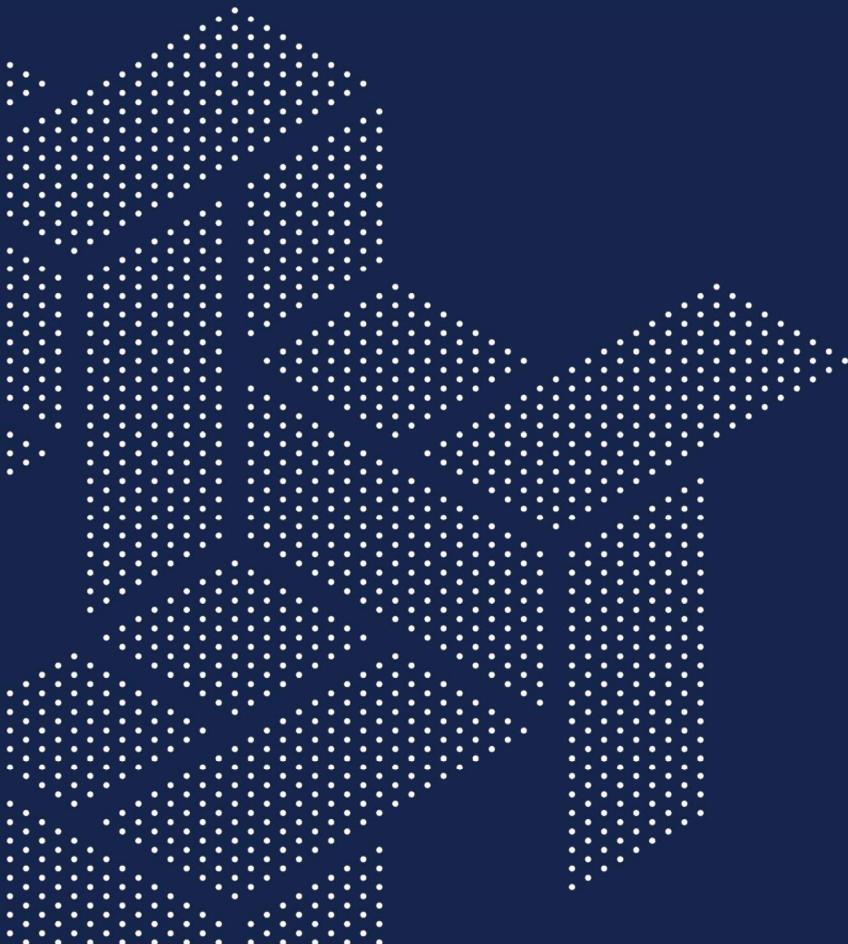
Bore Construction Diagram

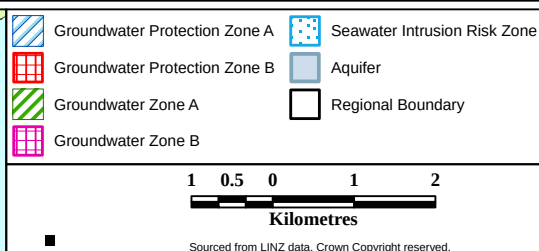
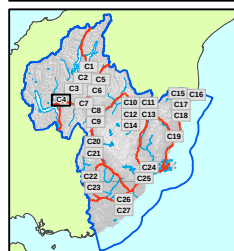
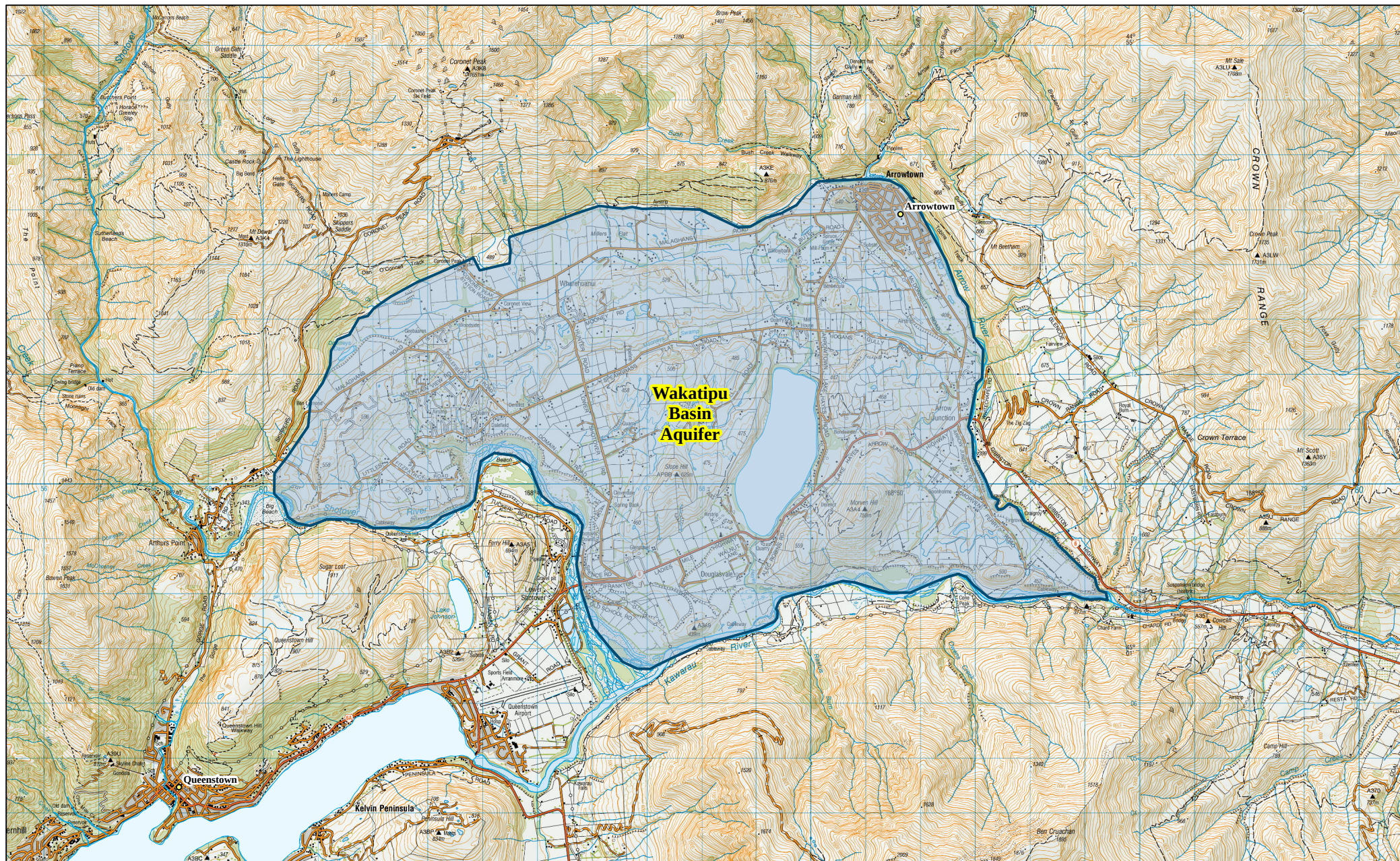
Bore number:
2852 bore no5



APPENDIX B

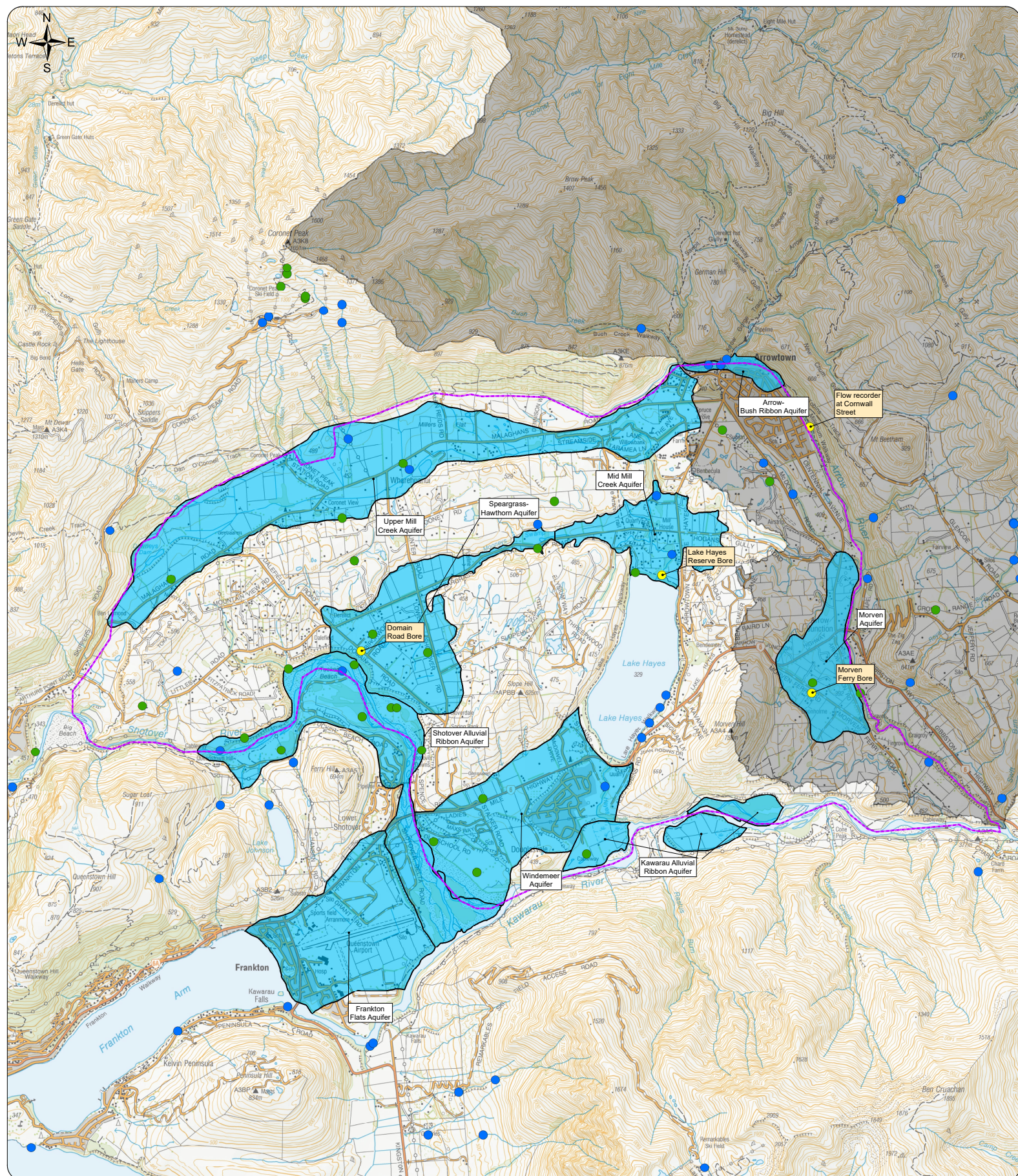
AQUIFER AND GEOLOGICAL MAPS





Map C4
Aquifers, Groundwater Zones, Groundwater Protection Zones, and Seawater Intrusion Risk Zones
 Refer to:
 - Schedules 2C, 3A and 4
 - Rules in 12.2, 12.A and 14.2
 - Policies 6.4.1A, 6.4.10A, 6.4.10A1, 8.6.5, 9.4.1 and 9.4.18 – 20

Basemap: Land Information New Zealand Topo50 Maps
 5 March 2022



Wakatipu Basin aquifers



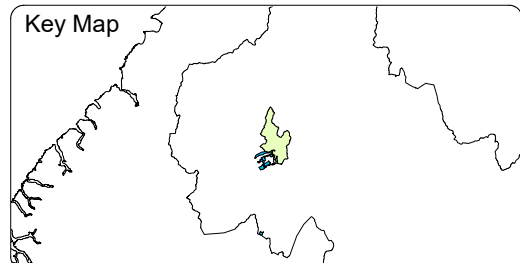
Basemap sourced from the LINZ Data Service and licensed by LINZ for re-use under the Creative Commons Attribution 3.0 New Zealand licence.

Date: 21/06/2017

Key

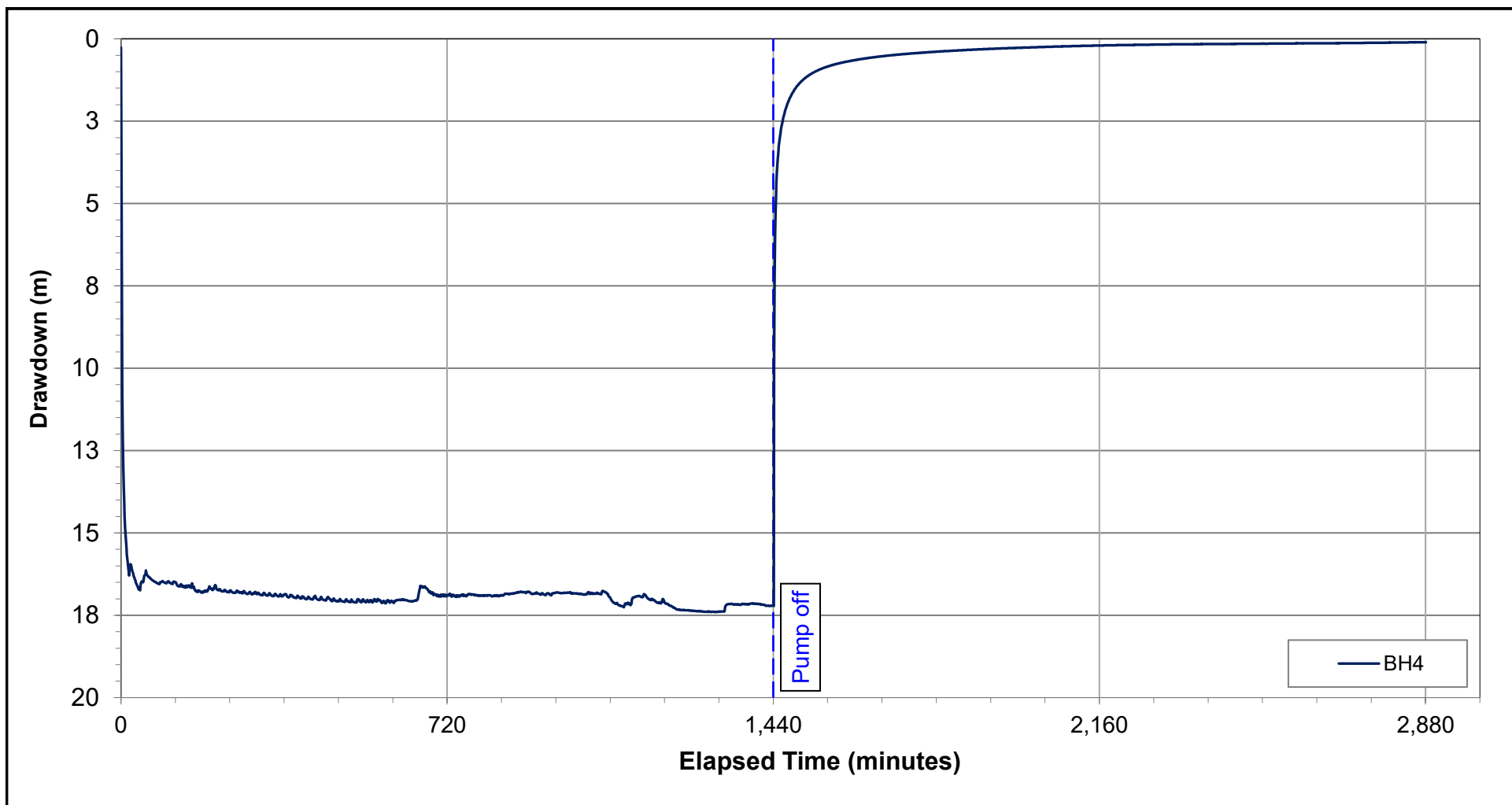
- Telemetered flow and level monitoring sites
- Groundwater take permit
- Surface Water take permit
- Wakatipu Basin Aquifer Boundary from Water Plan
- Arrow river catchment
- Wakatipu basin aquifers

Key Map



APPENDIX C PUMPING TEST ANALYSIS SHEETS





Water Supply Trial BH4
122 Morven Ferry Road

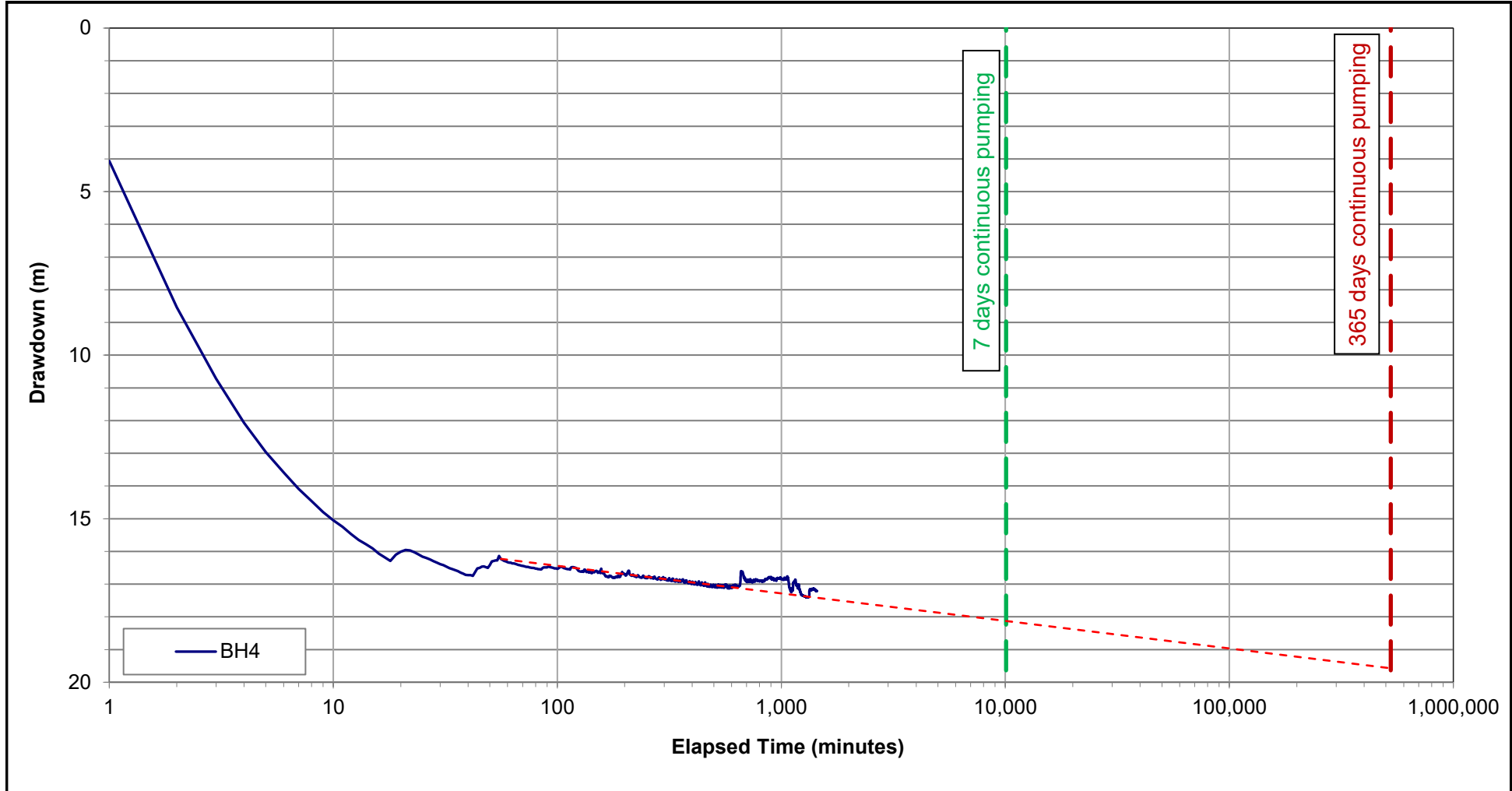
WGA

TITLE
Constant Rate Pumping Test Drawdown and Recovery, 19-20 November 2025
Normal - Normal Scale Plot. Data supplied by SouthDrill.

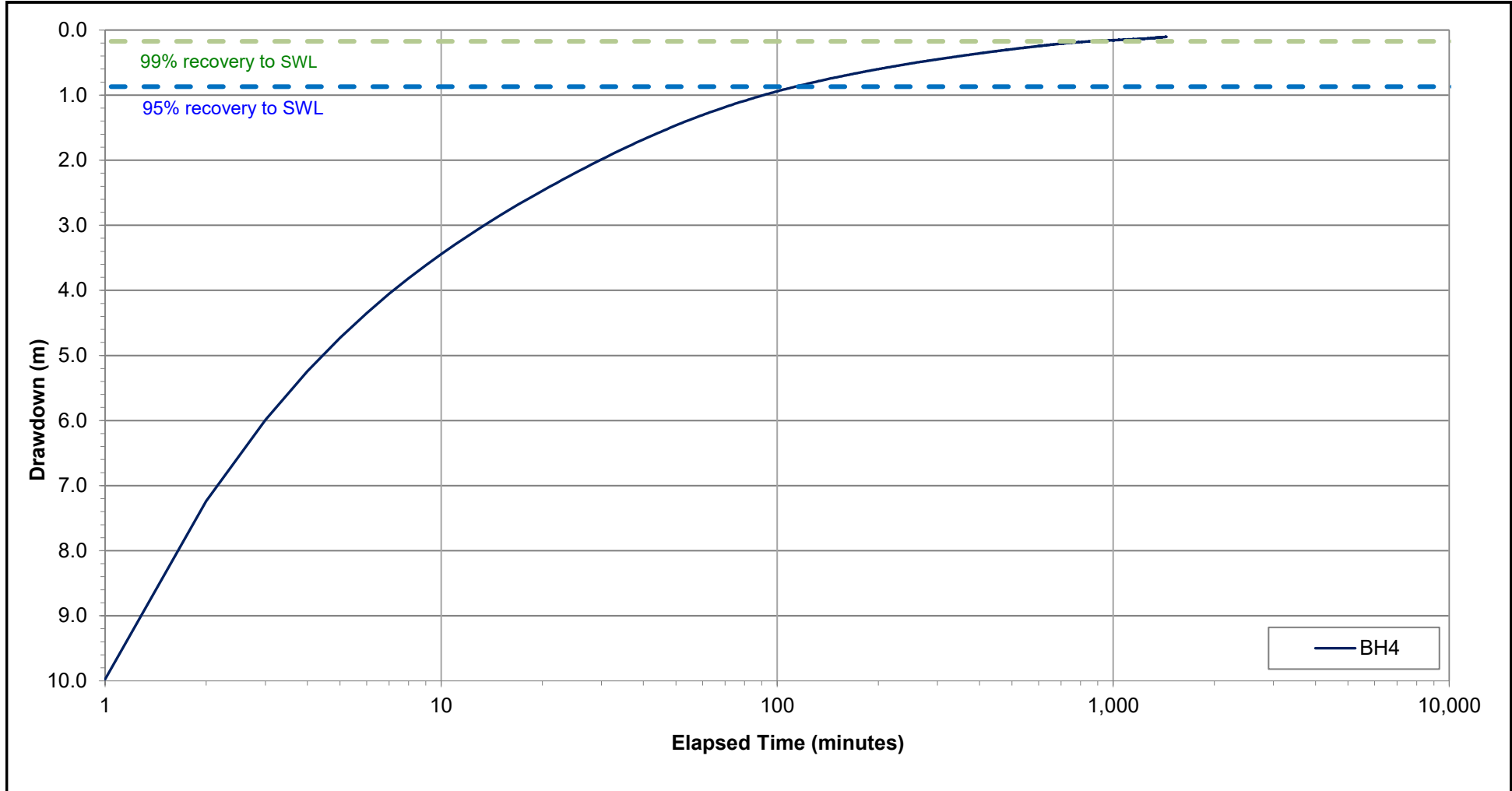
DRAWN J. Manning
CHECKED B. Sinclair
REVIEWED B. Sinclair

DATE 12 December 2025
SCALE na
FILE NO. na

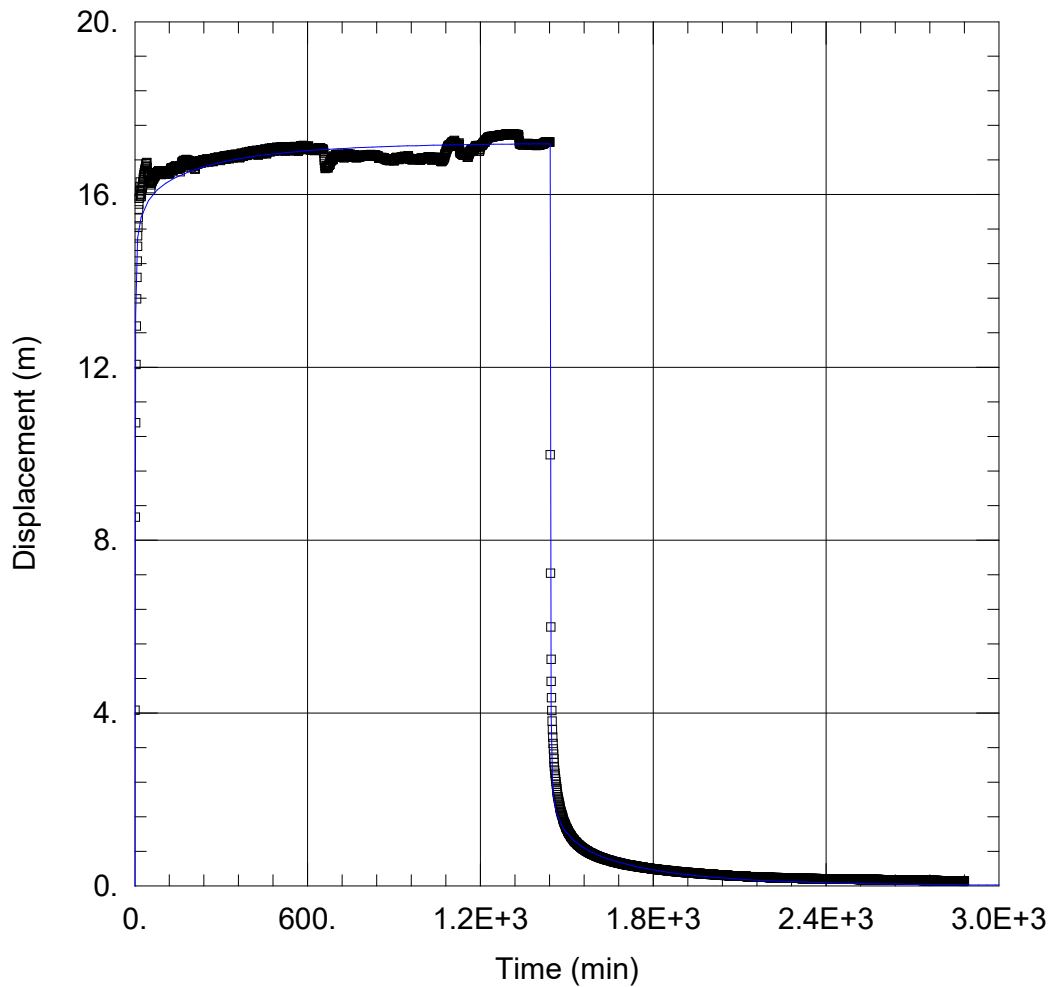
JOB NO. WGA252389
DWG. NO. na
FIGURE NO. C1



Water Supply Trial BH4 122 Morven Ferry Road WGA	TITLE			Projected Drawdown Following 120 Days Continuous Pumping Period	
				Log - Normal Scale Plot. Data supplied by SouthDrill.	
	DRAWN	J. Manning	DATE	12 December 2025	JOB NO. WGA252389
	CHECKED	B. Sinclair	SCALE	na	DWG. NO. na
	REVIEWED	B. Sinclair	FILE NO.	na	FIGURE NO. C2



Water Supply Trial BH4 122 Morven Ferry Road WGA	TITLE			Constant Rate Pumping Test Recovery Percentage, 19-20 November 2025	
				Log - Normal Scale Plot. Data supplied by SouthDrill.	
	DRAWN	J. Manning	DATE	12 December 2025	JOB NO. WGA252389
	CHECKED	B. Sinclair	SCALE	na	DWG. NO. na
	REVIEWED	B. Sinclair	FILE NO.	na	FIGURE NO. C3



WELL TEST ANALYSIS

Data Set: V:\...\BH4 - leaky.aqt

Date: 12/16/25

Time: 17:39:26

PROJECT INFORMATION

Company: WGA

Project: WGA252389

AQUIFER DATA

Saturated Thickness: 4.4 m

Aquitard Thickness (b'): 26. m

Anisotropy Ratio (Kz/Kr): 1.

Aquitard Thickness (b''): 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BH4	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ BH4	0	0

SOLUTION

Aquifer Model: Leaky

T = 47.83 m²/day

r/B' = 0.0001054

r/B'' = 0.

Sw = 0.

r(c) = 0.1 m

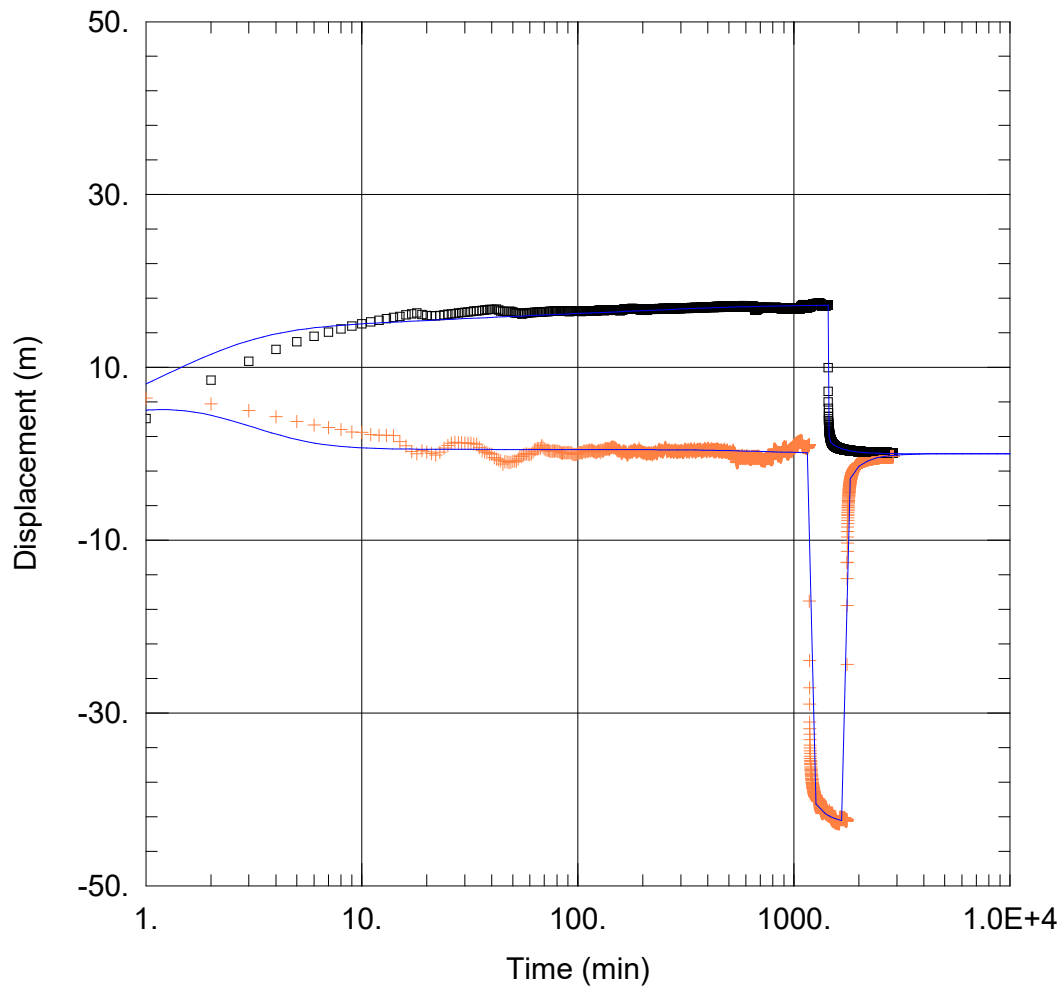
Solution Method: Moench (Case 1)

S = 9.632E-8

β' = 0.0006079

β'' = 0.

r(w) = 0.1 m



WELL TEST ANALYSIS

Data Set: V:\...\BH4 - leaky.aqt

Date: 12/16/25

Time: 17:37:53

PROJECT INFORMATION

Company: WGA

Project: WGA252389

AQUIFER DATA

Saturated Thickness: 4.4 m
Aquitard Thickness (b'): 26. m

Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b''): 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BH4	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ BH4	0	0

SOLUTION

Aquifer Model: Leaky

Solution Method: Moench (Case 1)

$T = 47.83 \text{ m}^2/\text{day}$

$S = 9.632\text{E-}8$

$r/B' = 0.0001054$

$\beta' = 0.0006079$

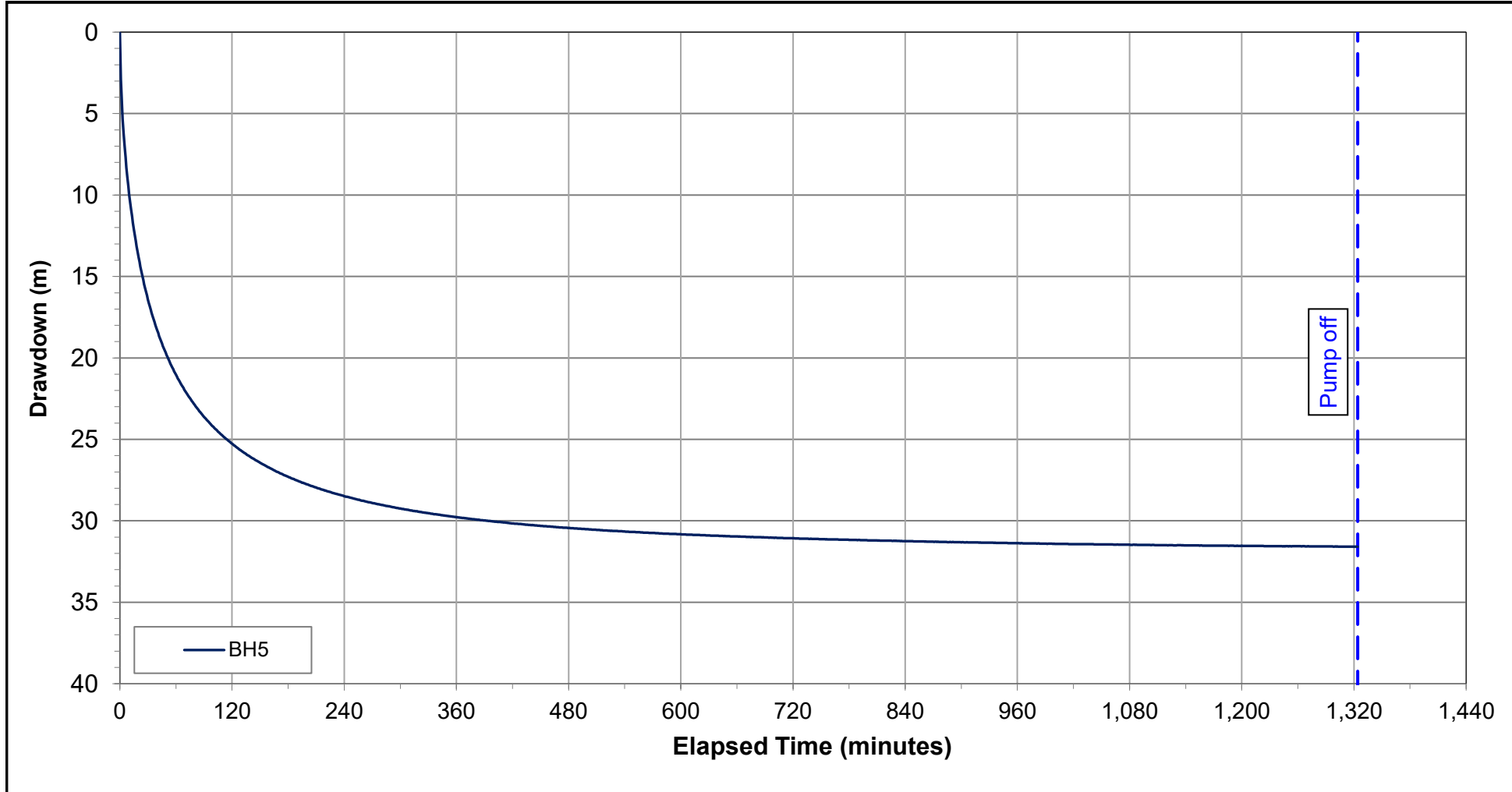
$r/B'' = 0.$

$\beta'' = 0.$

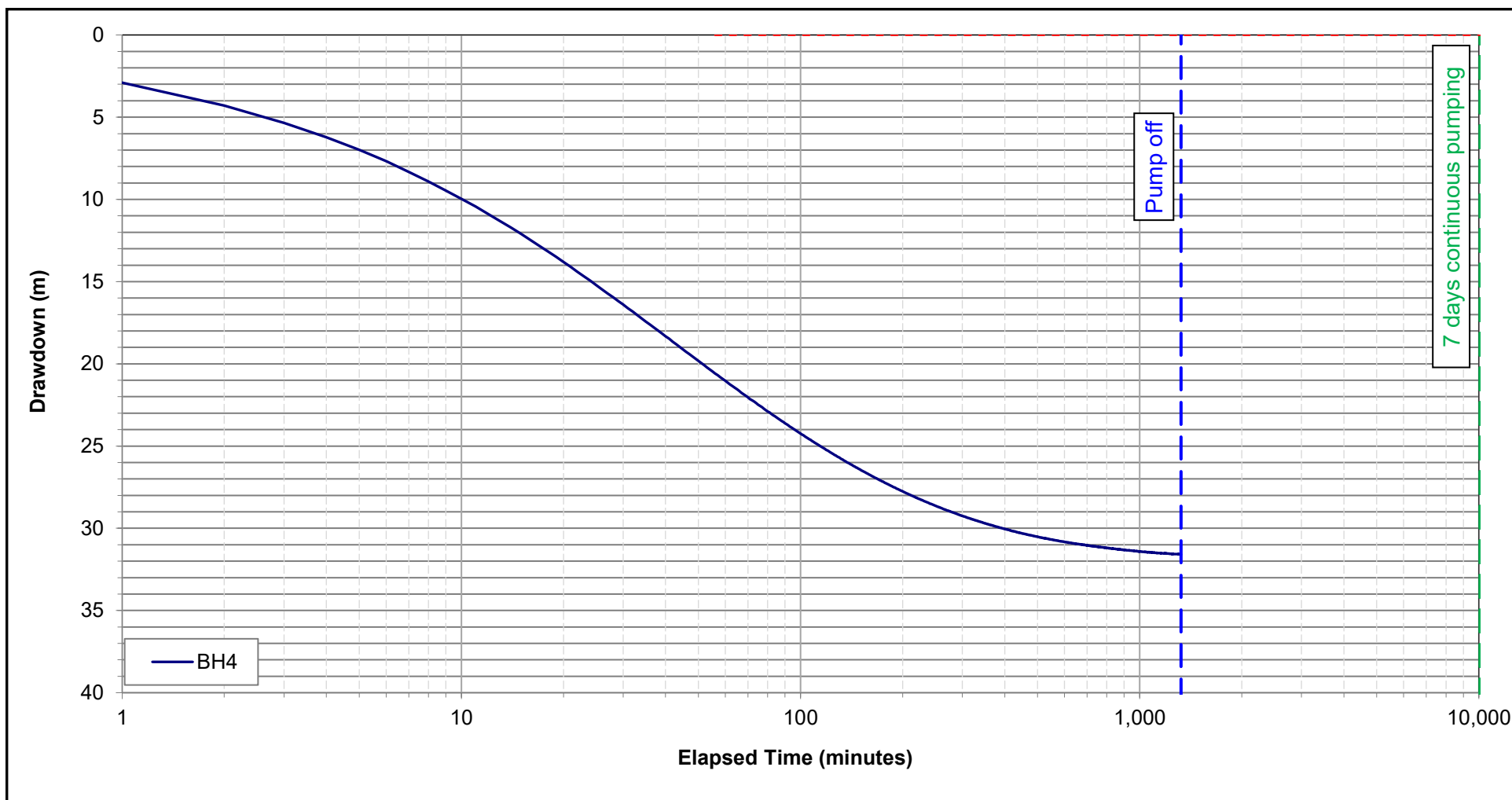
$Sw = 0.$

$r(w) = 0.1 \text{ m}$

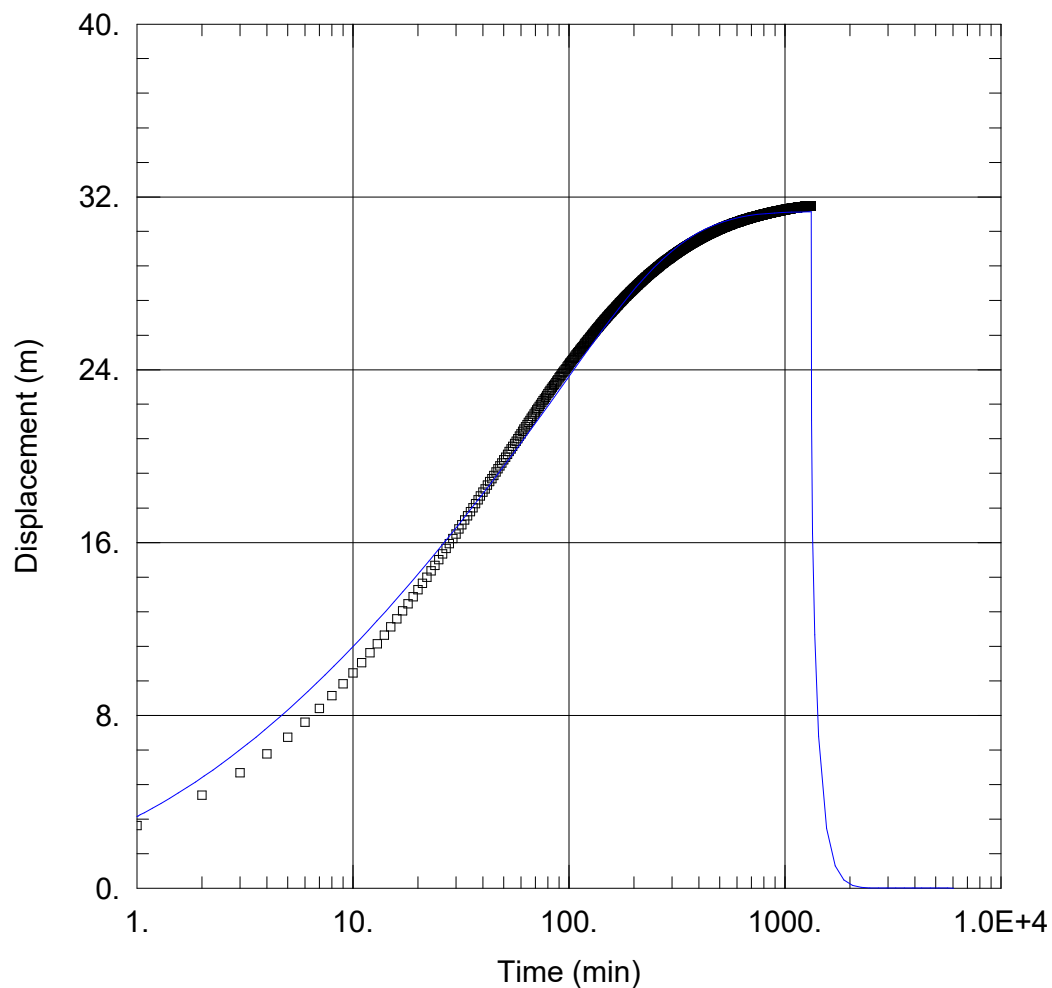
$r(c) = 0.1 \text{ m}$



Water Supply Trial BH5 122 Morven Ferry Road WGA	TITLE			Constant Rate Pumping Test Drawdown, 3 December 2025	
				Normal - Normal Scale Plot. Data supplied by SouthDrill.	
	DRAWN	B. Sinclair	DATE	15 December 2025	JOB NO. WGA252389
	CHECKED	J Manning	SCALE	na	DWG. NO. na
	REVIEWED	B. Sinclair	FILE NO.	na	FIGURE NO. C4



Water Supply Trial BH5 122 Morven Ferry Road WGA	TITLE Constant Rate Pumping Test Drawdown, 3 December 2025 Log - Normal Scale Plot. Data supplied by SouthDrill.			
	DRAWN	B. Sinclair	DATE	15 December 2025
	CHECKED	J Manning	SCALE	na
	REVIEWED	B. Sinclair	FILE NO.	na
			JOB NO.	WGA252389
			DWG. NO.	na
			FIGURE NO.	C5



WELL TEST ANALYSIS

Data Set: V:\...\BH5 - Hantush leaky.aqt

Date: 12/15/25

Time: 17:25:27

PROJECT INFORMATION

Company: WGA

Project: WGA252389

AQUIFER DATA

Saturated Thickness: 73. m

Anisotropy Ratio (Kz/Kr): 301.

Aquitard Thickness (b'): 29. m

Aquitard Thickness (b''): 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BH5	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ BH5	0	0

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush

$T = 5.174 \text{ m}^2/\text{day}$

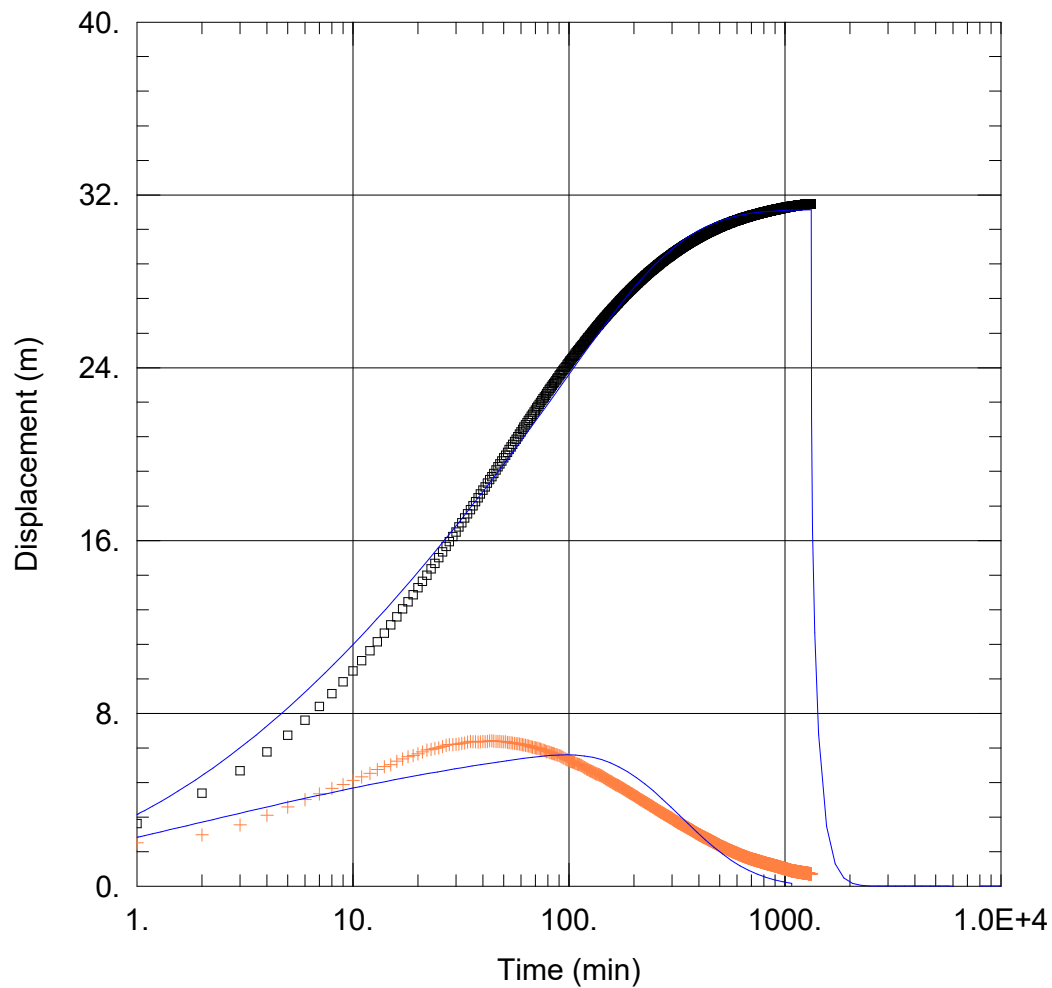
$S = 0.001291$

$r/B' = 0.4531$

$\beta' = 20.$

$r/B'' = 0.$

$\beta'' = 0.$



WELL TEST ANALYSIS

Data Set: V:\...\BH5 - Hantush leaky.aqt

Date: 12/15/25

Time: 17:24:44

PROJECT INFORMATION

Company: WGA

Project: WGA252389

AQUIFER DATA

Saturated Thickness: 73. m

Anisotropy Ratio (Kz/Kr): 301.

Aquitard Thickness (b'): 29. m

Aquitard Thickness (b''): 1. m

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
BH5	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ BH5	0	0

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush

$T = 5.174 \text{ m}^2/\text{day}$

$S = 0.001291$

$r/B' = 0.4531$

$\beta' = 20.$

$r/B'' = 0.$

$\beta'' = 0.$



FOR FURTHER INFORMATION CONTACT:

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